Evaluación de la exposición pasiva al tabaco (segunda y tercera mano), ambientes privados libres de humo e impacto en salud en la población pediátrica

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EVALUACIÓN DE LA EXPOSICIÓN PASIVA AL TABACO (SEGUNDA Y TERCERA MANO), AMBIENTES PRIVADOS LIBRES DE HUMO E IMPACTO EN SALUD EN LA POBLACIÓN PEDIÁTRICA

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uic barcelona

*"*No quieras entrar inmediatamente en el mar,
sino a través de los riachuelos, pues a lo difícil se debe llegar por lo fácil*".*

Consejos a un estudiante: SANTO TOMÁS DE AQUINO

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Abreviaciones

Agencia Internacional de Investigación sobre el Cáncer o International Agency for Research on Cancer (IARC)

Asociación Española de Pediatría (AEPED)

Convenio Marco para el Control del Tabaco (CMCT)

Enfermedad pulmonar obstructiva crónica (EPOC)

Encuesta Nacional de Salud de España (ENSE)

Environmental Tobacco Smoke (ETS)

EPHR (European Perinatal Health Report)

European Respiratory Society (ERS)

Estados Unidos de América (EUA)

Fum ambiental del tabac (FAT)

Fum de tercera mà (FTM)

Humo ambiental del tabaco (HAT)

Humo de Tercera Mano (HTM)

Instituto Nacional de Estadística (INE)

Intervalo de Confianza (IC)

Kilogramo (kg)

Metro cuadrado (m^2)

Metro cúbico (m^3)

Odds Ratio ajustada (ORa)

Organización Mundial de la Salud (OMS)

Partículas en suspensión menores de 2,5 micras (PM 2,5)

Riesgo Relativo (RR)

Thirdhand smoke (THS)

Tobacco Control Scale (TCS)

Tobacco-specific nitrosamines (TSNAs)

Trastorno por déficit de atención e hiperactividad (TDAH)

Unión Europea (UE)

Web of Science (WOS)

World Health Organization (WHO)

Resumen

El consumo de tabaco es la primera causa de morbimortalidad evitable en los países desarrollados. Además, la exposición al humo ambiental del tabaco (HAT) ha sido clasificada como carcinógeno tipo I según la Agencia Internacional de Investigación sobre el Cáncer (IARC según sus siglas en inglés) y produce más de 600.000 muertes anuales e importante morbilidad entre los no fumadores. La exposición al HAT perjudica especialmente a la población pediátrica y se puede producir desde el periodo prenatal, incrementando el riesgo de nacimiento pretérmino, asma, neumonía o alteraciones en el neurodesarrollo entre otros efectos.

En la actualidad, en la población pediátrica, la principal fuente de exposición al HAT son los ambientes privados, como casas y vehículos privados, debido a que es después de los colegios es donde pasan más tiempo, y gracias al incremento en las políticas de control del tabaquismo en los espacios públicos, que se han ido implementando por los diferentes países después del Convenio Marco para el Control del Tabaquismo de la Organización Mundial de la Salud (OMS). Por otro lado, en la última década ha crecido el interés por los contaminantes residuales del humo del tabaco que permanecen en las superficies tras haber fumado, lo que se conoce como humo de tercera mano (HTM), y es otra fuente de exposición pasiva al tabaco.

Los objetivos de la presente tesis doctoral fueron: 1) Analizar la correlación entre las medidas de control del tabaquismo implementadas en Europa y la prevalencia de nacimientos pretérmino y con bajo peso al nacimiento. 2) Caracterizar la prevalencia de hogares libres de humo y el apoyo social de la población adulta española sobre la regulación del consumo de tabaco en vehículos con y sin niños a bordo. 3) Describir la prevalencia de hogares libres de humo (con regulación total o parcial) y la prevalencia actual de exposición pasiva al humo del tabaco en niños menores de tres años en hogares y otros ambientes en España. 4) Realizar una revisión sistemática de la literatura científica sobre el humo de tercera mano. 5) Caracterizar la exposición al humo de tercera mano en hogares con niños menores de tres años en España y describir el conocimiento y las creencias de los efectos del mismo en niños.

La presente tesis doctoral es un compendio de cuatro artículos científicos en revistas indexadas en *Web of Science* y un manuscrito en revisión en una revista indexada en la misma base (ver sección: Artículos científicos de la tesis doctoral).

Las conclusiones principales de esta tesis doctoral podrían resumirse en: 1) El incremento las legislaciones para el control del tabaquismo en los países europeos se correlaciona, a nivel

ecológico, con una disminución en la prevalencia de nacimientos pretérmino. 2) En España, existe un soporte poblacional elevado para favorecer una legislación que regule el consumo de tabaco en los vehículos privados con menores a bordo (9 de cada 10 adultos). 3) Más del 80% de hogares españoles aplican algún tipo de regulación voluntaria sobre el consumo de tabaco (45% regulación total), incrementándose hasta el 85% la regulación total en hogares con niños de 3 a 36 meses.

Respecto al HTM, nuestra revisión sistemática muestra evidencias de los posibles efectos perjudiciales para la salud de esta exposición, siendo necesario más estudios a medio y largo plazo. El componente más analizado para determinar el HTM ha sido la nicotina, seguido por las nitrosaminas y la cotinina. Además, a nivel social, existe en la actualidad un desconocimiento sobre el HTM y sus potenciales consecuencias. Sin embargo, nuestros datos muestran que tras conocer la definición del mismo, la mayoría de los padres de niños menores de 3 años clasifican el HTM como dañino para la salud de sus hijos.

Resum

El consum de tabac és la primera causa de morbimortalitat evitable als països desenvolupats, a més, l'exposició al fum ambiental del tabac (FAT) ha estat classificada com carcinogen tipus I segons l'Agencia Internacional d'Investigació sobre el Càncer (IARC segons les seves sigles en anglès) i produeix més de 600.000 morts anuals amb important morbiditat entre els no fumadors. L'exposició al FAT perjudica especialment a la població pediàtrica i es pot produir des del període prenatal, incrementant el risc de naixement preterme, asma, pneumònia o alteracions en el neurodesenvolupament entre d'altres efectes.

A l'actualitat, a la població pediàtrica, la principal font d'exposició al FAT són els ambients privats, com les cases i vehicles particulars, degut a que després del col·legis es on passen més temps, i gràcies a l'increment a les polítiques pel control del tabaquisme als espais públics que s'han anat implementant pels diferents països després del Conveni Marc pel Control del Tabaquisme de l'Organització Mundial de la Salut (OMS). D'altra banda, a l'última dècada, ha crescut l'interès pels contaminants residuals del fum del tabac que romanen a les superfícies després d'haver fumat, el que es coneix com fum de tercera mà (FTM), i és un altra font d'exposició passiva al tabac.

Els objectius de la present tesi doctoral van ser: 1) Analitzar la correlació entre les mesures de control del tabaquisme implementades a Europa i la prevalença de naixements preterme i naixements amb baix pes al néixer. 2) Caracteritzar la prevalença de llars lliures de fum i el suport social de la població adulta espanyola sobre la regulació del consum de tabac als vehicles amb i sense nens a bord. 3) Descriure la prevalença de llars lliures de fum (amb regulació total o parcial) i la prevalença actual d'exposició passiva al fum del tabac en nens menors de tres anys en llars i altres ambients a Espanya. 4) Realitzar una revisió sistemàtica de la literatura científica sobre el fum de tercera mà. 5) Caracteritzar l'exposició al fum de tercera mà en llars amb nens menors de tres anys a Espanya i descriure el coneixement i les creences dels efectes del mateix en nens.

La present tesi doctoral és un compendi de quatre articles científics en revistes indexades a Web of Science i un manuscrit en revisió a una revista indexada a la mateixa base (veure secció: Articles científics de la tesi doctoral).

Les conclusions principals d'aquest projecte podrien resumir-se com: 1) L'increment de les legislacions pel control del tabaquisme als països europeus es correlaciona, a nivell ecològic, amb una disminució a la prevalença de naixements preterme. 2) A Espanya, hi ha un suport poblacional elevat per afavorir una legislació que reguli el consum de tabac als vehicles privats amb menors a bord (9 de cada 10 adults). 3) Més del 80% de llars espanyoles apliquen algun tipus de regulació voluntària pel consum de tabac (45% regulació total), elevant al 85% la regulació total en llars amb nens de 3 a 36 mesos.

Respecte al FTM, la nostra revisió sistemàtica mostra evidències dels possibles efectes perjudicials per la salut d'aquesta exposició, sent necessaris més estudis a mig i llarg termini. El component més analitzat per determinar el FTM és la nicotina, seguit per les nitrosamines i la cotinina. A més, a nivell social, existeix a l'actualitat un desconeixement sobre el FTM i les seves potencials conseqüències. No obstant això, les nostres dades mostren que després de conèixer la definició del FTM, la majoria dels pares de nens menors de 3 anys ho classifiquen com nociu per a la salut dels seus fills.

Abstract

Tobacco use is the leading cause of preventable morbidity and mortality in developed countries, and exposure to environmental tobacco smoke (ETS) has been classified as a type I carcinogen according to the International Agency for Research on Cancer (IARC). It is the cause for more than 600,000 deaths annually and significant morbidity among non-smokers. Exposure to ETS especially affects the pediatric population and could occur from the prenatal period, increasing the potential for preterm birth, asthma, pneumonia or neurodevelopmental alterations, among other effects.

Currently in the pediatric population, the main source of exposure to ETS is from private settings, such as homes and private vehicles, because after schools, it is where they spend more time, and thanks to the increase in tobacco control policies in public places that have been implemented by the different countries after the Framework agreement for Tobacco Control of the World Health Organization (WHO). On the other hand, in the last decade, interest has grown in the residual pollutants of tobacco smoke that remain on surfaces after smoking, which is known as thirdhand smoke (THS) and may be another source of ETS.

The objectives of this doctoral thesis are: 1) To analyze the correlation between the tobacco control measures implemented in Europe and the prevalence of preterm births and low birth weight. 2) Characterize the prevalence of smoke-free homes and the social support of the Spanish adult population on the regulation of tobacco consumption in private vehicles with and without children on board. 3) Describe the prevalence of smoke-free homes (with total or partial regulation) and the current prevalence of secondhand smoke exposure in children under three years of age in homes and other places in Spain. 4) Conduct a systematic review of the scientific literature on thirdhand smoke. 5) Characterize exposure to thirdhand smoke at homes with children under three years of age in Spain and describe the knowledge and beliefs of its effects on children.

The present doctoral thesis is a compendium of four scientific articles in journals indexed in Web of Science and a manuscript under review in the same database (see the section: Scientific articles of the doctoral thesis)

The main conclusions of this project could be summarized as follows: 1) The increase of the smoking control legislation in European countries correlates, at ecological level, with a decrease in the prevalence of preterm births. 2) In Spain, there is a high population support in favor of legislation that regulates the consumption of tobacco in private vehicles with minors on board (9 out of 10 adults). 3) More than 80% of Spanish households apply some type of voluntary regulation on tobacco consumption (45% of total regulation), raising to 85% the total regulation in households with children from 3 to 36 months.

Regarding THS, our systematic review shows evidence of the possible adverse health effects due to THS exposure, requiring more studies in medium and long-term. The most analyzed component to determine THS was nicotine, followed by nitrosamines and cotinine. In addition, there is currently a lack of knowledge about THS and its potential consequences on a social level. However, our data show that after knowing the definition of THS, most parents of children under 3 years classify THS as harmful for the health of their children.

1. Introducción

1.1. Consumo de tabaco y tabaquismo pasivo: un viejo conocido

Existen más de 5 millones de muertes anuales en el mundo debidas a enfermedades relacionadas con el tabaco, constituyendo la primera causa de morbi-mortalidad evitable en los países desarrollados y existiendo importantes diferencias en la prevalencia consumo de tabaco según el área geográfica del planeta (1–5). Si el consumo de tabaco continua durante el siglo XXI como hasta ahora, se estima que producirá alrededor de 1 billón de muertes (4,6).

Las consecuencias del tabaquismo para la salud poblacional se están estudiando desde hace más de 90 años (6–9). Existe una relación causal entre el tabaquismo y la disminución de la salud global; así como un incremento del riesgo de muerte en fumadores (6,10). El consumo de tabaco se relaciona con múltiples enfermedades, así como diferentes tipos de cánceres, destacando el cáncer de pulmón; enfermedades respiratorias, como enfermedad pulmonar obstructiva crónica (EPOC), asma o tuberculosis; enfermedades cardiovasculares como el accidente vascular cerebral o el infarto agudo de miocardio; además de incrementar el riesgo para desarrollar diabetes mellitus; degeneración macular asociada a la edad; disfunción eréctil; embarazo ectópico o artritis reumatoide, entre otras (11–13).

Además, el consumo de tabaco durante el embarazo también produce numerosos efectos adversos en la placenta y en el crecimiento fetal (14). Se ha relacionado con graves complicaciones que se pueden producir durante la gestación como la ruptura prematura de membranas, retraso en el crecimiento intrauterino, los nacimientos pretérmino o incluso incremento del riesgo de mortalidad perinatal (15,16). Además, existe un efecto dosis-respuesta entre el consumo de tabaco durante el embarazo y los nacimientos pretérmino (15,17–19).

El consumo de tabaco también tiene costes económicos, estimándose debido al tabaquismo un incremento del gasto sanitario medio entorno al 15% en países desarrollados (20,21). En Estados Unidos de América (EUA), se estima que el tabaquismo produce entre el 6 y el 18% del gasto sanitario anual y en Reino Unido entorno al 5% (6,20,21). Además, existe un incremento de absentismo laboral debido a enfermedades secundarias al tabaquismo, aunque, no menos controvertido, también produce importantes beneficios fiscales gubernamentales por los impuestos con los que se grava (11,20,21).

La epidemia del tabaco presenta un modelo similar entre los diferentes países compuesto por cuatro etapas (22). En la primera etapa, el consumo de tabaco es bajo en los hombres (menor del 15%) y casi inexistente entre las mujeres (menor del 5%). En esta primera etapa, fumar es una práctica bien aceptada socialmente, sin restricciones para el consumo. En la segunda etapa, el consumo de tabaco se incrementa entre los hombres, alcanzando hasta el 50-80% y también entre las mujeres, pero más lentamente. Al finalizar la segunda etapa, el tabaco provoca el 10% de las muertes en hombres. En la tercera etapa, existe un descenso en el consumo de tabaco entre los hombres y un incremento entre las mujeres que empieza a disminuir al final de la tercera etapa. En la tercera etapa, fumar comienza a ser socialmente inadecuado y el conocimiento de los efectos del tabaco en la salud está ampliamente extendido entre la población, empezándose a delimitar espacios sin humo en los lugares públicos y existiendo un gran aumento de la mortalidad atribuida al tabaco. En la cuarta etapa, la prevalencia de consumo de tabaco disminuye en ambos sexos, produciendo un descenso en la mortalidad progresivo (22).

En 2015, existían más de 933 millones de fumadores diarios a nivel mundial, aunque la mortalidad atribuida al tabaco varía de forma considerable dependiendo de la fuente y de los riesgos relativos utilizados, se estima que las muertes atribuidas al tabaco son entorno al 12%, por lo que el tabaco es responsable de 1,2 de cada 10 muertes a nivel mundial (3,6). Según datos de 2014, en la Unión Europea (UE), el 24% de la población es fumadora diaria, oscilando del 5% en Suecia al 36% en Bulgaria (23). La Encuesta Nacional de Salud de España (ENSE) realizada en España en 2017, muestra un consumo diario de tabaco del 22,1% entre la población durante el mismo año de la realización, siendo del 23,9% en la encuesta previa publicada en 2011 (24). En la UE, la mortalidad atribuida al tabaco es muy variable según la región, oscilando desde el 11,2% en Suecia al 25,1% en Grecia (4). En España, se produjeron entre los años 2010 y 2014, 259.348 muertes atribuidas al tabaco, suponiendo el 13% del total de defunciones en la población mayor de 34 años (25).

Hasta la década de los 70 del siglo pasado, se prestó poca atención a la exposición pasiva al tabaco o tabaquismo pasivo entre las personas no fumadoras. Sin embargo, numerosos estudios han evidenciado que la exposición al humo ambiental del tabaco (HAT) de las personas no fumadoras, igual que el consumo de tabaco, tiene numerosos efectos nocivos en la salud (6,26). El tabaquismo pasivo o la exposición al HAT en no fumadores ha sido clasificado como carcinógeno tipo I por la Agencia Internacional de Investigación sobre el Cáncer (IARC según sus siglas en inglés) de la Organización Mundial de la Salud (OMS) (26–28). Además, existe un efecto dosis-respuesta. Al igual que para el consumo de tabaco, existen diferencias importantes en la exposición al HAT según el área geográfica, explicadas en parte por la etapa de la epidemia del tabaquismo de cada país, ya que la exposición al HAT está directamente

relacionado con la prevalencia de consumo de tabaco, así como por las medidas de control del tabaquismo implementadas entre los diferentes países (26,27,29).
El HAT es una mezcla compleja de miles de gases y partículas emitidas por la combustión de productos de tabaco y del humo exhalado por los fumadores (30,31). La concentración de nicotina en el aire se utiliza como marcador del HAT con elevada sensibilidad y especificidad, y como biomarcador se utiliza la cotinina (26). El HAT inhalado en la exposición pasiva tiende a tener concentraciones más altas de muchas de las toxinas que se encuentran en el humo del cigarrillo, identificándose más de 50 carcinógenos distintos (11,26).

Numerosas investigaciones muestran los efectos adversos de la exposición al HAT y sus consecuencias para la salud, existiendo un gran número de no fumadores a nivel mundial que siguen expuestos al HAT (26,27,29). Se estima que la carga mundial de enfermedad atribuida a la exposición al HAT tiene un elevado impacto, produciendo más de 600.000 defunciones anuales (6,29). La exposición pasiva al humo del tabaco, igual que el tabaquismo activo, incrementa el riesgo de cáncer de pulmón (11,26,27,32). De hecho, se ha evidenciado un incremento del 20% de padecer cáncer de pulmón, en cónyuges no fumadores que conviven con un fumador (26). Además, existe un incremento estadísticamente significativo de riesgo de padecer cáncer de pulmón entre los no fumadores expuestos al HAT en los lugares de trabajo (11,26,27).

Pero el HAT no únicamente está relacionado con el cáncer de pulmón. Estudios previos han encontrado un incremento de riesgo en la aparición de otros cánceres como cáncer nasofaríngeo o cánceres gastrointestinales localizados en páncreas, estómago, colón o hígado entre las personas expuestas al HAT (26,27). Además, entre las mujeres, la exposición al HAT se ha relacionado con incremento de riesgo de aparición de cáncer de mama, cáncer de cérvix, o endometrio y en varones con cáncer de próstata (26,27,29). La exposición al HAT se ha relacionado en no fumadores con enfermedad coronaria, por su efecto protrombótico y disfunción endotelial, favoreciendo el desarrollo de aterosclerosis e incrementando el riesgo de enfermedad isquémica coronaria e infarto agudo de miocardio (26,31). Existe también una asociación positiva entre no fumadores expuestos al HAT a padecer enfermedades respiratorias como asma, rinitis aguda o sinusitis aguda, y una mayor susceptibilidad de padecer infecciones respiratorias (26,33).

En el mundo hasta el 35 % de las mujeres y el 33% de los hombres están expuestos al HAT (29). La exposición al HAT se estima que causa más de 600.000 muertes tempranas a nivel mundial, produciendo en España en el año 2011 más de 1000 muertes (29,34). La exposición al HAT en la UE varía de forma considerable según el país y las medidas para el control del tabaquismo implementadas, existiendo hasta un 20% de encuestados en la UE que afirman que la última vez que visitaron un bar, la gente estaba fumando dentro (23). Estas proporciones oscilan desde el 2% en Suecia al 87 % en Grecia (23). La exposición al HAT disminuye hasta el 9% de la población de la UE cuando el lugar de exposición son restaurantes (23).

En España, se estima que en la actualidad la exposición al HAT poblacional está alrededor de 45%, habiéndose producido un descenso significativo tras la implementación de las legislaciones para el control del tabaquismo, persistiendo en los hogares (12,7%), en los lugares de trabajo o estudio (13%), en los medios de transporte (12,7%) y en las actividades de ocio (32,2%) (35–37).

1.2. Población pediátrica: la población más vulnerable a la exposición pasiva al tabaco

La exposición al HAT o exposición pasiva al tabaco, se puede producir desde la etapa prenatal, evidenciándose niveles de cotinina elevados en líquido amniótico en mujeres embarazadas no fumadoras expuestas al HAT, y niveles de cotinina en la orina del recién nacido el primer día de vida (38,39). Desde la etapa prenatal, la exposición al HAT de la madre se asocia con retraso en el crecimiento intrauterino, bajo peso al nacimiento, nacimiento pretérmino, incremento del riesgo de padecer ciertos tipos de cáncer e incluso incremento de la mortalidad perinatal (26,40–45). Existe una relación dosis-respuesta entre el número de fumadores en el hogar y el riesgo de nacimiento pretérmino (40).

En el periodo prenatal, existe un crecimiento celular especialmente rápido, y el desarrollo y crecimiento pulmonar son procesos organizados en los cuales las interacciones del mesénquima con el epitelio pulmonar controlan y coordinan la expresión de múltiples factores reguladores (39,46,47). La exposición al HAT en el periodo prenatal es un factor exógeno que incrementa el riesgo de mutaciones celulares, anomalías congénitas o interacciones con el desarrollo o crecimiento pulmonar (39,47).

En pediatría, las vías metabólicas y el sistema inmune están en desarrollo, especialmente los primeros meses de vida (16,26,48). Por ello, los niños tienen una menor capacidad de desintoxicar y excretar productos químicos siendo más vulnerables a ellos (39,49). Además, la población pediátrica es más vulnerable a la exposición al HAT por ciertas características propias, existiendo aspectos especiales de susceptibilidad que varían según la etapa del desarrollo entre las que destacan una mayor frecuencia respiratoria o un sistema inmune en desarrollo (16,39,50).

Los niños, favorecidos por su mayor frecuencia respiratoria, inhalan proporcionalmente mayor cantidad de aire por kilogramo (kg) de peso corporal que los adultos (48,51). Por ejemplo, un niño de 1 año inhala 0,53 m^3/kg al día de aire frente a un adulto que inhala 0,2 m^3/kg al día (39,50). Al inhalar mayores volúmenes de aire, también inhalan más cantidades de contaminantes ambientales, perjudicándoles especialmente por su menor capacidad de eliminación (39,49,50). Además, en las primeras etapas del desarrollo existe una menor área de superficie pulmonar por kilogramo, por lo que la mayor cantidad de aire inspirado, si lleva contaminantes, afectará a un área proporcionalmente más pequeña de tejido pulmonar (50).

Entre los síntomas respiratorios producidos por la exposición al HAT en la infancia destacan, el incremento del riesgo de asma, neumonías, sibilantes recurrentes, tos, y una disminución de la capacidad pulmonar total (16,26,39,52–56). De hecho, existe un incremento del riesgo de padecer bronquitis aguda y de ingresos hospitalarios por enfermedad respiratoria en los niños con madres fumadoras (39,57). Además, si uno de los padres es fumador existe un incremento de riesgo de padecer cáncer de pulmón en los hijos expuestos al HAT (16,27). Además de los síntomas respiratorios en niños expuestos al HAT, existe un incremento en la incidencia de infecciones como otitis media aguda, o de padecer infecciones bacterianas graves o incluso, incremento de riesgo de muerte súbita (16,26,39,54,58–60).

La exposición al HAT desde el periodo prenatal y en el niño podría relacionarse con alteraciones en el neurodesarrollo o en el comportamiento como sintomatología de ansiedad o depresión siendo especialmente difícil de diferenciar, ya que los niños expuestos en periodo prenatal acostumbran a estar expuestos en periodo postnatal (16,39,56,61). También, existe un incremento de riesgo de padecer trastorno por déficit de atención e hiperactividad (TDAH) en niños expuestos al HAT en el hogar al menos 1 hora al día (62).

A nivel mundial, se ha estimado la exposición pasiva al HAT en niños entorno al 40% (26,29,39). Estos porcentajes se incrementan hasta el 60% en la zona del Pacífico Oeste y el Este de Europa, y descienden hasta el 12% en el continente Africano (29). En España, en menores de 15 años existe una exposición al HAT en lugares cerrados de 6,6% cuando es menos de 1 hora, y del 3,6% si la exposición es más de 1 hora, existiendo probablemente una infraestimación de los datos (24).

1.3. Respuesta global a la epidemia del tabaco: Políticas de control del tabaquismo

Debido al impacto para la salud del consumo de tabaco y exposición pasiva al HAT, la OMS creó un tratado para reducir el impacto mundial de la epidemia del tabaco, el Convenio Marco para el Control del Tabaco (CMCT) de la OMS que entró en vigor en 2005. El CMCT fue inicialmente ratificado, y aprobado por 40 países, incrementándose progresivamente la cifra hasta más de 180 Estados miembros de la OMS, que representan el 90% de la población mundial (10,63,64). El objetivo de la OMS con el CMCT era la protección de las generaciones presentes y futuras de las consecuencias del consumo y de la exposición al tabaco (6,63). El artículo 8 del CMCT se refiere a la protección contra la exposición al humo del tabaco, reconociendo la exposición al humo del tabaco como causa de morbilidad y mortalidad (63). Además, dicho artículo especifica la adopción y aplicación según la legislación del país de medidas eficaces para la protección frente a la exposición al HAT (63). Otras medidas incluidas en el CMCT son la regulación de la divulgación y promoción de productos de tabaco; la regulación del envasado y etiquetado de productos del tabaco; la educación, comunicación y concienciación pública; la regulación de la publicidad, promoción y patrocinio de tabaco; y la creación de medidas para favorecer el abandono del tabaco (63).

En 2003, el Banco Mundial propuso las seis intervenciones más costo-efectivas basadas en la evidencia científica para el control de la epidemia del tabaquismo (65). Estas medidas son: impuestos más elevados sobre los cigarrillos y otros productos del tabaco; prohibiciones/restricciones para fumar en lugares públicos y de trabajo (escuelas, centros sanitarios, transporte público, restaurantes, cines, etc.); prohibición completa de publicidad y promoción de todos los productos, logotipos y marcas de tabaco; mayor información al consumidor (contrapublicidad, cobertura de los medios de comunicación, hallazgos de investigación, etc.); etiquetas de advertencia grandes y directas en paquetes de cigarrillos y otros productos del tabaco y la ayuda a los fumadores que deseen dejar de fumar. El aumento de precios es la intervención más efectiva, obteniendo mejores resultados al implementar las medidas en conjunto (65).

En 2005, surgió la Escala de Control del Tabaquismo (*Tobacco Control Scale* en inglés, TCS) creada por Jooseens y Raw para cuantificar la implementación de las políticas de control del tabaquismo en los diferentes países europeos (66). La TCS se basa en las medidas descritas por el Banco Mundial y toma valores de 0 a 100 (66). Las medidas de la TCS son 6: Incremento de los precios, elevando los impuestos en los cigarrillos y otros productos del tabaco (puntuación de 0 a 30); prohibiciones y restricciones para fumar en lugares públicos y entornos de trabajo (puntuación de 0 a 22); información al consumidor a través de campañas de difusión pública, medios de comunicación y publicación de hallazgos realizados tras investigación (puntuación de 0 a 15); prohibiciones de publicidad y promoción de todos los productos del tabaco (puntuación de 0 a 13); etiquetas de advertencia de salud grandes y directas en los paquetes de tabaco y en otros productos del tabaco (puntuación de 0 a 10) y tratamientos para ayudar a los fumadores a dejar de fumar, incluyendo favorecer el acceso de los fumadores a los medicamentos (puntuación de 0 a 10). Con la suma de las diferentes medidas se obtiene la TCS, que permite clasificar según la implementación de dichas medidas a los diferentes países europeos (66–69). Desde que surgió la TCS, se ha ido actualizando de forma periódica, consiguiendo en cada actualización la inclusión de más países (69).

Además, para favorecer el cumplimiento del CMCT, la OMS introdujo en 2008, un plan de medidas conocidas con las siglas en inglés MPOWER, que se corresponden con varios artículos del tratado (63). Para implementar el plan de medidas MPOWER los países deben: M(*Monitor*): Monitorizar el consumo de tabaco y las políticas de prevención; P(*Protect*): Proteger a la población del humo del tabaco; O(*Offer*): Ofrecer ayuda para el abandono del tabaco; W(*Warn*): Advertir de los peligros del tabaco; E(*Enforce*): Hacer cumplir las prohibiciones sobre la publicidad, promoción y patrocinio del tabaco; R(*Raise*): Incrementar los impuestos al tabaco (6,63).

1.4. Impacto de las medidas de control del tabaquismo

Desde el año 2000, existe evidencia que las regulaciones[1] o legislaciones para del consumo de tabaco son un método efectivo para reducir la exposición pasiva al tabaco, ya que al no existir un umbral mínimo que garantice estar libre de riesgo para la exposición al HAT, se requieren

[1] A lo largo del texto, se usa el término regulación (o sus variantes) para indicar el acuerdo tácito o explícito sobre el uso de tabaco en determinados contextos. Generalmente, cuando nos referimos a regulación sancionada por organismos oficiales o autoridad correspondiente, hablamos de normas o de leyes (o sus equivalentes en inglés: *law, legislation, country regulation,* etc.). Sin embargo, ocasionalmente usamos también el término regulación al referirnos a aspectos sujetos a legislación, en ese caso, el contexto suele hacer evidente su significado preciso.

ambientes libres de humo que garanticen la salud de los no fumadores (11,26). De hecho, el principal argumento para la regulación o prohibición del consumo de tabaco en los lugares de trabajo es la protección de la salud de los no fumadores (26,27).

En las últimas décadas, y promovidas por el CMCT de la OMS, se ha producido un incremento de países que han implementado políticas que regulan la prohibición de fumar en lugares públicos cerrados y lugares de trabajo (26,29,31,70). Además, estas políticas junto con otras propuestas por el Banco Mundial como el incremento de las políticas de control del tabaquismo, basadas en el incremento de precios y la prohibición del consumo de tabaco en los lugares de trabajo y centros públicos, han conseguido una reducción significativa en la incidencia de enfermedades y muertes relacionadas con el tabaco, una disminución de los costes médicos relacionados con el tabaco y ganancias en los años de vida acumulados y los años de vida ajustados por calidad (21,31). Entre estas enfermedades, destacan la disminución en los infartos agudos de miocardio, y los accidentes cerebrovasculares, además de la disminución de las visitas hospitalarias y los ingresos hospitalarios debidos a enfermedad pulmonar obstructiva crónica y asma (31,71–74).

En España, el 1 de enero de 2006 entró en vigor la Ley 28/2005 de medidas sanitarias frente al tabaquismo y reguladora de la venta, el suministro, el consumo y la publicidad de los productos del tabaco (37). Esta ley supuso un gran avance para la salud pública de nuestro país, ya que incluyó regulaciones sobre publicidad, venta, suministro y consumo de productos del tabaco (37). Además, la ley disponía que las ventas minoristas y el suministro de productos de tabaco solo podían realizarse a través de estancos o locales autorizados, o mediante máquinas expendedoras que habían recibido las autorizaciones administrativas pertinentes, siendo todos los demás lugares expresamente prohibidos (37). También, se prohibió vender o entregar productos del tabaco a menores de edad (37). La ley prohibió la distribución promocional o gratuita de productos o servicios cuyo objetivo fuera de forma directa o indirecta la promoción y el patrocinio del tabaquismo (37). Además, dicha ley incorporó medidas para la prevención del consumo de tabaco, fomentando acciones para la educación e información sanitaria, además de abordar la promoción de programas para superar la adicción al tabaco. La ley prohibió fumar en todos los lugares de trabajo cerrados, lugares públicos, instalaciones de transporte público, hospitales e instalaciones de atención médica, escuelas, universidades, tiendas y centros comerciales (37).

Sin embargo, la Ley 28/2005 era incompleta en la protección de la salud de un colectivo importante de trabajadores ya que, a pesar de prohibir fumar en los lugares de trabajo, la hostelería estaba mayoritariamente exenta de la prohibición (37,75). La ley permitía a los propietarios de locales de menos de 100 m^2 escoger entre permitir o no fumar en el establecimiento y en los locales de más de 100 m^2, en los que la ley sí prohibía fumar, el propietario podía habilitar una zona para fumadores convenientemente aislada, que no superase el 30% de la superficie útil del local (37).

Esta situación de desprotección, principalmente en el sector de la hostelería motivó la revisión de la Ley 28/2005 y la posterior aprobación de una nueva ley. Esta nueva ley permanece en vigor desde el pasado 2 de enero de 2011, Ley 42/2010, que modifica la Ley 28/2005 de medidas sanitarias frente al tabaquismo y reguladora de la venta, el suministro, el consumo y la publicidad de los productos del tabaco (36). Entre las principales modificaciones que incluye la nueva ley, destaca la ampliación de la prohibición de fumar a todos los establecimientos del sector de la hostelería, independientemente de las características del local, y la prohibición fumar en algunos espacios exteriores de hospitales, centros educativos y en parques infantiles al aire libre (36). Pese a ello, esta legislación permite salas de fumadores designadas en los centros psiquiátricos, en hogares de ancianos, en prisiones y hasta en el 30% de las habitaciones de hotel; y también permite fumar en áreas al aire libre de universidades y centros educativos para adultos (36).

Una revisión de la literatura científica del impacto de las legislaciones de control del tabaquismo en España, Ley 28/2005 y Ley 42/2010, realizada por el Grupo de trabajo sobre tabaquismo de la Sociedad Española de Epidemiología mostró que en la última década, en España, se ha avanzado cuantitativa y cualitativamente en las políticas de prevención y control del tabaquismo, especialmente en los espacios cerrados de uso público (35,64). Fruto de este avance se ha producido una reducción en la exposición pasiva al tabaco en la población general lo cual ha tenido un impacto positivo en la reducción de la mortalidad y morbilidad de enfermedades relacionadas con la exposición al tabaco (infarto agudo de miocardio, enfermedad pulmonar obstructiva crónica, etc.) (64). Además, el cumplimiento y apoyo a la legislación para el control del tabaquismo es muy elevado (64). Sin embargo, no se puede atribuir un impacto a medio y corto plazo en la prevalencia del consumo de tabaco que presenta una tendencia descendente en las últimas décadas.

1.5. Exposición pasiva al tabaco en ambientes privados: nuevos retos para el control del tabaquismo

Los ambientes privados, las casas y los vehículos privados son en la actualidad uno de los remanentes principales de exposición al HAT, siendo los niños los más vulnerables a dicha exposición, debido a que tras los colegios, guarderías o institutos; los ambientes privados son los lugares donde pasan más tiempo (16,26,27,53,76). A nivel mundial, la exposición al HAT en niños en hogares varía según la región, siendo del 27,6% en África, el 34,3% en el Sudeste Asiático, el 50,6% en el Pacífico Occidental y hasta el 77,8% en Europa (77).

En la actualidad, existe un debate abierto sobre si las medidas para el control del tabaquismo se deberían extender a los ambientes privados, con algunos indicadores que sugieren que podrían reducir la aceptabilidad social del consumo de tabaco en público, y favorecer el abandono siendo beneficiosas para la salud poblacional (78–81). De hecho, en algunos países europeos y en EUA existen políticas antitabaco que favorecen la creación de edificios libres de humo (82–84).

En España, la Ley 42/2010 vigente en la actualidad, prohíbe explícitamente fumar en cualquier espacio cerrado de las áreas comunes de las comunidades de vecinos (ascensores, pasillos, escaleras etc.) (36). Sin embargo, deja la decisión de prohibir el consumo de tabaco en los espacios abiertos comunes (patios comunes, terrazas, jardines, piscinas) no designados como zonas o áreas infantiles a la comunidad de vecinos (36).

Por otro lado, los niños también pasan una parte considerable de su tiempo viajando, siendo los vehículos privados otro foco importante de exposición al HAT debido además, a que las concentraciones de contaminantes se acumulan rápidamente en los espacios confinados (16,53,85). Las concentraciones de nicotina dentro de los vehículos privados son mucho mayores que las concentraciones medidas en otros lugares cerrados (públicos o privados) (86).

Además, fumar mientras se conduce se ha reconocido como la segunda causa más habitual de distracción al volante y existe evidencia del efecto perjudicial en los accidentes de tráfico (87–95). En la última década, han empezado a surgir algunas legislaciones que establecen la prohibición frente al consumo de tabaco en vehículos privados si hay niños a bordo (85,96,97).

1.6. Exposición al humo de tercera mano

El término humo de tercera mano (HTM), tabaquismo de tercera mano o *thirhand smoke* (en inglés) se mencionó por primera vez en la literatura en 2006, utilizándose en 2009 por primera vez en un artículo científico (98,99). Aunque se conoce habitualmente como HTM puede recibir otras denominaciones como Humo residual del tabaco (*Residual tobacco smoke o Aged tobacco smoke* en inglés) (100,101).

Previamente a establecer el término HTM surgieron en la literatura los términos "Humo de segunda mano tardío" o "Exposición al tabaco ambiental" siendo inicialmente difícil la diferenciación entre humo de segunda mano y humo de tercera mano (102–106)

En 2011, un consenso de autores estableció la definición del HTM: "*El HTM consiste en aquellos contaminantes residuales del humo del tabaco que permanecen en las superficies y el polvo después de haber fumado, pudiendo pasar a fase gas o reaccionar con oxidantes y otros compuestos ambientales para producir contaminantes secundarios*" (100). Debido a los procesos de oxidación y reconstitución que ocurren en las superficies al depositarse se ha postulado que ciertos componentes del HTM podrían tener mayor toxicidad que el HAT (107,108). Además, algunos componentes del HAT se adhieren a las superficies, otros son reemitidos al aire ambiental y pueden reaccionar creando contaminantes que no estaban presentes en el humo del tabaco original (100,109). Desde el momento en el que se produce el HAT hasta semanas después, se producen reacciones químicas e interacciones (110).

Los componentes del HTM que se encuentran en el polvo y en las superficies pueden ser ingeridos, inhalados o incluso absorbidos a través de la piel (111–113). El HTM ha ganado protagonismo debido al incremento de estudios que muestran efectos nocivos para la salud, sin embargo, no son muy conocidas las implicaciones específicas en la salud de la exposición al HTM, aunque se empiezan a investigar, destacando que contienen sustancias mutagénicas y carcinogénicas (114–116).

En 2015, un estudio mostró el incremento de riesgo de cáncer en humanos a través de la ingestión no dietética y exposición dérmica a nitrosaminas específicas del tabaco (117). De hecho, se ha evidenciado un incremento en el riesgo de muerte asociado con el hecho de vivir con un fumador debido al HTM (118). Además, existen revisiones de autor sobre el HTM que muestran los cambios químicos, las concentraciones de los diferentes componentes del HTM y los efectos del HTM en células y en animales (119,120).

Al igual que en la exposición al HAT, los niños son más sensibles que los adultos a los efectos del HTM ya que, los ambientes privados como hogares y vehículos privados, son los lugares donde los niños después de los colegios o centros educativos pasan más tiempo sin poder evitar la exposición (116,121). Estos ambientes privados, si los padres o madres fuman, pueden ser una gran fuente de exposición al HTM. Además, está sensibilidad puede exacerbarse haciéndolos más vulnerables, debido a ciertas características propias de la infancia, como una mayor frecuencia respiratoria o un sistema inmune en desarrollo (48,51,122). Existen ciertos comportamientos propios de algunas etapas de la infancia, como la etapa de lactante o la primera infancia, en las que es habitual llevarse cosas a la boca, gatear y chupar todo tipo de objetos incrementando la exposición (123,124). Existe evidencia del efecto perjudicial del HTM en pediatría, incrementando las exacerbaciones asmáticas y otras enfermedades respiratorias en los niños (124).

2. Hipótesis y Objetivos

2.1. Hipótesis

1. Existe una correlación negativa entre el número de nacimientos pretérmino y con bajo peso al nacimiento y las políticas de control del tabaquismo implementadas en los diferentes países de Europa.

2. La prevalencia de hogares libres de humo es elevada en España tras la entrada en vigor de la Ley 42/2010.

3. Existe un elevado soporte poblacional a la regulación del consumo de tabaco en España en vehículos privados en presencia de menores.

4. La prevalencia de hogares libres de humo y el apoyo a la regulación o prohibición de consumo de tabaco en coches con menores a bordo es elevada.

5. La mayoría de la literatura científica publicada sobre el humo de tercera mano se basa en estudios experimentales, existiendo pocos estudios observacionales hasta la fecha.

6. El conocimiento sobre el humo de tercera mano es escaso en padres y madres de niños menores de 36 meses en España.

2.2. Objetivos

1. Analizar la correlación entre las medidas de control del tabaquismo implementadas en Europa y la prevalencia de nacimientos pretérmino y con bajo peso al nacer.

2. Caracterizar la prevalencia de hogares libres de humo y el apoyo social de la población adulta española sobre la regulación del consumo de tabaco en vehículos con y sin niños a bordo.

3. Describir la prevalencia de hogares libres de humo (con regulación total o parcial) y la prevalencia actual de exposición pasiva al humo del tabaco en niños menores de tres años en hogares y otros ambientes en España.

4. Realizar una revisión sistemática de la literatura científica sobre el humo de tercera mano.

5. Caracterizar conocimientos sobre el humo de tercera mano y las creencias de su impacto en la salud en niños menores de 3 años en España.

3. Objetivos y resultados de los artículos de la tesis

La presente tesis doctoral está formada por un compendio de cuatro artículos científicos publicados en revistas indexada en *Journal Citation Report* y un manuscrito que se encuentra en revisión en una revista también indexada en dicha base. Además, se adjuntan como anexos la correspondencia mantenida con el Editor de las revistas hasta la aceptación de cada uno de los artículos de la tesis doctoral, así como la respuesta a los revisores externos de los artículos publicados (Anexo 1 al 4). También se adjuntan los recortes de prensa derivados de la publicación de los artículos en los medios de comunicación (Anexo 5 y 6) y las ponencias presentandas en congresos en los que se han expuesto los resultados de la tesis doctoral (Anexo 7). Finalmente, cabe destacar que la doctoranda, durante la realización de la tesis y como parte de su formación predoctoral, ha participado como coautora en dos artículos científicos [2,3] en la línea de investigación de pediatría que han sido publicados en revistas indexadas en *Web of Science*, y un manuscrito actualmente en revisión [4], realizados con sus directores de tesis (Dr. Jose M Martínez-Sánchez y Dr. Albert Balaguer Santamaria).

Los cuatro artículos y el manuscrito de la tesis son los siguientes:

Artículo 1: Díez-Izquierdo, Ana; Balaguer, Albert; Lidón-Moyano, Cristina; Martín-Sánchez, Juan Carlos; Galán, Iñaki; Fernández, Esteve; Martínez-Sánchez, Jose M. Correlation between tobacco control policies and preterm births and low birth weight in Europe. Environmental Research 2018; 160: 547-553. DOI: 10.1016/j.envres.2017.10.033

Environmental Research está incluida en los *Journal Citation Report de ISI-Web of Science* con un factor de impacto en 2017 de 4,732 (posición 12/180 en la categoría "*Public, environmental and occupational health*")

[2] Rivas-Fernandez M, Roqué i Figuls M, Diez-Izquierdo A, Escribano J, Balaguer A. Infant position in neonates receiving mechanical ventilation (Review). Cochrane Database Syst Rev. 2016;11. DOI: 10.1002/14651858.CD003668.pub4.

[3] Cassanello P, Díez-Izquierdo A, Gorina N, Matilla-Santander N, Martínez-Sanchez JM, Balaguer A. Adaptation and study of the measurement properties of a sleep questionnaire for infants and pre-school children. An Pediatr. Asociación Española de Pediatría; 2018;89(4):230–7. DOI: 10.1016/j.anpede.2017.12.007

[4] Rivas-Fernandez M, Díez-Izquierdo A, Roqué i Figuls M, Tobías A, Balaguer A. Different strains of probiotics for preventing mortality and morbidity in preterm infants: A network meta-analysis. Underreview, CRD42016047640 Protocolo disponible en PROSPERO desde 2016: http://www.crd.york.ac.uk/PROSPERO/display_record.php?ID=CRD42016047640 Acceso 9 de enero de 2019.

Artículo 2: Díez-Izquierdo, Ana; Lidón-Moyano, Cristina; Martín-Sánchez, Juan Carlos; Matilla-Santande, Núria; Cassanello-Peñarroya, Pia; Balaguer, Albert; Martínez-Sánchez, Jose M. Smoke-free homes and attitudes towards banning smoking in vehicles carrying children in Spain (2016). Environmental Research 2017; 158: 590-597. DOI: 10.1016/j.envres.2017.07.012

Environmental Research está incluida en los *Journal Citation Report de ISI-Web of Science* con un factor de impacto en 2017 de 4,732 (posición 12/180 en la categoría "*Public, environmental and occupational health*").

Manuscrito 3: Díez-Izquierdo A, Cassanello P, Cartanyà-Hueso À, Matilla-Santander N, Martín JC, Balaguer A, Martinez-Sanchez JM. Prevalencia de hogares libres de humo y exposición pasiva al tabaco en población pediátrica (niños de 3 a 36 meses). *Manuscrito en revisión* en una revista incluida en los *Journal Citation Report de ISI-Web of Science.*

Artículo 4: Díez-Izquierdo, Ana; Cassanello-Peñarroya, Pia, Lidón-Moyano, Cristina; Matilla-Santander, Nuria; Balaguer, Albert; Martínez-Sánchez, Jose M. Update on Thirdhand Smoke: A Comprehensive Systematic Review. Environmental Research. 2018. DOI: 10.1016/j.envres.2018.07.020

Environmental Research está incluida en los *Journal Citation Report de ISI-Web of Science* con un factor de impacto en 2017 de 4,732 (posición 12/180 en la categoría "*Public, environmental and occupational health*")

Articulo 5: Díez-Izquierdo, Ana; Cassanello, Pia; Cartanyà, Aurea; Matilla-Santander, Núria; Balaguer, Albert; Martinez-Sanchez Jose M. Knowledge and attitudes towards Thirdhand smoke among parents with children under 3 years in Spain. Pediatric Research. 2018. DOI: 10.1038/s41390-018-0153-2

Pediatric Research está incluida en los *Journal Citation Report de ISI-Web of Science* con un factor de impacto en 2017 de 3,123 (posición 16/124 en la categoría "*Pediatrics – SCIE*").

El objetivo principal y principales resultados de los artículos y el manuscrito de la tesis son:

Artículo 1: Díez-Izquierdo, Ana; Balaguer, Albert; Lidón-Moyano, Cristina; Martín-Sánchez, Juan Carlos; Galán, Iñaki; Fernández, Esteve; Martínez-Sánchez, Jose M. Correlation between tobacco control policies and preterm births and low birth weight in Europe. Environmental Research 2018; 160: 547-553. DOI: 10.1016/j.envres.2017.10.033

Objetivo: Evaluar la correlación entre las políticas de control del tabaquismo, en particular prohibiciones para fumar en el lugar de trabajo y los lugares públicos, y la prevalencia de nacimientos pretérmino y con bajo peso en los países europeos.

Resultados: La escala de Control del tabaquismo "*Tobaco Control Scale*" de 2010 se correlacionó negativamente con la prevalencia de nacimientos pretérmino antes de la semana 37 (rsp = −0,51; Intervalo de Confianza (IC) del 95%: −0,77, −0,15; p = 0,006) y antes de la semana 32 (rsp = −0,42; 95% CI: −0,73; −0,01; p = 0,03) y con la prevalencia de bajo peso al nacimiento (<2500 gramos, (rsp = −0,42; 95% CI: −0,66; −0,09; p = 0,028) en países europeos en el año 2010. Encontramos una correlación inversa estadísticamente significativa entre el nivel de restricción de fumar en lugares públicos y la prevalencia de bajo peso al nacimiento (<2500 gramos rsp: −0,54; IC 95%: −0,72, −0,10; p = 0,017).

Artículo 2: Díez-Izquierdo, Ana; Lidón-Moyano, Cristina; Martín-Sánchez, Juan Carlos; Matilla-Santande, Núria; Cassanello-Peñarroya, Pia; Balaguer, Albert; Martínez-Sánchez, Jose M. Smoke-free homes and attitudes towards banning smoking in vehicles carrying children in Spain (2016). Environmental Research 2017; 158: 590-597. DOI: 10.1016/j.envres.2017.07.012

Objetivo: Describir la adopción voluntaria de hogares libres de humo y las actitudes sociales en España frente a la prohibición de fumar en los vehículos con niños a bordo.

Resultados: La mayoría de la población encuestada (83,0%) tenía algún tipo prohibición para el consumo de tabaco en el hogar (45,6% restricción completa y 37,5% parcial). Existen diferencias estadísticamente significativas según el grupo de edad (siendo la prevalencia más alta de 86,1% de 66 a 75 años y la prevalencia más baja de 77,8% de 46 a 65 años), según el consumo de tabaco (siendo la prevalencia más alta del 89,4% en nunca fumadores y la más baja del 75,0% en fumadores); con respecto a la prevalencia de hogares sin humo (p <0,05), siendo las prohibiciones parciales más frecuentes en los hogares de fumadores (49,0%). La mayoría de la población (61,6%) está a favor de la prohibición de fumar en automóviles, y el 90,1% apoyó una prohibición en vehículos con menores a bordo.

Las actitudes hacia la regulación del tabaquismo en los vehículos (con o sin niños a bordo) variaron significativamente según el grupo de edad (la prevalencia más alta fue del 81,9% de

66 a 75 años y la prevalencia más baja fue del 54,5% de 18 a 45 años) y según el consumo de tabaco (la prevalencia más alta fue de 71,4% en las personas que nunca habían fumado y la prevalencia más baja fue del 46,0% en los fumadores). Sin embargo, no se encontraron diferencias estadísticamente significativas con respecto a las actitudes hacia la regulación del consumo de tabaco en los vehículos con niños a bordo, independientemente de su sexo, edad, clase social o consumo de tabaco.

Manuscrito 3: Díez-Izquierdo A, Cassanello P, Cartanyà-Hueso À, Matilla-Santander N, Martín JC, Balaguer A, Martinez-Sanchez JM. Prevalencia de hogares libres de humo y exposición pasiva al tabaco en población pediátrica (niños de 3 a 36 meses). *Manuscrito en revisión.*

Objetivo: Describir los hogares libres de humo y la prevalencia de exposición pasiva al HAT en población pediátrica (de 3 a 36 meses) en España.

Resultados: 85,06% de los encuestados afirma tener un hogar libre de humo. El 12,02% de los encuestados tienen regulación parcial o no tiene regulación en el hogar, incrementándose cuando el progenitor es fumador (25,79%) o tiene estudios primarios o inferiores (20,18%). El 5,26% de los padres refiere exposición pasiva al tabaco en niños en el hogar, elevándose hasta el 14,22% cuando se produce en otros ambientes; incrementándose la diferencia entre los padres fumadores, con mayor edad y con menor nivel educativo ($p < 0,05$).

Artículo 4: Díez-Izquierdo, Ana; Cassanello-Peñarroya, Pia, Lidón-Moyano, Cristina; Matilla-Santander, Nuria; Balaguer, Albert; Martínez-Sánchez, Jose M. Update on Thirdhand Smoke: A Comprehensive Systematic Review. Environmental Research. 2018. DOI: 10.1016/j.envres.2018.07.020

Objetivo: Realizar una revisión sistemática de la literatura sobre el humo de tercera mano (HTM).

Resultados: Se incluyeron sesenta y ocho artículos en la revisión sistemática, 28 de ellos analizaron la concentración de la nicotina como componente del HTM (el método más comúnmente usado para medir el HTM en esos estudios fue la cromatografía, seguida de la espectrometría de masas). 21 evaluaron la exposición y el impacto del HTM en la salud (11 estudios analizaron el efecto del HTM en células [humanas y animales], 4 en animales, 1 en adultos y 5 en niños); 16 analizaron las creencias, los comportamientos y las políticas relacionadas con el HTM; y 3 evaluaron otros aspectos como el HTM en cigarrillos electrónicos o pipas. En los 68 estudios, se determinó el HTM midiendo los siguientes componentes: nicotina (30 estudios), nitrosaminas (17 estudios) y cotinina (15 estudios). Los hallazgos de la mayoría de estos estudios sugieren un posible impacto en la salud de la exposición al HTM (es decir citotoxicidad, alteraciones en el metabolismo, en la glucemia o estructura celular, alteraciones en el hígado, los pulmones, la piel y el comportamiento en ratones) y poca concienciación sobre los riesgos del HTM en la población general.

Artículo 5: Díez-Izquierdo, Ana; Cassanello, Pia; Cartanyà, Aurea; Matilla-Santander, Núria; Balaguer, Albert; Martinez-Sanchez Jose M. Knowledge and attitudes towards Thirdhand smoke among parents with children under 3 years in Spain. Pediatric Research. 2018. DOI: 10.1038/s41390-018-0153-2

Objetivo: Caracterizar los conocimientos y creencias sobre el HTM en padres de niños menores de 3 años en España.

Resultados: El 27% de los de los encuestados había oído hablar del HTM. Únicamente encontramos diferencias estadísticamente significativas entre los fumadores, siendo los fumadores quienes declaran un mayor conocimiento sobre el HTM. Un total del 86% de los encuestados creía que el HTM es perjudicial para sus hijos con diferencias estadísticamente significativas según el nivel educativo, más alto entre los padres con titulación universitaria (Odds Ratio ajustada (ORa) = 2,6) y según con los conocimientos previos sobre el HTM (ORa = 2,1).

4. Artículos científicos de la tesis doctoral

4.1. Correlation between tobacco control policies and preterm births and low birth weight in Europe

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Correlation between tobacco control policies and preterm births and low birth weight in Europe

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ABSTRACT

Objective: To assess the correlation between tobacco control policies— particularly smoking bans in work and public places—and the prevalence of preterm births and low birth weight in the European countries.

Methods: This is an ecological study and the unit of analysis set at the country level. Tobacco control data in Europe were obtained for the years 2010 and 2013 as measured by the Tobacco Control Scale (TCS), which reflects the level of implementation of tobacco control policies. Prevalence data for preterm births and low birth weight were obtained from two sources: the European Perinatal Health Report (EPHR), which provides data for 2010, and the Eurostat data, which includes the years 2013 and 2014. We analyzed the correlation between the TCS score and the prevalence of preterm birth and low birth weight in the European countries by means of Spearman (rsp) rank-correlation coefficients and their 95% confidence intervals (95%CI).

Results: The 2010 TCS was negatively correlated with the prevalence of preterm births before week 37 (rsp $= -0.51$; 95% CI: -0.77, -0.15; $p = 0.006$) and week 32 (rsp $= -0.42$; 95%CI: -0.73, -0.01; $p = 0.030$) and with the prevalence of the low birth weight (< 2500 g, (rsp $= -0.42$; 95% CI: -0.66, -0.09; $p = 0.028$) in European countries in 2010. We found a statistically significant inverse correlation between the level of restrictions on smoking in public places and the prevalence of low birth weight (< 2500 g rsp: -0.54; 95%CI: -0.72, -0.10; $p = 0.017$).

Conclusion: The level of smoke-free legislation in European countries correlates with lower preterm birth prevalence rates at the ecological level. Given the important negative effects of premature births for the public health system, these data support greater implementation of smoke-free policies and tend to support the implementation of tobacco control policies, but more research is needed.

1. Introduction

Preterm birth is the main cause of infant morbidity and mortality, with approximately 35% of infant deaths attributed to preterm birth; early births have also been implicated in a high percentage of long-term morbidity (Goldenberg et al., 2008; Blencowe et al., 2012; Howson et al., 2013; Shapiro-Mendoza et al., 2016). Preterm birth rates range from 5% to 18%, with wide variability among countries around the world (Blencowe et al., 2012; Kinney and Lawn, 2017). Despite advances in medical care in recent decades, the rate of preterm births has been increasing, even in developed countries (Blencowe et al., 2012; Kinney and Lawn, 2017).

Active smoking and SHS exposure during pregnancy are associated with several adverse effects during reproduction. Smoking during pregnancy has harmful effects on placenta and fetal growth (Mackay et al., 2012) and it has been implicated in several important

Abbreviations: TCS, Tobacco Control Scale; EPHR, European Perinatal Health Report; rsp, Spearman rank-correlation coefficients; 95%CI, 95% confidence intervals; SHS, secondhand smoke; CIs, confidence intervals; HDI, Human Development Index; GDP, gross domestic product; NICU, neonatal intensive care unit

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complications, including preterm labor (Nabet et al., 2005; Fantuzzi et al., 2007), intrauterine growth restriction, and low birth weight (Mackay et al., 2012). Moreover, there is a strong association between active smoking during pregnancy and preterm births, with a clear dose-response relationship (Simpson, 1957; Kyrklund-Blomberg and Cnattingius, 1998; Shah and Bracken, 2000; Ko et al., 2014). SHS exposure during pregnancy has also been associated with low birth weight and preterm births (Fantuzzi et al., 2007; Shah and Bracken, 2000; Misra and Nguyen, 1999; Windham et al., 1999; Leonardi-Bee et al., 2008; Crane et al., 2011; Wahabi et al., 2013; Jaakkola et al., 2001).

In the last decade, many countries have implemented tobacco control legislation—particularly smoking bans in work and public places—to protect non-smokers from SHS exposure. Similarly, numerous studies have assessed the impact of smoke-free policies and the benefits of such laws on the health of the population (International Agency for Research, 2017). However, those studies focused on adult populations; there is limited evidence on the impact of smoking legislation in pediatric populations (Dove et al., 2011; Jarvis et al., 2012; Been et al., 2015; Filippidis et al., 2017), particularly with regard to preterm births and birth weight (Been et al., 2015, 2014; Cox et al., 2013; Faber et al., 2008; Vicedo-Cabrera et al., 2016; Bakolis et al., 2016; Simón et al., 2017). According to a recent Cochrane review conducted to assess the impact of legislative smoking bans, the effect of such bans on perinatal outcomes (including preterm birth and low birth weight) cannot be determined based on the available evidence (Frazer et al., 2016).

In this context, we hypothesized that tobacco control policies should reduce tobacco consumption and SHS exposure during pregnancy and thereby also reduce preterm and low weight births after implementation of smoke-free legislation. Nevertheless, evidence on this topic in European countries is scant. Therefore, the objective of the present study was to evaluate the correlation between tobacco control policies—particularly smoking bans in work and public places—and the prevalence of preterm births and low birth weight in the European countries.

2. Methods

This is an ecological study with each country as the unit of analysis. Data was obtained from three different sources. We obtained tobacco control data (according to the Tobacco Control Scale; TCS see: http://www.tobaccocontrolscale.org/) in the European countries the years 2010 and 2013 (Joossens and Raw, 2011, 2014, 2006). The TCS provides a score for each country reflecting the level of implementation of tobacco control policies according to six cost-effective policies (Joossens and Raw, 2011, 2014, 2006).

Data on the prevalence of preterm births and low birth weight for the year 2010 were obtained from the European perinatal health report (EPHR) for 28 countries (Committee Euro-Peristat, 2017). The EPHR, published by Euro-peristat, was developed to establish a European perinatal health information system (Committee Euro-Peristat, 2017). We also obtained data on the prevalence of preterm birth and low birth weight in 2013 and 2014 for 14 countries, and in 2015 for 15 countries from the Eurostat. The Eurostat provides statistical information for European countries based on data collected from institutions in the different member countries (Eurostat. Database, 2015).

2.1. Variables

2.1.1. Tobacco control policies

We used data from the TCS (Joossens and Raw, 2011, 2014) to quantify the grade and effort of implementation of tobacco control policies in European countries. TCS is a systematic score system developed and drafted by a group of experts in 2006. It had supported from the European Commission and it can be used in more than 30 European countries, more specifically the TCS for 2010 was used in 30 European countries, and the TCS for 2013 was used in 34 European countries (Joossens and Raw, 2011, 2014). The six policies evaluated in the TCS are as follows (with scores shown in parentheses): 1) price increases through higher taxes on tobacco products (maximum 30 points); 2) bans/restrictions on smoking in public and workplaces (maximum 22 points); 3) better consumer information, including public information campaigns, media coverage and publicizing of research findings (maximum 15 points); 4) comprehensive bans on the advertising and promotion of all tobacco products, logos and brand names (maximum 13 points); 5) large, direct health-warning labels on cigarette boxes and other products (maximum 10 points); and 6) treatment to help dependent smokers to quit, including increased access to medications (maximum 10 points). The maximum TCS score is 100 points, indicating full implementation of all strategies.

2.1.2. Gestational age

We used two different sources to obtain the prevalence of preterm birth for 2010, 2013, 2014 and 2015. From the EPHR (Committee Euro-Peristat, 2017), we obtained the prevalence of preterm birth in the year 2010 for 28 European countries. Possible classifications are as follows: < 37 weeks gestational age, < 32 weeks gestational age or < 28 weeks gestational age.

From the EUROSTAT (Eurostat. Database, 2015), we obtained the prevalence of preterm birth for 14 European countries in 2013 and 2014, and for 15 European countries in 2015. In addition, we estimated the mean rate of preterm birth for 2013, 2014 and 2015 using the data extracted from the calculation of the intervals of gestational age ranges according to the number of births in each country in those years. We classified the data as follows: < 37 weeks gestational age, < 32 weeks gestational age, or < 28 weeks gestational age.

2.1.3. Birth weight

We obtained prevalence rates for low birth weight for the years 2010, 2013, 2014 and 2015 from two different sources, as follows: 1) From the EPHR (Committee Euro-Peristat, 2017), we obtained prevalence rates for babies weighing < 2500 g and < 1500 g in 2010 for 28 European countries. 2) From the EUROSTAT (Eurostat. Database, 2015), we obtained the prevalence of births with weights < 2500 g, < 2000 g, < 1500 g, and < 1000 g in 2013 and 2014 for 14 European countries and in 2015 for 15 European countries.

2.2. Statistical analysis

We analyzed the correlation between the TCS score in 2010 and the prevalence of preterm birth and low birth weight in European countries in the same year by means of Spearman rank-correlation coefficients (rsp). We also calculated 95% confidence intervals (CIs) for these values. In addition, we analyzed the correlation between each one of the six policies from TCS —particularly bans on smoking in workplaces and public places—and the prevalence of preterm births and low birth weight. We performed these same analyses for the TCS score in 2013 data to determine correlations with the prevalence of preterm birth and low birth weight in the years 2013, 2014 and 2015. Moreover, we performed a simple linear regression analysis between the TCS score or the public place bans score as the independent variable and the prevalence of preterm birth or low birth weight as the dependent variable to test for the statistically significant correlations. Finally, to study differences at socioeconomic level, we stratified the countries to perform the correlation according to countries above and below the median of high gross domestic product (GDP) per capita and human development index (HDI).

3. Results

Table 1 shows the data from the TCS and the public place bans policy for the years 2010 and 2013, with the available data on the prevalence of preterm births (< 37 weeks) and low birth weight births

Table 1
Data from TCS for 2010 & 2013 and prevalence of preterm and low birth weight for the years 2010, 2013, 2014 and 2015 for European countries.

	TCS 2010[a]		TCS 2013[a]		Preterm & LBW for 2010[b]		Preterm & LBW for 2013[c]		Preterm & LBW for 2014[c]		Preterm & LBW for 2015[c]	
Country	**TCS**	**Public place bans**	**TCS**	**Public place bans**	**Less than 2500 g**	**Less than 37 weeks**	**Less than 2500 g**	**Less than 37 weeks**	**Less than 2500 g**	**Less than 37 weeks**	**Less than 2500 g**	**Less than 37 weeks**
Austria	32	7	31	8	7.00%	8.50%	–	–	–	–	–	–
Belgium	50	13	47	13	7.30%	8.20%	–	–	–	–	–	–
Bulgaria	40	6	46	15			9.56%	6.45%	9.42%	7.09%	8.95%	6.77%
Cyprus	40	11	33	7	9.80%	10.50%	–	–	–	–	–	–
Czech Republic	34	7	34	9	7.50%	8.00%	8.02%	8.26%	7.68%	7.60%	7.64%	7.35%
Denmark	46	11	46	11	5.10%	6.40%	–	–	–	–	–	–
Estonia	43	12	43	12	4.10%	5.60%	–	–	–	–	–	–
Finland	52	17	55	17	4.30%		4.09%	5.58%	4.17%	5.77%	4.20%	5.70%
France	55	17	57	17	6.40%	6.60%	–	–	–	–	–	–
Germany	37	11	32	11	7.20%	8.50%	–	–	–	–	–	–
Greece	32	7	35	7	–	–	8.89%	11.12%	9.01%	11.41%	9.18%	11.24%
Hungary	34	6	48	13	8.50%	8.90%	8.64%	8.83%	8.61%	8.59%	8.40%	8.59%
Ireland	69	21	70	21	5.10%	5.70%	–	–	5.60%	6.30%	5.62%	6.38%
Italy	47	17	46	15	7.10%	7.40%	–	–	–	–	–	–
Latvia	44	14	41	14	4.80%	5.80%	–	–	–	–	–	–
Lithuania	41	12	35	12	4.70%	5.40%	4.58%	5.46%	4.25%	5.00%	4.12%	4.94%
Luxembourg	33	11	37	15	6.70%	8.10%	–	–	–	–	–	–
Malta	52	17	56	18	7.30%	7.10%	6.72%	5.46%	6.51%	6.70%	6.34%	6.80%
The Netherlands	46	13	47	13	6.20%	7.50%	–	–	–	–	–	–
Poland	43	11	43	11	5.70%	6.60%	5.96%	7.07%	5.92%	7.25%	5.78%	7.21%
Portugal	43	11	41	11	8.30%	7.60%	8.65%	7.82%	8.69%	7.72%	8.88%	7.99%
Romania	45	7	44	7	8.00%	8.20%	8.47%	8.51%	8.21%	8.30%	7.92%	8.32%
Slovakia	41	10	39	10	8.10%	7.10%	7.61%	6.16%	7.82%	6.10%	7.68%	6.04%
Slovenia	44	15	43	15	6.30%	7.20%	–	–	–	–	–	–
Spain	46	17	56	21	8.70%	15.50%	7.70%	6.34%	7.83%	6.47%	7.90%	6.41%
Sweden	51	15	48	15	4.40%	5.90%	–	–	–	–	–	–
United Kingdom	77	21	74	21	6.40%	7.10%	–	–	–	–	–	–
Iceland	61	17	66	17	3.30%	5.20%	–	–	–	–	–	–
Norway	62	17	61	17	4.90%	5.20%	–	–	–	–	–	–
Switzerland	48	11	45	11	6.50%	7.10%	6.57%	7.19%	–	–	6.45%	7.14%
Serbia	–	–	42	11	–	–	6.07%	6.69%	5.99%	6.49%	5.99%	6.51%

Data of the prevalence of preterm (less than 37 weeks) or low birth weight (less than 2500 g) is expressed as a percentage with two decimals. TCS: Tobacco Control Scale (maximum 100 points) quantifies the full implementation of tobacco control policies at country level and collects information about of the six most cost-effective tobacco control policies (Price, Public places bans, Public information campaign spending, Advertising bans, Health warnings, and Treatment); Public place bans: bans/restrictions on smoking in public and work places (maximum 22 points); LBW: Low birth weight.

[a] Data extracted from TCS for 2010 and 2013.

[b] Data extracted from EPHR (European Perinatal Health Report) for 2010.

[c] Data extracted from EUROSTAT for 2013, 2014 and 2015.

(< 2500 g) for European countries with data available for the years 2010, 2013, 2014 and 2015.

Table 2 shows the correlations between the TCS and the prevalence of preterm births and low birth weight. As that table shows, the TCS in 2010 were negatively correlated with the prevalence of preterm births (< 37 weeks and < 32 weeks) in European countries in 2010 (rsp = −0.51; 95% CI: −0.77, 0.15; p = 0.006; rsp = −0.42; 95% CI: −0.73, 0.01; p = 0.03). Similarly, a statistically significant correlation was found between the level of restrictions on smoking in public places in 2010 and the prevalence of preterm births (year 2010) before week 37 (Table 2). We observed similar correlation patterns between the other five tobacco control policies (price, public information campaigns, advertising bans, health warnings, and treatment) and the prevalence of preterm births, but only the level of advertising bans for preterm birth before week 37 (rsp = −0.53; 95%CI: −0.81, −0.10) and before week 32 (rsp = −0.41; 95%CI: −0.69, −0.05) and the price for preterm birth before week 37 (rsp = −0.47; 95%CI: −0.72, −0.13) and before week 28 (rsp = −0.54; 95%CI: −0.81, −0.23) showed a statistically significant correlation.

There was a statistically significant negative correlation between TCS in 2010 and the prevalence of low birth weight (< 2500 g) in European countries in 2010 (rsp = −0.42; 95% CI: −0.66, −0.09; p = 0.028). We also observed a significant inverse correlation between the level of restrictions on smoking in public places and the prevalence of low birth weight (< 2500 g) (rsp = −0.54; 95% CI: −0.72, −0.10; p = 0.017) (Table 2). All five of the other tobacco control policies (price, public information campaigns, advertising bans, health warnings, and treatment) correlated with the prevalence of low birth weight in 2010 (data not shown), but the statistically significant correlations were for the prevalence of births < 2500 g and the level of advertising bans (rsp = −0.50; 95%CI: −0.76, −0.07), the public information campaign (rsp = −0.41; 95%CI: −0.68, −0.05); and for the prevalence of births < 1500 g were the level of advertising bans (rsp = −0.38; 95%CI: −0.68, −0.03) and price (rsp = −0.29; 95%CI: −0.68, −0.01). Similar negative correlations were found among countries when stratifying according to GPD per capita and HDI median, with a higher correlation among countries with the GPD per capita and HDI over the median.

The TCS in 2013 was negatively correlated with the prevalence of preterm births and low birth weight in 2013, 2014 and 2015, although these associations were not statistically significant (Table 2). There was a significant negative correlation between the level of public place smoking bans in 2013 and the prevalence of preterm births before week 37 and week 32 in 2013, before week 32 in 2014 and before week 37 in 2015 (Table 2). The level of public information campaigns in 2013 was significantly negatively correlated with the prevalence of preterm births before week 32 in 2014 (rsp = −0.56; 95%CI: −0.83, −0.13, and with the prevalence of birth < 1500 g and < 1000 g respectively (rsp = −0.62; 95%CI: −0.86, −0.28) (rsp = −0.56; 95%CI: −0.83, −0.11).

The simple linear regression analysis of the statistically significant correlations between the TCS score or the public place bans score as the independent variable and the prevalence of preterm birth or low birth

Table 2
Spearman correlation coefficients (r_{sp}) and thir 95% confidence intervals (95%CI) between TCS and public place bans (2010 and 2013) and prevalence of birth weight and preterm births (2010, 2013, 2014 and 2015) in Europe.

	TCS from 2010 and data of prevalence from 2010[a]		TCS from 2013 and data of prevalence from 2013[b]		TCS from 2013 and data of prevalence from 2014[c]		TCS from 2013 and data of prevalence from 2015[d]	
	TCS	Public place bans	TCS	Public place bans	TCS	Public place bans	TCS	Public place bans
Terms of birth								
Less than 37 weeks (%)	−0.51 (−0.77, −0.15)	−0.47 (−0.76, −0.13)	−0.31 (−0.82, 0.34)	−0.64 (−0.95, −0.09)	−0.21 (−0.75, 0.39)	−0.52 (−0.89, −0.02)	−0.22 (−0.75, 0.39)	−0.53 (−0.88, 0.00)
p-value	0.006	0.013	0.283	0.014	0.468	0.056	0.423	0.040
Less than 32 weeks (%)	−0.42 (−0.73, −0.01)	−0.34 (−0.69, 0.084)	−0.46 (−0.85, 0.22)	−0.69 (−0.92, −0.19)	−0.30 (−0.73, 0.29)	−0.62 (−0.90, −0.15)	−0.03 (−0.54, 0.57)	−0.21 (−0.71, 0.33)
p-value	0.030	0.082	0.101	0.007	0.302	0.019	0.922	0.452
Less than 28 weeks (%)	−0.39 (−0.72, 0.03)	−0.26 (−0.64, 0.21)	−0.03 (−0.59, 0.58)	−0.01 (−0.65, 0.57)	−0.10 (−0.60, 0.48)	−0.14 (−0.68, 0.44)	0.14 (−0.40, 0.58)	0.07 (−0.50, 0.64)
p-value	0.052	0.207	0.923	0.970	0.727	0.623	0.624	0.808
Birth weight								
Less than 2500 g (%)	−0.42 (−0.66, −0.09)	−0.54 (−0.72, −0.10)	−0.09 (−0.61, 0.52)	−0.26 (−0.76, 0.29)	−0.16 (−0.67, 0.43)	−0.33 (−0.75, 0.22)	−0.16 (−0.67, 0.42)	−0.36 (−0.76, 0.17)
p-value	0.028	0.017	0.753	0.373	0.583	0.253	0.567	0.191
Less than 2000 g (%)	–	–	−0.29 (−0.77, 0.34)	−0.45 (−0.84, 0.11)	−0.34 (−0.80, 0.30)	−0.42 (−0.76, 0.10)	−0.25 (−0.72, 0.36)	−0.34 (−0.71, 0.14)
p-value	–	–	0.313	0.109	0.232	0.134	0.375	0.208
Less than 1500 g (%)	−0.37 (−0.72, 0.03)	−0.33 (−0.64, 0.06)	−0.24 (−0.74, 0.51)	−0.39 (−0.77, 0.22)	−0.38 (−0.84, 0.25)	−0.45 (−0.85, 0.10)	−0.17 (−0.68, 0.44)	−0.22 (−0.68, 0.28)
p-value	0.050	0.088	0.408	0.169	0.182	0.103	0.542	0.426
Less than 1000 g (%)	–	–	−0.09 (−0.73, 0.47)	−0.18 (−0.68, 0.47)	−0.31 (−0.63, 0.27)	−0.23 (−0.68, 0.47)	−0.23 (−0.76, 0.34)	−0.37 (0.78, 0.15)
p-value	–	–	0.750	0.539	0.276	0.434	0.407	0.170

There is no data available from the source (EPHR) for birth weight < 2000 g or birth weight < 1000 g.

TCS: Tobacco Control Scale (maximum 100 points) quantifies the full implementation of tobacco control policies at country level and collects information about of the six most cost-effective tobacco control policies (Price, Public places bans, Public information campaign spending, Advertising bans, Health warnings, and Treatment); Public place bans: bans/restrictions on smoking in public and work places (maximum 22 points).

[a] Data from 28 countries (Austria, Belgium, Cyprus, Czech-Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Iceland Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, The Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.) obtained of the European perinatal health report (EPHR).

[b] Data from 14 countries (Bulgaria, Czech Republic, Finland, Greece, Hungary, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Spain, Switzerland, Serbia) obtained of the EUROSTAT.

[c] Data from 14 countries (Bulgaria, Czech Republic, Finland, Greece, Hungary, Ireland Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Spain, Serbia) obtained of the EUROSTAT.

[d] Data from 15 countries (Bulgaria, Czech Republic, Finland, Greece, Hungary, Ireland, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Spain, Switzerland, Serbia) obtained of the EUROSTAT.

weight as the dependent variable show a decrease in the prevalence according to the increase of TCS (negative beta coefficient). However, we have only obtained statistically significant correlations in the coefficient with the public place bans score (data not shown). For the year with the most data (2010), the increase of one point in the public place bans score is estimated to produce a decrease of 1.6 for 1000 in births with low birth weight (less than 2500 g). For data from 2013, 2014, and 2015 the beta coefficient of the regression with statistically significant correlations were similar to that observed in 2010 with the beta coefficient statistically significant in preterm births with less than 37 weeks and with less than 32 weeks (data not shown).

4. Discussion

We found that, at an ecological level, several indicators of the level of tobacco control policies implemented in European countries (as the level of restrictions on smoking in public places, the level of advertising bans, the price or the level of public information campaigns) are inversely related to perinatal outcomes, particularly preterm births. This is the first study to investigate this important pediatric outcome across European countries, as previous studies were conducted only in a single country. The results of this study are consistent with previous individual studies that assessed the impact of smoke-free legislation in perinatal outcomes (Mackay et al., 2012; Fantuzzi et al., 2007; Crane et al., 2011; Jaakkola et al., 2001; Cox et al., 2013; Been et al., 2014; Faber et al., 2017; Vicedo-Cabrera et al., 2016; Bakolis et al., 2016; Simón et al., 2017; El-Mohandes et al., 2010; Bharadwaj et al., 2012).

A published study conducted in Switzerland showed a dose-response relationship between the level of smoking bans and preterm births, with a decline in early-term births (infants born at 37 and 38 weeks of gestation) (Vicedo-Cabrera et al., 2016). A meta-analysis of 11 studies (Been et al., 2014) assessed the impact of smoke-free legislation on perinatal and child health, finding that preterm births and hospital attendance for asthma decreased substantially after implementation of smoke-free legislation. Recently the same working group has updated the meta-analysis (Faber et al., 2017) including 35 studies to examine the effect of smoke-free legislation on perinatal and child health; this study shows that the implementation of smoke-free legislation is associated with significant reductions in the rates of preterm births (Faber et al., 2017). Another meta-analysis (Shah and Bracken, 2000) quantified the relationship between smoking during pregnancy and preterm delivery, finding a positive association between these two factors and a consistent dose-response relationship. The results of our study are in line with the aforementioned meta-analyses: we found a negative correlation between TCS and preterm births, particularly with smoking restriction in public and workplaces.

It is important to highlight the findings of the most recent Cochrane review (published in February 2016), which showed inconclusive results for the effect of legislative smoking bans on reducing preterm births and low birth weight (Frazer et al., 2016). In our study, although we found correlations between TCS and the prevalence of low birth weight, these were only statistically significant with the prevalence of birth weight less than 2500 g in 2010. For this reason, more studies are needed to confirm the real impact of tobacco control policies in perinatal outcomes. Furthermore, it would be highly recommended to analyse the impact of TCS in perinatal outcomes in countries all over the world because the TCS quantify the implementation of tobacco control policies at country level based on 6 policies described by the World Bank (Joossens and Raw, 2011, 2014, 2006). However, the TCS is the result of a survey of tobacco activity carried out in European countries and the survey was distributed through the correspondents of European Network for Smoking and Tobacco Prevention (ENSP) who had agreed to fill in their country data (European Cancer Leagues and Institut Català d'Oncologia, 2017).

Our results are consistent with other studies that have found that smoking bans are associated with reductions in the risk of preterm birth (Mackay et al., 2012; Cox et al., 2013; Bakolis et al., 2016; Simón et al., 2017; Bharadwaj et al., 2012). Specifically, we found that the prevalence of preterm births (before 37 weeks and 32 weeks) decreases with a higher TCS in public place smoking bans. Our hypothesis with the correlations for preterm births is that a larger sample size in 2013, 2014 and 2015 would show similar results. However, we did not find associations. A study conducted in Belgium reported similar results: the rate of preterm births in that country decreased after the implementation of various types of smoking bans, in particular workplace smoking prohibitions but also, to a lesser extent, smoking bans in restaurants and bars serving food (Cox et al., 2013). Following this trend, two studies have recently been published showing in two different European countries a decline in the rates of preterm and low birth weight after the introduction of smoking legislation (Bakolis et al., 2016; Simón et al., 2017). Smoking restrictions in public and workplaces, without assigning less importance to the other five policies from TCS, are especially relevant in this case, because it is a direct way of reducing SHS exposure in pregnant women and their children, reducing the risk of preterm delivery.

We observed a negative correlation between TCS and the prevalence of low birth weight in 2010, and between the level of restriction of smoking in public places and low birth weight in the same year. Although results were only statistically significant for the year 2010, other studies have found a significant association between these variables. Our hypothesis, as for preterm births, is that a larger sample size in 2013, 2014 and 2015 would show similar results, however, we have not been able to demonstrate it. A study carried out in Norway in 2004 found that the extension of smoking restrictions to bars and restaurants had a large effect on birth weight (Bharadwaj et al., 2012). Similarly, when legislation was introduced in Scotland in 2006 to prohibit smoking in public spaces, this resulted in a statistically significant reduction in low birth weight (Mackay et al., 2012). In addition, other studies have reported a statistically significant reduction in the incidence of small for gestational age births after the introduction of anti-smoking policies (Mackay et al., 2012; Kabir et al., 2013).

We have chosen to focus our study on preterm births because this is the second leading cause of death in children under age 5 and prematurity also increases the risk of death due to other causes (Blencowe et al., 2012; Liu et al., 2012). Although the proportion of deaths due to preterm birth is reported to be lower in low-income countries than in high-income countries, the cause-specific rates are much higher in low- and middle-income countries than in high-income countries (high gross domestic product (GDP) per capita), resulting in a major survival gap for preterm depending on which country they are born in. Most preterm infants from 28 to 32 weeks need special care at birth, and in cases of preterm infants with less than 28 weeks of age they need a neonatal intensive care unit (NICU) to survive and adequate NICUs are not available in many low- or middle-income countries. In this sense, we observed negative correlation among countries with high GPD per capita or HDI, with a higher correlation among the countries with a GPD per capita or HDI over the median (data not shown).

The main limitation of our study is the ecological design, which does not allow us to extrapolate the associations found at the country level to individuals. Similarly, the study design does not permit adjustments for potential individual confounders such as the age of the mother, the smoking status during the pregnancy of the mother and other family members, the socioeconomic status of the family, or the use of assisted reproductive technology. These variables could be a confounder or mediates between tobacco control policies and perinatal outcomes. Nevertheless, our results are in line with previous studies conducted at the individual level (Mackay et al., 2012; Cox et al., 2013; Vicedo-Cabrera et al., 2016; Bharadwaj et al., 2012; Kabir et al., 2013). Another potential limitation is the 2013, 2014 and 2015 prevalence data for preterm births and birth weights provided by Eurostat are only available for a limited number of countries. For this reason, the statistical power in the estimations of correlation significance could be low. In addition, the data of the EPHR are from 2010 because there are no more updated published data. However, the correlations between TCS and prevalence in the countries with available data for 2013, 2014 and 2015 are consistent with the comparison conducted using data from 2010, which included a much greater number of countries. An important strength of this study is that we performed three comparisons of two different TCS for four different years. This is a strength because we found consistent results in terms of the observed correlations. Moreover, the time interval between the TCS (2013 data) and the Eurostat data (2014 and 2015) provides an optimal time frame (1 year and 2 years respectively) to observe the potential effects of tobacco control policies on preterm and weight to birth.

Preterm births, even late preterm, are associated with clinical complications (Raju, 2012). Moreover, preterm births can have lifelong effects on children and, consequently, a high economic cost for governments (Blencowe et al., 2012; Liu et al., 2012). For many years, a variety of preventive measures have been implemented to reduce the prevalence of prematurity; unfortunately, these efforts have been largely unsuccessful (Blencowe et al., 2012; Liu et al., 2012). The implementation of smoke-free laws, as our data show, has the potential to yield considerable public health benefits. In conclusion, our study shows that the level of smoke-free legislation among European countries is correlated with a decrease in the prevalence of preterm birth at the ecological level. These findings suggest greater implementation of tobacco control policies with European countries and worldwide.

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Contributors' statements

Jose M. Martínez-Sanchez: conceptualized and designed the study, coordinated and supervised data collection, critically reviewed the manuscript, and approved the final manuscript as submitted. He is the principal investigator.

Ana Díez-Izquierdo: collected the data and prepared the database, drafted the initial manuscript and approved the final manuscript as submitted.

Cristina Lidón-Moyano: analyzed the data and critically reviewed the manuscript, and approved the final manuscript as submitted.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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4.2. Smoke-free homes and attitudes towards banning smoking in vehicles

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Smoke-free homes and attitudes towards banning smoking in vehicles carrying children in Spain (2016)

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ABSTRACT

Objective: To describe the voluntary adoption of smoke-free homes and social attitudes in Spain towards banning smoking in vehicles in which children are present.

Methods: Cross-sectional study of a representative sample of the adult Spanish population age range, 18–75 years (n = 1036). The field work was conducted via a computer-assisted telephone survey in March and April 2016. Survey respondents answered questions about smoking rules at home and attitudes towards a smoking ban in cars with or without children. Home smoking rules were defined as complete (smoking not allowed anywhere in the house), partial (smoking allowed in some areas inside the house) or absent (smoking allowed everywhere).

Results: Most (83.0%) of the surveyed population had some type of smoking restriction in place at home (45.6% complete and 37.5% partial). There were significant differences between groups according to age group (the highest prevalence was 86.1% from 66 to 75 years and the lowest prevalence was 77.8% from 46 to 65 years) and smoking status (the highest prevalence was 89.4% in people who had never been smokers and the lowest prevalence was 75.0% in current smokers) with regards to the prevalence of smoke-free homes ($p < 0.05$), with partial bans more prevalent in smoking households (49.0%). Most (61.6%) of the population favored banning smoking in cars, and 90.1% supported a ban in cars carrying minors. Attitudes towards smoking regulation in cars (with or without children) varied significantly by age group (the highest prevalence was 81.9% from 66 to 75 years and the lowest prevalence was 54.5% from 18 to 45 years) and smoking status (the highest prevalence was 71.4% in people who had never been smokers and the lowest prevalence was 46.0% in current smokers). However, no significant differences were found with regard to attitudes towards smoking regulation in cars carrying children, regardless of sex, age, social class, or smoking status.

Conclusion: Approximately half of the adult population in Spain have implemented a complete smoke-free rule at home. More than 9 out of 10 adults favor regulating smoking in cars in the presence of minors. These findings support the expansion of smoke-free regulations to include private vehicles, particularly when minors are in the car.

1. Introduction

Second-hand smoke (SHS) exposure has harmful health consequences because non-smokers exposed to SHS inhale the same damaging substances as active smokers (Oberg et al., 2011; U.S. Department of Health and Human Services, 2006; Strachan and Cook, 1997; Cook and Strachan, 1997). Children are more vulnerable to SHS because of their still-developing immune system, their faster breathing rate, and their inability (in some cases) to avoid the source (Semple et al., 2012, 2010; Rees and Connolly, 2006). SHS exposure has been associated with an increased risk of sudden infant death syndrome (Alm et al., 1998; Hawkins et al., 2016; Dybing and Sanner, 1999; Rees and

Abbreviations: aOR, adjusted Odds Ratio; CDC, Centers for Disease Control and Prevention; CI, Confidence Intervals; cOR, crude Odds Ratio; MUH, Multiunit Housing; Odds Ratio, OR; SHS, Secondhand Smoke; INE, Spanish National Institute of Statistics; US, United States of America; WHO, World Health Organization

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Connolly, 2006) and an increase in respiratory diseases such as asthma, persistent wheezing (Cheraghi and Salvi, 2009; Lewis et al., 1995; Tsai et al., 2010; Hawkins et al., 2016; Rees and Connolly, 2006), and otitis media in children (Dybing and Sanner, 1999; Oberg et al., 2011; Rees and Connolly, 2006; Adair-Bischoff and Sauve, 1998).

It is well-known that there is no safe level of SHS exposure (U.S. Department of Health and Human Services, 2006); consequently, in the last decade many countries have implemented laws to protect non-smokers from SHS exposure in indoor workplaces and public places (Oberg et al., 2011; U.S. Department of Health and Human Services, 2006; Guangyuan Liu et al., 2014). Moreover, there is a growing body of evidence indicating that the implementation of smoke-free laws has not—as one might suspect—led to an increase in tobacco use in private settings such as homes or cars (Jarvis et al., 2012; Martínez-Sánchez et al., 2014). Rather, the available evidence suggests that implementation of anti-smoking legislation is associated with a decrease in children's SHS exposure and with an increase in the percentage of smoke-free homes (Martínez-Sánchez et al., 2014; Sims et al., 2012; Jarvis et al., 2012; Lidón-Moyano et al., 2016). Similarly, smoke-free legislation seems to have had a positive impact on the pediatric population (Mackay et al., 2010, 2012; Been et al., 2015, 2014; Millett et al., 2013), as evidenced by reported health benefits associated with smoke-free bans in several countries, including a lower asthma-related hospital admission rate (Mackay et al., 2010; Millett et al., 2013) and a decrease in the rate of preterm births (Been et al., 2014; Mackay et al., 2012).

Despite this progress, many children are still exposed to SHS in private settings (predominantly in homes and cars) (Halterman et al., 2006). These places, where, after school, children spend much of their time, remain somewhat controversially unregulated. At present, there is an open debate on whether smoke-free legislation should be extended to private settings, with some suggesting that this could further reduce the social acceptability of public tobacco use, thereby promoting smoking cessation efforts and positively benefitting the health of the entire population (Kruger et al., 2015; Hopkins et al., 2010; USDHHS, 2012; Pizacani et al., 2004). In this sense, there is growing evidence that children living in homes with absolute smoking bans have lower levels of urinary cotinine (Wakefield et al., 2000; Blackburn et al., 2003).

In Spain, the current law governing smoking (Law 42/2010) (Gobierno de España, 2010) explicitly prohibits smoking in any enclosed space within any communal areas (elevators, hallways, stairs, etc.). However, this law leaves the decision to prohibit smoking in open spaces (common patios, terraces, gardens, swimming pools) not designated as children's areas to the board of owners (Law 42/2010) (Gobierno de España, 2010).

Given this context, the objective of the present study was to assess and describe the prevalence of smoke-free homes in Spain and to evaluate social attitudes towards regulating tobacco use in vehicles with or without children.

2. Methods

This was a cross-sectional study of a representative sample of the Spanish adult population between 16 and 75 years of age (n = 1045). For this study, we have excluded those under 18 years old (n = 9) because they would not be able to purchase cigarettes legally, they would have less decision-making in the smoking policy in the home, and in terms of smoking in motor vehicles with a minor they would be considered minors. The final sample for this study was 1036 participants.

We used data from the ÓMNIBUS survey from the DYM Institute (DYM, 2015). The sample size was calculated using the simple random sampling formula ($N = ((Z\alpha/2 \cdot p \cdot (1-p))/e)^2$), using a 50% estimated prevalence (p; prevalence that maximizes the sample size), a 95% confidence level ($\alpha = 0.05$) ($Z\alpha/2 = 1.96$) and a precision of 3.15%. The ÓMNIBUS survey is a cross-sectional study with more than one variable of interest. For this reason, the estimated prevalence is 50% to maximize the sample size and the power, although the prevalence of the different variables could be higher or lower. In this sense, having a greater sample size maximizes the external validity of the estimation. However, the precision used (3.15%) is lower than the precision commonly used in the National Health Surveys (precision between 2% and 2.5%) in order to increase the feasibility of the fieldwork. In this sense, increasing the precision (from 2.5% to 3.15%) affects the increase in the amplitude of the confidence interval. The survey was conducted in March and April 2016 using computer-assisted telephone interviews in Spanish. Households were randomly selected for interviews from municipal telephone directories. The interviewee was selected according to quotas based on age, sex, and work activity; this was necessary to ensure a final sample weighted by study design weights (inverse probability) based on the distribution of the data obtained by the Spanish National Institute of Statistics (INE) to obtain a greater representation of Spain. The weighting was performed by sex, age, area of residence (i.e., East, South, etc.), size of municipality of residence, and occupation.

2.1. Variables

We obtained information from the survey respondents (n = 1036) about the voluntary implementation of smoke-free homes and about attitudes towards a smoking ban in common areas of multiunit housing (MUH) buildings (e.g.: apartments, flats, building, etc.) and in vehicles (with or without children).

2.1.1. Smoke-free home

To estimate the prevalence of smoke-free homes, we asked the following question: “Which of the following situations best describes the smoking rules inside your house? 1) ‘Nobody can smoke’; 2) ‘You can only smoke in some places’; or 3) ‘You can smoke everywhere’. Based on the responses to this question, we defined household smoking rules as complete (smoking not allowed inside or connected outdoor areas of the house), partial (smoking allowed in some places inside or in connected outdoor areas of the house), or absent (smoking allowed everywhere inside the house). We then dichotomized this variable as ‘rules’ vs. "no rules" to indicate, respectively, the existence of some kind of smoking rules (complete or partial) or no smoking rules in the house.

2.1.2. Attitudes towards smoking regulations in common areas (i.e. elevator, stairs, walkways, etc.) of MUH

We measured attitudes towards smoking regulation in common areas using the following question: “Should smoking be prohibited within the common areas (i.e.: elevator, stairs, lobby, walkways, etc.) of MUH, with six possible answers: “totally agree”, “agree”, “neither agree nor disagree”, “disagree”, “totally disagree”, “don’t know/no answer”. We recoded this variable according to whether the respondents agreed with regulating smoking (“totally agree” and “agree”), disagreed (disagree” and “totally disagree”), and neither agree nor disagree (“neither agree nor disagree”). We asked all participants this question regardless of where they lived (flat, multiunit housing, house, etc.).

2.1.3. Attitudes towards smoking regulations in vehicles

We assessed attitudes towards regulating smoking in cars in general and in cars carrying children (minors). Smoking "in the presence of a child" was defined as smoking inside a vehicle where a minor under 18 was present. We asked the following two questions: “Should smoking be prohibited inside cars in the presence of minors?" and "Should smoking be prohibited inside cars, without exception?". The possible answers for both questions were: “totally agree”, “agree”, “neither agree nor disagree”, “disagree”, “totally disagree”, “don’t know/no answer”. Again, we recoded this variable according to whether the respondents agreed with regulating smoking (“totally agree” and “agree”), disagreed (disagree” and “totally disagree”), and neither agree nor disagree (“neither agree nor disagree”).

2.2. Statistical analysis

We calculated the percentages for responses about: a) the voluntary implementation of smoke-free homes; b) attitudes towards smoking regulation in house common areas; and c) attitudes towards smoking regulation in cars (with and without minors). Respondents who answered "don't know / no answer" were excluded from the analysis. All responses were stratified by the following categories: sex; age (categorized as young adults, aged 18–45 years; adults, age 46–65; and elderly, age 66–75); social class (categorized into high, medium, and low according to the educational level of the respondent and the occupation of the primary provider in the family); educational level (categorized as primary or lower (no qualification up to middle school diploma), secondary or intermediate (high school) and university or higher (university degree)); inhabitants (< 20.000; from 20.000 to 250.000, > 250.000); geographical area (north, center, south); and cigarette smoking status (categorized as "current smoker", defined as daily or occasional smokers at the time the survey was conducted; "former smoker", which were participants who did not smoke cigarettes at the time of the survey but who had smoked cigarettes in the past; and "never-smokers", participants who had never smoked cigarettes). We compared the prevalence using a Chi Square test. We also calculated the crude odds ratios (cOR) with 95% confidence intervals (CI) and the adjusted OR (aOR) for sex, age, inhabitants, and social class. For the attitudes to the regulation we fitted a multinomial regression model using category of disagree as a reference in order to calculate the ORc and ORa. Data analyses were performed using the SPSS statistical software program, version 21. In addition, all statistical analyses were weighted in accordance with the sample design.

3. Results

Table 1 shows the prevalence of some type of smoke-free home classified by the participants' demographic and social characteristics. Most participants (83.0%; 95% CI: 80.6–85.2) declared having adopted some type of smoke-free rules at home (complete ban in 45.6% and partial ban in 37.5%). 58.5% (95% IC: 49.2–67.3) of participants in the older age group had complete rules versus 27.6% (95% IC: 20.1–36.6) with partial rules. In addition, there is also a higher percentage of complete rules than partial among never smokers (54.4% versus 35%, $p < 0.05$) (Table 1). The differences according to smoking status in the age-adjusted prevalences were also higher among never smokers (data not shown). After adjusting for sex, age, inhabitants, and social class, the same patterns remained significant.

Slightly less than half (45.6%; 95%CI: 42.5–48.7) of the participants reported having adopted a complete smoke-free home, although with significant differences by age group and smoking status (Tables 1, 2). Partial smoking bans were implemented in 37.5% (95% CI: 34.5–40.5) of households, with significant differences according to age group. The highest prevalence of partial smoking ban was found in the younger age group (18–45 years) with a 39.6% (95%CI: 35.5–43.8) and the lowest was found in the older age group (66–75 years) with a 27.6% (95%CI: 20.1–36.6). Significant differences of partial smoking ban were also found for smoking status; being 49.0% (95%CI: 43.0–55.1) in current smokers and 30.8% (95%CI: 25.8–36.3) in former smokers (Tables 1, 2). The percentage of homes of current smokers with a partially smoke-free home was significantly higher than smoking households with completely smoke-free homes (49.0% vs. 26.0%, $p < 0.05$). The odds ratios (ORc and ORa) were consistent with this finding (Table 2). No statistically significant differences were found according to social class, educational level, inhabitants and geographical area.

85.7% of participants declared to be in favor of banning smoking in common areas of buildings, while 6.6% disagree, and 7.7% responded to neither agree nor disagree. Table 3 shows the percentage of respondents in favor of banning smoking in common areas of buildings according to independent variables. There were statistically significant differences in the percentages of people who

Table 1
Prevalence of smoke-free homes in Spain (2016).

		Any type of rules (complete and partial)			Complete rules			Partial rules		
	n	%	95% CI	p-value	%	95% CI	p-value	%	95% CI	p-value
Overall	1036	83.0	80.6 – 85.2	–	45.6	42.5 – 48.7	–	37.5	34.5 – 40.5	–
Sex				0.362			0.203			0.037
Men	515	82.0	78.2 – 85.1		47.7	43.3 – 52.1		34.2	30.1 – 38.5	
Women	521	84.2	80.7 – 87.2		43.5	39.2 – 48.0		40.7	36.4 – 45.0	
Age group (Years)				0.004			0.002			0.048
18–45	547	85.9	82.6 – 88.6		46.3	42.1 – 50.6		39.6	35.5 – 43.8	
46–65	367	77.8	73.1 – 81.9		40.2	35.2 – 45.4		37.6	32.7 – 42.8	
66–75	105	86.1	78.4 – 91.5		58.5	49.2 – 67.3		27.6	20.1 – 36.6	
Social class				0.751			0.128			0.077
Low	111	80.7	71.9 – 87.4		50.7	41.1 – 60.3		30.0	21.8 – 39.5	
Medium	745	83.1	80.2 – 85.7		43.6	40.1 – 47.3		39.5	36.0 – 43.1	
High	180	84.1	77.8 – 89.0		50.5	43.0 – 58.0		33.6	26.8 – 41.0	
Educational level				0.113			0.676			0.552
Low	317	81.1	76.3 – 85.2		43.6	38.1 – 49.3		37.5	32.2 – 43.1	
Medium	374	86.3	82.3 – 89.5		47.0	41.8 – 52.2		39.3	34.4 – 44.5	
High	344	81.3	76.7 – 85.2		45.9	40.6 – 51.3		35.4	30.4 – 40.7	
Inhabitants				0.899			0.210			0.128
< 20.000	329	82.3	77.7 – 86.6		45.9	40.4 – 51.4		36.4	31.3 – 41.9	
20.000–250.000	380	83.1	78.9 – 86.6		48.5	43.4 – 53.7		34.6	29.9 – 39.6	
> 250.000	327	83.7	79.1 – 87.4		41.9	36.5 – 47.5		41.8	36.4 – 47.3	
Geographic area				0.158			0.176			0.160
North	327	84.0	79.5 – 87.7		49.8	44.3 – 55.4		34.2	29.1 – 39.7	
Center	494	84.3	80.7 – 87.3		43.9	39.5 – 48.4		40.4	36.1 – 44.9	
South	215	78.7	72.5 – 83.8		43.1	36.5 – 50.1		35.5	29.2 – 42.4	
Tobacco smoking				< 0.001			< 0.001			< 0.001
Current smokers	275	75.0	69.4 – 79.9		26.0	21.0 – 31.7		49.0	43.0 – 55.1	
Former smokers	315	81.1	76.3 – 85.2		50.3	44.7 – 56.0		30.8	25.8 – 36.3	
Never-smokers	446	89.4	86.0 – 92.0		54.4	49.6 – 59.0		35.0	30.6 – 39.7	

CI: Confidence intervals.

Table 2
Association between smoke-free homes and sociodemographic variables in Spain (2016).

		Any type of rules (complete and partial)				Complete rules				Partial rules			
	n	cOR	95%CI	aOR	95%CI	cOR	95%CI	aOR	95%CI	cOR	95%CI	aOR	95%CI
Sex													
Men	515	ref.	–	ref.	–	1.2	0.9 – 1.5	1.2	0.9 – 1.6	ref.	–	ref.	–
Women	521	1.2	0.8 – 1.7	1.2	0.8 – 1.7	ref.	–	ref.	–	1.3	1.0 – 1.7	1.3	1.0 – 1.8
Age group (years)													
18–45	547	1.7	1.2 – 2.5	1.7	1.2 – 2.5	1.3	1.0 – 1.7	1.3	1.0 – 1.7	1.7	1.1 – 2.8	1.7	1.0 – 2.8
46–65	367	ref.	–	ref.	–	ref.	–	ref.	–	1.6	1.0 – 2.6	1.6	0.9 – 2.6
66–75	105	1.8	1.0 – 3.1	1.8	1.0 – 3.3	2.1	1.4 – 3.3	2.1	1.3 – 3.3	ref.	–	ref.	–
Social class													
Low	111	ref.	–	ref.	–	1.3	0.9 – 2.0	1.2	0.8 – 1.8	ref.	–	ref.	–
Medium	745	1.2	0.7 – 2.0	1.3	0.7 – 2.5	ref.	–	ref.	–	1.5	1.0 – 2.4	1.4	0.9 – 2.2
High	180	1.3	0.7 – 2.4	1.3	0.7 – 2.5	1.3	0.9 – 1.9	1.3	0.9 – 1.9	1.2	0.7 – 2.0	1.7	0.6 – 1.8
Educational level													
Low	317	ref.	–	ref.	–	ref.	–	ref.	–	1.1	0.8 – 1.5	1.3	0.9 – 1.8
Medium	374	1.5	1.0 – 2.2	1.4	0.9 – 2.2	1.1	0.8 – 1.6	1.3	0.9 – 1.8	1.2	0.8 – 1.6	1.2	0.8 – 1.6
High	344	1.01	0.7 – 1.5	0.9	0.6 – 1.4	1.1	0.8 – 1.5	1.2	0.8 – 1.7	ref.	–	ref.	–
Inhabitants													
< 20.000	329	ref.	–	ref.	–	1.2	0.9 – 1.6	1.2	0.9 – 1.7	1.1	0.8 – 1.5	1.1	0.8 – 1.5
20.000–250.000	380	1.1	0.7 – 1.6	1.1	0.7 – 1.6	1.3	1.0 – 1.8	1.4	1.0 – 1.9	ref.	–	ref.	–
> 250.000	327	1.1	0.7 – 1.6	1.1	0.7 – 1.6	ref.	–	ref.	–	1.4	1.0 – 2.0	1.4	1.0 – 2.0
Geographic area													
North	327	1.4	0.9 – 2.3	1.5	0.9 – 2.4	1.3	0.9 – 1.9	1.4	1.0 – 2.1	ref.	–	ref.	–
Center	494	1.5	1.0 – 2.2	1.4	0.9 – 2.2	1.0	0.7 – 1.5	1.1	0.7 – 1.5	1.3	1.0 – 1.8	1.3	1.0 – 1.8
South	215	ref.	–	ref.	–	ref.	–	ref.	–	1.1	0.7 – 1.6	1.1	0.8 – 1.7
Tobacco smoking													
Current smokers	275	ref.	–	ref.	–	ref.	–	ref.	–	2.2	1.5 – 3.1	2.1	1.5 – 3.0
Former smokers	315	1.4	0.9 – 2.2	1.5	1.0 – 2.3	2.9	2.0 – 4.2	2.9	2.0 – 4.2	ref.	–	ref.	–
Never-smokers	446	2.8	1.8 – 4.3	2.7	1.7 – 4.1	3.4	2.4 – 4.8	3.4	2.3 – 4.8	1.2	0.9 – 1.7	1.2	0.8 – 1.6

cOR: Crude Odds Ratio. aOR: Adjusted Odds Ratio for sex, age, inhabitants, and social class. CI: Confidence intervals. The reference category to calculate the OR was the category with the lowest prevalence.

Table 3
Prevalence of respondents who support regulations to prohibit smoking in common areas of multihousing units in Spain (2016).

		Support regulation smoking in Commons areas						
	n	%	95% CI	p-value	cOR	95%CI	aOR	95%CI
Overall	1036	85.7	83.4 – 87.8	–	–	–	–	–
Sex				0.448				
Men	515	85.5	82.1 – 88.4		ref.	–	ref.	–
Women	521	85.9	82.5 – 88.7		1.4	0.8 – 2.5	1.4	0.8 – 2.5
Age group (years)				0.694				
18–45	547	85.2	81.8 – 88.0		ref.	–	ref.	–
46–65	367	86.3	82.2 – 89.5		1.2	0.6 – 2.2	1.2	0.7 – 2.2
66–75	105	86.5	78.9 – 91.8		2.0	0.7 – 5.3	2.3	0.8 – 6.5
Social class				0.292				
Low	111	77.9	68.9 – 85.0		ref.	–	ref.	–
Medium	745	86.3	83.6 – 88.7		1.6	0.7 – 3.7	1.8	0.8 – 4.3
High	180	88.0	82.1 – 92.2		2.5	0.9 – 7.0	2.9	1.0 – 8.4
Educational level				0.014				
Low	317	80.3	75.4 – 84.4		ref.	–	ref.	–
Medium	374	87.0	83.1 – 90.0		1.8	1.0 – 3.5	2.6	1.1 – 6.1
High	344	89.3	85.4 – 92.2		2.5	1.1 – 5.7	2.0	1.0 – 4.0
Inhabitants				0.239				
< 20.000	329	81.9	77.2 – 85.8		ref.	–	ref.	–
20.000–250.000	380	87.4	83.5 – 90.4		1.1	0.5 – 2.1	1.0	0.5 – 2.0
> 250.000	327	87.7	83.5 – 90.9		1.5	0.8 – 2.9	1.4	0.7 – 2.7
Geographic area				0.122				
North	327	88.5	84.45 – 91.7		1.7	0.8 – 3.2	1.6	0.8 – 3.1
Center	494	83.3	79.6 – 86.4		ref.	–	ref.	–
South	215	87.0	81.5 – 91.0		1.9	0.9 – 4.3	2.3	1.0 – 5.2
Tobacco smoking				0.023				
Current smokers	275	81.0	75.8 – 85.4		ref.	–	ref.	–
Former smokers	315	86.3	81.9 – 89.8		2.5	1.1 – 5.4	1.4	0.9 – 2.2
Never-smokers	446	88.2	84.7 – 91.0		1.8	0.9 – 3.4	1.7	0.9 – 3.3

cOR: Crude Odds Ratio. aOR: Adjusted Odds Ratio for sex, age, inhabitants, and social class. CI: Confidence intervals. The reference category to calculate the OR was the category with the lowest prevalence.

Table 4
Percentage and OR of respondents who are in favor of regulating smoking in vehicles with and without children in Spain (2016).

		In cars with children							In all cars (with or without children)						
	n	%	95% CI	p-value	ORc	95%CI	ORa	95%CI	%	95% CI	p-value	ORc	95%CI	ORa	95%CI
Overall	1036	90.1	88.1 – 91.8	–	–	–	–	–	61.6	58.6 – 64.6	–	–	–	–	–
Sex				0.770							0.013				
Men	515	89.6	86.5 – 92.0		ref.	–	ref.	–	59.9	55.5 – 64.2		ref.	–	ref.	–
Women	521	90.6	87.7 – 92.9		1.4	0.7 – 2.9	1.4	0.7 – 2.9	63.3	59.0 – 67.6		1.6	1.1 – 12.2	1.6	1.1 – 2.2
Age group (years)				0.443							< 0.001				
18–45	547	89.1	86.2 – 91.2		ref.	–	ref.	–	54.5	50.2 – 58.7		ref.	–	ref.	–
46–65	367	90.6	87.0 – 93.3		0.9	0.4 – 1.9	0.9	0.4 – 2.0	65.5	60.4 – 70.3		1.4	1.0 – 2.1	1.5	1.0 – 2.1
66–75	105	92.9	86.4 – 96.6		1.8	0.5 – 6.6	2.3	0.6 – 8.9	81.9	73.7 – 88.1		5.4	2.4 – 12.2	5.4	2.3 – 12.6
Social class				0.125							0.845				
Low	111	85.6	77.4 – 91.3		ref.	–	ref.	–	59.3	49.5 – 68.4		ref.	–	ref.	–
Medium	745	90.1	87.7 – 92.1		2.1	0.9– 5.02	2.3	0.9 – 6.0	62.4	58.8 – 65.9		0.7	0.4 – 1.3	0.9	0.5 – 1.7
High	180	92.8	87.8 – 96.0		6.6	1.5 – 27.9	7.5	1.7 – 33.7	60.0	52.5 – 67.2		0.8	0.4 – 1.6	1.0	0.5 – 2.1
Educational level				0.010							0.448				
Low	317	87.3	83.0 – 90.6		ref.	–	ref.	–	64.8	59.3 – 70.0		1.	0.9 – 2.1	1.1	0.7 – 1.8
Medium	374	89.4	85.7 – 92.2		2.3	1.0 – 5.3	2.3	0.9 – 6.0	61.4	56.3 – 66.3		1.1	0.7 – 1.6	1.1	0.7 – 1.7
High	344	93.5	90.2 – 95.8		3.4	1.4 – 8.2	3.0	1.1 – 8.0	58.9	53.5 – 64.1		ref.	–	ref.	–
Inhabitants				0.872							0.743				
< 20.000	329	89.4	85.4 – 92.4		ref.	–	ref.	–	62.1	56.8 – 67.5		1.0	0.7 – 1.5	1.1	0.7 – 1.6
20.000–250.000	380	90.2	86.7 – 93.0		1.3	0.5 – 3.0	1.2	0.5 – 2.9	62.8	57.7 – 67.7		0.9	0.6 – 1.4	0.9	0.6 – 1.3
> 250.000	327	90.7	86.9 – 93.5		1.5	0.7 – 3.3	1.3	0.6 – 3.0	59.6	54.0 – 64.9		ref.	–	ref.	–
Geographic area				0.137							0.295				
North	327	92.0	88.3 – 94.6		1.5	0.7 – 3.6	1.5	0.6 – 3.6	64.9	59.5 – 70.0		1.3	0.9 – 2.0	1.3	0.9 – 1.9
Center	494	88.3	85.1 – 90.9		ref.	–	ref.	–	58.8	54.3 – 63.1		ref.	–	ref.	–
South	215	91.4	86.6 – 94.6		1.0	0.4 – 2.5	1.2	0.5 – 3.0	63.2	56.3 – 69.6		1.4	0.9 – 2.3	1.5	0.9 – 2.5
Tobacco smoking				0.040							< 0.001				
Current smokers	275	85.5	80.7 – 89.4		ref.	–	ref.	–	46.0	40.0 – 52.1		ref.	–	ref.	–
Former smokers	315	91.4	87.6 – 94.2		1.2	0.5 – 3.2	1.1	0.5 – 2.9	61.4	55.8 – 66.8		2.4	1.5 – 3.7	2.2	1.4 – 3.4
Never-smokers	446	92.0	88.9 – 94.2		1.1	0.5 – 2.6	1.1	0.4 – 2.4	71.4	66.9 – 75.5		4.3	2.8 – 6.7	4.2	2.7 – 6.4

cOR: Crude Odds Ratio. aOR: Adjusted Odds Ratio for sex, age, inhabitants, and social class. CI: Confidence intervals. The reference category to calculate the OR was the category with the lowest prevalence.

declared to be in favor of banning smoking in common areas of buildings according to educational level and smoking status (Table 3).

90.1% of participants declared to be in favor of banning smoking in cars with children on board, 4.6% of respondents disagree, and 5.3% responded to neither agree nor disagree. Table 4 shows the percentage of respondents in favor of banning smoking in vehicles with children and in all cars (with or without children). No statistically significant differences in the percentages of people who declared to be in favor of banning smoking in presence of children were found among the various sociodemographic categories except smoking status and educational level (Table 4). The strongest support for this ban in cars with children was in never-smokers (92.0%; 95%CI: 88.9–94.2) and among people with high educational level (93.5%; 95%CI: 90.2–95.8). Additionally, 61.6% of participants declared to be in favor of banning smoking in cars without exceptions (with or without children on board), 22.0% respondents disagree, and 16.4% responded to neither agree nor disagree. Statistically significant differences of people who declared to be in favor of banning smoking in cars without exceptions were found by sex, age group and smoking status (Table 4). The strongest support for this ban in cars without exceptions was among women population (63.3%; 95%CI: 59.0–67.6), the oldest population group (66–75 years old; 81.9%, 95%CI: 73.7–88.1) and never-smokers (71.4%; 95% CI: 66.9–75.5).

4. Discussion

In Spain, more than 8 in 10 households have voluntary adopted some type of smoke-free rules in their homes. More than half of all households, and 25% of smokers, have adopted a complete ban on smoking at home. Moreover, the vast majority (90%) of the adult population support banning smoking in cars carrying minors. These results are relevant given that private settings such as homes and vehicles are the largest source of SHS exposure among the pediatric population (Halterman et al., 2006; Mbulo et al., 2016) and in many countries (including Spain) there are currently no laws in place to control smoking in such settings.

In this study, we found a higher prevalence of smoke-free homes (complete or partial) among people who had never smoked. This pattern is consistent with previous studies carried out in the general population from various European countries and the United States (US) (King et al., 2013; Mons et al., 2013; St. Claire et al., 2012). Mons et al. (Mons et al., 2013) found a higher prevalence of smoke-free homes among the older population, results that are only consistent with our findings for complete rules. This finding could be attributable to the fact that, in Europe and especially in Spain, the prevalence of former or never-smokers is higher in the elderly than in the younger population (Sanidad, 2011). In our study, the percentage of completely smoke-free homes was almost half of the percentage reported by King and colleagues (King et al., 2013) for all sociodemographic variables. This could be partially explained because in our study the older population could have been underestimated (they constitute around 10% of the sample and we have no information about people over 75 years old). On the other hand, another potential explanation could be the different tradition of anti-tobacco legislation in the US in comparison with Spain, being implemented more recently in Spain (complete smoke-free legislation came into effect in 2011) than in the US (more than 20 years ago). The differences between the two studies were especially pronounced among the oldest population. Our results are in line with other authors studies previously (Mons et al., 2013; King et al., 2013) that found that current smokers accounted for the highest percentage of households with partial bans, probably because even though smokers need a place to smoke, social awareness of the harmful effects of SHS exposure has increased in recent years, thus prompting even smokers to place some restrictions on smoking in the home.

The prevalence of partial smoke-free rules among respondents of child-bearing age, between 18 and 45 years old, was high in both sexes. We found that in this age group there is a high prevalence of smokers (29%). Moreover, this is especially remarkable, since it is also has the highest prevalence of current smokers in this age group in Spain (Sanidad, 2011). It seems probable that this support for a partial ban is due to the presence of children, for whom SHS exposure is perceived as most harmful. Unfortunately, we do not have information on the presence of children at home. However, a previous study has observed that the presence of young children in a household was a strong predictor of smoking bans at home with a pronounced dose-response relationship with the age of children (Mons et al., 2013). For this reason, pediatricians should promote the implementation of complete smoke-free home rules. Clearly, the never-smokers are those most likely to have a smoke-free home. Unlike other studies (King et al., 2013), we found no significant differences between social classes, nor did we find any differences by, level of education, or region. It is worth noting that social class could be a proxy for educational level and thus these two variables are unlikely to show differences. On the other hand, the smoking status of other members of the household could affect the voluntary adoption of smoke-free homes. Unfortunately, we do not have information about this variable. Future studies could address this topic.

The percentage of households with smoke-free rules has grown exponentially in the US in the last 20 years, from 43.1% in 1992 to 81.1% in 2010 (King et al., 2013). These changes are attributable to several factors, including the enactment of laws prohibiting smoking in public and work places, together with the resulting changes in the social acceptability of smoking. In fact, some studies have shown that smoke-free policies in public settings promote the voluntary adoption of, and support for, smoke-free homes (Cheng et al., 2011; Fong et al., 2006). In addition, it has been shown that voluntary smoke-free homes are associated with smokers attempting to quit, and that this may help them to quit (Pizacani et al., 2004). Furthermore, the available evidence demonstrates that the implementation of smoke-free legislation in public places and workplaces does not increase tobacco use in private settings (houses and cars) (Martínez-Sánchez et al., 2014; Jarvis et al., 2012). Therefore, a benefits of individual/voluntary interventions designed to protect children from tobacco smoke exposure is clear; nevertheless, population-level measures are needed to obtain greater benefits (Rosen et al., 2015, 2014).

Spanish smoking legislation, Law 42/2010 (Gobierno de España, 2010), which came into force in Spain in January 2011, prohibits smoking in common enclosed areas of buildings but leaves it to the community of neighbors to decide to prohibit smoking in open spaces not designated as children's areas. The present study was conducted five years after the passage of this law. We found strong support for this type of regulation, in particular by the elderly and the highest educational level groups. This support is likely to be due to the well-established relationship between higher level of studies and a greater awareness of the impact of SHS exposure. Additionally, the governments' efforts should be focused on social education about the dangers of smoking habits.

In recent years, smoke-free MUH (completely smoke-free buildings, including both private and common areas) has proliferated in the US and in several European countries (U.S. Department of Health and Human Services. & Prevention 2011; Snyder et al., 2015; Koster et al., 2012). The emergence of these housing units is likely because this is the only way to completely avoid tobacco smoke from neighbors (U.S. Department of Health and Human Services. & Prevention 2011; Snyder et al., 2015; Koster et al., 2012). Likewise, certain regions in the US, such as California (State of California, 2016), NY city, and Chicago have extended smoking prohibitions even further by banning smoking on beaches and in parks (Council, 2011; The Board of Commissioners of the Chicago Park District, 2014). It appears that these types of regulations are spreading, as exemplified by the June 2016 smoking ban in reservoirs and parks in Singapore (Government, 2016). In Spain, one measure the government could take would be to prohibit tobacco use in public housing units (in Spanish: vivienda de protección oficial: VPO) as an initial measure to protect people from SHS exposure at home.

After houses, cars are the most common source of SHS exposure among children (Halterman et al., 2006). Cars are a potentially serious source of SHS exposure given that concentrations of pollutants from cigarette smoke can accumulate rapidly in confined spaces (Murphy-Hoefer et al., 2014; Jones et al., 2009). Moreover, nicotine concentrations inside motor vehicles are much higher than air nicotine concentrations measured in public or private indoor places (Jones et al., 2009). Fine particulate matter, such as PM 2.5, is used as a marker of SHS exposure concentrations, especially in places where there are no other sources of combustion (Hyland et al., 2008; Semple et al., 2010). The World Health Organization (WHO) recommends that PM 2.5 air quality guidance levels of 25 μg/m3 be applied to indoor environments (Penney et al., 2010). In studies carried out in Canada, the UK, and New Zealand to assess PM 2.5 levels in cars with smokers, the levels exceed WHO recommendations (Semple et al., 2012; Ott et al., 2008; Rees and Connolly, 2006; Sendzik et al., 2009; Edwards et al., 2006). For these reasons, several countries have implemented regulations to prohibit smoking in cars in the presence of children (Canadian Cancer Society, 2014; World Health Organization, 2017; Christopher et al., 2015; Deutscher Bundestag, 2015).

In Spain, smoking in cars is currently unregulated. However, our study shows that 90% of the population supports smoke-free laws in cars in the presence of children. It is noteworthy that 86% of current smokers also support such regulations. In countries that have banned smoking in cars carrying children, the percentage of smokers and non-smokers who supported such laws prior to implementation was very high, a finding that is consistent with our study (Hitchman et al., 2011). Moreover, several studies have shown that positive attitudes towards smoke-free legislation increase after implementation (Fong et al., 2006; Murphy-Hoefer et al., 2014; Cheng et al., 2011). In England, smoking in vehicles in the presence of children was prohibited in 2015 (Department of Health, 2015). Given this context, our results suggest that the introduction of smoking bans to protect children from the health risks of SHS exposure in cars is likely to be supported by the majority of the population (more than 90%). In 2014, the Centers for Disease Control and Prevention (CDC) published the results of a study on the prevalence of smoke-free cars in Maine after a ban on smoking in cars was implemented, with significant reductions in prevalence after the law was passed (Murphy-Hoefer et al., 2014). Moreover, the percentage of smoke-free homes increased significantly after passage of that legislation (Murphy-Hoefer et al., 2014; Hitchman et al., 2011).

Smoking while driving has been widely recognized as the second most common cause of distraction while driving and there is growing evidence about the negative impact of such distraction on motor vehicles accidents (Wang et al., 1995; Stutts et al., 2001; Mcevoy et al., 2007 Sullman, 2012; Prat et al., 2015; Mangiaracina and Palumbo, 2006; Wen et al., 2005; Martínez-sánchez et al., 2012; Bakiri et al., 2013). In our study, although the attitudes towards smoking regulation in cars carrying children were high among smokers, smokers also (unsurprisingly) showed the lowest support for completely banning all smoking in cars. The public should be better informed about the risk of smoking as a distraction, and road safety laws and regulations need to be updated to reflect these risks.

The main limitations of this study are those derived from the use of surveys (Rada, 2004), the use of a computerized questionnaire by telephone interview could potentially threaten the internal validity of the study due to information bias. Although tobacco consumption in Europe and Spain could be partially socially stigmatized (Evans-Polce et al., 2015), we consider that the social desirability bias could be minimal in our study. However, our results could partially overestimate the prevalence of complete rules when smokers visit houses with complete rules and are exceptionally allowed to smoke. Another limitation of the study is the potential selection bias due to telephone directory sampling. In Spain, according to the "National Commission of

Markets and Competition" (CNMC) (Comisión Nacional de los Mercados y la Competencia, 2016) in 2015, there were almost 13.5 million landline residential telephones (around 74% of Spanish households). However, we do not have data stratified by social class or by age to evaluate. It could be possible that low social class have a lower percentage of landlines. In terms of strengths, the main strength is the use of a representative sample of the Spanish adult population. In addition, all analyses used weighted data of the Spanish population, thus increasing the external validity of the study.

In conclusion, the Spanish population seems to overwhelmingly support regulating smoking in vehicles carrying children. In addition, a non-negligible percentage of households (around half of the population) in Spain has a complete smoke free rule at home and more than 80% have either partially or completely smoke-free homes (37% partial rule). Although, the percentage of any kind of rule is high, partial rules are insufficient to protect children from SHS, for this reason, additional efforts are needed to promote and implement complete rules in homes in Spain. Given these findings, we believe that governments should strive to bring greater attention to the public about the negative health effects of SHS exposure. In addition, regulations should be strengthened to protect children and more studies are needed to establish the economic and public health impact.

Competing interests

The authors declare that they have no conflicts of interest.

Contributors' Statements

JMMS conceptualized and designed the study. ADI drafted the first manuscript with the supervision of JMMS. CLM analyzed the data. All authors contributed substantially to the interpretation of the data and the successive versions of the manuscript. All authors contributed to the manuscript and approved its final version. JMMS conceived the study and is the principal investigator of the project.

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4.3. Prevalencia de hogares libres de humo y exposición pasiva al tabaco en población pediátrica (niños de 3 a 36 meses)

Prevalencia de hogares libres de humo y exposición pasiva al tabaco en población pediátrica (niños de 3 a 36 meses)

Prevalence of smoke-free homes and passive exposure to tobacco in pediatric population (children from 3 to 36 months).

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Abreviaciones: Estados Unidos de America (USA), Estudi sobre l'Epidemiologia del Son (EPISON), Humo Ambiental del Tabaco (HAT), Hospital Universitari General de Catalunya (HUGC), Humo de Tercera Mano (HTM), Intervalo de confianza (IC), Instituto Nacional de Estadística (INE), No Se/No Contesto (NS/NC), Odds Ratio ajustada (ORa), Universitat Internacional de Catalunya (UIC-Barcelona), Versus (VS).

Palabras Clave: exposición pasiva al humo ambiental del tabaco, hogares libres de humo, humo de segunda mano, pediatría, políticas antitabaco.

Keywords: Tobacco smoke exposure; Smoke-free homes; Second-hand smoke; smoke-free policies.

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ABSTRACT:

Objetivo: Describir los hogares libres de humo y la prevalencia de exposición pasiva al HAT en población pediátrica (de 3 a 36 meses) en España.

Diseño: Estudio transversal

Emplazamiento: Cuestionario *on line* realizado de marzo a noviembre de 2017.

Participantes: 1.406 padres, madres o tutores con hijos de 3 a 36 meses

Método: Se recogió información sobre la adopción voluntaria de normas de consumo de tabaco en el hogar y exposición al HAT en casa y otros ambientes.

Resultados: 85,06% de los encuestados afirma tener un hogar libre de humo. El 12,02% de los encuestados tienen regulación parcial o no tiene regulación en el hogar, incrementándose cuando el progenitor es fumador (25,79%) o tienen estudios primarios o inferiores (20,18%). El 5,26% de los padres refiere exposición pasiva al tabaco en niños en sus hogares, elevándose hasta el 14,22% cuando se produce en otros ambientes, incrementándose ($p< 0,05$) la diferencia entre los padres fumadores, con mayor edad y con menor nivel educativo.

Conclusión: Los hogares libres de humo son mayoritarios en nuestro país; pero persiste la exposición pasiva al tabaco en el hogar con niños menores de 3 años, especialmente en familias con menor nivel educativo. Por ello, se deberían incentivar campañas de sensibilización sobre los efectos de la exposición pasiva en menores especialmente en familias con menos recursos.

ABSTRACT:

Objective: To describe smoke-free households and the prevalence of SHS in the pediatric population (from 3 to 36 months) in Spain.

Study design: Cross-sectional study.

Site: Online questionnaire carried out from March to November of 2017.

Participants: 1,406 parents, mothers or guardians with children from 3 to 36 months.

Methods: Information was collected on the voluntary adoption of tobacco use regulations at home and SHS exposure at home and other environments.

Results: 85.06% of respondents claim to have a smoke-free home. 12.02% of respondents have partial regulation or do not have regulation at home, increasing when the parent is a smoker (25.79%) or has primary or lower education (20.18%). 5.26% of parents reported SHS exposure in their children at their homes, rising to 14.22% when it occurs in other environments, increasing the difference between smoking parents, with higher age and with lower educational level ($p < 0.05$).

Conclusion: The smoke-free homes are the majority in our country; but SHS exposure to tobacco at home persists in children under 3 years of age, especially in families with a lower educational level. Therefore, awareness-raising campaigns on the effects of passive exposure on minors among families with a lower socioeconomic status should be encouraged.

INTRODUCCIÓN:

En la actualidad, los efectos sobre la salud de los no fumadores de la exposición pasiva al humo ambiental del tabaco (HAT) o humo de segunda mano son bien conocidos. La población pediátrica, por sus características propias de la infancia, es más vulnerable al presentar una mayor frecuencia respiratoria, un sistema inmune en desarrollo, además de una incapacidad para evitar la fuente de exposición (1,3). La exposición pasiva al HAT se ha asociado con un incremento de enfermedades respiratorias en la infancia; como asma o sibilantes persistentes, alteraciones en el crecimiento y el desarrollo pulmonar (4,5). Así como, existe un incremento del riesgo de otitis media aguda, muerte súbita del lactante, prematuridad o retraso del crecimiento intrauterino en los niños expuestos al HAT (1–4,6). Cabe destacar que no existe un nivel de exposición al HAT libre de riesgo, produciendo un efecto dosis-respuesta (4,5). Por ello, en las últimas décadas se han implementado políticas de espacios libres de humo con un efecto beneficioso en la salud poblacional, especialmente relevante en pediatría (7–12). Concretamente se ha registrado un descenso en las exacerbaciones asmáticas y en los nacimientos pretérmino tras la introducción de políticas de espacios libres de humos en diferentes países (7–11). Se ha encontrado a nivel ecológico una correlación entre la prevalencia de nacimientos pretérminos y las políticas de control del tabaquismo en Europa (12). En España, tras la introducción de la Ley 42/2010 que prohibió, entre otras medidas, fumar en espacios públicos cerrados y colectivos (13), se registró un descenso en los nacimientos pretérmino y en las hospitalizaciones secundarias a crisis asmáticas (10,14).

Aunque se ha avanzado mucho en el control del tabaquismo en espacios públicos, los ambientes privados, particularmente los domicilios, continúan siendo una de las principales fuentes de exposición al HAT (5,15). Esto es especialmente relevante en la población pediátrica, ya que son los hogares donde los niños pasan gran parte de su tiempo después de los centros educativos (colegios, guarderías o institutos), existiendo escasos datos de la exposición al HAT (5,15,16). Además, actualmente existe cierta controversia sobre si se debe aplicar o no una regulación del consumo de tabaco en estos ambientes privados (5,17).

Por todo ello, el objetivo de este estudio es evaluar y describir en población pediátrica (niños menores de 3 años) la prevalencia de hogares libres de humo (con regulación total o parcial) y la prevalencia actual de exposición pasiva al HAT en hogares y otros ambientes en España.

PACIENTES Y MÉTODOS:

Estudio transversal con una muestra de padres y cuidadores con niños de 3 a 36 meses (n = 1406) llevado a cabo en España (1112 de la comunidad autónoma de Cataluña, 168 de otra comunidad autónoma y 126 sin información de la comunidad autónoma) que aceptaron participar. Se utilizaron datos del estudio EPISON, un proyecto para evaluar la calidad del sueño en los niños realizado a través de cuestionarios en línea en español (www.epison.es) a padres o cuidadores con niños de 3 a 36 meses, cuyo objetivo era analizar la prevalencia entre la calidad del sueño en niños con factores sociodemográficos y la adherencia a rutinas de sueño en las familias. Los criterios de inclusión fueron todos aquellos padres con niños de 3 a 36 meses de edad que hablaran español y aceptaran participar.

Las encuestas se realizaron de marzo a noviembre de 2017 con una duración aproximada de 15 minutos con una sección sobre la epidemia del tabaco (consumo de tabaco, hogares libres de humo y exposición pasiva al tabaco). Aunque los encuestados completaron información personal, la información fue tratada de forma anónima. Los participantes fueron reclutados a través del uso de medios digitales (redes sociales, correos electrónicos a guarderías de Cataluña, aplicaciones móviles y hojas informativas distribuidas en las consultas pediátricas del Hospital Universitari General de Catalunya (HUGC)) en los cuales fueron invitados a participar voluntariamente completando la encuesta. El mensaje difundido explicaba de forma breve el proyecto EPISON ofreciendo la participación voluntaria a través de un link a la página web para completar la encuesta. Previamente al acceso a la encuesta, los participantes completaron el consentimiento informado. Los participantes no recibieron ningún incentivo económico o regalo. Para llevar a cabo el estudio, se obtuvo la aprobación del Comité de Ética del HUGC y el Comité de Ética de la Investigación de la Universitat Internacional de Catalunya (UIC-Barcelona).

Variables:

Se recopiló información sobre hogares libres de humo mediante la siguiente pregunta: "¿Qué situación describe mejor las "normas" para fumar dentro de tu casa?" con 4 posibles respuestas: "Nadie puede fumar (no se fuma)", "Sólo se puede fumar en algunos lugares dentro de casa", "Se puede fumar donde sea (no hay normas)", "No Se/No Contesto (NS/NC)". A partir de esta pregunta se recodificó en hogares libres de humo a aquellos participantes que respondieron: "Nadie puede fumar (no se fuma)" y hogares con regulación parcial o sin regulación a aquellos participantes que respondieron: "Sólo se puede fumar en algunos lugares dentro de casa" y "Se puede fumar donde sea (no hay normas)". La exposición al HAT en niños en el hogar y en otros ambientes se obtuvo a partir de la siguiente pregunta: "Durante las 2 últimas semanas, ¿tu hijo/a ha estado expuesto pasivamente al tabaco en tu casa? y ¿en otro lugar que no sea tu casa?" con una respuesta dicotómica (Si o No) para cada una de las preguntas. Además, se recogió el consumo de tabaco del encuestado.

Análisis estadístico:

Se calcularon las prevalencias de hogares libre de humo y exposición pasiva al tabaco en los niños en casa y otros ambientes. Todas las respuestas fueron estratificadas por sexo del niño; edad del niño (categorizado como: menores de 1 año, entre 1 y 2 años o más de 2 años); hermanos/as (categorizados como: sí o no); relación del niño con el encuestado (categorizado como: madre, padre u otra); consumo de tabaco del encuestado (categorizado como: fumadores, exfumadores, nunca fumadores); nivel educativo de encuestado (categorizado como primaria o inferior, secundaria, estudios superiores o universitarios), edad del encuestado (menor de 25 años, de 25 a 35 años, más de 35 años). Además, se han estimado las Odds Ratio ajustadas (ORa), por el sexo, la edad, el nivel educativo y el hábito tabáquico de los encuestados, con sus intervalos de confianza (IC) al 95%.

RESULTADOS:

La tabla 1 reporta la descriptiva de la muestra. El 94,3% encuestados son madres, 82% son no fumadores (47,6% nunca fumadores y 34,4% exfumadores), frente a un 18,0% de fumadores. El 64,8% de los encuestados tiene estudios superiores, frente al 27,3% con estudios secundarios y 7,9% con estudios primarios o inferiores. Hasta el 40,4% de los encuestados son mayores de 35 años, siendo un 56,2% de entre 25 y 35 años y un 3,4% menores de 25 años.

La tabla 1 además muestra la prevalencia de hogares libres de humo, con regulación completa, con regulación parcial o sin regulación, en los que viven niños de 3 a 36 meses. El 85,06 % de los hogares con niños entre 3 y 36 meses tenían una regulación total para el consumo de tabaco (eran hogares libres de humo). Se encontraron diferencias estadísticamente significativas en la prevalencia de hogares libres de humo según la relación del niño con el encuestado, siendo mayor cuando el que respondía el cuestionario era el padre (91,67% padre *vs.* 84.92% madre), según el hábito tabáquico del encuestado (73,02% fumadores; 85,21% exfumadores; 89,94% nunca fumadores) (ORa: 3,71 en nunca fumadores) y según el nivel educativo del encuestado (72,49% primaria o inferior; 78,31% secundaria; 89,51% estudios superiores o universitarios) (ORa: 2,26 si padres con estudios superiores o universitarios) (Tabla 1). No se encontraron diferencias estadísticamente significativas en hogares libres de humo según las características del niño (sexo, edad y hermanos/as) ni según la edad del familiar encuestado (Tabla 1).

El 12,02 % de los encuestados afirma tener regulación parcial en algunas zonas del hogar o no tener regulación para el consumo del tabaco en el hogar. Se encontraron diferencias estadísticamente significativas en hogares con regulación parcial o sin regulación según el consumo de tabaco del encuestado (25,79% fumadores; 11,67% exfumadores; 7,21% nunca fumadores) (ORa: 0,27 en nunca fumadores) y según el nivel educativo del encuestado (20,18% primaria o inferior; 18,78% secundaria; 8,04% estudios superiores o universitarios) (ORa: 0,44 para los que tienen estudios superiores o universitarios) (Tabla 1). No se encontraron diferencias estadísticamente significativas en hogares con regulación parcial o sin regulación según las características del niño (sexo, edad, hermanos/as) ni según la relación con el encuestado o la edad del encuestado (Tabla 1).

El 5,26% de los niños de 3 a 36 meses están expuestos al HAT en sus hogares, encontrándose diferencias estadísticamente significativas según el consumo de tabaco del familiar (9,13% fumadores; 5,00% exfumadores; 4,05% nunca fumadores) (ORa: 2,95 en nunca fumadores), el nivel educativo del encuestado (9,17% primaria o inferior; 7,41% secundaria; 3,91% estudios superiores o universitarios) (ORa: 2,05 para los que tienen estudios superiores o universitarios) o la edad del encuestado (15,56% si menor de 25 años; 5,00% de 25 a 35 años; 4,78% si más de 35 años) (ORa: 3,33 para los mayores de 35 años) (Tabla 2). No se encontraron diferencias estadísticamente significativas en la exposición pasiva HAT en hogares según las características del niño (sexo, edad, hermanos/as) o la relación con el encuestado (Tabla 2).

Cuando la exposición pasiva al HAT en niños se produce en otros ambientes diferentes del hogar, la prevalencia es del 14,22%, encontrándose diferencias estadísticamente significativas según si tenían hermanos/as (17,35% hijos únicos; 12,34% hermanos/as), según el hábito tabáquico del encuestado (22,62% fumadores; 12,92% exfumadores; 12,02% nunca fumadores) (ORa: 1,99 en nunca fumadores) y según la edad del encuestado (22,22% si menor de 25 años; 16,94% de 25 a 35 años; 9,75% si más de 35 años) (ORa: 2,59 para los mayores de 35 años) (Tabla 2). No se encontraron diferencias estadísticamente significativas a la exposición pasiva al HAT en otros ambientes según las características del niño (sexo y edad), la relación con el encuestado y el nivel educativo del encuestado están al borde de la significación estadística (Tabla 2).

DISCUSIÓN:

8 de cada 10 hogares con niños entre 3 y 36 meses en España son hogares libres de humo. La prevalencia de hogares con una regulación total para el consumo de tabaco con niños entre 3 y 36 meses es elevada en nuestro país (más del 85%). Este porcentaje es casi el doble que en España en 2016 para la población general (45,6%) (18). Además, existen diferencias estadísticamente significativas en la prevalencia de hogares libres de humo según el nivel educativo del encuestado, con casi un 90% de hogares libres de humo entre población con estudios universitarios o superiores frente a un 72,49% entre aquellos con estudios primarios o inferiores, puede ser debido a un mayor conocimiento de los efectos nocivos en la salud que produce la exposición pasiva al HAT (19). Existen diferencias estadísticamente significativas según el consumo de tabaco de los padres, existiendo casi un 90% de hogares libres de humo en padres nunca fumadores frente al 73% en padres fumadores. Pese a ello, estudios previos muestran un incremento de hogares libres de humo con regulación voluntaria completa en fumadores tras la introducción de políticas antitabaco (20).

En nuestro estudio, la exposición pasiva al HAT en niños en el hogar es del 5% siendo estadísticamente superior entre los fumadores (9%), aquellos padres con nivel educativo más bajo (estudios primarios o inferiores) (9%) y entre los padres más jóvenes (menores de 25 años) (16%). Nuestros resultados muestran el mismo patrón que los estudios previos (21–23). De hecho, estos estudios también muestran como factores predisponentes a dicha exposición en niños, el nivel socioeconómico bajo o el ser familia monoparental (18,21–23). Cabe destacar el elevado porcentaje de exposición al HAT en el hogar en padres menores de 25 años (16%), esto puede ser debido probablemente a una menor concienciación del efecto perjudicial para la salud de sus hijos.

Nuestro estudio mostró que el 14% de los niños entre 3 a 36 meses están expuestos al tabaco en otros ambientes diferentes al domicilio. Aunque en nuestro país, existe una buena regulación de espacios libres de humo desde la entrada en vigor de la Ley 42/2010 todavía siguen existiendo zonas donde los menores están expuestos pasivamente al tabaco (13). Por ello, se debería vigilar el correcto cumplimiento de la legislación vigente. Además, de favorecer la creación de más ambientes libres de humo donde pueda haber niños, como parques y playas, así como ampliar la regulación del consumo de tabaco a ciertos espacios exteriores. En Este sentido, ciertas áreas de Estados Unidos de América (EUA) como California, la ciudad de Nueva York o Chicago se han creado prohibiciones para el consumo de tabaco en parques y playas (24–26).

Respecto a la legislación del consumo de tabaco en los hogares, existen políticas de regulación del consumo de tabaco en EUA y algunos países europeos que favorecen los edificios libres de humo y que han proliferado en los últimos años por ser la única manera de evitar la exposición pasiva al HAT producida por los vecinos, ya que el HAT puede infiltrarse desde las viviendas o zonas comunitarias en las que se permite fumar (16,27,28). Hasta el 74% de la población adulta de EUA está a favor de los hogares libres de humo públicos (*smoke-free public housing*), incrementándose en nunca fumadores a más del 80% (29). En España, todavía no existe ningún tipo de legislación al respecto, ya que actualmente se prohíbe fumar en espacios cerrados comunes (como ascensores o escaleras), dejando libertad a la comunidad de vecinos para prohibir el consumo de tabaco en espacios abiertos comunes que no sean designados como zonas infantiles (como patios, terrazas, jardines o piscinas) (13). Se deberían crear políticas en nuestro país que favorezcan los edificios libres de humo, por ejemplo, en las viviendas subvencionadas (ej: ayuda al alquiler de la vivienda o vivienda de protección oficial) (30,31).

Otro aspecto importante es la regulación del consumo de tabaco en los vehículos privados en presencia de niños. En este sentido, en Reino Unido y ciertas regiones de EUA existe la prohibición para fumar en los vehículos cuando hay un niño a bordo ya que después de los hogares, son la fuente más habitual de exposición al HAT en niños (17,32,33). Estas regulaciones para el consumo de tabaco en vehículos en presencia de menores han producido secundariamente una elevación de los hogares libres de humo (32,33). En nuestro país más del

90% de la población está a favor del regular el consumo de tabaco en vehículos con niños a bordo siendo una prevalencia similar a los países que actualmente tienen en vigor estas leyes, previamente a su implementación (18,33). Además, el consumo de tabaco al volante ha sido reconocida como causa importante de distracción (36). Por ello, se debería incluir la prohibición del consumo de tabaco en vehículos con niños a bordo.

En 2006, un estudio en EUA encontró que casi la mitad de los niños asmáticos vivían con un fumador, e incluso únicamente de 2 de cada 3 niños con asma de difícil control vivían en un hogar libre de humo (17). Además, un 80% de los profesionales sanitarios interrogaba sobre la exposición pasiva en el hogar, pero solo el 58% les daba consejos para disminuir la exposición en sus hijos (17). En la actualidad, existe una elevada concienciación por parte de los profesionales sanitarios sobre la epidemia del tabaco así como de la exposición pasiva al HAT en niños, pero es necesaria una mayor formación en el asesoramiento para dejar de fumar en los padres (35,36). Los profesionales sanitarios tienen un importante papel al ser la promoción de la salud una herramienta clave para conseguir una mayor concienciación social, especialmente aquellos que tratan con el paciente pediátrico y sus familiares.

Además, numerosas investigaciones muestran los efectos perjudiciales no únicamente debidos a la exposición pasiva al HAT, sino también al humo de tercera mano (HTM), entendiéndose como el humo generado por el tabaco que se deposita en las superficies, e interacciona con otras partículas del ambiente (37,38). De hecho, se ha postulado que algunos de los componentes del HTM pueden tener mayor toxicidad que el humo del tabaco debido a los procesos de oxidación y reconstitución que ocurren en las superficies al depositarse (37,38). De hecho, la población pediátrica es especialmente vulnerable a dicha exposición, además de por la imposibilidad de evitar la fuente de exposición, por las características propias que posee (38). Al no existir un nivel de exposición mínimo no perjudicial ni para la exposición pasiva ni para el HTM, las políticas antitabaco deberían fomentar la creación de más ambientes libres de humo, especialmente en presencia de niños (5).

Las limitaciones más importantes de nuestro estudio son aquellas derivadas del uso de encuestas que pueden crear un sesgo de información (39). Además, la muestra puede no ser representativa de toda la población española debido a la voluntariedad de la encuesta y a que la difusión fue llevada a cabo en consultas de pediatría de un único hospital, aunque la mayoría de la muestra fue reclutada a través de internet y móvil. Al comparar las características de los encuestados con los últimos datos publicados por el Instituto Nacional de Estadística (INE) encontrando que la media de edad de las madres es similar a la media española del INE (40). En nuestra muestra los niños menores de 1 año están menos representados y existe un mayor porcentaje con hermanos que la media en España (40). Además, en nuestra muestra los fumadores están infrarepresentados y los padres con estudios superiores sobrerepresentados en comparación con los datos INE. Existe por tanto una limitación en la representatividad de la muestra.

8 de cada 10 hogares con niños entre 3 y 36 meses en España son hogares libres de humo. pero no es suficiente, ya que la prevalencia disminuye drásticamente en hogares con menor nivel educativo o fumadores. Por ellos, se deben favorecer campañas educativas sobre los riesgos de la exposición pasiva al HAT en niños y focalizarse en los colectivos más perjudicados. Además, se debería continuar avanzando en políticas antitabaco, favoreciendo la creación de más ambientes libres de humo donde los niños puedan verse expuestos.

Por ello, los profesionales sanitarios deben formarse en el asesoramiento y educación a los niños y sus familias. Además, se deberían favorecer políticas antitabaco que fomenten los ambientes libres de humo.

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Tabla 1. Prevalencia de hogares libres de humo con niños de 3 a 36 meses

		Hogares libres de humo				Hogares con regulación parcial o sin regulación			
	n	%	p-valor	ORa*	IC95%	%	p-valor	ORa*	IC95%
Total	1406	85,06%				12,02%			
Sexo del niño/a			0,448				0,714		
Masculino	726	84,29%		1	-	12,40%		1	-
Femenino	680	85,88%		1,10	(0,79-1,55)	11,62%		0,91	(0,65-1,27)
Edad del niño/a			0,694				0,904		
<1 año	368	86,41%		1	-	11,41%		1	-
De 1 a 2 años	984	84,55%		0,95	(0,64-1,40)	12,20%		1,05	(0,72-1,57)
Más de 2 años	54	85,19%		0,70	(0,30-1,83)	12,96%		1,43	(0,55-3,31)
Hermanos/as			0,759				0,773		
No	539	85,35%		1	-	12,43%		1	-
Si	867	84,60%		1,02	(0,72-1,43)	11,76%		0,98	(0,70-1,40)
Relación con el encuestado			0,006				0,109		
Madre	1326	84,92%		1	-	12,44%		1	-
Padre	72	91,67%		3,09	(1,11-12,87)	4,17%		0,32	(0,08-0,90)
Otra	8	50,00%		0,50	(0,07-10,16)	12,50%		2.00	(0,10-14,69)
Consumo de Tabaco			<0,001				<0,001		
Fumador	252	73,02%		1	-	25,79%		1	-
Exfumador	480	85,21%		2,17	(1,45-3,28)	11,67%		0,46	(0,31-0,69)
Nunca fumador	666	89,94%		3,71	(2,42-5,73)	7,21%		0,27	(0,26-0,78)
Nivel educativo del encuestado			<0,001				<0,001		
Primaria o inferior	109	72,49%		1	-	20,18%		1	-
Secundaria	378	78,31%		1,04	(0,59-1,79)	18,78%		0,96	(0,56-1,70)
Estudios superiores o universitarios	896	89,51%		2,27	(1,28-3,89)	8,04%		0,44	(0,26-0,78)
Edad del encuestado			0,959				0,548		
Menor de 25 años	45	86,67%		1	-	11,11%		1	-
De 25 a 35 años	720	85,14%		0,70	(0,23-1,73)	12,92%		1,44	(0,58-4,37)
Más de 35 años	523	85,09%		0,82	(0,27-2,11)	10,90%		1,21	(0,47-3,77)

* Ajustado por sexo, edad, consumo de tabaco y nivel educativo del encuestado. Odds Ratio ajustada (ORa), Intervalo de Confianza (IC)

Tabla 2. Exposición pasiva al tabaco en los niños

		Expuestos en el hogar				Expuestos en otros ambientes			
	n	%	p-valor	ORa*	IC95%	%	p-valor	ORa*	IC95%
Total	1406	5,26%				14,22%			
Sexo del niño/a			0,305				0,787		
Masculino	726	5,92%		1	-	13,91%		1	-
Femenino	680	4,56%		1,34	(0,83-2,20)	14,56%		0,98	(0,73-1,34)
Edad del niño/a			0,438				0,160		
<1 año	368	5,98%		1	-	13,86%		1	-
de 1 a 2 años	984	5,18%		1,13	(0,66-1,89)	14,84%		0,97	(0,68-1,36)
Más de 2 años	54	1,85%		2,95	(0,59-53,63)	5,56%		2,75	(0,96-11,65)
Hermanos/as			0,132				0,013		
No	539	6,49%		1	-	17,25%		1	-
Si	867	4,50%		1,48	(0,91-2,38)	12,34%		1,43	(1,05-1,95)
Relación con el encuestado			0,082				0,464		
Madre	1326	5,51%		1	-	14,40%		1	-
Padre	72	0,00%		-	-	12,50%		1,16	(0,59-2,56)
Otra	8	12,50%		0,22	(0,00-4,35)	0,00%		-	-
Consumo de tabaco			0,009				<0,001		
Fumador	252	9,13%		1	-	22,62%		1	-
Exfumador	480	5,00%		1,73	(0,94-3,18)	12,92%		1,87	(1,24-2,81)
Nunca fumador	666	4,05%		2,95	(1,12-3,78)	12,02%		1,99	(1,34-2,94)
Nivel educativo del encuestado			0,006				0,097		
Primaria o inferior	109	9,17%		1	-	14,68%		1	-
Secundaria	378	7,41%		1,20	(0,54-2,50)	17,46%		0,79	(0,42-1,41)
Estudios superiores o universitarios	896	3,91%		2,05	(0,92-4,21)	12,83%		0,99	(0,54-1,73)
Edad del encuestado			0,007				<0,001		
Menor de 25 años	45	15,56%		1	-	22,22%		1	-
De 25 a 35 años	720	5,00%		3,29	(1,25-7,71)	16,94%		1,35	(0,61-2,78)
Más de 35 años	523	4,78%		3,33	(1,22-8,23)	9,75%		2,59	(1,13-5,52)

* Ajustado por sexo, edad, consumo de tabaco y nivel educatico del encuestado. Odds Ratio (ORa), Intervalo de Confianza (IC)

4.4. Update on Thirdhand Smoke: A Comprehensive Systematic Review

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Review article

Update on thirdhand smoke: A comprehensive systematic review

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ABSTRACT

Objective: The objective of this study is to perform a comprehensive review of the literature about thirdhand smoke (THS).

Methods: Systematic review of all aspects of THS. Standard methodological procedures were used to search the following databases through April 2018: MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane Central Register of Controlled Trials (CENTRAL), and Web of Science (WOS) in Indo-European languages. To identify published grey literature, the first 200 hits from Google Scholar™ were evaluated. Clinical trial databases, conference proceedings, and reference lists from the identified articles were also searched. Two unblinded review authors independently assessed trials for inclusion in the review. These same reviewers also extracted study data in accordance with PRISMA guidelines. The study protocol was registered with PROSPERO (CRD42018083619).

Results: Sixty-eight articles were included in this systematic review. Of these, 28 analyzed the concentration of nicotine as a component of THS (the most commonly-used method to measure THS in those studies was chromatography, followed by the mass spectrometry), 21 evaluated the exposure and impact of THS on health (11 studies analyzed the effect of THS in cells [human and animal], 4 in animals, 1 in adults, and 5 in children), 16 investigated the beliefs, behaviours, and policies related to THS, and 3 evaluated other aspects such as THS in e-cigarettes or hookahs. In these 68 studies, THS was determined by measuring the following components: nicotine (30 studies), nitrosamines (17 studies) and cotinine (15 studies). The findings from most of these studies suggest a potential health impact of THS exposure (i.e.: cytotoxicity, metabolic alterations in metabolism, in glycemia; or cell structure; alterations in liver, lung, skin and behaviour in mice), and low awareness about the risks of THS among the general population.

Conclusions: Numerous specific biomarkers of THS were evaluated, with the most common being nicotine, nitrosamines, and cotinine. The most common method of preparing THS dust samples were cotton wipes, while chromatography, used alone or coupled with mass spectrometry, was the most common analytical technique. We have tried to establish common bases after reviewing all the current literature of the THS although, there is great heterogeneity between the studies and we have not always succeeded. The studies in this review demonstrate the harmful effects of THS on health in cells, in animal models, and in people including children. However, in people, the long-term effects remain unknown and more research is needed. These studies show that knowledge about THS and its potential harmful effects are poorly understood among the general population. For this reason, THS should receive greater emphasis in education and awareness policies.

Abbreviations: CENTRAL, Cochrane Central Register of Controlled Trials; CINAHL, Cumulative Index to Nursing and Allied Health Literature; 3-EP, 3-ethenylpyridine; e-cig, e-cigarettes; FeNO, exhaled nitric oxide; h, hours; ICTRP, International Clinical Trials Registry Platform; min, minutes; MUH, Multi-Unit Housing; NNAL, 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; NICU, Neonatal Intensive Care Unit; NNK, 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone; PAHs, Polycyclic aromatic hydrocarbons; SAF, Secondary Aerosol Formation; SHS, Secondhand smoke; THS, Thirdhand Smoke; TSE, Tobacco Smoke Exposure; TSNA, tobacco-specific nitrosamines; US, United States; VOCs, Volatile Organic Components; WOS, Web of Science

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1. Introduction

Starting from the premise that there is no safe level of exposure to tobacco smoke (U.S. Department of Health and Human Services, 2006), numerous studies have shown that secondhand smoke (SHS) exposure or environmental tobacco smoke (ETS) can have many adverse health consequences (U.S. Department of Health and Human Services, 2006; Öberg et al., 2011). Consequently, many governments around the world have been implementing laws that prohibit smoking in public and work places (Öberg et al., 2011; Framework Convention on Tobacco Control, 2014; World Health Organization, 2015; World Health Organization (WHO), 2017). This, in turn, has increased awareness of the harmful effects of tobacco smoke exposure (TSE) (Cheng et al., 2011; Murphy-Hoefer et al., 2014). The term of thirdhand smoke (THS) was described for the first time in the published literature in 2006 (Szabo, 2006). Before the term THS became widely-used in the scientific literature, other terms introducing this topic on aging SHS or ETS, being in the majority difficult the differentiation between SHS and THS (Schick and Glantz, 2007; Sleiman et al., 2009, 2010a, 2010b, 2013; Hoh et al., 2012; Giraldi et al., 2013).

Since that time, extensive research has been performed, although THS was note used in a scientific article until 2009 (Winickoff et al., 2009). Although the most common term is THS, thirdhand smoke is also known as *Residual tobacco smoke* or *Aged tobacco smoke* (Fortmann et al., 2010; Matt et al., 2011). In fact, in 2011, an expert consensus statement defined THS as follows: *"THS consists of residual tobacco smoke pollutants that remain on surfaces and in dust after tobacco has been smoked; are re-emitted into the gas phase; or react with oxidants and other compounds in the environment to yield secondary pollutants"* (Matt et al., 2011). Due to these processes of oxidation and reconstitution, it has even been claimed that THS could have greater toxicity than tobacco smoke or SHS exposure (Quintana et al., 2013; Matt et al., 2016). Some components of SHS adhere to indoor surfaces, others are reissued back into the indoor air, and may react with atmospheric species creating other pollutants not present in the original fresh smoke (Sleiman et al., 2010a, 2010b, 2014; Matt et al., 2011). Chemical reactions take place from the moment tobacco smoke is produced and may continue for weeks (Bahl et al., 2016b).

The components of THS found in indoor dust and surfaces could be ingested, inhaled or even absorbed through the skin (Ferrante et al., 2013; Northrup et al., 2016a; Becquemin et al., 2010). A study published in 2015 showed the potential cancer risk to tobacco specific nitrosamines in humans through non-dietary ingestion and dermal exposure (Ramírez et al., 2015). In fact, although more research has been performed to assess SHS than THS, recent studies have shown that THS increases the mortality risk associated with living with a smoker (Sleiman et al., 2014).

THS has gained importance due to a growing body of evidence of its adverse health effects; however, the specific health implications of THS exposure are not well-understood (Martins-Green et al., 2014; Adhami et al., 2016), although the available research to date has demonstrated that THS contains both mutagenic and carcinogenic substances (Hang et al., 2013). Importantly, children may be much more sensitive than adults to the potential harmful effects of house dust (John et al., 2009; Xu et al., 2015) given that spend a lot of time in private settings (such as homes or cars) where they cannot avoid exposure to SHS and THS (Martins-Green et al., 2014; Díez-Izquierdo et al., 2017). Moreover, this exposure may be exacerbated by certain behaviours characteristic of the pediatric population, especially infants, such as hand-to-mouth ingesting, crawling and sucking, all of which make this population more vulnerable to THS exposure (Jung et al., 2012; Roberts et al., 2017). Furthermore, it is during childhood when functional development of the respiratory, immune, and metabolic systems occurs. In addition, children have a higher respiratory rate than adults, further increasing the risk of exposure to THS. There is growing evidence of the detrimental effect of THS in exacerbations of asthma and other respiratory illnesses in children (Jung et al., 2012).

A recent review (Jacob et al., 2017) showed the chemical changes and the concentrations of the different components of THS. Another recent review (Hang et al., 2017) showed the effects of THS in cells and animals. Nonetheless, despite the increasing number of studies carried out in recent years, there is no established marker for THS in the literature (Schick et al., 2017). The marker that has received the most support as a collection technique for THS is surface wipe sampling for nicotine (Quintana et al., 2013). Moreover, to our knowledge, no systematic reviews have been conducted to evaluate all available published scientific literature on THS. For this reason, the aim of the present study was to systematically review all the scientific literature published about THS to date (through April 2018). In this review, we describe the main research topics for THS and summarize the current evidence to show where future research could focus.

2. Methods

2.1. Search strategy

We carried out a systematic review of studies included in four databases: MEDLINE via the PubMed interface, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Web of Science (WOS), and Cochrane Central Register of Controlled Trials (CENTRAL). We also searched Google for the first 200 hits on Google Scholar™ to identify grey literature and the following clinical trials registries for ongoing or recently completed trials: clinicaltrials.gov; controlled-trials.com; and the International Clinical Trials Registry Platform (ICTP) by the World Health Organization. We also searched the reference lists of all relevant reviews and other studies, and scanned paper issues of journals relevant to our topic. We searched from database inception until April 2018. All studies published in Indo-European languages were considered. Review articles, letters to the editor, and non-original articles (such as abstracts for conferences) were excluded, although all of these were scanned to identify other potential studies. This systematic review was conducted in accordance with the PRISMA guidelines (Liberati et al., 2009) to the extent possible given the heterogeneity of the articles. Ethics approval was not required. The study protocol was registered with PROSPERO (CRD42018083619).

Fig. 1 shows the bibliography search strategy within the various databases. The search strategy was implemented to include both keyword and medical subject headings searches under existing database organizational schemes. We searched MEDLINE through PubMed: ((((thirdhand smoke [All Fields]) OR (third hand smoke [All Fields])) OR "residual tobacco smoke" [All Fields]) OR third hand smoke [MeSH Terms]) OR thirdhand smoke [MeSH Terms]). We included the articles whose main study objective was related to THS. For this reason, we excluded studies in which THS had no direct relation to the study aims and studies in which the intervention was not clearly differentiated from SHS or if THS was generally referred to as Environmental Tobacco Smoke (i.e., both SHS and THS).

Given the heterogeneity study types for THS, we defined three main types of THS studies and classified our review in four sections according to these relevant topics: 1) Components and concentrations of THS (28 articles); 2) Impact of THS on health (21 articles); 3) Beliefs, behaviours and policies related to THS (16 articles); and 4) Other aspects of THS (3 articles). The section on "Impact of THS on health" included all articles regardless of the type the participants (i.e., cells, tissues, animals, or humans).

The variables recorded in the different sections for the articles were as follows: 1) *Components and concentrations of THS*: first author and year of publication; study objective; matrix; setting; components; type of study design; analytical method used to measure TSH; and main result of the study. *2 Exposure and Impact of THS on health*: first author and year of publication; study objective; outcome; population; type of study design; intervention; and main results. 3) *Beliefs, behaviours and*

Bibliographic search strategy	Number of hits
MEDLINE (PubMed):	
((((thirdhand smoke [All Fields]) OR (third hand smoke [All Fields])) OR "residual tobacco smoke‟ [All Fields]) OR third hand smoke[MeSH Terms]) OR thirdhand smoke[MeSH Terms])	201
Cumulative Index to Nursing and Allied Health Literature (**CINAHL):**	
third hand smoke OR thirdhand smoke OR "residual tobacco smoke" by full text	148
Web Of Science (WOS):	
TS=(Thirdhand smoke OR third hand smoke OR ‟residual tobacco smoke”)	499
Cochrane Central Register of Controlled Trials (CENTRAL):	
Title, abstract or keywords: (third hand smoke OR thirdhand smoke OR residual tobacco smoke)	33

Fig. 1. Bibliographic search strategy.

policies related to THS: first author and year of publication; study objective; population; setting; intervention; type of study design; and main results. 4) *Other aspects of THS*: first author and year of publication; study objective; population; matrix; setting; type of study design; and main results.

2.2. Study Selection and data extraction

The abstracts of all articles obtained during the initial broad search were reviewed independently by two reviewers (ADI and PCP) to identify potential eligible studies. Full-text articles of the studies considered to merit a more in-depth analysis were obtained and assessed for eligibility by two reviewers independently (ADI and PCP) using the predefined eligibility criteria. Differences in opinion were resolved by group discussion among all reviewers to reach consensus. Fig. 2 presents the flow diagram for study retrieval and selection.

Two investigators (ADI and PCP) independently extracted and reported data on the following aspects of each study, which were reported on standardized forms: study design; year of publication; description of study population; interventions; and data outcomes (including adverse events). Any disagreements were resolved by consensus among all authors.

3. Results

A total of 881 potentially relevant articles were identified. After reading titles and abstracts and removing duplicates, a total of 221 full-text articles were assessed for eligibility; of these, 153 articles were excluded for the following reasons: congress or meetings abstracts (n = 16); duplicated information (n = 1); review article (n = 19); letter to editor (n = 22); non-scientific articles (n = 2); non-Indo-European language (n = 1); and unrelated topic (main objective was not THS)

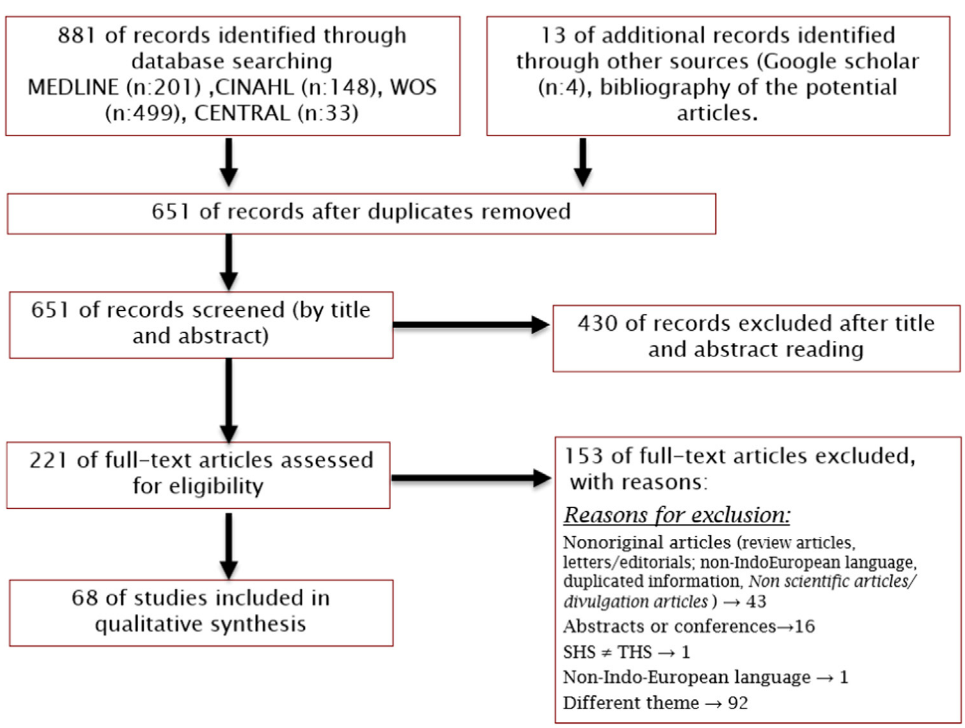

Fig. 2. Flow diagram: study retrieval and selection (adapted from PRISMA).

Table 1
Summary of included articles in the systematic review.

Author (year)	Author (year)	Characteristic of included studies - Main Results
Components and concentrations of THS		
Bahl (2014) Becquemin (2010) Cheng (2016) Figueiro (2016) Fortmann (2010)	Northrup (2016) Peng (2017) Petrick (2011) Petrick and Svidovsky (2011) Purio (2015)	This group included 28 studies. The characteristics of the included studies are detailed in Table 2. 16 studies were carried out in America (15 whereof in the US and 1 in Brazil), 6 in Asia and 6 in Europe. The objectives of the studies were quite heterogeneous. 3 studies aim to investigate THS markers; 10 studies investigate THS pollutants: 5 of them in houses, 2 in cars, 1 in a hotel, 1 in a casino and 1 in a university campus; 4 studies analyzed the method for determining THS, assessed the sample collection and preparation procedure comparing different devices or looking for the best measuring device; 2 studies evaluated the effect of aging on THS components; 2 other studies evaluated surface reactions; 1 study analyzed concentrations and sizes of smoke particles after resuspension; 1 study analyzed the reduction of THS with a device; and 1 study examined the correlation between odor concentration and the chemical composition of TSE.
Hoh (2012) Kuki (2015) Lewinson (2015)	Ramírez (2012) Ramirez (2015) Santos e Silva (2016)	11 of the studies analyzed the components of THS in laboratory, 11 studies in houses, 2 studies in university campuses, 2 studies in hotels, 1 study in a casino and 2 studies in cars. The method performed to analyse THS matrix was: 4 studies used chromatography papers, 6 studies used cotton wipes or swab, 6 studies used clothes or sheets or fabrics (4 of whom used cotton), 6 studies used urine samples, 2 studies used cellulose substrates, 10 studies used dust samples (collected in different ways).
Matt (2011) Matt (2013) Matt (2014)	Schick (2014) Sleiman (2010) Sleiman (2014)	The analysis of the setting for THS was: 4 studies used tobacco smokes generators or smoking machines, 10 of the studies were performed in boxes, chambers or laboratories, 11 studies used material from particular homes (7 smokers homes and 4 smokers and non-smokers homes), 3 studies used material from vehicles, 1 from a university campus, 2 studies from hotels and 1 study from a casino. When the analysis of the components from THS was performed, the following was found in common among the different studies: 18 of the studies analyzed nicotine, 10 studies analyzed cotinine, 10 studies analyzed nitrosamines, 3 studies analyzed myosmine and 2 studies used Volatile Organic compounds (VOCs) concentration.
Matt (2016) Matt (2018)	Thomas (2011) Thomas(2014)	The most used method to measure THS was chromatography (liquid or gas) combined with mass spectrometry in 15 studies. The chromatographic method was used alone in 3 more studies and the mass spectrometry was used alone in 2 more studies. The study design types of the articles were as following: 17 experimental studies, 1 quasiexperimental, 3 observational studies, 5 cross-sectional studies, 2 case-control studies.
Noguchi (2016)	Ueta (2010)	
Impact of THS on Health		
In Vitro studies		
Bahl, Johnson (2016) Bahl, Shim (2016) Bahl, Weng (2016)	Hang (2013) Xu (2015)	This group included 21 studies. The characteristics of the included studies are detailed in Table 3. 16 studies were carried out in America (15 whereof in the US and 1 in Brazil), 3 in Asia and 2 in Europe.
In Vivo Studies		
Adhami (2016) Adhami et al., (2017)	Hang (2017) Hang (2018)	11 studies analyzed the effect of THS in cells (1 in human cells, 4 in animal cells and 6 in animal and human cells), 4 studies analyzed the effect of THS in animals, 1 study analyzed the effect of THS in adults and 5 studies analyzed the effect of THS on children. When was performed the analysis of the THS matrix: 4 studies used terry cloth, 3 studies used chromatography paper, 3 studies used cellulose paper, 3 studies used urine, 4 studies cages with common household fabrics or cloths, 2 studies used cotton wipes and 2 studies analyzed hand (palm or finger). When was done the analysis of the setting for THS: 11 studies were done in laboratories and 6 studies used smoking machines. When the analysis of the components from THS was performed: 9 studies used nicotine as a component of THS, 7 studies used nitrosamines and 5 studies used cotinine. Other studies use myosmine or nicotelline, but some do not specify which components of THS they analyzed.
Dhall (2016)	Karim (2015)	Outcomes in common among the studies were: cytotoxicity of THS was analyzed in 6 studies, cell viability was analyzed in 2 studies, cell damage was analyzed in 4 studies and specifically the DNA damage was analyzed in 2 studies. Moreover, the respiratory symptoms were analyzed in 2 studies. Not all studies detailed the method for the measurement of THS, but chromatography (gas or liquid) was used in 7 studies, alone or in combination with spectrometry, also used in 7 studies. Moreover, the gravimethic method was used in 3 studies.
Figueiró (2018) Hammer (2011)	Martins-Green (2014) Rehan (2011)	Outcomes in common among the studies were: cytotoxicity of THS was analyzed in 6 studies, cell viability was analyzed in 2 studies, cell damage was analyzed in 4 studies and specifically the DNA damage was analyzed in 2 studies. Moreover, the respiratory symptoms were analyzed in 2 studies. Not all studies detailed the method for the measurement of THS, but chromatography (gas or liquid) was used in 7 studies, alone or in combination with spectrometry, also used in 7 studies. Moreover, the gravimethic method was used in 3 studies.
Human studies		The study design types were analyzed obtaining 15 experimental studies, 1 observational study and 5 cross-sectional studies.
de la Riva-Velasco (2012) Jung (2012) Leung (2018)	Mahabee-Gittens et al., (2018) Northrup (2016) Ramirez (2014)	
Beliefs, behaviours and policies of THS		
Baheiraei (2018) Chen (2016)	Kayser (2013) Patel (2012)	This group included 16 studies. The characteristics of the included studies are detailed in Table 4. 14 studies were carried out in America, all but one was made in the US, and 2 in Asia.
Darlow (2017) Delgado-Rendon (2017) Delgado Rendon (2017) Drehmer (2014) Escoffery (2013)	Roberts (2017) Samet (2015) Walley (2015) Wilbur (2015) Winickoff (2009)	9 studies analyzed the beliefs or the concerns about THS in adult population, specifically one of them analyzed the beliefs in healthcare professionals, 1 study analyzed the smoke-free policies in California hotels, 1 study analyzed the impact of smoke-free policies on costs, and 3 studies analyzed perceptions of smoking cessation interventions. We have found 3 different population groups. The first group analyzed children and included one study, the second analyzed parents, expectant fathers or caregivers and included 5 studies and the last comprises an heterogeneous group of adults ranging from healthcare professionals, hotel managers, caretakers, realtors or low-income people and included 9 studies. In all the studies, the intervention was performed through a questionnaire, survey or interview. In 4 of the cases, it was carried out by telephone and in one case a telephone follow-up was carried out. In 10 of the studies were analyzed as an outcome the beliefs or attitudes towards THS.
Haardörfer (2017)	Zakarian (2017)	The study design types were analyzed obtaining 13 cross-sectional studies, 2 observational studies and 1 case- control study.

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Table 1 (*continued*)

Author (year)	Author (year)	Characteristic of included studies - Main Results
Other aspects of THS		
Bush (2015) Goniewicz (2015) Kassem (2014)		This group included 3 studies. The characteristics of the included studies are described in Table 5. The studies were carried out in the US. The objective in 2 of the studies was to examine the nicotine residues deposited by the electronic cigarette and in the third case was to examine the nicotine residues deposited by the hookah. The components of THS were analyzed in two of the studies in e-cigarettes (e-cig) and hookah smoking houses and in the third study in a laboratory chamber. The matrix of THS in studies with e-cig was kimwipe. The method of measurement was in the 3 studies the chromatography. The outcome was the nicotine levels and it was common between the studies. The study design types were heterogeneous: one observational study, one cross-sectional study and one experimental study.

(n = 92) (Fig. 2). One study was excluded despite meeting the inclusion criteria because the preliminary data in that article (published in 2012) was subsequently published by the same author in 2014 under the same trial registration number (Drehmer et al., 2012, 2014). One study was excluded because the effect of THS was not assessed independently, nor identified specifically as THS (Matt et al., 2008). Another study was excluded because although the abstract was available in English, the full text was only available in a non-Indo-European language (Korean) with no translation available (Kim, 2012).

Thus, a total of 68 articles were ultimately included in the systematic review. Of these 68 studies, 48 were carried out in America (46 in the United States and 2 in South America), 11 in Asia, and eight in Europe. These 68 studies evaluated the following THS components: nicotine concentration (n = 30), nitrosamines (n = 17), cotinine (n = 15), myosmine (n = 4), volatile organic components (VOCs; n = 2), and nicotelline (n = 1). In the studies that analyzed more than one component, each of the components was counted individually. We classified the results of the studies according to the outcomes; Table 1 presents a summary of all articles included in the review according to this classification.

3.1. Components and concentration of THS

Table 1 summarizes the 28 studies about components and concentration of THS. The characteristics of the included studies are described in Table 2. One study (Matt et al., 2016) showed that THS pollutants persisted in smokers' homes 6 months after quitting. Another study (Matt et al., 2010) analyzed the persistence of THS pollutants in the home two months after the smokers had been removed and replaced with non-smoking guests. One study identified tobacco-specific carcinogens such as 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) on surfaces (Thomas et al., 2014). Another study demonstrated that households with an indoor ban, in which less than 10 cigarettes per day were smoked, had lower levels of THS contamination than homes without any smoking prohibitions and in homes where at least 11 cigarettes were smoked daily (Northrup et al., 2016c).

Nicotine levels as markers of THS were identified in common areas of a university campus (Santos e Silva et al., 2016). Matt and colleagues compared hotels with complete smoking bans with those that allowed smoking in some of the rooms, finding significant differences between the hotels in THS pollutants and evidencing elevated levels of urinary 4-(methylnitrosamino)- 1-(3-pyridyl)-1-butanol (NNAL) after staying in the 10 most polluted rooms (Matt et al., 2014). In addition, Lewinson analyzed extended-stay hotels by questionnaire to residents who referred smoke residues in the guest rooms and common spaces (Lewinson and Bryant, 2015). Moreover, Matt et al. showed a decrease in THS exposure after introducing a smoking ban in a casino, although that study also evidenced the persistence of deep THS reservoirs lasting for months after the ban was introduced (Matt et al., 2018).

THS was also analyzed in cars. Matt and colleagues analyzed rental cars, finding that most non-smoking cars contained nicotine residues in dust and on surfaces. Higher levels of THS pollution were found in older cars and in those with high-mileage, independently of the car's smoking status (Matt et al., 2013). In addition, smokers reported a lower use of air conditioning, finding their cars dustier (Fortmann et al., 2010).

One study was conducted to determine if iso-NNAL could serve as a suitable biomarker of THS in children under age 10 who lived with smoking parents (Thomas et al., 2011). Although Iso-NNAL was not detected in the children's' urine samples, results showed detectable levels of total NNAL in the urine samples of more than 90% of children, with a significant positive association between biomarker levels and the THS exposure of children (Thomas et al., 2011).

Sleiman found that SHS markers, such as 3-ethenylpyridine (3-EP) and nicotine, disappeared from the gas phase after 2 h, depositing mostly on surfaces discovering other specific components of the cigarette smoke, such as acetonitrile, 2 methyl-furan or 2–5 dimethyl-furan increase progressively in the gas phase up to 18 h after having smoked (Sleiman et al., 2014).

Bahl compared cotton and polyester fabrics 19 months after they had been packaged, finding significant quantities of THS in both fabrics, but a higher level of THS components in cotton (Bahl et al., 2014). Schick showed THS deposits on clothes and the surfaces of certain products within 60 min of exposure (Schick et al., 2014). Also, it was evaluated the effect of aging on THS components on exposed cotton cloth by demonstrating nicotine and NNK. That study showed deposits of polycyclic aromatic hydrocarbons (PAHs), nicotine, and tobacco-specific nitrosamine on surfaces (Schick et al., 2014). Cheng et al. found that higher levels of THS products in natural fibers (wool and cotton) than in polyester after using two different methods to measure these levels (Cheng et al., 2016). Ueta and collaborators found higher concentrations of ammonia and 2-furaldehyde in cotton and linen, and also a limited absorption of VOCs in polyester and silk (Ueta et al., 2010).

Some studies evaluated different methods to determine the components of THS, but obtained a similar component pattern (Ueta et al., 2010; Kuki et al., 2015; Cheng et al., 2016; Peng et al., 2017) (Table 2). Petrick investigated the chemical reactions on the surfaces of THS between nicotine and ozone, showing its role in secondary aerosol formation (SAF) (Petrick et al., 2011a, 2011b). Purio proposed using a filter to decrease the concentration of THS components, showing a significant decrease in concentration levels in an enclosed box (Purio et al., 2015).

The most common method (15 studies) to measure THS was chromatography (liquid or gas) combined with mass spectrometry. The chromatographic method was used alone in three other studies while mass spectrometry was used alone in two other studies (Table 2). Eight other studies used a variety of different methods to determine THS components, in some cases using more than one technique (Table 2). Figueiró et al. evaluated two different procedures to collect THS, both of which yielded similar concentrations of nicotine in paper and in cotton samples (Figueiró et al., 2016).

Four studies analyzed the effects of aging on THS and the reactions and transformations that they undergo (Table 2). Two studies analyzed potential THS biomarkers (Table 2). One study evaluated the various procedures used to collect THS and to prepare the samples (Table 2). Two studies analyzed the suitability of measuring devices and one study analyzed a device to reduce THS (Table 2).

Table 2
Components and Concentration of THS.

Author (year)	Objective of the study	Matrix	Setting	Components	Type of design	Analytical method to measure TSH	Main result
Bahl (2014)	The effect of aging on THS components, exposure levels and remediation measures.	Sheet of cotton terry cloth, sheet of polyester fleece were stored in polyethylene bags in the dark. Aqueous extract for THS in DMEM.	Automatic smoking machine. Laboratory chamber.	Nicotine, myosmine, bipyridine, cotinine, N-formylnornicotine, nicotelline, NNN, NNK, NNA	Experimental	LC-MS/MS	Fabrics aged for 19 months after smoke exposure retained significant amounts of THS chemicals. During aqueous extraction, cotton cloth released about 41 times as much nicotine and about 78 times the amount of tobacco specific nitrosamines (TSNAs) as polyester after one hour of aqueous extraction. C of nicotine and TSNAs in extracts of terry cloth exposed to smoke were used to estimate toddlers oral exposure and adult dermal exposure to THS. Nicotine exposure from THS residue can be 6.8 times higher in toddlers and 24 times higher in adults and TSNA exposure can be 16 times higher in toddlers and 56 times higher in adults than what would be inhaled by a passive smoker.
Becquemin (2010)	Resuspension from the cigarette particles to indoor air in a closed room.	Particles sizes (between 0,20 µm and 10 µm)	Non-ventilated furnished room	Particle sizes (between 0.28 µm and 10 µm), C in the aire above the floor.	Experimental	Impactor (ELPI)	After cigarrete smoking, the airborne particles were of ultrafine sizes. C was divided by 100 in the first 4 h and again by 100 in the following 24 h. After resuspension, the C was multiplied by 100, going back to that observed 4 h after smoking.
Cheng (2016)	To detect THS in a real environment, choose a marker (ideally be specific to tobacco smoke, stable and easily obtainable).	Clothing fibers (cotton, wool, polyester) placed in a sampling bag and filled with dry air.	Experimental box (24 cm × 16 cm × 12 cm, volume 4.6 l)	Appearance of tested fibers before exposure ETS, fiber mass gain (mg), Frequency shift of fibers, THS resindence period of clothing fibers	Experimental	SAW gas sensor	All fibers become yellow after exposure to ETS, all fibers gained mass (the gain of mass decreased in the order wool, cotton, and polyester with a gain about one tenth that of wool). In the SAW detection, the frequency shift of THS after 72 h was still twice the background level (in the tested fibers, wool gave the largest frequency shift, followed by cotton, and polyester). The residence period of THS on natural fiber and a prolonged residence period in wool and cotton is greater than on synthetic polyester fiber.
Figueiró (2016)	To evaluate procedures to collect THS and prepare the samples to perform three in vitro toxicity tests	Cellulose chromatography papers (25 cm^2), Cotton wipes (equivalent area of papers). THS extracted using DMEM.	Acrylic chamber (laboratory). Smoker home (kitchen)	Nicotine C, proliferation rate in Hep− 2 cells, micrographs of cellular culture exposed	Experimental	Colorimetric method (determination nicotine), chromatographic separation (for identification nicotine in paper samples), colorimetric assay (for cellular growth), neutral red absorption (citotoxicity assay)	The C of nicotine in DMEM extract of THS in paper and cotton was similar to those in methanol extract ($p > 0.05$). Alterations in the mitochondrial and lysosomal functions were found in both paper and cotton samples; however, the cytotoxic effect was not always observed. There was a decrease of 21–31% in MTT assay and 38–56% in NRU assay ($p < 0.003$). There was a dose-response relationship between the amount of cigarettes and lysosomal viability; the correlation was higher for cotton samples ($r = -0.843$, $p < 0.001$).
Fortmann (2010)	To show that smoking cigarettes in the enclosed environment of a car leads to	Questionnaire, Dust collected in Teflon bottles with HVS-4 in glass vials. Surface nicotine: screened cotton wipes	Cars sold by nonsmokers(n:40) and smokers (n:47)	Nicotine C in dust, in air, in surface wipe samples, smell of tobacco inside the vehicles.	Cross-sectional study	Organic Vapor Monitor	Smokers reported using air conditioning less ($p < 0.05$) and driving with windows down more often than nonsmokers ($p = 0.05$); their

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Table 2 (*continued*)

Author (year)	Objective of the study	Matrix	Setting	Components	Type of design	Analytical method to measure TSH	Main result
	the contamination of a car's microenvironment with residual TSP. Explore drivers, smoker behaviours and properties of car environment to identify the relationship between TSE and residual TSP. Investigate differences among nonsmokers and smokers with and without smoking bans and factors that contribute to the contamination of cars with residual TSP.	with 1 ml of ascorbic acid, 100 cm^2, placed in glass vials. Passive air monitors: badges (modified 37 mm 3 M organic Vapor Monitor with Teflon filter).					cars were also dustier ($p < 0.01$) and exhibited more ash and burn marks than nonsmokers' cars ($p < 0.001$). Number of cigarettes smoked by the primary driver was the strongest predictor of residual TSP indicators (p:0.001). Reported cleaning and ventilation behaviours were not related to TSE (heavy smokers did not attempt to compensate for greater TSE by cleaning or ventilating their vehicles). Driving with windows rolled down was associated with greater nicotine on the dashboard.
Hoh (2012)	To show if environmental tobacco smoke is a source of PAHs in SHD.	Dust samples (1 m × 1 m) in a collection bottle using HVS4 cyclone vacuum. Dilution of THS extracts.	Homes of smokers & nonsmokers (Finaly analyzed:132)	Naphthalene (ng/g), acenaphthylene (ng/g and ng/m2), acenaphthene (ng/g and ng/m2), fluorene (ng/g and ng/m2), phenanthrene (ng/g and ng/m^2), anthracene (ng/g and ng/m^2), fluoranthene(ng/g and ng/m^2), pyrene(ng/g and ng/m^2), ben (a)anthracene(ng/g and ng/m^2), chrysene(ng/g and ng/m^2), benzo(b &k)flouranthene(ng/g and ng/m^2), benzo(a)pyrene,indeno(1,2,3,*c*,d) pyrene(ng/g and ng/m^2), dibenz (a,h)anthracene,benzo(g,*h*,i) perylene(ng/g and ng/m^2), B2PAHs (ng/g and ng/m^2), total PAHs(ng/g and ng/m^2).	Case Control	Chromatography + mass spectrometer (GC/MS)	Total PAHs were significantly higher in smokers homes than nonsmokers homes Also, significant linear correlations between nicotine and total PAH levels in SHD. Dust collected (g/m^2) was significantly greater in smoker homes and might dilute PAH concentration in SHD inconsistently. Therefore, dust PAH loading (ng PAH/m^2) is a better indicator of PAH content in SHD. House dust PAH loadings in the bedroom and living room in the same home were significantly correlated (R^2 = 0.468, $p < 0.001$). We observed a significant association between nicotine concentration in SHD and levels of PAH.
Kuki (2015)	To analyse the THS novel mass spectrometric and tobacco smoke by DART ionisation tandem mass spectrometry.	Sweater of a smoker exposed, sheet of paper, coffee cup.	Laboratory (exposition open air while 2 cigarettes were smoked)	Nicotine	Experimental	DART-MS/MS,	The residual tobacco smoke contamination (THS) on the clothes of a smoker was examined by direct analysis in real time (DART) mass spectrometry. DART-MS enabled sensitive and selective analysis of nicotine as the indicator of tobacco smoke pollution. Tandem mass spectrometric (MS/MS) experiments were also performed to confirm the identification of nicotine. Transferred THS originated from the fingers of a smoker on to other objects was also detected by DART mass spectrometry.
Lewinson (2015)	To show if hotel environments are places where hospitality workers and patrons are at an increased risk for smoke exposure and associated health hazards.	Questionnaire (n:37)	8 extended-stay hotels	Questions about 1st, 2nd,3hd.	Cross-sectional	–	Residents described smoke residue throughout the hotel and inside guest rooms. Smoke residue accumulated in frequently used spaces. Even in hotels with exterior corridor designs, residents still smelled cigarette residue lingering in stairways and just outside of room doors.
Matt (2011)	To examine whether THS persists in smokers' homes after they move out and non-smokers move in, and	Interview, for surface nicotine: prescreened cotton wipes (cosmetic 100% cotton facial wipes), Dust samples (1mx1m) in collection bottle	Homes (of smokers & non-smokers) before and after a change of	Indoor smoking (cigarettes/week), air nicotine(ug/m3), surface nicotine (ug/m2), dust nicotine (ug/g,ug/m2), urine cotinine (ng/ml), finger	Quasiexperimental	LC-MS-MS using electrospray ionisation (ESI)	Smoker homes' dust, surface and air nicotine levels decreased after the change of occupancy ($p < 0.001$); however, dust and surfaces showed higher contamination levels in former

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Table 2 (*continued*)

Author (year)	Objective of the study	Matrix	Setting	Components	Type of design	Analytical method to measure TSH	Main result
	whether new non-smoking residents are exposed to THS in these homes.	with a HVS4, for air nicotine: passive diffusion monitor badge, urine sample. Dilution of THS extracts.	occupancy. (37 homes + 5 cars)	nicotine (ng/wipe), reported exposure (cigarrettes/week)			smoker homes than former non-smoker homes ($p < 0.05$). Non-smoking participants' finger nicotine was higher in former smoker homes compared to former non-smoker homes ($p < 0.05$). Finger nicotine levels among non-smokers living in former smoker homes were significantly correlated with dust and surface nicotine and urine cotinine.
Matt (2013)	To examine the effectiveness of non-smoking policies in car rental companies in the US.	Air samples (collected with a sorbent tube connected to a sampling pump), dust samples (collected with HSV4 into Teflon bottles), screened cotton wipes wetter with 1–2 ml each of 1% ascorbic acid (to wipe a 100 cm^2 area, glass phials). Dilution of THS extract.	250 rental cars (non-smoker,smoker & unknown)	Air nicotine (ng/m3), air 3-ethenylpyridine(3-EP) (ng/m3), dust nicotine(ug/g), surface nicotine (ug/m2)	Cross-sectional	LC-MS-MS using electrospray ionisation. Isotope dilution MS	A majority of putative non-smoker cars had nicotine in dust, on surfaces, in air and other signs of tobacco use. Independent of a car's smoking status, older and higher mileage cars had higher levels of THS pollution in dust and on surfaces ($p < 0.05$), indicating that pollutants accumulated over time. Compared with smoker cars, non-smoker cars had lower levels of nicotine on surfaces ($p < 0.01$) and in dust ($p < 0.05$) and lower levels of nicotine ($p < 0.05$) and 3-ethynylpyridine ($p < 0.05$) in the air. Non-smoking signage in cars was associated with lower levels of THS pollutants in dust and air ($p < 0.05$)
Matt (2014)	To examine tobacco smoke pollution (THS) in hotels with and without complete smoking bans and to investigate whether non-smoking guests staying overnight in these hotels were exposed to tobacco smoke pollutants.	Air samples (collected with a sorbent tube connected to a sampling pump), pre-screened cotton rounds wetter with 1–2 ml each of 1% ascorbic acid (100% cotton cosmetic rounds, to wipe a 100 cm^2 area), pre-wetted cotton round (finger), urine sample. Dilution of THS extract.	Hotels (n:10) with (n:30) without complete smoking bans.	Nicotine and 3EP in surfaces (ug/m2) air nicotine and air 3EP (ng/m3), nicotine and 3 P on fingers (ng/wipe), urine cotinine (ng/ml), urine NNAL	Cross-sectional	LC-MS/MS, LC-MS/MS using positive ion electrospray ionisation (ESI). Isotope dilution mass spectrometry (IDMS)	Compared with hotels with complete smoking bans, surface nicotine and air 3EP were elevated in non-smoking and smoking rooms of hotels that allowed smoking. Air nicotine levels in smoking rooms were significantly higher than those in non-smoking rooms of hotels with and without complete smoking bans. Hallway surfaces outside of smoking rooms also showed higher levels of nicotine than those outside of non-smoking rooms. Nonsmoking confederates staying in hotels without complete smoking bans showed higher levels of finger nicotine and urine cotinine than those staying in hotels with complete smoking bans. Confederates showed significant elevations in urinary NNAL after staying in the 10 most polluted rooms.
Matt (2016)	To explore the levels of THS pollution and exposure to tobacco smoke toxicants in homes of former smokers	Prescreened cotton rounds (100% facial wipes), dust samples (1 m × 1 m) in a collection bottle with HVS 4 cyclone vacuum (Dilution of THS extracts). Urine sample	Homes of smokers who successfully quit smoking.	Surface nicotine loading (ug/m2), finger nicotine loading (ng/wipe), dust nicotine concentration (ug/g), dust nicotine loading (ug/m^2), Levels of TSNAs: NNK (ng/g) (ng/m^2), NNN (ng/g) (ng/m^2), NAT (ng/g) (ng/m^2), NAB (ng/g) (ng/m^2), urinary cotinine(ng/ml), urinary NNAL (pg/ml)	Observational	LS-MS/MS	A significant short-term reduction of nicotine on surfaces and fingers of non-smoking residents without further significant changes. Concentrations of nicotine and nicotine-derived nitrosamine ketone (NNK) in dust did not change and remained near BL levels after cessation. Dust nicotine and NNK loadings significantly increased immediately following cessation before returning to and remaining at near BL levels. Cotinine and NNAL showed significant initial declines without further significant changes.
Matt (2018)	To investigate the THS reservoir that is created in a casino through long-term	Surface wipe samples, floor dust samples (collected using a cyclone	A casino visited by 9 participants before,	Air nicotine (ug/m3), surface nicotine (ug/m2), dust nicotine C (ug/g), finger nicotine (ng/wipe)	Observational	LC-MS/MS	High levels of THS were found in dust and surfaces. The smoking ban led to immediate improvements in air quality, surface nicotine

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Table 2 (*continued*)

Author (year)	Objective of the study	Matrix	Setting	Components	Type of design	Analytical method to measure TSH	Main result
	tobacco use, how this reservoir changes after a smoking ban is implemented and then reversed, and if the THS reservoirs result in exposure to non-smokers visiting the casino.	vacuum, HVS4); finger wipe samples, urine sample.	during and after a smoking ban	respirable suspended particle matter < 2.5 micrometres in diameter, TSNAs, Urinary NNAL(pg/ml), Urinary Cotinine (ng/ml).			levels were unchanged and remained very high for the first month of the smoking ban. Surface nicotine decreased by 90% after 1 month ($p < 0.01$), but nicotine and tobacco-specific nitrosamines in dust decreased more slowly, declining by 90% only after 3 months ($p < 0.01$). Exposure was significantly reduced after the ban, but the benefits of the ban were reversed after smoking resumed.
Noguchi (2016)	To examine the correlation between the odor concentration and the chemical composition of: SHS, THS and ETS.	Plastic bag (SHS) Surface of a plastic bag (THS collected by plastic bag evacuated by vacuum pump) Odor sampling bag (Volume 3.0 L. Collection: with a flex pump with a flow rate of 30 L/min) (Outside smoking area)	Tobacco smoke generator. Outside smoking area in University of Tokio	Odor and VOCs concentration measurements, acetaldehyde, acetic acid, acetonitrile, acrolein, acetone, isoprene, nicotine	Experimental	Sensory test method termed the triangle-odor-bag-method (sniff test) (for Odor). PTR-MS (for VOC)	The odor concentration of the SHS samples was 3 or 4 orders of magnitude higher than that of the field. ETS samples, and three orders of magnitude higher than that of the THS samples. The C ratios of the constituent chemicals in THS to those in SHS were about 10^{-4}, corresponding to the ratio of the odor C. The C ratios of the constituent chemicals in the field ETS samples were much lower than the ratios of the odor Cs.
Northrup (2016)	To characterize the level of THS found in the homes of infants admitted to a NICU, and explore the associations of household characteristics that might influence THS levels. To reexamine THS levels after a 6-month period in a subgroup of participants, during which time families enrolled in a SHS intervention study may have sustained, implemented (for the first time), or discontinued an indoor smoking ban.	Questionnaire, cotton wipe exposed to the air but not wiping surfaces, passive air monitors, diffusion filters, urine sample. Dilution of THS extract.	Homes with at least one smoker living in the household and with an infant in the NICU (n:22).	Characteristics of smokers and household, surface nicotine (ug/m2), indoor home smoking ban, air nicotine (ug/m3), urine cotinine (ng/ml)	Observational	–	Households with an indoor ban, in which not more than 10 cigarettes/d were smoked, had the lowest levels of THS contamination compared to homes with no ban ($p < 0.001$) and compared to homes with an indoor ban in which greater numbers of cigarettes were smoked ($p < 0$ 0.001). Homes with an indoor ban in which at least 11 cigarettes/d were smoked were not different from homes without a ban. The follow-up sample of 22 homes provided initial evidence indicating that, unless a ban was implemented, THS levels in homes continued to increase over time.
Peng (2017)	To determine nicotine in THS utilising LC-ED.	Dust wipes obtained wiping and placed glass vials.	The fronting of doors and windows facing onto entrance ways (n:5)	Nicotine	Experimental	LC-ED	The optimum chromatographic conditions were identified as a 150 mm × 4.6 mm, 5 μm C18 column with a mobile phase consisting of 65% methanol, 35% pH 8 20 mM phosphate buffer. Hydrodynamic voltammetry was used to optimise the applied potential which was identified to be + 1.8 V (vs. stainless steel). Under these conditions, a linear range for nicotine of 13–3240 μg/L (0.26 ng–65 ng on column) was obtained, with a detection limit of 3.0 μg/L (0.06 ng on column).
Petrick (2011)	To investigate surface reactions between nicotine ozone on model indoor surfaces (cellulose powder, cotton, and paper). The effect of substrate type on nicotine surface oxidative kinetics also examined.	Model surfaces: strips of chromatography paper (17.5 × 13.5 cm), cotton cloth samples (10 × 3 cm), wallboard samples (9 × 1 × 1.3 cm) (Extracted with accelerated solvent extraction). Gas phase compounds: Tenax TA in sorbent tubes (Extracted with accelerated	Chamber smoke aged (building)	C of nitrogenated SHS compounds, nicotine, pyridine, 3-ethenylpyrirdine, PM2.5, Pyrrole, N-methylformamide, myosmine. heterocyclic compounds (1,3 diazine or pyrazine, 4-pyridinol, nicotine, indazole, 2,4bypyridil, 9H-Pyridol indole,1-methyl/9HPyridol indole-	Experimental	GC-IT-MS/MS	In the presence of ozone, no gas phrase nicotine was detected as *a* result of re-emission, and higher concentrations of nicotine oxidation products were observed than when ventilation was performed with ozone-free air. Analysis of the model surfaces showed that heterogeneous nicotine-ozone reactions was faster on paper than cotton, and both were faster on the paper

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Table 2 (*continued*)

Author (year)	Objective of the study	Matrix	Setting	Components	Type of design	Analytical method to measure TSH	Main result
		solvent extraction). SVOCs: XAD-Coated denuders (Extracted with a Integrated Organic Gas and Particle Sampler).		terpyridine); phenolic compounds (hydroquinone); nicotine oxidation by products (2,5 pyridine cardoxylic acid/nicotinic acid, nicotinamide, B-nicotyrine, cotinine); PAHs (Naphthalene,1–3dimethyl, 1Hphenalene/fluorene,pyrene/ fluoranthene, phenanthrene,1-methyl-7–1-methylethyl, Naphthacene/benzo(a)anthracene/ triphenylene, 1,2dihydrobenzo(b) floranthene/12-binaphthalene); other(dibenzofuran,pyrolol			than cotton, and both were faster than on wallboard. However, wallboard played *a* dominant role in ozone-initiated reaction in the chamber due to its large total geometric surface area and sink potential compared to the other substrates.
Petrick and Svidov-sky (2011)	To investigate the role of ozone and indoor surfaces in chemical transformations of tobacco smoke residues.	Cellulose powder, white cotton cloth, chromatography paper. (Evaporation of the solved exposed to nicotine-chloroform solution)	Laboratory	SOA formation, surface product analysis (myosmine, cotinine),	Experimental	FTIR-ATR with a scanning mobility particle sizing (SMPS)	During chamber ventilation in the presence of ozone (180 ppb), ozone decayed at a rate of 5.6 h^{-1} and coincided with a factor of 5 less nicotine absorbed to wallboard. In the presence of ozone, no gas phase nicotine was detected as a result of re-mission, and higher C of nicotine oxidation products were observed than when ventilation was performed with ozone-free air. Analysis of the model surfaces showed that heterogeneous nicotine-ozone reaction was faster on paper than cotton, and both were faster than on wallboard. However, wallboard played a dominant role in ozone-initiated reaction in the chamber due to its large total geometric surface area and sink potential compared to the other substrates.
Purio (2015)	To reduce THS by using activated carbon filter (Purifier) in a controlled area	858 in3 transparent plastic box (2 × 2 × 5 m)	Laboratory	Carbon monoxide, benzene, butane (after purifier)	Experimental	Gas sensors	Through experimental trial in a size of 858in3 controlled area with a span of 50 min air filtration, it showed that 84% of Carbon Monoxide was at the minimum ppm level, while for Butane and Benzene were 94% and 84% respectively.
Ramírez et al. (2012)	To the develop a selective analytical method for the determination of nicotine and N-nitrosamines (9 volatile N-nitrosamines and 5 TSNAs) in indoor dust based on in-cell clean-up PLE, followed by GC×GC-NCD determination.	House dust using conventional vacuum cleaners stored in amber glass vials. Dilution of THS extracts.	House of smokers & non smokers	Nicotine, NDMA,NMEA, NDEA, NDPA, Nmor,NPyr, Npip, NDBA,NDPhA, NAT, NAB, NNK, NNAL.	Experimental	2 chromatographic systems: GC-MS equipment. Gas chromatograph and 225 Nitrogen Chemiluminescen-se Detector (GCXGC-NCD).	All the analytes were found in the samples, nicotine being the most abundant compound in smokers' dust and one of the most abundant in non-smokers' dust.
Ramirez (2015)	The optimization and validation of a highly sensitive and selective analytical method for simultaneously determining a wide range of polarity and volatility tobacco-related carcinogenic ONs in settled house dust samples.	Settled dust using conventional vacuum cleaners stored in amber glass vials. Dilution of THS extracts.	Homes of smokers & non-smokers (n:18)	NDMA,NMEA,NDEA,NDPA,OT,NB,-NMor,NPyr, Npip,OA, NDBA,Nicotine, 2AN, 4ABP,NNN,NNK,1NP (Parent ion (*m/z*, CID amplitude (V) or CID storage level (*m/z*))	Experimental	Varian gas chromatograph connected to a Varian 4000 ion trap mass detector (GC-IT-MS). Gas chromatograph and 225 Nitrogen	The performance of the optimized PLE/GC × GC-NCD method was tested by quantifying the target compounds in house dust samples from smokers' and non-smokers' homes. The median carcinogen compounds detected was 3.8 g $^{-1}$and 1.1 g^{-1}in smokers' and non-smokers' house dust, respectively.

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Table 2 (*continued*)

Author (year)	Objective of the study	Matrix	Setting	Components	Type of design	Analytical method to measure TSH	Main result
						Chemiluminescen-se Detector (GCXGC-NCD)	
Santos e Silva (2016)	To investigate the extent of THS within our university campus to assess exposure to individuals.	Dust-wipe samples obtaining wiping, placed in acetonitrile glass vial. Dilution of THS extracts.	Glass fronting of doors and windows facing onto entranceways (outdoor communal areas)	Nicotine levels (ug/m2), recovery data for nicotine	Experimental	HILIC with UV detection	Communal entrance ways were found to be contaminated with THS nicotine levels of between 5.09 µg/m2 and 309 µg/m2 comparable to that found in other previous studies of indoor environments.
Schick (2014)	To test the effects of aging on the concentration of PAHs, nicotine and tobacco-specific nitrosamines in cigarette smoke (aerosol, fresh and aged cigarette smoke, cloth and paper exposed)	Stainless steel, 3 M chromatography paper, 100% cotton terry cloth (extracted with teflon-coated glass fiber filters). Sampling cartridges with a PM10 inlet (for PAH samples, collected at 10 l/min for 4 h)	Automatic smoking machine. Laboratory chamber- in 3 different sites.	Nicotine, cotinine, TSNAs, NNN, NNA, NNK.	Experimental	Gas GS/MS/MS	The majority of the PAHs, nicotine, cotinine and tobacco-specific nitrosamines that are released during smoking in homes and public places deposit on room surfaces. 60% of polycyclic aromatic hydrocarbons, 70% of the nicotine and 80% of the tobacco-specific nitrosamines in SHS stick to room surfaces and are not removed under normal ventilation conditions. The ratio of NNK: nicotine on the exposed cloth was 10 fold higher than in aerosol samples.
Sleiman (2010)	To show that residual nicotine from tobacco smoke absorbed to indoor surfaces reacts with ambient nitrous acid (HONO) to form carcinogenic TSNAs.	Cellulose substrates (23cmX1cmX3mm) (vaporized in glass tubular-flow reactor), an impinger filled with methanol in an ice bath (gas products)	Chamber with smoking machine, (2 samples: extracted for a smoker driver)	TSNAs (NNA, NNK, NNN), nicotine, Formaldehyde, N-nitroso-pyrrolidine, Methyl− 3-pyridinecarboxylate, N-methylnicotinamide, 4(N-methyl-N-nitrosamino)2-oxi-mino− 1–3-pyridil)− 1-butanone, cotinine, 1-methyl5(3pyridinyl) pyrazole.	Experimental	GC-IT-MS/MS	1-(N-methyl-N-nitrosamino)− 1-(3-pyridinyl)− 4-butanal, a TSNA absent in freshly emitted tobacco smoke, was identified as the major product. The potent carcinogens 4-(methy-lnitrosamino)− 1(3-pyridinyl)− 1-butanone and N-nitroso nornicotine. Time course measurements revealed fast TSNA formation, with up to 0.4% conversion of nicotine.
Sleiman (2014)	To identify and quantify airborne THS pollutants available for respiratory exposure, identified potential environmental tracers, and estimated health impacts to nonsmokers	Multibed sorbent cartridges	Laboratory chamber (Air collection for 16.5 and 60 min at 160 ml/min after smoking 17–18 h). Smoker's house (1), (Air collection for 10–20 min at 100 L/min 8 h after 3 cigarettes has been smoked).	C of volatile constituents: nitrogenated VOCs,aromatic hydrocarbons, carbonyls & chlorinated VOCs, alkanes.	Experimental	Gas chromatography/ time of flight mass spectometer (GC X GC-TOFMS), Gravimetrically (with Teflon-coated fiberglass filters (TCGF)	The commonly used SHS tracers 3-EP and nicotine were no longer present in the gas phase after 2 h, likely due mostly to sorption to surfaces. By contrast, other VOCs persisted in the gas phase for at least 18 h, particularly furans, carbonyls, and nitriles. The C ratio of acetonitrile to 3-EP increased substantially with aging. This ratio may provide a useful metric for differentiating freshly emitted (SHS) from aged smoke (THS). Among the 29 VOCs detected in the smoker's home at moderate to high concentrations, 18 compounds were also detected in simultaneously sampled outdoor air, but acetonitrile, 2-methyl furan, and 2,5-dimethyl furan appeared to be specific to cigarette smoke. The levels of acrolein, methacrolein, and acrylonitrile exceeded Cs considered harmful by the State of California. An initial exposure and impact assessment was conducted for a subset of pollutants by computing disability-adjusted life years lost, using available toxicological and epidemiological information. Exposure to PM2.5 contributed to more than 90% of the predicted harm. Acrolein, furan, acrylonitrile,

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Table 2 (*continued*)

Author (year)	Objective of the study	Matrix	Setting	Components	Type of design	Analytical method to measure TSH	Main result
							and 1,3-butadiene were considered to be the most harmful VOCs. Depending on which criteria are used to establish the separation between SHS and THS, 5 − 60% of the predicted health damage could be attributed to THS exposure.
Thomas (2011)	To evaluate if iso-NNAL, has been adequate biomarker for THS and to evaluate the levels of total NNAL in children exposed to SHS	Questionnaire. Level of PM2.5 in home environment. Passive air nicotine (dosimeters). Urine sample sterile.	Participant's home (smokers) (n:79)	Total NNAL, total cotinine, total nicotine. Iso-NNAL	Cross-sectional	TSI Side Park AM510 personal aerosol monitor (recording PM2.5). Gas chromatographic and liquid chromatography-electrospray (LC-ESI-MS/MS) (urine).	90% of the children had detectable total NNAL in urine; total nicotine and total cotinine were also detected in most samples. Significant positive relation between biomarker levels and exposure of children in the home. Levels were highest in homes with no smoking restrictions. African American children had significantly higher levels than other children. Iso-NNAL was not detected in any urine sample.
Thomas (2014)	To investigate the presence of tobacco-specific carcinogens in dust homes.	Questionnaire, dosimeter, 100% cotton swab. Dilution of THS extract.	Homes of smokers and homes of no smokers volunteer staff.	Characteristics of smokers homes, NNK (*m/z*) (pg/100 cm2), NNAL(*m/z*), (pyridine-D4)NNK(*m/z*), (pyridine-D4)NNAL(*m/z*), child cotinine (ng/ml)	Case-control.	Gas chromatography. LC-MS/MS	They positively identified NNK on surfaces in 33 of 37 smokers' homes (700 ± 788 pg/100 cm2 [range, not detected–3500 pg/100 cm2]), but only in 3 of 19 nonsmokers' homes (235 ± 176 pg/100 cm2 in the homes where NNK was detected [range, not detected–435 pg/100 cm2]). ($p < 0.0001$).
Ueta (2010)	To determinate the VOCs for a systematic evaluation of THS. Additionally, the proposed method was applied to the determination of actual THS in an automobile.	Fabric samples (cotton, linen, silk, acetate, polyester), breath samples (Tedlar bags). Extracted with vacuum sampling device; for VOCs was used a medium with copolymer of MA and EDMA.	Trail with a metal box with the clothing fabric and burning tobacco inside)	Benzene, 2,5-DMF, toluene, pyrrole, o,m-xylene,2-furaldehyde	Experimental	GC-MS	A trace amount of smoking-related VOCs was successfully determined by the proposed method. The adsorption and desorption behaviours of smoking-related VOCs were clearly different for each fabric material. The VOCs in the smokers' breath results suggested that no significant effect of the smokers' breath on the potential pollution occurred in the typical life space.

2-Aminoaphthalene (2AN), 4-Aminobiphenyl (4ABP), 2, 5-dimethyl furan (2,5-DMF), 3-ethenylpyridine (3-EP), Basal (BL), Collision induced dissociation (CID), Concentration (C), centimeters (cm), 1-methyl-5-pyridin-3-yl-pyrrolidin-2one (cotinine), Direct analysis in real time (DART), Dulbecco's modified Eagle's medium (DMEM), Ethylene glycol dimethacrylate (EDMA), electrospray ionisation (ESI), ion electrospray ionisation (ESI), Environmental Tobacco Smoke (ETS), Fourier transform infrared spectroscopy with attenuated total reflectance element (FTIR-ATR), Gas chromatography/time of flight mass spectometer (GC X GC-TOFMS), Gas chromatography equipped with a ion trap-tandem mass spectrometric detection (GC-IT-MS/MS), Gas chromatograph with mass spectrometer (GC-MS), 225 Nitrogen Chemiluminescense Detector (GCXGC-NCD), High-Volume-Small Surface –sampler (HVS4), hours (h), Hydrophilic interaction liquid chromatography (HILC), nitrous acid (HONO), Isotope dilution mass spectrometry (IDMS), liquid chromatography with electrochemical detection (LC-ED), Liquid chromatography-tandem mass spectrometry (LC-MS/MS), liquid chromatography/mass spectrometry/mass spectrometry (LC-MS/MS), liquid chromatography tandem mass spectrometry (LC-MS-MS), liters (l), millimeters (mm), Methacrylic acid (MA), Mass spectrometry (MS), N-nitrosoanabasine(3-(1-nitroso-2-piperidinyl)pyridine) (NAB), N-nitrosoanatabine (1,2,3,6-tetrahydro-1-nitroso-2,30-bipyridine) (NAT), Nitrobenzene (NB), N-nitrosodibutylamine (NDBA), N-nitrosodiethylamine (NDEA), nitrosodipropylamine (NDPA), N-Nitrosodimetilamina (NDMA), N-Nitrosomethylethylamine (NMEA), Neonatal Intensive Care Unit (NICU), 1-Nitropyrene (1NP), N-nitrosodiphenylamine (NDPhA), N-nitrosomorpholine (NMor), 1-(N-methyl-N-nitrosamino)-1-(3-pyridinyl)-4-butanal) (NNA), 4-(methylnitrosamino)- 1-(3-pyridyl)-1-butanol (NNAL), 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK), N-nitrosonornicotine (NNN), N-nitrosopyrrolidine (NPyr), N-nitrosopiperidine (NPIP), Neural red uptake (NRU), O-Anisidine (OA), Organic nitrogen compounds (ONs), O-Toluidine (OT), polycyclic aromatic hydrocarbons (PAHs), pressurized liquid extraction (PLE), fine particulate matter (PM2.5), Proton transfer Reaction Mass spectrometry (PTR-MS), Surface acoustic wave (SAW), Settled house dust (SHD), Secondhand smoke (SHS), Secondary organic aerosol (SOA), Teflon-coated fiberglass filters (TCGF), Thirdhandsmoke (THS), tobacco smoke emissions (TSE), Tobacco-specific nitrosamines (TSNAs), tobacco smoke pollution (TSP), United States (US), Volatile Organic Components (VOCs).

3.2. Exposure and impact of THS on health

Table 1 summarizes the 21 studies about the exposure and impact of THS on health. The characteristics of those studies are described in Table 3 and they have been classified in vitro studies, in vivo studies and human studies.

Studies that evaluated THS cytotoxicity (Hammer et al., 2011; Bahl et al., 2016b, 2016c) found that THS exposure caused alterations in both animal and human cellular functions (Bahl et al., 2016c) and an increase in cytotoxicity (Hammer et al., 2011; Bahl et al., 2016a, 2016b, 2016c). Bahl et al. (2016b) created two scenarios to simulate real environments (cars and rooms), showing that a small number of cigarettes is sufficient to exert a cytotoxic effect and that the effect of THS in animal and human cells varies according to variations in sunlight or the culture medium. Those authors also analyzed the mitochondria exposed to THS finding that exposure did not cause cell death but generated mitochondrial stress and small alterations in gene expression in animal and human cells (Bahl et al., 2016a). Hang et al. analyzed THS in short- and long-term lung cancer cells from mice and humans, showing structural changes in DNA (Hang et al., 2013). In relation to this, Xu showed exposure to low doses of THS alters the gene expression of male reproductive murine cells (Xu et al., 2015). Bahl et al. (2016c) identified acrolein as a highly cytotoxic VOC in THS. Figueiró was the first to evaluate the effect of THS in animal and human cells collected from the homes of smokers (Figueiró et al., 2018).

We found 5 studies that analyzed the relationship between THS and either tissues or animals (Rehan et al., 2011; Martins-Green et al., 2014; Karim et al., 2015; Adhami et al., 2016; Dhall et al., 2016) (Table 3). Rehan et al. evaluated whether THS components other than nicotine could adversely affect lung development in fetal rats (Rehan et al., 2011). Adhami et al. assessed changes in glycemia and insulinemia produced by THS exposure in mice (Adhami et al., 2016). Martins-Green et al. (2014) analysed changes in liver, lung, and skin tissue and behaviour in a mouse model, showing that collagen production increased as did the number of inflammatory cytokines in lung tissue. Karim et al. (2015) evaluated platelet biology in mice. Dhall and collaborators found delayed wound healing and an altered inflammatory response in the skin of exposed mice (Dhall et al., 2016). Hang et al. (2018) found that early exposure to THS was associated with increased lung cancer risk in mice.

Ramírez et al. (2014) studied the relationship between THS exposure in people and the risk of cancer. They estimated the potential cancer risk by age based on exposure to carcinogen N-nitrosamines and tobacco-specific nitrosamines (TSNA) measured in house dust samples, showing an increased risk of cancer in the homes of smokers, with a greater risk if the exposure occurred at an earlier age (Ramírez et al., 2014).

Leung et al. (2018) independently investigated the prevalence of SHS and THS in adolescents. Those authors found a linear relationship between respiratory symptoms and THS levels at home in non-smokers. Jung et al. (2012) investigated the effect of parental smoking on respiratory morbidity in children, reporting an increase in cough related-symptoms in the THS group versus unexposed individuals. Northup et al. estimated the THS exposure of the infant children of smoking mothers who were admitted to a Neonatal Intensive Care Unit (NICU), finding detectable levels of cotinine and its main metabolite in the urine samples of the infants and also nicotine levels on the surface of incubators (Northrup et al., 2016b). Another study found that children with asthma who were not exposed to THS had lower levels of exhaled nitric oxide (FeNO) compared to asthmatic children who were exposed to THS (De la Riva-Velasco, Krishnan and Dozor, 2012).

3.3. Beliefs, behaviours and policies related to THS

A total of 16 studies were included in this group (Table 1). The characteristics of these studies are described in Table 4.

Zakarian et al. (2017) showed that over 90% of hotels had smoking rooms scattered among non-smoking rooms, and about half of the smoking hotels reported that guests requesting a specific rooms were sometimes assigned to the other room type. Wilbur et al. (2015) examined smoke-free policies from the point of view of Multi-Unit Housing (MUH) caretakers, finding positive caretaker experiences with smoke-free policies. In fact, the MUH caretakers reported needing less time for unit turnover, in supplies, and in capital replacements. In addition, the caretakers had a higher satisfaction when working in a smoke-free environment (Wilbur et al., 2015). Delgado-Rendon et al. described the behaviours related to THS among a Hispanic population living in a MUH; in that study, smoking was banned by 97% of participants inside the home and 85% of the residents were in favour of a complete ban on smoking in apartment buildings (Delgado-Rendon et al., 2017b). Escoffery et al. conducted a survey to evaluate the opinions of a low-income population about THS, finding that most of participants had never heard about THS and did not know what THS was (Escoffery et al., 2013). Another study conducted in the year 2012 had a similar finding, with none of the 24 participants knowing what THS was (Delgado Rendón et al., 2017a).

Samet et al. (2015) interviewed a group of realtors and car dealers to assess their opinions about THS, finding that most were concerned about the effect of past smoking on property values and many reported using techniques to try to eliminate THS. Darlow et al. (2017) found that up to one out third of health professionals had heard about THS before the survey, and two out thirds believed that THS issues do not receive enough attention.

Kayser and Semenic (2013) interviewed expectant or new fathers who were considering smoking cessation, finding that these men altered their smoking behaviours (such as smoking exclusively outside of the home or trying to quit smoking) during pregnancy or postpartum in order to protect their partners and infants. Drehmer et al. (2014) evaluated the possible association between the belief that THS is damaging to children and the attitudes of smoking parents, home or car smoking policies, and quitting behaviours. Winickoff evaluated adult health beliefs about children exposed to THS and whether there are differences between smokers and nonsmokers (Winickoff et al., 2009). That study found that only 43% of smokers agreed that THS harms children versus 65% of non-smokers (Winickoff et al., 2009). Moreover, strict rules prohibiting smoking in homes were more prevalent among nonsmokers (Winickoff et al., 2009).

Baheiraei et al. (2018) shows the relationship between smoking bans at home and parental awareness and beliefs about the impact of SHS and THS on infants' health. Roberts et al. analyzed people's risk perception of exposing children to SHS and THS, finding that very few respondents perceived THS exposure to present a risk, although non-smokers and respondents living with children were more likely to see smoking in home as a risk factor for health problems (Roberts et al., 2017). Two studies showed how a brief intervention (a short video) in parents or caregivers of children can produce changes in behaviours against tobacco and TSE (Patel et al., 2012; Walley et al., 2015). Chen investigated the association between positive and negative reactions to THS and openness to smoking in young never-smoking children, finding that negative reactions to THS such as "uncomfortable eye" or "dislike the smell" were associated with non-initiation among the non-smokers (Chen et al., 2016). Haardörfer et al. (2017) developed a brief scale to use as a model for measuring beliefs about THS and to determine whether THS beliefs are correlated with smoking behaviours and smoke-free policies at home.

3.4. Other aspects of THS

This group included only 3 studies (Table 1). The characteristics of these studies are described in Table 5. All three of these studies were conducted in the United States. These studies had similar objectives: to examine nicotine residues deposited by electronic cigarettes (two

Table 3
Impact of THS on health.

Author (year)	Objective of the study	Matrix (THS)	Setting (THS)	Components (THS)	Outcome	Population	Type of design of study	Analytical method to measure the TSH	Intervention	Main Result
In Vitro Studies										
Bahl, Johnson (2016)	To test the effect of THS on mitochondrial dynamics, structure, and function.	Terry cloth exposed to cigarette smoke wraped in closed plastic bag for 11 months. After exposed in amber bottles. Aqueous extracts of THS prepared in DMEM	Experimental chamber	/	Citotoxicity of THS (mitochondrial morphology,al-teration proliferation rate)	mNSC (mousse), hESC (human)	Experimental	/	Exposure and extraction of THS from terry cloth, mitochondrial characteristics, ROS production and oxidation of mitochondrial proteins, MMP, transcriptional profile of genes associated with mitochondrial function	Cs of THS that did not kill cells caused stress-induced mitochondrial hyperfusion (SIMH), which was characterized by changes in mitochondrial morphology indicative of fusion, increased mitochondrial membrane potential (MMP), increased ATP levels, increased superoxide production, and increased oxidation of mitochondrial proteins. SIMH was accompanied by a decrease in Fis1 expression, and a decrease in apoptosis-related genes, including Aifm2, Bbc3, and Bid. There was also down regulation of Ucp2, Ucp4, and Ucp5, genes that decrease MMP thereby reducing oxidative phosphorylation, while promoting glycolysis. These effects, which collectively accompany SIMH, are a prosurvival mechanism to rescue damaged mitochondria and protect cells from apoptosis. Prolonged exposure to THS caused a reduction in MMP and decreased cell proliferation.
Bahl, Shim (2016)	To test the hypothesis that low levels of THS adversely impact cell health and survival and that the chemicals in THS change as THS ages.	Seat car cover fabric and carpet exposed. Terry cloth extracted in DMEM. Aqueous extracts of THS.	Acrylic chamber, experimental chamber.	Nicotine, cotinine, N-formylnornico-tine, myosmine, 2,3-bypyridine, nicotelline, NNA, NNK, NNN, NAT, NAB (ng/g fabric)	Citotoxicity and genotoxicity	mNSC (mousse), hDF(human), hPM (human)	Experimental	LC-MS/MS	2 controlled laboratory exposure scenarios and low levels of THS. One exposure modeled THS in a car parked outdoors, while the second modeled THS in a room without sunlight. The fabrics were exposed to cigarette smoke and then extracted in culture medium.	The C of TSNAs increased with aging in the indoor experiment. THS extracts were used for cytotoxicity testing using mNSC, hDF and hPM. Extracts from the car experiment inhibited mNSC proliferation in a live cell imaging assay and induced single strand DNA breaks in mNSC and hDF. In the indoor experiment, THS extracts made with medium containing serumproteins were significantly more toxic than extracts made with basal medium, and mNSC and hPM were more sensitive than hDF in the car experiment.
Bahl, Weng (2016)	To evaluate the cytotoxicity and mode of action of fresh and aged THS, the toxicity of VOCs in THS, and the	Terry cloth, polyester, paper exposed to cigarette smoke wrapped in plastic bag. Aqueous extracts	Experimental chamber	VOCs (Toluene, acetonitrile, 3-Ethylenepyridin-e, phenol, 1-h-Pyrrolo(2,3-b) pyridine,2-methyl-	Cytotoxicity of THS	mNSC (mousse), hPF (human), lung epithelial cells (A549) (human).	Experimental	Proton transfer reaction mass spectrometry (PTR-MS, IONICON), gas chromatography-	THS generated in experimental chamber and terry cloth, polyester fleece, and paper exposed. Identification of VOC in THS extracts. Culturing	THS extracts induced blebbing, immotility, vacuolization, cell fragmentation, severing of microfilaments and depolymerization of microtubules in mNSC. Cytotoxicity was inversely related to headspace volume in the

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Table 3 (*continued*)

Author (year)	Objective of the study	Matrix (THS)	Setting (THS)	Components (THS)	Outcome	Population	Type of design of study	Analytical method to measure the TSH	Intervention	Main Result
	molecular targets of acrolein, a VOC in THS.	of THS prepared in DMEM.		benzaldehyde,a-cetophenone, quinoline, benzonitriole, acetone, 2-pentanone,2-butanone				mass spectrometry	cells were exposed to THS.	extraction container and was lost upon aging VOCs in THS, and in combination, their cytotoxicity increased. Acrolein inhibited proliferation of mNSC and hPF and altered expression of cell cycle regulatory genes. 24 h of treatment with acrolein altered some expression of transcription gens.
Hang (2013)	To assess the genotoxicity of THS in human cell lines using two in vitro assays by measuring DNA strand breaks and oxidative DNA damage in exposed human cell lines	Cellulose paper substrates, chromatography paper immersed in serum DMEM. Dilution of THS extracts.	Smoking machine in a teflon-lined cubic chamber and stainless steel chamber.	COT, N-formylnornicotine, NNA, NNK, NNN, bipyridine, nicotelline.	DNA damage	Human hepatocellular carcinoma (HepG2), normal lung epithelial BEAS− 2B cell line (ATCC) (human)	Experimental	LC-MS/MS, Gas chromatography-ion-trap-tandem mass spectrometry (GC-IT-MS/MS)	Analysis quantified TSNAs and common tobacco alkaloids in extracts of THS that had sorbed onto cellulose substrates. Exposure of human cells to either acute or chronic THS.	Exposure of human HepG2 cells to either acute or chronic THS for 24 h resulted in significant increases in DNA strand breaks. Cell cultures exposed to NNA alone showed significantly higher levels of DNA damage in the same assay. NNA is absent in freshly emitted SHS, but it is the main TSNA formed in THS when nicotine reacts with HONO long after smoking takes place. The PCR assay quantified significantly higher levels of oxidative DNA damage in (HPRT and POLB) genes of cultured human cells exposed to chronic THS for 24 h compared with untreated cells.
Xu (2015)	To test the effects of THS exposure on male reproductive cells, metabolomic analysis and RT-PCR	Chromatography paper extracted in DMEM. Dilution of THS extracts.	Stainless steel chamber	Nicotine, cotinine, NNK	Cell viability	GC− 2 cells and TM− 4 cells (murine)	Experimental	Dionex, spectrometer, isotopes (nicotine)	Laboratory exposure of male germ cell lines to show the effect of THS on them.	THS not affect cell viability in either GC2 or TM4 cells, while 500–50,000 μg/ml significantly reduced viability. GC2 cells show statistical changes in metabolites. TM 4 cells show statistical changes in metabolic profiles. There was no significant difference in cell viability, cell cycle, and apoptosis between THS treatment and the control groups. Multi-parameter cytotoxicity could alter metabolism in GC− 2 and TM− 4 cells indicating potential effects of THS on male reproduction.
In vivo studies										
Adhami (2016)	To determine how THS exposure causes insulin resistance in the absence of obesity and how that affects skeletal muscle function.	Cellulose filter paper introduced in a filtering device on the vacuum with suction.	Smoking apparatus in 2 exposure chambers.	/	Cell damage/ viability	Quadriceps muscle, blood (glucose, insulin) of mice (animals)	Experimental	Gain of weight with TPM	Mice exposed to THS under conditions that mimic exposure of humans. The experimental group was exposed to THS from 3 weeks of age to 24 weeks. Using Teague smoking apparatus. Two packs of 3R4F cig were smoked every day.	THS affects lipid peroxidation, protein nitrosylation and DNA damage, producing hyperglycemia and insulinemia. Indeed, reduced levels of insulin receptor were found, PI3K, AKT, all important molecules in insulin signaling and glucose uptake by cells.

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Table 3 (*continued*)

Author (year)	Objective of the study	Matrix (THS)	Setting (THS)	Components (THS)	Outcome	Population	Type of design of study	Analytical method to measure the TSH	Intervention	Main Result
Adhami (2017)	To determine whether there is a time-dependent effect of THS exposure on health.	Cages with common household fabrics	Smoking apparatus, exposure chamber	/	Citotoxicity, DNA damage.	Fasting blood glucose, insulin, CRH, ACTH, Epinephine, cortisol, POMC, dopamine, IL− 1alfa, IL− 4,IL− 6, IL10, GM-CSF, TNFalfa, AST, urea, H2O2, SOD, catalase, GPx, nitrotyrosine, lipid peroxidation DNA damage, ATP, Lactate, NRF, POMC (Mice).	Experimental	Gravimetric method	In vivo exposure. Mice were exposed to THS for 1,2,4, or 6 months.	THS exposure, as early as 1 month, resulted in increased circulating inflammatory cytokines, tumor necrosis factor by an order of magnitude of 2 and granulocyte macrophage colony-stimulating factor by an order of magnitude of 1.5 and in increases in the stress hormone epinephrine and the liver damage biomarker AST, increased in magnitude 1.5 and 2.5 times compared with controls, respectively. THS exposure for 2 months resulted in further damage and at 4 and 6 months, many factors related to oxidative stress were altered and caused molecular damage. Also, the mice became hyperglycemic and hyperinsulinemic.
Dhall (2016)	To investigate the mechanisms by which THS causes impaired wound healing.	Cages with common household fabrics	Smoking apparatus, exposure chamber	/	Effect on wound healing (effect on tissues)	SOD activity, H2O2 activity, catalase activity, GPx activity, TBARS, nitrotyrosine, DNA, cytokine/ chemokine levels, angiogenesis (mice)	Experimental	Gravimetric method	The THS group was exposed to THS from right after weaning to 24 weeks (6 months), whereas the control group was exposed to clean air.	Mice living under conditions that mimic THS exposure in humans display delayed wound closure, impaired collagen deposition, altered inflammatory response, decreased angiogenesis, microvessels with fibrin cuffs and a highly proteolytic wound environment. Moreover, THS-exposed mouse wounds have high levels of oxidative stress and significantly lower levels of antioxidant activity leading to molecular damage, including protein nitration, lipid peroxidation and DNA damage that contribute to tissue dysfunction.
Figueiró (2018)	To assess, for the first time, the cellular effects of THS from smokers' homes in three mammalian cell lines.	Cellulose chromatography papers (10 cmx2.5 cmx0.34 cm). Cotton wipes (cosmetic 100% cotton facial wipes) for surface wipe nicotine levels. extracted DMEM	12 houses samples (9 smoker homes and 3 nonsmoker homes)	Surface nicotine (ng/cm2)	Cytotoxicity effect	Cells (human from lung, and animals from rats tumors)	Experimental	Gas chromatography-mass spectrometry (GC/MS)	Papers were placed in nine smoker's homes and three nonsmoker's homes. An area equivalent to the paper size was cleaned with a cotton wipe. A549, Hep− 2 and 3T3 cells were exposed to THS for 24 h and cellular functions were assessed by MTT, neutral red (NR) reuptake and trypan blue exclusion assays.	High levels of nicotine were found in samples from smokers' homes. Cellular proliferation was similar in almost all samples after THS exposure. Few changes in the cellular functions were observed, mainly higher mitochondrial activity, in paper samples.

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Table 3 (*continued*)

Author (year)	Objective of the study	Matrix (THS)	Setting (THS)	Components (THS)	Outcome	Population	Type of design of study	Analytical method to measure the TSH	Intervention	Main Result
Hammer (2011)	To examine the potential of textile-bound nicotine for permeation through human skin and to assess the effects of cigarette smoke extracts from clothes on fibroblasts, neurocytes and zebrafish embryos	Cotton cloth under a glass flask (textile sweat extracts: TSE)	Experimental chamber	Nicotine	Cell damage, cytotoxicity assay, neurotoxicity.	Fibroblasts (murine and human), Tectum neurons (avian), early larval (zebrafish).	Experimental	Liquid scintillation counting (LSC) (for nicotine)	Effect of THS exposition to human skin, murine fibroblast, avian neurons and zebrasifh early larval.	Tritiated nicotine from contaminated cotton textiles penetrated through adult human full-thickness skin as well as through a 3D in vitro skin model in diffusion chambers. We also observed a significant concentration-dependent cytotoxicity of textile smoke extracts on fibroblast viability and structure as well as on neurocytes. Early larval tests with zebrafish embryos were used as a valid assay for testing acute vertebrate toxicity. Zebrafish development was delayed and most of the embryos died when exposed to smoke extracts from textiles.
Hang (2017)	To investigate the effect of THS exposure on bodyweight and the hematopoietic system in mice during two specific life stages: neonatal and early adulthood.	Cages with common cloths	Stainless steel chamber	/	Cytotoxicity (Effect on BMI and immunity)	Blood, cells (mice)	Experimental	/	Mice divided into experimental and control groups. The neonatal experimental group was exposed to THS from birth during 3 weeks. The adult experimental group was exposed to THS from 12 to 15 weeks of age.	At the end of neonatal exposure, THS-treated mice had significantly lower bodyweight than their respective control mice. However, 5 weeks after neonatal exposure ended, THS-treated mice weighed the same as controls. Adult THS exposure did not change bodyweight of mice. Neonatal and adult THS exposure had profound effects on the hematopoietic system. 14 weeks after neonatal THS exposure ended, eosinophil number and platelet volume were significantly higher, while haematocrit, mean cell volume, and platelet counts were significantly lower compared to control. Similarly, adult THS exposure also decreased platelet counts and increased neutrophil counts. Moreover, both neonatal and adult THS exposure caused a significant increase in percentage of B-cells and significantly decreased percentage of myeloid cells.
Hang (2018)	To test the hypothesis that short-term early exposure to THS increases the incidence of lung adenocarcinoma in A/J mice later	100% cotton terrycloth samples	Smoking machine in a teflon-lined cubic chamber and stainless steel chamber (for chronic THS)	Nicotine, cotinine, 3-EP,N-FNNIC,NNK,NN-A, Myosmine, NAT, 2,3-Bypyridine, NAB, Nicotelline, Naphthalene, 1-	Lung cancer incidence in mice, THS chemical characterization, activation of p53 pathway,DNA	Mice (lung tumors), human lung cancer cells	Experimental	LC-MS/MS	Mice divided into experimental (n:24) and control (n:19) groups. The experimental group was exposed to THS from 4 to 7weeks of age, the control group was never exposed. Also, a in	40 weeks after THS exposure from 4 to 7 weeks of age, the mice had increased incidence of lung adenocarcinoma, tumor size and, multiplicity, compared with controls. In vitro studies using cultured human lung cancer cells showed that THS exposure induced

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Table 3 (*continued*)

Author (year)	Objective of the study	Matrix (THS)	Setting (THS)	Components (THS)	Outcome	Population	Type of design of study	Analytical method to measure the TSH	Intervention	Main Result
	in life, and to delineate the molecular and cellular mechanisms that underlie THS-induced tumorigenicity.			Methyl naphthalene, 2-Methyl naphthalene, acenaphthyle-ne,acenaphthene, fluorene, phenantherene, anthracene, fluoranthene, Pyrene, Chrysene, Benzon(a) anthracene	damage, cell proliferation				vitro study has done using human lung cancer cells.	DNA double-strand breaks and increased cell proliferation and colony formation. RNA sequencing analysis revealed that THS exposure induced endoplasmic reticulum stress and activated p53 signaling
Karim (2015)	To investigate the impact of THS exposure in the context of platelet biology (activation, hemostasis, thrombogenesis) and related disease states.	Cages with common household fabrics	Smoking apparatus, exposure chamber	/	Effect on hemostasis and thrombogenesis	Plateret aggregation, hemostasis, thrombogenesis (mice)	Experimental	Gravimethic method	The THS group was exposed to THS from right after weaning to 24 weeks (6 months), whereas the control group was exposed to clean air for the same period. Mice baseline carotid artery blood flow was measured. Blood flow was continuously monitored for 30 min or until blood flow reached stable occlusion. Mice were subjected to the tail transection technique to measure the bleeding cessation time.	THS-exposed mice exhibited an enhanced platelet aggregation and secretion responses as well as enhanced integrin GPIIb-IIIa activation. It was found that THS exposure shortens the tail bleeding time and the occlusion time in a model of thrombosis.
Martins-Green (2014)	To investigate the effects of THS on liver, lung, skin healing, and behaviour, using an animal model exposed to THS under conditions that mimic exposure of humans.	Cellulose filter papers for the gain weighted.	Smoking apparatus in 3 exposure chambers.	Level of NNAL in exposed mice	Cell damage/ alterations	Histology, alterations in liver, lung, skin, glucose, urine, behaviours of mice (animals).	Experimental	Gain of weight with total particulate matter (TPM).	The experimental group was exposed to THS from right after weaning to 24 weeks.	THS-exposed mice show alterations in multiple organ systems and excrete levels of NNAL. In liver, THS leads to increased lipid levels and non-alcoholic fatty liver disease. In lung, THS stimulates excess collagen production and high levels of inflammatory cytokines. In wounded skin, healing in THS-exposed mice has many characteristics of the poor healing of surgical incisions observed in human smokers. Behavioural tests show that THS-exposed mice become hyperactive.

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Table 3 (*continued*)

Author (year)	Objective of the study	Matrix (THS)	Setting (THS)	Components (THS)	Outcome	Population	Type of design of study	Analytical method to measure the TSH	Intervention	Main Result
Rehan (2011)	To investigate if apart from nicotine, other components of THS would also affect lung development adversely (growth and differentiation of the developing lung)	/	/	Nicotine, NNK, NNA (all at 1×10^{-5}, 1×10^{-8}, 1×10^{-11})	Cell damage	Lung tissue from fetal rats (animals)	Experimental	/	Fetal rat lung explants were exposed to nicotine, (NNA), (NNK), the two main tobacco-specific N-nitrosamine constituents of THS for 24 h.	NNK and NNA exposure resulted in breakdown of alveolar epithelial-mesenchymal cross-talk, reflecting lipofibroblast to myofibroblast transdifferentiation. Also, an increase in apoptosis with nicotine as well as with NNK and NNA.
Human studies										
de la Riva-Velasco (2012)	To examine the effects of very low-level ETS exposure on FeNO and other markers of airway inflammation in school-age children with asthma on daily inhaled corticosteroids (ICS).	Questionnaire, urine sample	Urinary cotinine (ng/ml), EBC (with ph), FeNO measurement	Urinary cotinine (ng/ml), exhaled breath condensate (ph, FeNO(ppb))	Levels of FeNO in children with Asthma (exposed & no exposed to THS)	Children with asthma (8–18 years of age) (n:33)	Observational (retrospective)	ELISA	Children with stable asthma did a spirometry, ACQ, FeNO, exhaled breath condensate (EBC, pH), and EBC ammonia were compared between children with and without ETS exposure as determined by urinary cotinine	10 (30%) had urinary cotinine levels ≥ 1 ng/ml. Median ACQ was 0.29 (IQR: 0.22–0.57) for those with cotinine levels < 1 ng/ml and 0.64 (IQR: 0.57–1.1) for those with cotinine levels of ≥ 1 ng/ml, $p = 0$ 0.02. Median FeNO (ppb) was 23.9 (IQR: 15.2–34.5) for unexposed subjects and 9.6 (IQR: 5.1–15.8) for exposed subjects, $p = 0$ 0.008.
Jung (2012)	To investigate the association between parental smoking patterns and the prevalence of respiratory and ocular symptoms in children to determine the effect of both SHS and THS at home.	Questionnaire	/	Questions of ISAAC, Q of lower respiratory symptoms, Q of upper respiratory and eye symptoms.	Children's respiratory morbidity	Children 6–11 years (n:31584)	Descriptive study (cross-sectional)	/	The children's parents were asked about their smoking status and completed self-reported questionnaires regarding their children's symptoms related to asthma and other upper or lower respiratory illnesses	The children with Non-Smoking patients were 40.9%, THS group 40.6%, and SHS group 18.5%. THS group showed lower ORs for most respiratory symptoms when compared with those of SHS group, however, THS group revealed increased ORs compared with Non-Smoking in cough-related symptoms. There was a linear trend in frequencies of cough and sputum-related symptoms according to the degree of exposure to cigarette smoke ($p < 0.05$).
Leung (2018)	To investigate the prevalence of exposure to SHS at home from inside the home, SHS at home from neighbours, THS at home, and SHS outside home separately and collectively	Questionnaire adapted from the Global Youth Tobacco Survey	/	Questions of tobacco exposure, about respiratory symptoms.	Respiratory symptoms	Secondary students' schools (n:50762)	Descriptive study (cross-sectional)	/	Self-reported questionnaire was administered in 79 secondary schools randomly selected from all the 18 districts in Hong Kong with a probability proportional to the total number of schools in the respective districts in 2010–2011.	Tobacco smoke exposure at home was 23.2% considering SHS exposure from inside the home, but increased to 33.2% including SHS from neighbours and 36.2% further including THS. Including SHS outside home (55.3%), 63.3% of adolescents were exposed to SHS anywhere or THS at home. In never smokers, SHS from each source and THS at home were linearly

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Table 3 (*continued*)

Author (year)	Objective of the study	Matrix (THS)	Setting (THS)	Components (THS)	Outcome	Population	Type of design of study	Analytical method to measure the TSH	Intervention	Main Result
	in Hong Kong adolescents and the associations with respiratory symptoms in never smokers.									associated with respiratory symptoms. Exposure to more sources yielded stronger associations with respiratory symptoms (p for trend < 0.001). The ORa (95% CI) were 1.04 (0.97–1.11), 1.12 (1.03–1.22), 1.40 (1.26–1.56) and 1.99 (1.74–2.28) for 1, 2, 3, and 4 sources, respectively.
Mahabee-Gittens (2018)	To investigate if THS pollutants accumulate on the hands of ill children who live in environments where tobacco is used and to describe any associated clinical characteristics.	The palm and palmar of their dominant hand of ill children	Nicotine (ng/wipe)	Nicotine of dominant hand, cotinine	Hand nicotine and salivary cotinine.	Pediatric patients with potentially SHS-related illness (n:25)	Descriptive study (cross-sectional)	/	An intervention for caregivers who smoke, presenting to the emergency department with a potentially SHS-related illness were potentially eligible. The children provided samples, (hand, saliva). Parents reported sociodemographic characteristics.	All children had detectable hand nicotine (range = 18.3–690.9 ng/wipe). All but one had detectable cotinine (range = 1.2–28.8 ng/ml). Multiple linear regression results showed a significant positive association between hand nicotine and cotinine (p = 0.009; semipartial r^2 = 0.24), independent of child age.
Northup (2016)	To estimate infant exposure in the NICU after visits from household smokers.	Questionnaire, Surface nicotine (wipe index finger-no sample; 10 × 10 cm template taped to the couch and a screened cotton wipes for cribs the top of railing was measured, urine samples (cotton pads in infants' diaper). Dilution of THS extracts.	Index finger nicotine (ng), Crib/incubator (ug/m^2), Furniture (ug/m^2)	Nicotine (ug/m^2), urine: cotinine(ng/ml), 3-HC(ng/ml), NNAL(pg/ml), NNK	THS exposure in NICU patients	Smoking mothers with an infant in NICU (n:5).	Descriptive study (cross-sectional)	Liquid chromatography-tandem mass spectrometry	Participants provided surface nicotine samples from their fingers, infants' crib/incubator and hospital-provided furniture. Infant urine was analyzed for cotinine, cotinine's major metabolite: 3HC and NNAL, NNK.	Incubators/cribs and other furniture had detectable surface nicotine. Detectable levels of cotinine, 3HC and NNAL were found in the infants' urine.
Ramirez (2014)	To show the potential cancer risk by age group through nondietary ingestion and dermal exposure to carcinogen N-	Questionnaire, dust sample with an acetone wash stored in glass vials.	Private homes (n:46)	NDMA, NMEA, NDEA, NDPA, Nmor, NPyr, Npip, NDBA, Nicotine, NNN, NNT, NNK, NNAL (ug/g)	Levels of THS components, cancer risk assessment of THS exposure	House dust samples from private homes (smokers & non smokers) (n:46).	Descriptive study (cross-sectional)	Gas chromatography coupled with a nitrogen chemiluminescence detector (GCXGC-NCD)	Determination of nicotine and TSNAs, and N-nitrosamines in settled house dust samples from homes.	Calculated cancer risks through exposure to the observed levels of TSNAs at an early life stage (1–6 years old) exceeded the upper-bound risk recommended in 77% of smokers' and 64% of non-smokers' homes. The maximum risk from exposure to all nitrosamines

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Author (year)	Objective of the study	Matrix (THS)	Setting (THS)	Components (THS)	Outcome	Population	Type of design of study	Analytical method to measure the TSH	Intervention	Main Result
	nitrosamines and TSNAs.									measured in a smoker occupied home was one excess cancer case per one thousand population exposed.

3-hidroxycotinine (3-HC), Adenosine triphosphate (ATP), Adrenocorticotropic hormone (ACTH), Aspartate aminotransferase (AST), Asthma Control Questionnaire (ACQ), aspartate aminotransferase (AST), Body Mass Index (BMI), cigarettes (cig), d0- and d8-nicotelline, d0- and d9-cotinine (COT), Corticotropin-releasing hormone (CRH), Dulbecco's Modified Eagle's Medium (DMEM), deoxyribonucleic acid (DNA), exhaled breath condensate (EBC), Enzime-linked immunosorbent assay (ELISA), Environmental Tobacco Smoke (ETS), exhaled nitric oxide (FeNO), Gas chromatography-ion-trap-tandem mass spectrometry (GC-IT-MS/MS), gas chromatography coupled with a nitrogen chemiluminiscence detector (GCXGC-NCD), glutathione peroxidase (GPx), hydrogen peroxide (H2O2), Tobacco-specific nitrosamines (TSNAs), human dermal fibroblasts (hDF), human embrionic stem cells (hESC), H (hours), human pulmonary fibroblast (hPF), human palatalmesenchyme cells (hPM), hypoxanthine phosphoribosyltransferase 1 (HPRT), Interleukin (IL), International Study of Asthma and Allergies in Childhood (ISAAC), Liquid chromatography coupled with tandem mass spectrometry (LC-MS/MS), Liquid chromatography-tandem mass spectrometry (LC-MS/MS), Liquid scintillation counting (LSC), Mitochondrial membrane potential (MMP), mousse neural stem cells (mNSC), N-nitrosoanabasine (3-(1-nitroso-2-piperidinyl)pyridine) (NAB), N-nitrosoanatabine (1,2,3,6-tetrahydro – 1-nitroso-2,30-bipyridine) (NAT), N-Nitrosodimetilamina (NDMA), N-Nitrosomethylethylamine (NMEA), N-nitrosodiethylamine (NDEA), nitrosodipropylamine (NDPA), Neonatal Intensive Care Unit (NICU), N-nitrosomorpholine (NMor), N-nitrosopyrrolidine (NPYR), N-nitrosopiperidine (NPIP), N-nitrosodibutylamine (NDBA), Nuclear Respiratory Factor (NRF), N-nitrosonornicotine (NNN), N-nitrosothiazolidine (NNT), 4-(methylnitrosamino) – 1-(3-pyridyl) – 1-butanone (NNK),), 1-(N-methyl-N-nitrosamino) – 1-(3-pyridinyl)-4-butanal) (NNA), 4-(methylnitrosamino) – 1-(3-pyridyl) – 1-butanol (NNAL), 4-(Methylnitrosamino)-4-(3-pyridyl)butanal (NNA), 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol (NNAL), 4-methylnitrosamino-1-(3-pyridil)-1-butanone (NNK), N-nitrosonornicotine (NNN),Odds Ratio (OR), adjusted odds ratios (ORa), Polymerase Chain Reaction (PCR), polymerase β (POLB), Proton transfer reaction mass spectrometry (PTR-MS), Proopiomelanocortin (POMC), questions (Q), Reactive oxygen species (ROS), Reverse Transcription-Polymerase Chain Reaction (RT-PCR), Secondhand smoke (SHS), Stress-induced mitochondrial hyperfusion (SIMH), superoxide dismutase (SOD), thiobarbituric acid reactive substances (TBARS), thirdhandsmoke (THS), Tobacco Smoke Exposure (TSE), Total Particulate Matter (TPM), volatile organic chemicals (VOCs), nitrous acid (HONO).

studies) (Bush et al., 2015; Goniewicz et al., 2015) or by the hookah (one study) (Kassem et al., 2014). THS components were analyzed in two of the studies in e-cigarettes (e-cig) and hookah smoking houses and in the third study in a laboratory chamber (Goniewicz et al., 2015). In the e-cig studies, the kimwipe matrix was used for THS. All three studies used chromatography for the measurements and all used the same outcome measure: nicotine levels. The study design types were heterogeneous: one was observational, one cross-sectional, and one experimental (Table 5).

4. Discussion

In recent years, evidence about the harmful effects of THS, particularly among the pediatric population, has continued to grow. Notwithstanding this growing body of evidence, there is much that we do not know about the long-term effects of THS. The aim of the present comprehensive review of all the current literature is to assess the research performed to date on THS and to identify gaps in the literature that require more research.

The recent review by Jacob and colleagues (Jacob et al., 2017) emphasized the need to use specific biomarkers for THS other than those commonly used for SHS. Those authors emphasized, in particular, the importance of tobacco alkaloids and nitrosamines (TSNA). In the present review, we found that surface nicotine is the most analyzed component to detect THS, followed by nitrosamines and cotinine. It seems clear that surface nicotine is a useful tool to determine THS, especially given the evidence reported by Quintana et al., who found that surface wipe sampling for nicotine is a reliable, valid, and relatively simple method to quantify THS (Quintana et al., 2013). However, other methods to determine biomarkers of exposure to tobacco delivery products in urine or air are also available (Schick et al., 2017). Among the studies performed to date, the most widely used techniques for sample collection was the use of cotton wipes to collect dust samples while chromatography, with or without mass spectrometry, was the most common method for sample analysis. The results provided by these studies are adequate; however, comparative methodological studies are needed to confirm the most appropriate instruments for the analysis. Nonetheless, gas-chromatography-ion trap tandem mass spectrometry has been widely used to analyse TSNAs in SHS samples (Sleiman et al., 2009).

Studies of fabrics show a greater deposit of smoke-related chemicals in natural fibers (cotton and wood) than in polyester, with a longer duration of THS residues (Ueta et al., 2010; Bahl et al., 2014; Cheng et al., 2016). Two possible hypotheses could explain this phenomenon: 1) smoke chemicals bind less strongly to polyester than to cotton or 2) these compounds may be harder to extract in polyester; of these two hypotheses, the former is considered more likely (Bahl et al., 2014). This is important because fabrics are considered reservoirs of THS in indoor environments and a source of THS exposure.

Exposure to THS may have important detrimental health effects (Table 3). Evidence from experimental studies carried out in cells and animals suggest that THS exposure may produce genotoxic and cytotoxic cellular damage, such as immotility, vacuolization, cell fragmentation, or alterations at the mitochondrial level. Alterations in liver metabolism, thrombosis and angiogenesis have all been demonstrated in mice exposed to THS (Karim et al., 2015; Dhall et al., 2016). In addition, studies have shown that THS exposure causes alterations in the number of eosinophils, platelets and B cells. Importantly, the long-term implications of the alterations produced in the genes of male reproductive murine cells exposed to THS are still unknown (Xu et al., 2015). Several studies carried out in cell lines and in animals have found a dose-response relationship based on THS exposure (Karim et al., 2015; Bahl et al., 2016a, 2016b, 2016c). Martins-Green et al. (2014) showed that THS exposure is related to hyperactive behaviour in mice, which mimics human. Two other studies found that THS exposure is associated with respiratory symptoms (Jung et al., 2012; Leung et al.,

Table 4
Beliefs and behaviours of THS.

Author (year)	Objective	Population	Setting/place	Intervention	Outcome	Main result	Type of design of study
Baheiraei (2018)	To determine the prevalence of cigarette smoking bans in homes as well as associated factors in families with infants in Tehran, Iran.	Families with infants (n:1112)	10 healthcare centers in Tehran, Iran	Interview	Smoking ban at home. Parental awareness and belief in the impact of SHS and THS on infant health.	Complete smoking ban in homes was 37.3% Parental awareness of the impacts of SHS and THS on infant health was 2.33 ± 1.34 (mean ± SD; range: 0–6); most parents (64.6%) were inadequately aware of the effects of cigarette smoke on their infant's health. Furthermore, 79.6% of parents completely agreed with the impacts of SHS exposure on their infant's health, and 42.4% of parents completely agreed with the effects of THS exposure on their infant's health.	Descriptive study (cross-sectional)
Chen (2016)	To investigate the associations between reactions to THS and openness to smoking in young children.	Chinese primary school students. 36 schools were randomly selected (n: 4762).	Primary schools (Hong Kong).	School-based survey. An anonymous, self-administered questionnaire in simple Chinese.	Primary school students reported their reactions to THS, smoking status and openness to smoking.	In never smokers, openness to smoking was negatively associated with 'dislike the smell' (ORa: 0.52, 95% CI 0.39–0.68), 'coughing/choking' (0.53, 0.38–0.75), 'eye uncomfortable' (0.62, 0.40–0.95) and negative reaction factor score of 2–5 (vs. 0) (0.59, 0.40–0.88), and was positively associated with 'pleasant/happy' (2.80,1.54–5.09), 'excited' (2.83, 1.17–6.87), 'like the smell' (3.06, 1.49–6.26) and positive reaction factor score of 1–4 (vs. 0) (2.86, 1.83–4.48). In experimental or former smokers, fewer associations reached statistical significance.	Descriptive study (cross-sectional)
Darlow (2017)	To assess beliefs and behaviours regarding THS among healthcare professionals, and to examine associations among smoking attitudes/beliefs, provider demographics, and THS beliefs and behaviours.	Healthcare professionals at a comprehensive cancer center and affiliated general hospital in a northeastern urban area. Philadelphia (n: 204).	Cancer center and affiliated general hospital in a northeastern urban area. Philadelphia (US).	Online questionnaires	Third hand smoking attitudes and beliefs	About 1/3 had heard of THS before completing the survey, and more than 2/3 of the sample believed that THS issues do not receive enough attention. Being female, endorsing the belief that smoking affects the quality of parenting, and support for government action towards smoking bans were significantly associated with providers' belief that THS is harmful. Endorsing the belief that smoking affects the quality of parenting and belief that THS is harmful were significantly associated with the likelihood of discussing THS with others.	Descriptive study (Cross-sectional)

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Table 4 (*continued*)

Author (year)	Objective	Population	Setting/place	Intervention	Outcome	Main result	Type of design of study
Delgado-Rendon (2017)	To develop cultural relevant health education tools to empower residents of MUH to take action to protect themselves and their families from SHS and THS	Hispanic, 18 years or older and resident in MUH, (n:24)	MUH. Los Angeles (US)	Interview	Knowledge and misconceptions about SHS and THS, exposure to THS, perceptions to extent of the problem in MUH, conversations with neighbours about smoking, policy awareness and attitudes, talking to landlords about SHS and THS, potential solutions to protect tenants from SHS and THS	Hispanic residents reported unpleasant experiences with SHS and THS and were generally knowledgeable about the adverse health effects, although they were not familiar with the term "THS". Some participants also mention marijuana smoke as a potential health hazard. Hispanic cultural values made participants reluctant to confront their neighbours but also motivated them to find ways to protect their families from smoke.	Descriptive study (cross-sectional)
Delgado Rendon (2017)	To describe the characteristics, attitudes, knowledge and behaviours related to SHS, THS and marijuana smoke exposure (MSHS) of a sample of Hispanic tenants in randomly selected MUH units in eastern metro Los Angeles	Hispanic tenants adults living in randomly selected MUH. (n:402)	MUH.Los Angeles (US)	Interview	Characteristics of the participants, health literacy in English and Spanish, tenants' living conditions and rules related to smoking, knowledge, attitudes, self-efficacy and behaviours related to SHS and THS, intentions to take action. Demographic variables associated with knowledge self-efficacy, attitudes, and intentions.	Although most participants (97%) banned smoking inside their homes, 80% reported infiltration of SHS inside their apartments within the last year. Most (85%) favoured a complete ban on smoking in apartment buildings. 28% t did not know that MSHS is also harmful to their health. Knowledge scores were higher among Spanish-speakers ($p < 0.05$).	Descriptive study (cross-sectional)
Drehmer (2014)	To determine if the belief that thirdhand smoke is harmful to children is associated with smoking parents attitudes, home or car smoking policies, and quitting behaviours	Smoking parents in an exit survey after a pediatric office visit in 10 intervention and 10 control practices (n: 1947). 12 follow-up data were collected. (n: 1355)	Pediatric office. 8 states in the US.	Surveys	“Breathing air in a room today where people smoked yesterday can harm the health of babies and children" (THS). Parents attitudes about the benefits of quitting, perception of harm from smoking, and opinions about how smoking affects overall well-being, ”How acceptable do you feel it is for your child's doctor, nurse, or other health care provider to talk to you about your smoking?”,	THS harm belief was associated with a strictly enforced smoke-free home and car and attempts to quit smoking. Sensitizing parents to thirdhand smoke risk could facilitate beneficial tobacco control outcomes. A significantly higher percentage (71 vs 50%) of parents who did not hold the THS harm belief at baseline made at least 1 quit attempt if they agreed that thirdhand smoke is harmful at 12-month follow-up.	Observational
Escoffery (2013)	To examine knowledge and opinions of THS among a low-income population.	6 focus groups, of smokers and non-smokers. (n:39)	Clinics in Atlanta and Georgia (US)	Survey + group discussion	Beliefs about SHS. Knowledge and attitudes about THS. Perceived harm of residue and of the air between smoker and non smoker group.	Most of the participants had not heard about it and did not know what THS was. When asked about the dangers of THS, some participants made references to children indicating that they can easily inhale or ingest the residue leading to harmful effects. Almost all the participants stated that they thought being educated about THS would motivate people to make their homes smoke free	Descriptive study (cross-sectional)

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Table 4 (*continued*)

Author (year)	Objective	Population	Setting/place	Intervention	Outcome	Main result	Type of design of study
Haardörfer (2017)	To present the development of a THS Beliefs Scale and its initial psychometric properties tested among participants of a survey panel.	Adults living with a smoker and a non smoker, and allow at least one some smoking in the home with 6 month of follow up (by phone or mail) (n:508)	People recruited through a call center that connects callers to needed social services such as utilities assistance in Houston, Texas for a SFH intervention trial (US).	3 mails and 1 coaching call to help. Create a SFH.	Beliefs about THS scale development and scale psychometric properties, participants characteristics.	The 9-item scale showed excellent internal consistency. Confirmatory factor analysis indicated good model fit for the 2 factor solution in a low-income population. Tests of construct validity indicated differences due to exposure to the smoke-free homes intervention, by smoking status, whether participants own or rent their home, and smoking ban status in the home	Observational
Kayser (2013)	To identify smoking and quitting motives among expectant or new fathers who were in the precontemplation or contemplation stage of smoking cessation and to explore their perceptions of smoking cessation interventions.	Convenience sample of five expectant fathers and five new fathers (n:10)	Conducted in an outpatient antenatal clinic and postpartum unit of a large university hospital.	Surveys	Changes in smoking behaviours, smoking and quitting motives, opinions about smoking cessation support, reactions to interview and normative feedback.	All the participants made changes in their smoking behaviours during pregnancy or postpartum to protect their partners and infants from the odor and/or potential harm of SHS and THS. Our findings reveal that pregnancy and childbirth may be a time when men experience additional and unique stress that influences continued smoking but may also give rise to unique motives for future smoking reduction and cessation among men previously resistant to quitting. Expectant or new fathers may be more drawn to smoking cessation interventions.	Descriptive study (cross-sectional)
Patel (2012)	To determine the impact of brief THS intervention on smoking behaviours of caregivers of children seen in an urban pediatric	Prospective 6-month follow-up pilot study of a convenience sample consented caregivers were randomized to a control or intervention group. (n:42).	Pediatric ED, of a Urban hospital in US.	Surveys, case-control interventions	Change in smoking status. Policies for smoking in home or car	Results revealed the treatment group was more likely to change smoking policies (OR 2.0, 95% CI 0.166 – 24.069), reduce the number of cigarettes (OR 4.88, 95% CI 0.785–30.286), or quit smoking (OR 1.12, 95% CI 0.346–3.590).	Case- Control study
Roberts (2017)	To evaluate the general population's risk perception of the dangers that ETS exposure poses to children, including an analysis of the risk perceptions for exposure to both SHS and THS. To assess how these risk perceptions, differ between cohorts based on present and past smoking habits and the presence or absence of individuals < 18 years living in respondents' homes.	Adults (n:310).	Academic medical center (US).	Surveys	Comparisons between current smokers and nonsmokers and between previous smokers and respondents who never smoked. Comparison of responses based on presence of children in the respondents' homes.	Nonsmokers and respondents living with children were more likely to see smoking in the home as affecting all the queried health problems ($p < 0.05$). Knowledge of the risks of SHS exposure is limited, and very few respondents perceived risk from THS exposure	Descriptive study (cross-sectional)

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Table 4 (*continued*)

Author (year)	Objective	Population	Setting/place	Intervention	Outcome	Main result	Type of design of study
Samet (2015)	To gain an understanding of the current level of concern about THS property transfer, including home sales, property rentals, and the purchase of a used vehicle.	Realtors (n:27) and car dealers (n:20).	Los Angeles (US)	Survey by phone or in-person interview of key stakeholders to better understand approaches to address THS in the real state and automobile industries	Characteristics of real state or dealership with regard to previous habits in properties.	Most respondents indicated concerns about past smoking for property value and reported using various techniques to eliminate THS.	Descriptive study (cross-sectional)
Walley (2015)	To show if a brief intervention provided to parents and caregivers during their child's hospitalization would be associated with improved knowledge regarding the harmful effects of THS and encourage behaviours changes that may reduce the child's exposure.	Parents or caregivers. Questionnaire. (n:167; Follow up for n:123).	Tertiary hospital in Birmingham, Alabama (US)	Survey self-administered before intervention included: a motivational video. Immediate postintervention knowledge parents was assessed which contained the same knowledge questions but in different order and phrasing..telephone follow up 1–3 months.	Behaviour changes in tobacco smoke exposure. Knowledge about adverse effects of TSE in children	Parents and caregivers of smoke-exposed children hospitalized for respiratory illnesses had high baseline knowledge of the effects of TSE. The mean number of correct responses from the 6 questions at baseline improved immediately postintervention and the improved knowledge was maintained at 1 and 3 months. The majority of smoking and nonsmoking parents reported behaviour changes that could lead to reduction in the child TSE. Behaviour changes reported included initiating home and vehicle smoking bans, discussing reduction of the child's smoke exposure, and showing the video to others. Improvement in knowledge after this brief intervention was associated with reported initiation of home and vehicle smoking bans (p:0.01)	Observational
Wilbur (2015)	To examine the impact of smoke-free policies on costs.	Landura and PPM executives identified eligible caretakers. (n: 20).	US companies.	Phone interviews,	Time Needed for Unit Turnover, Supplies Needed for Unit Turnover, Capital Replacements Necessitated by Smoke Damage, Caretaker Experiences with Smoke-Free Policies	Decrease in time needed for unit turnover, decrease in supplies needed for unit turnover, decrease in capital replacements necessitated by smoke damage, positive caretaker experiences with smoke-free policies	Descriptive study (cross-sectional)
Winickoff (2009)	To assess health beliefs of adults regarding THS exposure of children and whether smokers and nonsmokers differ in those beliefs. To determine the prevalence of recognizing the dangers associated with THS.	Adults (n:1478)	Data from the social climate survey of Tobacco Control. Annual cross-sectional survey (US)	Telephone interview of a representative sample of US adults selected using random-digit-dialing.	SHS harms health of children, THS harms health of children, smoking ban at home, home smoking policies.	95.4% of nonsmokers versus 84.1% of smokers agreed that SHS harms the health of children, and 65.2% of nonsmokers versus 43.3% of smokers agreed that thirdhand smoke harms children. Strict rules prohibiting smoking in the home were more prevalent among nonsmokers: 88.4% vs 26.7%. THS harms the health of children remained independently associated with rules prohibiting smoking in the home. SHS hurts the health of children was not independently associated with rules prohibiting smoking in the home and car.	Descriptive study (cross-sectional)

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Table 4 (*continued*)

Author (year)	Objective	Population	Setting/place	Intervention	Outcome	Main result	Type of design of study
Zakarian (2017)	To examine hotels' smoking policies and their implementation.	California hotel managers (n:383)	California hotels (US)	Telephone survey	Prevalence of 100% smoke-free properties, prevalence of hotels with 100% nonsmoking guest rooms, prevalence of smoking-permitted rooms, prevalence of other smoking-permitted hotel areas, communication of smoking policies to hotel guests, protections for nonsmoking hotel guests, violations of hotel smoking policies, aditional special cleaning.	Overall, 60.6% of hotels reported that smoking was prohibited in all guest rooms, and 4.7% reported that smoking was prohibited everywhere on their property. While California law permitted smoking in up to 65% of guest rooms, only 6.9% of rooms were reported as smoking-permitted. Over 90% of hotels had smoking rooms scattered among nonsmoking rooms, and about half of the smoking hotels reported that guests requesting either smoking or nonsmoking rooms were sometimes assigned to the other room type. When guests smoked in nonsmoking rooms fees could be substantial, but were often uncollected.	Descriptive study (cross-sectional)

Emergency Department (ED), marijuana smoke exposure (MSHS), Multiunit housing (MUH), OR (Odds Ratio), Adjusted Odds Ratio (ORa), Partnership Property Management (PPM), Randomized Control Trail (RCT), Smoke free home (SFH), Secondhand smoke (SHS), Thirdhand smoke (THS), United States (US).

2018). Exposure to THS and its impact on healthy is particularly relevant in the pediatric population. Although the studies carried out on children are not abundant, it is possible to extrapolate well-known evidence as private settings (the main source of THS) is the place where children spend more time after school (Martins-Green et al., 2014). Given the unique characteristics of children and infants versus adults, such as their developing immune system, or hand-to-mouth eating, crawling or sucking, it seems likely that this population may be especially vulnerable to THS exposure (Jung et al., 2012; Roberts et al., 2017). Recent studies have shown that children exposed to THS environments receive higher doses per kg of body weight than adults (Bahl et al., 2016a). Other studies suggest that THS exposure causes mitochondrial stress and decreased proliferation of neural stem cells, which could affect the development of the brain in children, since some THS components can penetrate the blood brain barrier (Bahl et al., 2016a). However, more studies are needed to better characterize the mid to long-term consequences of THS exposure in terms of population health, especially among children.

This systematic review shows that numerous studies have been conducted to analyse the beliefs, behaviours and policies related to THS. We identified five studies that investigated population risk perceptions of THS (Escoffery et al., 2013; Samet et al., 2015; Delgado Rendón et al., 2017a; Roberts et al., 2017). Interestingly, realtors and car dealers try to eliminate THS due to concerns about the negative impact of THS on the value of their products. Realtors have reported that potential buyers with children are particularly wary of buying property contaminated by THS. Among car dealers, 90% consider that used cars from smokers is problematic as it affects the value of the vehicle (Samet et al., 2015).

One study found that nearly all respondents living in a MUH reported that they prohibit smoking inside their homes, with up to 85% of them in favour of implementing a complete ban on smoking in the apartment building (Delgado-Rendón et al., 2017a, 2017b). In another study, caregivers of a MUH interviewed after the application of smoke-free policies were highly satisfied with the ban and even noted a certain decrease in their workload (Wilbur et al., 2015).

Novel research includes two studies (Delgado Rendón et al., 2017a, 2017b) that described marijuana smoke exposure. A recent systematic review described the effects of second- and thirdhand marijuana smoke exposure (Holitzki et al., 2017). However, more research is needed to determine the effect of long-term exposure on health.

One survey (Roberts et al., 2017) showed that non-smokers with children were more likely to see smoking at home as a health problem. Studies of adults with children have found a lack of knowledge about the effects of THS exposure, indicating that greater social awareness is necessary. For example, Kayser et al. showed that expectant fathers changed their smoking habits (such as smoking outside the home) during pregnancy or the postpartum period to protect the children and their partners from exposure (Kayser and Semenic, 2013). Baheiraei and colleagues found that those parents who believe that THS has an impact on the health of their children are more likely to implement a complete smoking ban at home (Baheiraei et al., 2018). Walley et al. demonstrated that a brief intervention on the effects of the TSE to parents of hospitalized children produced changes in smoking behaviours, including implementation of home or vehicle smoking bans (Walley et al., 2015). Patel et al. also showed a beneficial effect of a brief intervention designed to increase awareness about the effects of THS exposure in caregivers, leading to a change in smoking behaviours that benefitted the children (Patel et al., 2012). Nevertheless, unawareness of the effects of THS remains poor, as demonstrated by the findings of two studies, both of which found that many (in fact, most) respondents did not know what THS was or did not think that THS exposure presented any risks (Escoffery et al., 2013; Roberts et al., 2017). Darlow et al. found that health professionals who believe THS to be harmful are more likely to discuss this issue with others, which is why it is crucial to provide health professionals, especially

Table 5
Other aspects of THS.

Author (year)	Objective	Population/places	Matrix	Setting	Analytical method	Type of design/ study	Main result	Outcome
Bush (2015)	To examine the nicotine residue in e- cigarette users' homes.	Smokers of vape in their home regularly on a daily basis. (n:22). Control group (n:8). Smoker's homes	Surface wipe sample: using half of a Kimwipe 10cmx10cm. Dilution of THS extracts.	Smokers e-cig. vaping houses	Gas chromatography	Descriptive study (cross-sectional)	Nicotine levels in e-cigarette users homes was significantly lower than that found in cigarette smokers homes (average concentration 7.7 ± 17.2 vs. 1303 ± 2676 g/m2; $p < 0.05$). There was no significant difference in the amount of nicotine in homes of e-cigarette users and non-users.	Nicotine levels (ug)
Goniewicz (2015)	To assess the deposition of nicotine on various surfaces as a marker of THS exposure from e-cigarettes	Laboratory chamber	Surface wipe sample: using Kimwipe, template with a10cmx10cm. Dilution of THS extracts	Exposure chamber	Gas chromatography	Experimental	Three out of four experiments showed a significant increase in the amount of nicotine on all five surfaces.	Nicotine deposited (ug/m^2)
Kassem (2014)	To investigate nicotine levels in indoor air and on surfaces inside homes of hookah-only smokers, and carcinogen and other toxicant uptake in children living in these homes.	Homes of hookah smokers. (n:24). US.	Air samples (collected with passive diffusion monitor badges). Badges: a modified 37-mm diffusive cassette with a sodium bisulphate-treated Teflon-coated glass fiber filter. Surface wipes: collected with cotton wipe (10 × 10 cm), in amber glass bottles. Urine samples. Dilution of THS extracts.	Houses with hookah smokers	Liquid chromatography tandem mass spectrometry (LC-MS/MS) with electrospray ionisation.	Observational	Nicotine levels in indoor air and on surfaces in the child bedrooms in homes of daily hookah smokers were significantly higher than in homes of nonsmokers. Uptake of nicotine, NNK, and acrolein in children living in daily hookah smoker homes was significantly higher than in children living in nonsmoker homes. Uptake of nicotine and NNK in children living in weekly/monthly hookah smoker homes was significantly higher than in children living in nonsmoker homes. Urine cotinine was detected in 75% of samples from children living in daily hookah, 85% of samples from children living in weekly/monthly smoker homes and 60% of samples from children living in nonsmoker homes. Air nicotine levels in living rooms were positively correlated with the total number of hookah heads smoked during the 7 days, and air nicotine levels in child bedrooms were positively correlated with air nicotine levels in the living rooms.	Air and surface nicotine (ug/m3, ug/m2), NNK, and acrolein, Cotinine (ng/mg creatinine), total NNAL (pg/mg creatinine), 3-HPMA (pmol/mg creatinine)

E- cigarrette (e-cig), Liquid chromatography tandem mass spectrometry (LC-MS/MS), 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK).

paediatricians, with more education about THS. Increased awareness among these professionals could lead to greater social awareness among parents, and in turn help to limit or prevent exposure of children (Darlow et al., 2016). In fact, less than 50% of smokers agreed that THS harms children, unlike SHS where the percentage rises to more than 80% (Winickoff et al., 2009). These arguments indicate why governments and health professionals should prioritize informing the population about the effects of exposure to THS. Governmental policies—such as smoke-free rental apartment buildings—are needed to protect the population, especially children, from exposure to these harmful substances. Recently (in February 2017), the U.S. government established smoke-free policies in public housing units (including common areas) (Department of Housing and Urban development, 2016), a policy that other governments could emulate. In this sense, guidelines were recently published on the clinical management of thirdhand smoke exposure in pediatric health care (Drehmer et al., 2017).

Although the study by Smith et al. was excluded from the present review, the findings of that review of tobacco use policies in military housing are worth mentioning (Smith et al., 2015). That study reported that smoking is not allowed in housing units that share ventilation system with other units (except in the Air Force), thus ensuring that family housing, hotels and submarines are all protected from THS exposure. For this reason, governments around the world should implement smoke-free policies in all households of public officials or households receiving social assistance (e.g., rental apartments for youths or the unemployed). Another study excluded from this review (a meeting abstract) also showed interesting results: NNK had more adverse effects on lung growth and differentiation than nicotine (Chien et al., 2011). These results open a door to future research to determine which components of THS have the most detrimental effects on health. The study by Quintana et al., which was also excluded (abstract only), showed that THS pollutants in a casino decreased after a complete smoke-free ban was implemented in 2014 (Quintana et al., 2015).

Initial investigation on THS exposure exists when smoking with other devices than conventional cigarettes, showing THS exposure associated with e-cig and pipe, although when the levels of THS exposure of e-cig where compared against smoking tobacco cigarettes, these levels were smaller (Kassem et al., 2014; Bush and Goniewicz, 2015; Goniewicz and Lee, 2015). Two other studies (abstracts only) excluded from this systematic review (Goldberger et al., 2011, 2012) described THS exposure from opium smoking in Afghanistan, revealing that > 70% of hair samples from women and children living in exposed homes were positive for opium products at 2 years of follow-up. Despite the limited number of studies on smoking devices other than cigarettes, all of them show evidence of THS exposure.

In 2014, Bell reviewed the literature from a public health point of view, showing that social awareness of THS risks was virtually nonexistent (Bell, 2014). There are studies showing that more than half of the population did not know what THS is and its risks for health (Escoffery et al., 2013; Darlow et al., 2017; Roberts et al., 2017). In this context, awareness-raising campaigns should be promoted by our governments and health professionals should receive training about THS. The risk of transfer of THS begins to take hold, although at present there are still very little evidence as such, it is named as fourhand smoke in some articles of the review (Bekö et al., 2018; Kuki et al., 2015).

The main limitation of the present review is the heterogeneity of the original studies that have been included, which makes it difficult to synthesize the results. Although our initial intention was to perform a meta-analysis of the studies, this was not possible due to the wide heterogeneity of the data. Nonetheless, we were able to identify many common findings among the included studies. Another limitation, probably due to the characteristics of the included studies, was the inability to have a risk of bias in spite of having tried.

This systematic review includes all of the original studies published to date on THS. Our findings highlight a wide degree of heterogeneity among those studies. The matrixes and methods used in the various studies differed widely, thus limiting the comparability of the studies. Nevertheless, the data in these studies confirm the negative health effects of THS, showing that THS exposure is harmful, both to adults and, especially, children. However, it is sometimes difficult to separate SHS and THS, and data on the effects of long-term exposure to THS are not available. Importantly, our findings indicate that the general population has a poor knowledge of what THS is and are largely unaware of its effects on health.

Based on the finding of this systematic review, we recommend that future studies attempt to unify criteria to the extent possible, using samples of THS obtained from real-world environments. Studies carried out in laboratory rooms demonstrate the harmful effects of THS at the cellular level and in animal, but more real-world evidence would be beneficial in humans. Most studies have been carried out in private rather than public places, especially in private houses. Clearly, it is important to continue studying the effects of THS in these locations given that this is the most common place where the population is exposed to THS. Although some studies sought to identify specific components of THS (Thomas et al., 2011), most analyzed the most common components of tobacco on surfaces (nicotine, nitrosamines, and cotinine). Although evaluation of such components is the most cost-effective approach, the most relevant component in organic fluids remains to be determined given the paucity of available studies on this topic. It is very clear that exposure to THS negatively impacts health and for this reason it would be unethical to carry out randomized clinical trials (and it would also be difficult to be fully control the level of THS exposure). Therefore, we recommend that observational studies be conducted to better understand the consequences of THS exposure, especially in the pediatric population, over the medium and long-term.

This systematic review highlights the lack of social awareness about THS and the consequences of exposure to these substances. That said, brief educational interventions can produce important changes in people's habits (such as smoking outdoors to limit the exposure of children to THS), as demonstrated in several studies (Patel et al., 2012; Walley et al., 2015). Therefore, it is especially important to improve social awareness of the existing problem and to involve governments in creating protective policies against exposure. Such policies would include, for example, subsidizing smoke-free buildings, establishing clauses that prohibit smoking in homes that rental subsidies, or even giving tax benefits to smoke-free homes. The finding in this review confirm the harmful effects of THS on health. Nevertheless, more studies are needed to evaluate the mid- to long-term consequences of such exposure.

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4.5. Thirdhand smoke among parents with children under 3 years in Spain

POPULATION STUDY ARTICLE

Knowledge and attitudes toward thirdhand smoke among parents with children under 3 years in Spain

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INTRODUCTION: The knowledge and beliefs about what is thirdhand smoke (THS) are limited. Our objective is to characterize the knowledge and beliefs about THS in parents of children under 3 years old in Spain.
METHODS: A cross-sectional study ($n = 1406$ parents) was conducted online in 2017. We collected information about the knowledge of THS given later, written information with the definition of THS, and asking about beliefs of the effects of THS on children's health.
RESULTS: A total of 27% of the respondents had heard about THS. We only found significant differences among smoking status, being the smokers who declare higher knowledge about THS. A total of 86% of the respondents believed that THS is harmful to their children with statistically significant differences according to educational level, higher among parents with a university degree (ORa = 2.6), and according to the previous knowledge on THS (ORa = 2.1).
CONCLUSIONS: This is the first study in Europe to describe the knowledge and belief of THS. Around 3 out of 10 parents have heard about THS and more than 8 out of 10 parents believed that THS is harmful to their children. Currently, they were not aware of THS but after providing brief information about it, most of them agreed that THS exposure is harmful to their children.

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INTRODUCTION

In 2006, the term thirdhand smoke (THS) was first mentioned in commercial press,[1] also known as *residual tobacco smoke* or *aged tobacco smoke*.[2,3] However, the concept was not defined until 2011 as "residual tobacco smoke pollutants that remain on surfaces and in dust after tobacco has been smoked; are re-emitted into the gas phrase; or react with oxidants and other compounds in the environment to yield secondary pollutants" by Matt et al.[2]

Numerous studies showed the adverse health consequences of secondhand smoke (SHS), with no minimum safe level to tobacco smoke exposure[4,5] In fact, there are some components of SHS that adhere to indoor surfaces, or are reissued back into the indoor air and may react with atmospheric species creating other pollutants that are not present in the original fresh smoke.[6,7] Therefore, it has been postulated that some of the components of THS could have greater toxicity than tobacco smoke or SHS due to the oxidation and reconstitution processes that occur on the surfaces when deposited.[8–10] Some of the components of THS found in indoor dust and surfaces could be ingested, inhaled, or even absorbed through the skin.[11–13] Moreover, some of the components of THS are kept in the fibers of the clothes up to 19 months.[14] Recently, some author's review has been published summarizing the effects of THS on cells, animals, and humans.[10,15,16] Also, THS has been related with an increase in mortality risk due to living with a smoker.[7]

Children have a developing immune system, a higher respiratory rate, and in addition, infants crawl and carry things continuously to the mouth.[17,18] These specific characteristics of children make them more vulnerable to THS exposure.[17,19] Furthermore, in children population, exists as an inability to move away from the principal settings of passive exposure to contaminants as private settings, particularly houses and cars, making them especially vulnerable to THS.[20] In this sense, a previous cross-sectional study found associations between exposure to THS and adverse respiratory symptoms in children.[18] Related to this, a guidance for the clinical management of THS exposure in child healthcare setting has recently been published.[19]

To the best of our knowledge, there are few descriptive studies describing the knowledge and beliefs of THS in adults related to the pediatric population, and there is no study conducted in Europe.[10,21–26] This is the first study in which parents and caregivers of children are asked about their knowledge of THS, and after explaining briefly the THS term, they are asked again if they believe that THS is harmful to the health of their children. The objective of this study is to describe the knowledge and beliefs about THS in parents or caregivers of children under 3 years in Spain.

METHODS

This was a cross-sectional study of a sample of parents ($n = 1406$) with children between 3 and 36 months carried out in Spain (1112 from Catalonia region, 168 from other Spanish regions, and 126 without information of the region) who accepted to participate in the study. We used the data from a study about the quality of the sleep of the children called EpiSon conducted via online

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questionnaires to parents or caregivers with children between 3 and 36 months. The objective of the EpiSon study was to analyze the relationship between sleep quality in children and the adherence to sleep hygiene routines in families according to sociodemograhic variables. The questionnaire of EpiSon study also included a section about THS.

The inclusion criteria from the study were all those parents or caregivers with a child from 3 to 36 months of age who spoke Spanish and agreed to participate. The exclusion criteria from the study were all those parents or caregivers with a child from less than 3 months or more than 36 months of age, or parents or caregivers who did not speak Spanish.

The surveys were conducted in Spanish from March to November of 2017 with a duration of approximately 15 min for all questions (questions regarding the study of sleep patterns and a section about thirdhand smoke). Even though respondents filled in personal information, the data were treated anonymously. The recruitment of the participants was done through ballots distributed in the waiting room of the pediatric consultation of HUGC. The ballots explained briefly the EpiSon project and offered the voluntary participation through a link to the website to complete the survey. In addition, digital media such as social network, private emails, and kindergarten emails were used, and mobile applications explaining with the same text as the ballot the purpose of the study and requesting participation. To gain access to completing the survey, participants filled in the informed consent online. In the informed consent document, the voluntariness, confidentiality, and anonymization of personal data were specified. The participants did not receive an economic incentive or a gift. To carry out the study, approval from the Ethics Comittee of the HUGC and the Ethics Committee of Research (CER) of the Universitat Internacional de Catalunya (UIC-Barcelona) was obtained.

Variables

We gathered information about the smoking status, the secondhand smoke exposure of their children, the voluntary regulation of tobacco consumption at their home, and their knowledge and beliefs regarding THS harmful effects for their children. First, we asked about the smoking status of the respondent of the questionnaire using the following question: "¿Do you smoke?" with three possible answers: "Yes, currently", "No, but I smoked", and "No, I have never smoked". Then, we asked about the secondhand smoke exposure of the children with the following questions: "During the past 2 weeks, ¿Has your child been exposed to secondhand smoke in your home" with a possible dichotomous answer (Yes or No) and "¿Has your child been exposed to secondhand smoke in another place different from your home?" with a possible dichotomous answer (Yes or No). In addition, we asked about the voluntary regulation of tobacco consumption at homes with the following question: "Which situation describes better the "rules" of smoking INSIDE your home?" with four possible answers: "Nobody can smoke (smoke is not allowed)", "You can only smoke in some places inside the house", "You can smoke anywhere (there are no rules)", and "Don't know/no answer". Then, we asked about general knowledge of THS using the following question: "Have you heard about "Thirdhand smoke" before?" with a possible dichotomous answer (Yes or No). Just after, written information about the concept of THS was given to all the participants with the following sentence: "Thirdhand smoke" (or third-hand smoke) is the smoke generated by tobacco and deposited in the form of waste on surfaces such as furniture, textiles or food. We then asked about the beliefs of the effects of THS on children's health using the following question: "Do you think exposure to Thirdhand smoke is harmful to children?" with six possible answers: "Yes, totally agree", "Yes, agree", "Neither agree, nor disagree", "Disagree", "Strongly disagree", and "Don't know/no answer". We recoded this variable according to whether the respondents agreed with THS being harmful to their children ("Yes, totally agree", "Yes, agree") or disagreed ("Neither agree, nor disagree", "Disagree", "Strongly disagree", and "Don't know/no answer"). All the variables questions with the possible answers have been added to Appendix 1.

Statistical analysis

We calculated the percentages for responses about THS knowledge and beliefs of the effects of THS on children, and SHS exposure at home among those respondents who previously knew THS. THS knowledge and belief responses were stratified by the following categories: sex of the child; age of the child (categorized as less than 1 year, 1–2 years, and more than 2 years); siblings (categorized as yes or no); relationship of the child with the respondent (categorized as mother, father, and other); smoking status (categorized as smokers, former smokers, and never smokers); level of education of the respondent (categorized as primary or less, secondary, and university); age of the respondent (categorized as less than 25 years old, between 25 and 35 years old, and more than 35 years old). For the belief of the effects of THS, we stratified according to the previous knowledge of THS (categorized as yes or no). We also calculated the adjusted odds ratio (ORa) with 95% confidence intervals (CI) for sex, age, educational level, and smoking status of respondents through logistic regression. Data analyses were performed using the R statistical software program, version 3.4.2.

RESULTS

Table 1 shows the baseline characteristics of the respondents. Table 2 shows the knowledge about THS among respondents. A total of 27% of respondents reported having heard about THS. We only found statistically significant differences in the THS knowledge to smoking status, being that this awareness was higher among smokers (35.3% smokers, 22.7% former smokers, and 27% never smokers) (Table 2). There were not significant differences according to child characteristics (sex, age, siblings, and relationship with the respondent) and characteristics of the parents (level of education and age of the respondent) (Table 2).

A total of 86% (95% CI: 84–87.8) of participants believed that THS is harmful to their children (after being informed of the meaning of THS in the questionnaire). We found statistically significant differences about the perception of THS harmful effect according to educational level (being higher among parents with university degree) (90.4% university degree, 82.9% secondary degree, and 81.3% primary degree or less) and the previous knowledge about THS (93.9% and 83.4%, respectively) (Table 3).

We did not find statistically significant differences in SHS exposure at home from children among those respondents who previously knew THS (ORa = 0.9; 95% CI: 0.6–1.6). We also did not find statistically significant differences in smoke-free rules at home between those respondents who previously knew THS against those who did not (ORa = 0.7; 95% CI: 0.5–1.1).

DISCUSSION

This is the first study in Europe to describe the knowledge and beliefs of THS among parents with children under 3 years. Around 3 out of 10 parents had previously heard about THS and more than 8 out of 10 parents believed that THS exposure is harmful to their children. There were no differences in the knowledge and belief of THS according to sociodemographic variables. We only found statistically significant differences according to smoking status.

A total of 86% of the respondents believed that THS is harmful to their children. Moreover, it is interesting to point out that 90% of respondents with higher education level believe that THS is harmful for children's health. In addition, the belief increases to

Table 1. Baseline characteristics of the respondents of EpiSon study, 2017

	n	%
Sex of the child		
Men	726	48.4
Women	680	51.6
Age of the child		
Less than 1 year old	368	26.2
Between 1 and 2 years old	984	67
More than 2 years old	54	3.8
Age of the child (mean, sd)	1.15 (0.8)	
Brothers or sisters		
No	539	38.3
Yes	867	61.7
Relationship with the child		
Mother	1326	94.3
Father	72	5.1
Other	8	0.6
Smoking status		
Smokers	252	18
Former smokers	480	34.3
Never smokers	666	47.6
Educational level		
Primary or less	109	7.9
Secondary	378	27.3
University	896	64.8
Age of the respondent (mother and father)		
Less than 25 years old	44	3.4
Between 25 and 35 years old	719	56.2
More than 35 years old	517	40.4
Age of the respondent (mean, sd)	34.23 (4.9)	

sd standard deviation

more than 90% of respondents among those who knew THS prior to the survey. A study conducted in the United States (US) showed a higher prevalence than our study, with up to 91% of parents believing that THS was harmful to the health of their children.[25] In contrast, a study from Iran population recently published shows that 42.4% of parents completely agree with the harmful effects of THS exposure on their infant's health.[26] Furthermore, those parents who believed that THS was harmful used cessation assistance more frequently, up to 1.7 times more compared with parents who did not believe and were more likely to have a strictly enforced smoke-free home and car policies.[25,26] In addition, another study showed that a brief intervention in education about THS to the caregivers attending an emergency room with their children under 36 months produced changes in their smoking behaviors (as changes in the smoking policy in home or car, a reduction in the number of cigarettes smoked, or quitting smoking).[24] This fact highlights the importance of educating on this subject, and the need of social educational policies especially focused on parents and caregivers. Moreover, one study showed an independent association between the belief that THS harms children and the voluntary adoption of smoke-free rule at home.[22] At present, there are few studies on THS knowledge among general populations and as far as all have been carried out in low-income communities.[27,28] One of them refers that most of its 39 participants do not know what THS was, although after defining the concept, some perceived risk in the exposure to THS in children.[27] In another study, conducted in 2012 in Los Angeles, California with 24 participants recruited in a low-income neighborhood, none of the participants knew the definition of THS.[28] This is the first study, with a large sample size showing the prevalence of the knowledge of THS.

Table 2. Knowledge of the concept of thirdhand smoke (THS) in parents with children younger than 3 years old according to sociodemographic and smoking status in Spain (2017)

	n	%	95% CI	*p*-Value	OR[a]	95% CI
Overall	1406	27	(24.7–9.4)			
Sex of the child				0.413		
Men	726	28	(24.7–31.4)		1	—
Women	680	25.9	(22.7–29.4)		0.9	(0.5–1.3)
Age of the child				0.489		
Less than 1 year old	368	26.4	(22–31.2)		1	—
Between 1 and 2 years old	984	27.5	(24.8–30.5)		1	(0.7–1.2)
More than 2 years old	54	20.4	(11.1–33.9)		0.7	(0.3–1.4)
Brothers or sisters				0.226		
No	539	25	(21.5–29)		1	—
Yes	867	28.1	(25.2–31.3)		1.2	(0.9–1.6)
Smoking status[b]				0.001		
Smokers	252	35.3	(29.5–41.6)		1	—
Former smokers	480	22.7	(19.1–26.8)		0.6	(0.4–0.8)
Never smokers	666	27	(23.7–30.6)		0.7	(0.5–1)
Educational level[b]				0.053		
Primary or less	109	34.9	(26.1–44.6)		1	—
Secondary	378	28.6	(24.1–33.5)		0.7	(0.5–1.2)
University	896	24.9	(22.1–27.9)		0.6	(0.4–1)
Relationship with the child[b]				0.520		
Mother	1326	27.2	(24.9–29.7)		1	—
Father	72	23.6	(14.7–35.3)		0.8	(0.4–1.4)
Other	8	12.5	(0.7–53.3)		0.7	(0–4.8)
Age[b]				0.168		
Less than 25 years old	45	37.8	(21.2–53.5)		1	—
Between 25 and 35 years old	720	26.9	(23.8–30.4)		0.6	(0.3–1.2)
More than 35 years old	523	25	(21.4–29)		0.6	(0.3–1.1)

CI confidence intervals, *OR* odds ratio
[a]Adjusted for sex, age, smoking status, and level of education of the respondent
[b]Information of the respondent of the survey

Previous studies showed a statistically significant relationship between those parents who believe that THS has an impact on the health of their children and home-smoking ban.[22,25,26] Because of this, we expected to find differences among those participants who knew THS previously, in tobacco smoke exposure in their children, and in the percentage of smoke-free rules at home, as opposed to those who did not know. However, we have not found statistically significant differences, so we believe that more educational and training measures should be emphasized on the risks of exposure to SHS and THS.

Two studies assessed the impact of brief educational interventions on THS (i.e., motivational video or brief education) on the

Table 3. Belief that thirdhand smoke (THS) is harmful for children's health in parents with children younger than 3 years old according to sociodemographic and smoking status in Spain (2017)

	n	%	95% CI	*p*-Value	OR[a]	95% CI
Overall	1406	86%	(84–87.8)			
Sex of the child				0.339		
Men	726	86.9%	(84.2–89.2)		1	—
Women	680	85%	(82–87.6)		1	(0.7–1.6)
Age of the child				0.810		
Less than 1 year old	368	86.1%	(82.1–89.4)		1	—
Between 1 and 2 years old	984	85.8%	(83.4–87.9)		1.3	(0.8–2)
More than 2 years old	54	88.9%	(76.7–95.4)		4.1	(0.8–74)
Brothers or sisters				0.633		
No	539	86.6%	(83.4–89.3)		1	—
Yes	867	85.6%	(83–87.8)		0.8	(0.5–1.3)
Smoking status[b]				<0.001		
Smokers	252	81.3%	(75.9–85.8)		1	—
Former smokers	480	82.9%	(79.2–86.1)		1.1	(0.6–1.8)
Never smokers	666	90.4%	(87.8–92.5)		2.6	(1.4–4.8)
Educational level[b]				0.190		
Primary or less	109	81.6%	(72.8–88.2)		1	—
Secondary	378	82.4%	(80.2–87.8)		0.7	(0.3–1.6)
University	896	87%	(84.6–89.1)		0.8	(0.3–1.8)
Relationship with the child[b]				0.091		
Mother	1326	86.3%	(84.4–88.1)		1	—
Father	72	81.9%	(70.7–89.7)		0.6	(0.3–1.3)
Other	8	62.5%	(25.9–89.8)		—	—
Age[b]				0.220		
Less than 25 years old	45	86.7%	(72.5–94.4)		1	—
Between 25 and 35 years old	720	87.2%	(84.5–89.5)		1	(0.2–3.2)
More than 35 years old	523	83.7%	(80.2–86.7)		1.1	(0.2–3.4)
Knowing THS previously to the survey				<0.001		
No	1014	83.4%	(81–85.6)		1	—
Yes	379	93.9%	(90.9–96)		2.1	(1.2;3.8)

CI confidence intervals, *OR* odds ratio
[a]Adjusted for sex, age, smoking status, and level of education of the respondent
[b]Information of the respondent of the survey

smoking behavior of parents or caregivers of children who come to the emergency room or are hospitalized for respiratory illnesses.[23,24] Both studies show that a greater knowledge of THS increases the smoking ban in houses and cars.[23,24] In our study, explaining the definition of THS could be interpreted as a population educational message although it was not the objective of the study. Moreover, the design of our study is not adequate to evaluate a brief educational intervention from the point of view of public health.

In 2011, the Law 42/2010 that prohibits the tobacco consumption in bars, restaurants, and some outdoor spaces such as around hospitals or schools,[29] came into force in Spain. With the support of the antismoking legislation, a greater social awareness of the effects of exposure to tobacco smoke has been created, with almost an 83% of households having any type of prohibition on tobacco consumption.[30] In recent years, smoke-free multiunit housing, completely smoke-free buildings, including both private and common areas, has proliferated in the United States and several European countries[31–33] but in Spain, there are not yet specific policies.

The most important limitations of our study are those derived from the use of an online survey that it could create an information bias, although being an online survey and not having an interviewer present, the unacceptability bias would be lower.[34] Although the main topic of the survey was about sleep habits in children, we do not believe that this has influenced our results.

The fact that in the survey written information about THS was given followed by a question about the belief of the harmful effect of THS could have overestimated the perception of harmful effects of THS exposure. However, we believe that this overestimation is minimal because the parents who did not know the term THS had a lower perception of the harmful effects than parents who knew THS (83% vs. 94%, Table 3). Moreover, our sample may not be representative of the general population of our country due to the voluntary involvement of participants, and the dissemination was carried out in the general pediatric consultation of only one hospital, although also most of the samples through Internet and mobile recruitment. We have compared the characteristics of respondents with the latest data of 2017 published by the National Institute of Statistics in Spain (INE) to test the representativeness of the sample, finding certain limitations of our sample.[35] First, 94% of the respondents were mothers, so our data are not representative of the attitudes and believes of fathers about THS. However, the average age of the mothers is similar to the INE Spanish average. Second, children under 1 year are less represented (26%) in our sample than the average of Spain; otherwise, the percentage of siblings (62%) was higher than in the Spanish population. Finally, in our sample, smokers are underrepresented and parents with university studies are overrepresented compared to the INE Spanish data. For this reason, the result of our study could be some bias to infer to fathers.

Our study shows that current knowledge about THS is scarce. After reporting what THS is, a broad majority of parents believe that THS is harmful to their children's health. Due to the fact that the pediatric population may be more vulnerable to THS exposure,[18,20] information about THS effects should be promoted and facilitate the implementation of smoke-free environments in private settings (cars and vehicles) to reduce the exposure to SHS and THS.

ADDITIONAL INFORMATION

The online version of this article (https://doi.org/10.1038/s41390-018-0153-2) contains supplementary material, which is available to authorized users.

Competing interests: The authors declare that they have no competing interests.

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5. Discusión conjunta de los artículos

5.1. Correlación entre las medidas de control del tabaco en Europa y los nacimientos pretérmino y con bajo peso

El primer artículo de la tesis, publicado en *Environmental Research*, describe la correlación entre las políticas de control del tabaquismo y los nacimientos pretérmino y con bajo peso en Europa desde el año 2010 al 2015 (125). Específicamente, nuestro estudio muestra que la prevalencia de nacimientos pretérmino (antes de la semana 37 y de la semana 32 de edad gestacional) disminuyen significativamente a mayor puntuación en el ítem del TCS global y con la puntuación específica de la prohibición de fumar en lugares públicos con los datos del TCS y prevalencias del año 2010 (125). Aunque la correlación negativa se mantiene en el resto de los años estudiados, se pierde la significación estadística debido, según nuestra hipótesis, al pequeño número de países con datos de la prevalencia de nacimientos pretérmino disponibles para los años 2013, 2014 y 2015 (125). Nuestros resultados, a nivel ecológico, van en la misma dirección que los resultados de estudios previos realizados a nivel individual en diversos países europeos, que evidencian el impacto de las legislaciones de control del tabaquismo a nivel perinatal (126–130). En Bélgica, un estudio previo muestra un descenso en los nacimientos pretérmino tras la implementación de varias legislaciones antitabaco, especialmente marcado tras la prohibición de fumar en los lugares de trabajo (127). Además, otros estudios muestran en diferentes países, un descenso en los nacimientos pretérmino y con bajo peso tras la introducción de legislaciones antitabaco (129,131).

Por ello, la implementación de políticas antitabaco se asocia con disminuciones significativas en las tasas de nacimientos pretérmino (132). Además, se ha cuantificado la relación entre fumar durante el embarazo y los nacimientos pretérmino encontrando una asociación positiva y una relación dosis-respuesta (15). Cabe destacar, la correlación inversa encontrada entre los nacimientos pretérmino y algunas de las medidas de la TCS, adoptadas de las medidas descritas por el Banco Mundial, como las restricciones para el consumo de tabaco en lugares públicos, el nivel de prohibición en la publicidad y las campañas de difusión pública. Además, la implementación de políticas de control del tabaquismo ha evidenciado una disminución en la asistencia hospitalaria por asma en población pediátrica (128).

Nuestros datos también muestran una correlación, estadísticamente significativa, entre el TCS y la prevalencia de bajo peso al nacimiento en menores de 2500 gramos en el año 2010. Estos datos son consistentes con la revisión Cochrane de 2016 que muestra resultados no concluyentes para los nacimientos con bajo peso para la edad gestacional (31). Nuestra hipótesis, al igual que para los nacimientos pretérmino, es que un mayor tamaño muestral en los años 2013, 2014 y 2015 mostraría resultados estadísticamente significativos, al igual que los encontrados en el año 2010 (125). En Noruega, en 2004, se evidenció que la extensión de las restricciones para el consumo de tabaco en bares y restaurantes benefició al peso al nacimiento de los recién nacidos (130). De forma similar, al introducirse la legislación que prohíbe fumar en lugares públicos en Escocia, se evidenciaron reducciones estadísticamente significativas en los nacimientos con bajo peso (14).

Nuestros resultados son consistentes con otros estudios, a nivel individual, que también han encontrado reducciones en el riesgo de nacimientos pretérmino asociados a la implementación de legislaciones antitabaco (14,127,129–131).

5.2. Hogares libres de humo y exposición pasiva al tabaco de menores en el hogar y otros ambientes

Debido a la implementación de medidas para el control del tabaquismo llevada a cabo por los diferentes Gobiernos, actualmente la principal fuente de exposición en población pediátrica son los ambientes privados, ya que después de los centros educativos, es donde pasan más tiempo (16,26,29,31).

El segundo artículo de la tesis publicado en *Environmental Research*, y el tercer manuscrito, actualmente en revisión, muestran la prevalencia de hogares libres de humo en España en los últimos años (121,133). El primero, en población general y el segundo, en hogares con niños menores de 3 años.

El porcentaje de hogares con regulaciones voluntarias para el consumo de tabaco ha crecido de forma exponencial en EUA en los últimos 20 años, siendo del 43,1% en el año 1992 e incrementándose hasta el 81,1% en el año 2010 (134). En España, la legislación sobre el consumo de tabaco que entró en vigor en enero de 2011, Ley 42/2010, prohíbe fumar en áreas cerradas comunes de edificios, pero deja a la comunidad de vecinos decidir sobre la prohibición de fumar en espacios abiertos no designados como áreas infantiles (36).

Los resultados del segundo artículo de la tesis doctoral muestran una elevada prevalencia de hogares de libres de humo (con regulación voluntaria completa o parcial) en nunca fumadores en España (121). Estos datos son consistentes con estudios previos realizados en otros países europeos y en EUA (134–136). El porcentaje de hogares libres de humo (con regulación completa) en España, es casi la mitad del referido por King et al. en EUA (134). Esta diferencia podría deberse a que en nuestro estudio la población de mayor edad puede haber sido infraestimada, al constituir únicamente un 10% de la muestra y no disponer de información sobre población de más de 75 años. Además, podría haber influido la existencia de una mayor tradición en la legislación antitabaco en EUA en comparación con España (134).

Nuestros datos siguiendo la tendencia de estudios previos, muestran que los fumadores tienen un mayor porcentaje de hogares con regulación parcial, debido probablemente a que, a pesar de existir en la actualidad una mayor concienciación social, también precisan de un lugar donde fumar (121,134,135). Además, existe una prevalencia elevada de regulaciones parciales en hogares entre la población en edad fértil, entre 18 y 45 años en España, siendo el intervalo poblacional con la mayor prevalencia de fumadores (137). Pese a ello, la presencia de niños en el hogar es un factor predictor para la prohibición del consumo tabaco en el mismo (135).

Nuestro estudio muestra que los nunca fumadores son los que más frecuentemente tienen hogares libres de humo (121). A diferencia de estudios previos, realizados en diferentes países, no hemos encontrado diferencias estadísticamente significativas en la prevalencia de hogares libres de humo según la clase social, el nivel educativo o el área geográfica del país (134).

En el tercer manuscrito de la tesis se evidencia que más del 85% de los hogares en España con niños de 3 a 36 meses tienen una regulación voluntaria que prohíbe el consumo de tabaco en el hogar (133). En este estudio existen diferencias estadísticamente significativas en la prevalencia de hogares libres de humo según el nivel educativo del encuestado, siendo casi del 90% en la población con estudios superiores o universitarios, habiéndose evidenciado resultados similares en estudios previos llevados a cabo en otros países (53,133,134).

La exposición pasiva al HAT en niños en el hogar es del 5%, existiendo diferencias estadísticamente significativas según el consumo de tabaco, el nivel educativo y la edad de los padres, siendo factores predictivos de la exposición (78,134,138).

En los últimos años, han surgido en algunos países, como EUA o Dinamarca, los edificios libres de humo o en inglés *Smoke free MultiUnit Housing*. Son edificios completamente libres de humo, incluyendo las áreas privadas y comunes, siendo la única forma de evitar por completo el HAT de los vecinos (82–84). En España, la legislación actual deja a la comunidad de vecinos la decisión de prohibir fumar en los espacios abiertos comunes (patios, terrazas, jardines, piscinas) que no sean designados como áreas infantiles, pero prohíbe fumar en los espacios cerrados de las áreas comunes de las comunidades de vecinos (ascensores, pasillos, escaleras, etc.) (36). Una acción a considerar para incrementar las políticas de control del tabaquismo en España sería la ampliación de la regulación para el consumo de tabaco en hogares, prohibiendo el consumo de tabaco en todos los espacios abiertos comunes, y además creando iniciativas como descuentos fiscales, viviendas de protección oficial y legislaciones que favorezcan los edificios libres de humo para reducir la exposición en los ambientes privados.

Además, en ciertas regiones de EUA, como el estado de California, la ciudad de Nueva York y la de Chicago han ampliado las prohibiciones de fumar, extendiéndolas a playas y parques (139–142). En España, la Ley 42/2010 prohíbe fumar en lugares de trabajo y espacios públicos cerrados, pese a ello, nuestros datos muestran que existe una exposición de hasta el 14% en niños de 3 a 36 meses en otros ambientes diferentes del hogar (36,133). El artículo 13 de la Ley 42/2010, especifica que se potenciarán la puesta en marcha de programas de actuación en la atención primaria pediátrica con información específica para los padres fumadores y se crearán campañas sobre los perjuicios que la exposición al HAT provoca en los menores (36). Pese a ello, en España, no existe en la actualidad, ningún proyecto de ley para restringir el consumo de tabaco en otros espacios exteriores donde los niños pueden estar expuestos como las playas o parques, así como las terrazas de los bares y restaurantes.

A nivel mundial, cada vez existe una mayor concienciación social y apoyo global para incrementar la legislación sobre el consumo de tabaco. Este hecho ha llevado a que en Tokio, la ciudad que será sede de los próximos Juegos Olímpicos, se prohíba el consumo de tabaco en bares y restaurantes de más de 100 metros y en la totalidad de organismos públicos, guarderías y escuelas (143). Aunque inicialmente con motivo del nombramiento de la ciudad como próxima sede de los Juegos Olímpicos de 2020 se intentó crear una ciudad libre de humo, finalmente las presiones e intereses de la industria y de una parte de la sociedad lo han limitado.

5.3. Apoyo a la regulación del consumo de tabaco en vehículos

Después de los hogares, los vehículos privados son la fuente de exposición pasiva más habitual en niños (53). Los coches son una fuente de exposición importante debido al rápido acúmulo de contaminantes del HAT en un espacio cerrado (85,86). De hecho, las concentraciones de nicotina medidas en los vehículos son mucho más elevadas que las medidas en otros ambientes cerrados (públicos o privados) (86). Además, fumar es la segunda causa más común de distracción al volante (87–95)

En los vehículos con fumadores en su interior, las partículas en suspensión menores de 2,5 micras (PM 2,5) se han utilizado como marcador objetivo de la exposición al HAT en espacios cerrados sin otra fuente de exposición ambiental, como la contaminación, superando los niveles recomendados por la OMS para la calidad del aire (25 µg/m3) (51,122,144–149). Por ello, diversos países han implementado regulaciones que prohíben el consumo de tabaco en vehículos privados en presencia de niños (150–153).

En España, actualmente el consumo de tabaco en vehículos permanece sin regulación, sin embargo, nuestro estudio muestra que un 90% de la población apoya la prohibición del consumo de tabaco en coches en presencia de niños, siendo el soporte entre los fumadores de hasta el 86% (121). Actualmente, el soporte social descrito es muy similar o incluso superior al soporte existente en los países con prohibición para el consumo de tabaco en vehículos en presencia de menores previa a la implementación de la ley que lo regula (85,151). De hecho, en País Vasco existió un proyecto de ley para regular el consumo de tabaco en presencia de menores, pero finalmente no se incluyó en la Ley 1/2016 (154).

Como se ha comentado en la introducción de la tesis, la entrada en vigor de la legislación española para el control del tabaquismo ha sido un gran avance en nuestro país, Leyes 28/2005 y 42/2010, sin embargo, se podría optimizar considerando la implementación de nuevas medidas que favorezcan más otros ambientes libres de humo como, espacios exteriores en los lugares públicos (playas, parques, etc.) y algunos espacios privados cerrados en presencia de menores (36,37). En este sentido, la legislación española actual incluye la prohibición de fumar en los transportes públicos, pero se debería considerar su ampliación al transporte privado, especialmente en vehículos presencia de menores, como ya se está aplicando en otros países (85,96,151).

En 2006, casi la mitad de los niños asmáticos de EUA convivían con un fumador, y únicamente 2 de cada 3 niños con asma de difícil control vivían en un hogar libre de humo (53). En la actualidad, existe una elevada detección por parte de los profesionales sanitarios en la exposición pasiva al HAT en niños, pero también es necesaria una mayor formación en el asesoramiento para abandonar el hábito tabáquico en los padres por parte de los profesionales sanitarios, durante las visitas rutinarias o de urgencias realizadas a sus hijos (155,156).

5.4. Humo de tercera mano: revisión de la literatura y conocimientos entre padres de niños entre 3 y 36 meses

El cuarto artículo de la tesis publicado en *Environmental Research* es una revisión sistemática de toda la literatura científica publicada hasta abril de 2018 sobre el HTM para evaluar la investigación realizada e identificar los puntos que requieren mayor investigación (157).

La revisión sistemática muestra que la nicotina en las superficies es el componente más analizado para detectar el HTM, seguido de las nitrosaminas y la cotinina (157). Estudios previos habían demostrado que la nicotina en superficies es un método relativamente sencillo, confiable y válido para cuantificar el HTM (108), aunque también están disponibles otros métodos para determinar los biomarcadores de la exposición al HAT en la orina o en el aire (158). Para la recolección de las muestras, la técnica más utilizada fueron las toallitas de algodón para recolectar el polvo, y para el análisis de muestras, el método más utilizado fue la cromatografía, con o sin espectrometría de masas (157). La espectrometría de masas ha sido ampliamente utilizada para analizar las nitrosaminas específicas del tabaco, conocidas en inglés como *Tobacco-specific nitrosamines*, con las siglas TSNAs, en las muestras de exposición al HAT. Son necesarios estudios metodológicos comparativos para confirmar el instrumento más apropiado para el análisis de las muestras del HTM (103).

Las telas y tejidos se consideran depósitos del HTM en ambientes interiores y una fuente de exposición al HTM. Los estudios realizados en tejidos o telas muestran un mayor depósito de sustancias químicas relacionadas con el humo del tabaco en las fibras naturales (algodón y lana) que en el poliéster, con una mayor duración de los residuos de HTM (159–161).

Los estudios experimentales realizados en células y animales sugieren que la exposición al HTM produce daño celular genotóxico y citotóxico, pero todavía se desconocen las implicaciones a largo plazo de las alteraciones producidas por la exposición al HTM, aunque se ha encontrado una relación dosis-respuesta basada en dicha exposición (110,162–166). Además, la exposición al HTM se ha relacionado con el incremento de los síntomas respiratorios en la población (124,167).

La exposición al HTM es particularmente relevante en la población pediátrica (168). Aunque los estudios realizados en niños no son abundantes, es posible extrapolar la evidencia existente sobre ambientes privados, que son la principal fuente de exposición al HTM y también son el lugar donde los niños pasan más tiempo después de los colegios (123,168,169). Los niños son especialmente vulnerables por tener el sistema respiratorio e inmunológico en desarrollo, y por gatear y llevarse las cosas a la boca en la etapa de lactantes y la primera infancia (116,123,124). Se ha demostrado que los niños expuestos al HTM reciben dosis más altas por kilogramo de peso corporal que los adultos, e incluso que la exposición al HTM disminuye la proliferación de células madre neurales, pudiendo afectar al desarrollo neurológico, ya que algunos componentes del HTM pueden traspasar la barrera hematoencefálica (165). Pese a la tendencia que muestran los estudios realizados hasta la fecha, son necesarios más estudios para caracterizar mejor las consecuencias a medio y largo plazo de la exposición al HTM en términos de salud poblacional, especialmente en pediatría.

La revisión sistemática identificó cinco estudios que investigaron las percepciones sobre el riesgo a la exposición al HTM de la población. Curiosamente, los agentes inmobiliarios y los vendedores de automóviles intentan eliminar el HTM debido a la preocupación sobre el impacto en el valor de sus productos (170). Además, el 90% de los vendedores de coches considera que los automóviles usados por fumadores son más problemáticos, ya que se afecta el valor del vehículo (170). Actualmente, existe una falta de conocimiento poblacional sobre el HTM y los efectos nocivos de su exposición (123,171). Varios estudios muestran que aquellos padres que creen que el HTM tiene un impacto negativo en la salud de sus hijos tienen más probabilidades de implementar una prohibición para en consumo de tabaco en el hogar o de abandonar el hábito tabáquico, por lo que es necesario incrementar la conciencia social sobre el HTM y las consecuencias de su exposición (172–174).

Además, aquellos profesionales de la salud que conocen el HTM y creen que es perjudicial para la salud, es más probable que discutan el tema con sus pacientes, por lo que es crucial brindarles información, especialmente a los pediatras, ya que podría disminuir la exposición en niños al informar a los padres (175). En este sentido, se han publicado directrices sobre el manejo clínico de la exposición al HTM en la atención médica pediátrica (168).

Pero, la exposición al HTM no se limita al cigarrillo convencional, sino que también se asocia con el cigarrillo electrónico y la pipa (176–178). Incluso se ha empezado a estudiar la exposición al HTM por consumo de marihuana, siendo necesarios más estudios para determinar el efecto de dicha exposición en la salud a medio y largo plazo (172,179–182).

El quinto artículo de la tesis, publicado en *Pediatric Reseach* es el primer estudio en Europa que describe el conocimiento y las creencias sobre el HTM en padres con niños menores de 3 años (183). El 87% de los padres cree que el HTM es dañino para su hijo, incrementándose el porcentaje en aquellos padres con mayor nivel educativo (183). Un estudio realizado en EUA muestra una prevalencia más elevada que en nuestro estudio, de hasta el 91%, frente a un estudio realizado en Irán con una prevalencia del 42% (172,182). Además, pese a que en nuestro estudio no lo hemos podido realizar, se ha demostrado que una breve intervención educacional sobre el HTM en aquellos cuidadores que acudían a urgencias con su hijo menor de 36 meses produce cambios en los comportamientos frente al tabaco, cambios en el consumo de tabaco en el hogar o en el coche, disminución en el número de cigarrillos consumidos o incluso, abandono del consumo de tabaco (184). Este hecho enfatiza la necesidad de políticas educativas.

Nuestro estudio muestra un conocimiento sobre el HTM entorno al 30% de los padres, pero en la actualidad son escasos los estudios que muestran el conocimiento sobre el HTM en la población y están realizados en poblaciones con bajos recursos (171,181). Este estudio es el primero con un tamaño muestral elevado que muestra la prevalencia sobre el conocimiento del HTM (183).

En la actualidad, gracias a las medidas individuales llevadas a cabo, existe un incremento en el conocimiento de los efectos de la exposición al HAT, debiéndose fomentar todavía el conocimiento sobre los efectos en la salud de la exposición al HTM y favorecer nuevas investigaciones sobre los efectos a medio y largo plazo. Por ello, es necesario la creación de nuevas medidas poblacionales, tal y como contempla la Ley 42/2010, para poder obtener mayores beneficios y una protección total en a la población pediátrica (36,185,186).

6. Limitaciones

Las potenciales limitaciones de los 5 trabajos incluidos en la presente tesis doctoral difieren según el estudio y son:

1) La principal limitación del primer artículo de la tesis es el propio diseño ecológico, ya que no nos permite extrapolar los resultados a nivel individual (125). Sin embargo, los resultados del estudio siguen la tendencia de estudios previos realizados a nivel individual (126,127,130,187,188). Además, algunas variables pueden haber sido confusoras y el diseño ecológico no ha permitido realizar ajustes para evitarlo. Creemos que las variables que pueden haber sido confusoras son por ejemplo la edad de la madre, el hábito tabáquico de la madre y de los convivientes durante el embarazo, el nivel socioeconómico familiar o el uso de técnicas de reproducción asistida. Otra potencial limitación, es que los datos de EUROSTAT para nacimientos pretérmino y con bajo peso para los años 2013, 2014 y 2015 únicamente estaban disponibles para un número limitado de países (189). Además, los datos de Euro-Peristat publicados en el Informe de Salud Perinatal Europeo, en inglés *European Perinatal Health Report* con las siglas *EPHR*, incluye más países, pero únicamente con datos del año 2010, porque no se habían publicado datos más actualizados (190). Sin embargo, las correlaciones entre el TCS y los datos disponibles para los años 2013, 2014 y 2015 son consistentes con los datos del año 2010 por lo que creemos que, si hubiéramos obtenido un mayor tamaño muestral en los años 2013, 2014 y 2015, hubiéramos obtenido más resultados estadísticamente significativos.

2) La principal limitación del segundo, quinto artículo y del manuscrito (tercer trabajo) son aquellas derivadas del uso de encuestas (191). Los tres artículos utilizan información recolectada telefónicamente o a través de cuestionarios en línea (121,133,183), lo cual puede afectar a la validez interna de la encuesta debido al sesgo de información. Pese a que el consumo de tabaco puede ser parcialmente estigmatizado, consideramos que el sesgo de complacencia es mínimo en nuestros estudios (192). En el segundo artículo, otra potencial limitación es debida al sesgo de selección por utilizar el listín telefónico para el muestreo, ya que la Comisión Nacional de los Mercados y la Competencia en 2015 estimó que existían alrededor de un 74% de hogares españoles con línea telefónica fija, sin tener datos estratificados por clase social o edad, pudiendo ser posible que en las clases sociales más bajas hubiera un menor porcentaje de líneas telefónicas fijas (193). En el tercer trabajo y quinto artículo de la tesis, es posible que la muestra no sea representativa de toda la población española, debido a que la difusión fue llevada a cabo en las consultas de pediatría de un único hospital, aunque la mayoría de la muestra fue reclutada a través de internet y móvil por

difusión por medios sociales y correos electrónicos a guarderías (133,183). Sin embargo, al comparar las características sociodemográficas de la muestra del tercer trabajo y el quinto artículo de la tesis con los datos publicados para población española por el Instituto Nacional de Estadística (INE) encontramos que la edad de la madre es similar, sin embargo, los niños menores de 1 año están menos representados y existe un mayor porcentaje con hermanos que en la media de España (194). Además, en nuestra muestra los padres con estudios superiores están sobrerepresentados y los fumadores infrarepresentados, por lo que existe una limitación en la representatividad de la muestra (194). Los datos sobre conocimientos sobre el HTM en la población podrían haberse sobreestimado por el hecho de que la información con la definición del HTM fue dada seguidamente tras preguntar sobre el conocimiento sobre el HTM y previamente a preguntar sobre los efectos nocivos del HTM. Sin embargo, esta sobreestimación es mínima, porque la prevalencia también es baja en otros estudios que muestran el conocimiento sobre el HTM (171,181).

3) La principal limitación de la revisión sistemática, el cuarto artículo de la tesis, es la heterogeneidad de los estudios incluidos, que ha dificultado la síntesis de los resultados. Aunque el proyecto original, era realizar un metaanálisis, tal y como consta en el protocolo inicial publicado en PROSPERO[5], no fue posible debido a la heterogeneidad de los datos (157,195). Otra potencial limitación, debida probablemente a las características de los estudios incluidos, ha sido la imposibilidad de realizar un análisis de los sesgos a pesar de haberlo intentado.

[5] PROSPERO es una base de datos internacional de revisiones sistemáticas. Las características clave del protocolo de revisión se registran y mantienen como un registro permanente. Tiene como objetivo proporcionar una lista completa de las revisiones sistemáticas registradas al inicio para ayudar a evitar la duplicación y reducir las oportunidades de sesgo de información al permitir la comparación de la revisión completada con lo que se planeó en el protocolo (195).

7. Conclusiones

1. El aumento de las medidas de control del tabaquismo en los países europeos se correlaciona con menor prevalencia de nacimientos pretérmino (a nivel ecológico).

2. Existe un apoyo elevado por parte de la población española a la regulación del consumo de tabaco en vehículos con niños a bordo (9 de cada 10 españoles lo apoyan).

3. En España, casi la mitad de los hogares tienen una regulación voluntaria completa para el consumo de tabaco en el hogar (hogares libres de humo) y un tercio de los hogares tienen una regulación voluntaria parcial.

4. 8 de cada 10 hogares con niños de 3 a 36 meses en España son hogares libres de humo, con una disminución drástica cuando los padres son fumadores o con menor nivel educativo.

5. En España, se reporta una exposición significativa al HAT en población pediátrica en hogares y en otros ambientes.

6. Los estudios llevados a cabo sobre el HTM muestran su efecto dañino a nivel celular y animal, aunque son necesarios más estudios en entornos reales (condiciones reales) para ver el efecto en humanos.

7. La mayoría de los estudios sobre el HTM analizan los componentes más comunes del tabaco en las superficies (nicotina, nitrosaminas y cotinina), permaneciendo por determinar el componente más relevante en fluidos orgánicos.

8. Debido al impacto negativo del HTM en la salud, recomendamos la realización de estudios observacionales para comprender las consecuencias de la exposición a corto, medio y largo plazo especialmente en pediatría.

9. Actualmente existe un desconocimiento por parte de la población sobre el HTM y las consecuencias debidas a la exposición.

10. Pese a que en la actualidad existe un escaso conocimiento social sobre el HTM, tras conocer la definición del mismo, la mayoría de los padres cree que el HTM es dañino para la salud de sus hijos.

8. Implicaciones en Pediatría y Salud Pública

1. La correlación entre las medidas de control del tabaquismo y la disminución en la prevalencia de nacimientos pretérmino apoyan la necesidad de implementar más medidas a nivel europeo y mundial.

2. Aunque existe una tendencia que muestra que las legislaciones para el control del tabaquismo disminuyen a nivel ecológico la prevalencia de nacimientos con bajo peso, son necesarios más estudios para confirmarlo.

3. El elevado soporte de la población española a favor de regular el consumo de tabaco en vehículos con niños a bordo, sugiere que podría ser un buen momento para legislarlo.

4. Existen en España alrededor del 45% de hogares con regulaciones voluntarias completas para el consumo de tabaco. Por ello, son necesarias nuevas medidas de promoción de la salud, que promuevan el incremento de hogares con regulaciones voluntarias (hogares libres de humo).

5. Debido a la elevada prevalencia de hogares libres de humo cuando uno de los convivientes del hogar es un niño, se debería estimular la creación de campañas educativas que favorezcan el conocimiento sobre los riesgos de la exposición pasiva al HAT en población pediátrica. Además, debido a la mayor concienciación social actual sobre el efecto perjudicial de la exposición al HAT, se debería favorecer la creación de espacios libres de humo en ambientes exteriores como playas, parques y terrazas de bares y restaurantes.

6. La mayoría de los estudios sobre el HTM, realizados fuera del laboratorio, se han llevado a cabo en ambientes privados, hogares, siendo especialmente importante continuar con esta línea de investigación, ya que es el remanente y la fuente principal de exposición en población pediátrica.

7. Hasta el momento el HTM se ha evaluado determinando en superficies los componentes más habituales del tabaco, idealmente se deberían investigar también los mejores biomarcadores para el HTM en los fluidos y/o tejidos orgánicos humanos.

8. Son necesarios estudios a nivel poblacional, preferiblemente estudios observacionales de cohortes, para entender las consecuencias de la exposición al HTM a medio y largo plazo en la población.

9. Son necesarias intervenciones educacionales para concienciar del HTM y de los efectos nocivos de la exposición en la salud, enfatizando entre los profesionales sanitarios, siendo especialmente importante implicar a los gobiernos en la creación de políticas protectoras que eviten la exposición.

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ANEXOS

ANEXO 1. Correspondencia del artículo de la tesis: "*Correlation between tobacco control policies and preterm births and low birth weight in Europe*".

ANEXO 1.1. Carta de presentación al Editor *de Environmental Research*

Barcelona (Spain), July 15th, 2017.

Prof. José L.Domingo
Editor
Enviromental Research

Dear Prof. Domingo,

Please find enclosed our manuscript "Correlation between tobacco control policies and preterm births and low birth weight in Europe" for your consideration in Enviromental Research as an *Original Investigation*.

Preterm birth is the main cause of infant morbidity and mortality worldwide. Moreover, active smoking and secondhand smoke exposure during pregnancy are associated with several adverse effects during reproduction. In this sense, there is a lack of evidence about the association between tobacco control legislation and the prevalence of preterm births and low births weight across countries. This is the first study to assess, to our knowledge, the association between tobacco control policies— particularly smoking bans in the work place and public spaces—and the prevalence of preterm births and low birth weight in the European Union (EU). Our data show that, at the ecological level, a negative and statistically significant correlation between tobacco control policies, particularly restriction of smoking in public spaces and workplaces, and the prevalence of preterm births. Given the important negative effects of premature births for the public health system, our study supports greater implementation of tobacco control policies.

All of the authors have read and approved the paper and it has not been published previously nor is it being considered by any other peer-reviewed journal. The authors declare there are no conflicts of interest.

We would of course be ready to provide further information about our data and methods you desire. Correspondence about the manuscript should be addressed to me as indicated in the first page of the manuscript.

Thank you very much for your kind attention.

Yours sincerely,

Jose M Martínez-Sánchez, PhD, MPH, BSc (E-mail: jmmartinez@uic.es)

ANEXO 1.2. Respuesta del Editor y comentarios de los revisores de *Environmental Research*

De: Jose Domingo (Environmental Research) [mailto:EviseSupport@elsevier.com]
Enviado el: jueves, 17 de agosto de 2017 16:43
Para:jmmartinez@uic.es
Asunto: Invitation to revise manuscript ER_2017_1218 (MAJOR revisions)
Ref: ER_2017_1218
Title: Correlation between tobacco control policies and preterm births and low birth weight in Europe.
Journal: Environmental Research

Dear Dr. Martínez-Sánchez,

Thank you for submitting your manuscript to Environmental Research. We have completed the review of your manuscript. A summary is appended below. While revising the paper please consider the reviewers' comments carefully. We look forward to receiving your detailed response and your revised manuscript.

To submit your revised manuscript:

- Log into EVISE® at: http://www.evise.com/evise/faces/pages/navigation/NavController.jspx?JRNL_ACR=ER
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- Interactive Plots: Interactive plot viewer providing easy access to the data behind plots. Please prepare a .CSV file with your plot data and test it online here before submitting as supplementary material.

I look forward to receiving your revised manuscript by the revision due date.

Kind regards,

Professor Domingo
Editor-in-Chief
Environmental Research

Comments from the editors and reviewers:
-**Reviewer 1**

Thank you for the opportunity to review this paper. The authors have looked into a very important issue, the association between tobacco control policies and preterm births/low birth weight. The manuscript is generally well written, but I am of the opinion that the analysis is limited. See my detailed comments below.

1. Abstract/Results. For associations that were not statistically significant, avoid saying that there was an association, but not statistically significant. The correct interpretation is that there was no association.

2. Introduction, lines 187-189. Does this range refer to the EU, Europe, the world? Please clarify.

3. Introduction, lines 194-200. These sentences seem redundant. The general consequences of tobacco are well known. It would be better to use this space to connect tobacco with the outcomes explored in this study.

4. Methods. The authors have focused on EU countries. Tobacco Control Scale includes non-EU European countries and Eurostat also provides data for non-EU countries. I see no particular reason why non-EU countries wouldn't be included. The authors should look at the available data and include any other countries which have data available.

5. Methods, line 307. TCS has been used in 30 countries. In theory, it can be used in all countries.

6. Methods, lines 384-388. It is not entirely clear exactly what has been done. Reading the results, I understand that Spearman coefficients were calculated for each component of the TCS and for TCS as a whole. But this should be explicitly mentioned in the Methods.

7. Methods. Although the analytical approach seems reasonable, I think that the authors could do further analyses. Spearman indicates correlation but does not quantify this association. The authors could also do a simple linear regression with TCS score as the independent variable and preterm births/low birth weight as the dependent variable. The coefficient would quantify the association.

8. Methods. The main concern regarding this study is that the TCS score is probably strongly correlated with the prevalence of smoking in each country. The prevalence of smoking can be a strong determinant of preterm births/low birth weight. Thus, the findings of this analysis might be heavily confounded by smoking prevalence. The authors have data for a few countries only, but if they do linear regression for 2010, they could potentially adjust for smoking prevalence or/and GDP per capita, which might also be strongly associated with the outcomes. In any case, this major limitation should be extensively discussed.

9. Results, line 423. Again, there was no correlation.

10. Discussion, line 460. Why several? Be more specific.

11. Discussion, lines 571-578. The comments about the Swiss study are repetitive; this has already been discussed earlier.

12. Discussion. TCS was correlated with some of the outcomes, but not with others. For example, in 2010, TCS-bans was correlated with pre-term births <37 weeks, but not with pre-term births <32 weeks. I'd like to see some discussion about this. Do the authors think these are chance findings? Is there a reasonable biological mechanism?

-**Reviewer 2**

This is an ecological study whose aim is to evaluate the association between tobacco control policies and preterm births and low birth weight in the European Union.

Main impressions: the association between smoking and low birth weight and preterm birth rates is interesting from a public health point of view. The study has several limitations that are correctly listed by the author in the discussion section. The most important one is that results are not adjusted for country-specific socio-economic levels.

The topic of the study is coherent with the principal aim of the Journal, which is assessing the effect of chemical pollutants on human health.

Comments and suggestions

1.Although data is retrievable from public sources on the internet, I strongly recommend to provide a table with a descriptive analysis of data, reporting: Tobacco Control Scale (TCS) 2010, 2013; TCS on public place bans 2010, 2013; prevalence of pre-term birth and low birth weight for each Country.

2.Authors should find a way to adjust the correlation statistics using at least one country-specific socio-economic variable. It's up to the Authors decide which socioeconomic variable is more suitable for that. We may suggest the following variables: prevalence of graduates, health expenditure per capita or healthcare expenditure as percentage of GDP.

3. Statistical analysis should not be included in the "Variables" paragraph.

4. In table 1 Authors should add a foot note in order to explain why there are no figures in the category "less than 28 weeks", for preterm birth; "less than 2000G", and "less than 1000 g" for low birth weight. Authors reported reasons of that in the "methods" section, but they have to add an explanation also in the table.

5.Authors could add two sentences in the "discussion" section a comment on the reason why only advertising bans are significantly correlated with prevalence of pre-term birth.

6. In the "methods" section, paragraph 2.1.2, line 346-50, it is not clear the procedures for the estimation of the mean rate of preterm birth. You could re-phrase this sentence in order to clarify what you did.

-**Reviewer 3**

The article is well written and well documented. However, it would need one important clarification: there is a clear difference between tobacco control policies and smoke-free policies. Smoke free policies are only a part of tobacco control policies. Smoke-free policies are 22% of the TCS score which measures tobacco control policies.

The TCS is tobacco control policy and smoking bans are smoke-free policies.

The confusion is all along the article:some examples

Abstract methods line 71-72: TCS reflects the level of implementation of TOBACCO CONTROL POLICIES (only partially smoke-free policies)

Abtract conclusion line 92-93 these data support greater implementation of SMOKE-FREE policies AND TEND TO SUPPORT THE IMPLEMENTATION OF TOBACCO CONTROL POLICIES, BUT MORE RESEARCH IS NEEDED

Discussion: line 515 more studies are needed to confirm the real impact of TOBACCO CONTROL POLICIES in perinatal outcomes

Discussion : line 517 and 519: all the references in line 519 do refer to smoking bans and NOT to tobacco control policies as stated in line 517.

ANEXO 1.3. Respuesta al Editor y a los comentarios de los revisores de *Environmental Research*

Reference: ER_2017_1218

Correlation between tobacco control policies and preterm births and low birth weight in Europe

Thank you for considering our manuscript. We would like to thank to the Editor and the reviewers for the useful comments. We provide a new version of the manuscript according to the reviewers (with highlighted changes) and our point-by-point response to all those comments.

Moreover, we have updated the data, adding new information from EUROSTAT about preterm births and low birth weight for the year 2015 and obtaining some new data from the EPHR being able to add information for the number of births with less than 28 weeks for the year 2010 (as recommend one of the reviewers).

Reviewer 1

Thank you for the opportunity to review this paper. The authors have looked into a very important issue, the association between tobacco control policies and preterm births/low birth weight. The manuscript is generally well written, but I am of the opinion that the analysis is limited. See my detailed comments below.

Thank you very much for the useful comment.

1. **Abstract/Results. For associations that were not statistically significant, avoid saying that there was an association, but not statistically significant. The correct interpretation is that there was no association.**

As the reviewer suggested, we have omitted from the results section of the abstract those correlation that were not statistically significant. However, there are some results that were previously not significant and now they are due to the incorporation of new data (please see respond to the comment #4 of the reviewer#1).

2. **Introduction, lines 187-189. Does this range refer to the EU, Europe, the world? Please clarify.**

Thank you, we have clarified it and added the corresponding bibliography, as follows:

> "Preterm birth rates range from 5% to 18%, with wide variability among countries around the world (2, 5)."

3. **Introduction, lines 194-200. These sentences seem redundant. The general consequences of tobacco are well known. It would be better to use this space to connect tobacco with the outcomes explored in this study.**

Thanks for the comment, we have omitted it.

4. **Methods. The authors have focused on EU countries. Tobacco Control Scale includes non-EU European countries and Eurostat also provides data for non-EU countries. I see no particular reason why non-EU countries wouldn't be included. The authors should look at the available data and include any other countries which have data available.**

Thank you very much for the comment, we initially thought of including EU countries because it was hard to find information from other European countries. In reviewing the data, we have added information from some European countries (non-EU) with the TCS (please see new table 1 of the manuscript). We have added the following information:

- For 2010: we have added data for 3 European Countries: Iceland, Norway and Switzerland, from EUROPERISTAT.
- For 2013: we have added data for 2 European Countries: Serbia and Switzerland, from EUROSTAT.
- For 2014: we have added data for 2 European Countries: Ireland and Serbia, from EUROSTAT.
- We have also updated our data and added the available data from all European countries in 2015.

We have modified throughout the manuscript the term EU-countries by European countries.

5. **Methods, line 307. TCS has been used in 30 countries. In theory, it can be used in all countries.**

Thanks for the comment. The TCS in 2010 was used in 30 countries, and the TCS in 2013 was used in 34 countries. We have clarified this in the manuscript, as follows:

> "It had supported from the European Commission and it can be used in more than 30 European countries, more specifically the TCS of 2010 was used in 30 European countries, and the TCS of 2013 was used in 34 European countries. (33,34)."

Unfortunately, although it would be very interesting to analyse the data of countries worldwide, it is not possible since the Tobacco Control Scale is only gathered in European countries. The TCS is the result of a survey of tobacco activity carried out in European countries and it serves to quantify the implementation of tobacco control policies at country level based on 6 policies described by the World Bank. Actually, the survey was distributed through the correspondents of European Network for Smoking and Tobacco Prevention (ENSP) who had agreed to fill in their country data.

We have mentioned this aspect in the Discussion section as follows:

> "Furthermore, it would be highly recommended g to analyze the impact of TCS in perinatal outcomes in countries all over the world because the TCS quantify the implementation of tobacco control policies at country level based on 6 policies described by the World Bank. However, the TCS is the result of a survey of tobacco activity carried out in European countries and the survey was distributed through the correspondents of European Network for Smoking and

> Tobacco Prevention (ENSP) who had agreed to fill in their country data (36)."

6. **Methods, lines 384-388. It is not entirely clear exactly what has been done. Reading the results, I understand that Spearman coefficients were calculated for each component of the TCS and for TCS as a whole. But this should be explicitly mentioned in the Methods.**

Thank you very much for the comment. We have calculated the Spearman correlation coefficient for each one of the six TCS policies and for the TCS in general, with the prevalence of preterm and low birth weight. As recommended the reviewer, we have clarified it in methods section, as follows:

> "In addition, we analyzed the correlation between each one of the six policies from TCS—particularly bans on smoking in workplaces and public places—and the prevalence of preterm births and low birth weight."

7. **Methods. Although the analytical approach seems reasonable, I think that the authors could do further analyses. Spearman indicates correlation, but does not quantify this association. The authors could also do a simple linear regression with TCS score as the independent variable and preterm births/low birth weight as the dependent variable. The coefficient would quantify the association.**

Thank you very much for the comment, we agree that the correlation coefficient of Spearman measures correlation but does not measure magnitude. Following the recommendation of the reviewer, we have calculated with the statistically significant correlations a simple linear regression, with the TCS score or the public place bans score as the independent variable, and the prevalence of preterm births or low birth weights as the dependent variable.

We added in methods and results section, as follows:

Methods:

> "Moreover, we performed a simple linear regression analysis between the TCS score or the public place bans score as the independent variable and the prevalence of preterm birth or low birth weight as the dependent variable for the statistically significant correlations."

Results:

> "The simple linear regression analysis of the statistically significant correlations between the TCS score or the public place bans score as the independent variable and the prevalence of preterm birth or low birth weight as the dependent variable show a decrease in the prevalence according to the increase of TCS (negative beta coefficient). However, we have only obtained statistically significant in the coefficient with the public place bans score (data not shown).

> For the year with more data (2010), the increase of one point in the public place bans score is estimated to produce a decrease of 1.6 for 1,000 in births with low birth weight (less than 2,500 grams). Data from 2013, 2014, and 2015 the beta coefficient of the regression with correlations statistically significant were similar that observed in 2010 being the beta coefficient statistically significant in preterm births with less than 37 weeks and with less than 32 weeks (data not shown)."

8. **Methods. The main concern regarding this study is that the TCS score is probably strongly correlated with the prevalence of smoking in each country. The prevalence of smoking can be a strong determinant of preterm births/low birth weight. Thus, the findings of this analysis might be heavily confounded by smoking prevalence. The authors have data for a few countries only, but if they do linear regression for 2010, they could potentially adjust for smoking prevalence or/and GDP per capita, which might also be strongly associated with the outcomes. In any case, this major limitation should be extensively discussed.**

Thank you very much for the interesting comment. Following the comment of the reviewer, we have stratified the statistically significant correlations according to the countries with a GDP per capita, or according to the HDI, over or above the median. We observed the same negative correlations in both categories; however, the correlations were higher among countries with high GDP or HDI. Moreover, in the years with fewer data, the confidence interval of the correlations was very high.

We have included the following paragraph in the new version of the manuscript:

Methods:

> "Finally, to study differences at socioeconomic level, we have stratified the countries to perform the correlation according to countries above and below the median of high gross domestic product (GDP) per capita and human development index (HDI)."

Results:

> "Similar negative correlations were found among countries when stratifying according to GPD per capita and HDI median, being higher the correlation among countries with the GPD per capita and HDI over the median."

Discussion:

> "Although the proportion of deaths due to preterm birth is lower in low-income countries than in high-income countries, the cause-specific rates are much higher in low- and middle-income countries than in high-income countries (high gross domestic product (GDP) per capita), resulting in a major survival gap for preterm depending on which country they are born. Most preterm infants from 28 to 32

weeks need special care at birth, and in cases of preterm infants with less than 28 weeks of age they need a neonatal intensive care unit (NICU) to survive and adequate NICUs are not available in many low- or middle-income countries. In this sense, we observed negative correlation among countries with high GPD per capita or HDI, being higher the correlation among the countries with a GPD per capita or HDI over the median (data not shown)."

Bibliography consulted:

Howson CP, Kinney M V, McDougall L,et al. Born too soon: preterm birth matters. *Reproductive Health*. 2013;10(1):1. http://dx.doi.org/10.1186/1742-4755-10-S1-S1

9. Results, line 423. Again, there was no correlation.

Thanks for the comment. We have modified it with the new data, as follows:

"There was a statistically significant negative correlation between TCS in 2010 and the prevalence of low birth weight (< 2,500 grams) in European countries in 2010 (rsp= -0.42; 95% CI:-0.66, -0.09; p=0.028). We also observed a significant inverse correlation between the level of restrictions on smoking in public places and the prevalence of low birth weight (<2,500 grams) (rsp= -0.54; 95% CI:-0.72, -0.10; p=0.017) (Table 2). All five of the other tobacco control policies (price, public information campaigns, advertising bans, health warnings, and treatment) correlated with the prevalence of low birth weight in 2010 (data not shown), but the statistically significant correlations were for the prevalence of births < 2,500 grams and the level of advertising bans (rsp= -0.50; 95%CI:-0.76, -0.07), the public information campaign (rsp= -0.41; 95%CI:-0.68, -0.05); and for the prevalence of births < 1,500 grams were the level of advertising bans (rsp= -0.38; 95%CI: -0.68, -0.03) and price (rsp= -0.29; 95%CI: -0.68, -0.01)."

10. Discussion, line 460. Why several? Be more specific.

Thanks for the comment, we have clarified as follows:

"We found that, at an ecological level, several indicators of the level of tobacco control policies implemented in European countries (as the level of restrictions on smoking in public places, the level of advertising bans, the price or the level of public information campaigns) are inversely related to perinatal outcomes, particularly preterm births."

11. Discussion, lines 571-578. The comments about the Swiss study are repetitive; this has already been discussed earlier.

Thanks for the comment, we have omitted it for being repetitive.

12. **Discussion. TCS was correlated with some of the outcomes, but not with others. For example, in 2010, TCS-bans was correlated with pre-term births <37 weeks, but not with pre-term births <32 weeks. I'd like to see some discussion about this. Do the authors think these are chance findings? Is there a reasonable biological mechanism?**

Some of the European countries have not published births stratified by gestational age at birth or by birth weight (and this decreased our sample). Our hypothesis is that the results are statistically significant in those cases in which the sample size is larger, since there is a greater number of preterm births with <37 weeks than with <32 weeks or <28 weeks. Furthermore, the best way to avoid neonatal respiratory distress syndrome is preventing preterm birth, but when it is not possible, the administration of prenatal corticoids to the mother is strongly recommended. The prenatal corticosteroids increase the synthesis of pulmonary surfactant and act in the remodeling and maturation of the pulmonary elastic structure in the fetus. Embryologically, there are five stages of lung maturation: embryonic (from 4 to 11 weeks), pseudoglandular Period (from 5 - 16 weeks), canalicular Period (from 16 to 26 weeks), Saccular (Terminal Sac) Period (from 26 weeks to after birth) and Alveolar Period (late fetal period to childhood).

In general, in the canalicular period, respiratory bronchioles and alveolar ducts develop and in the saccular period terminal sacs develop. By 20 weeks Type II alveolar cells begin producing surfactant. Surfactant permits expansion of terminal sacs. The fetus needs to be between 26 and 28 weeks before enough surfactant is produced by himself. Because of it, at higher gestational age there is an increase in survival and a decrease in morbidity due to prematurity.

Preterm infants with less than 28 weeks of postmenstrual age need a neonatal intensive care unit (NICU) to survive and furthermore, most of the preterm infants from 28 to 32 weeks need special cares at birth and adequate NICUs are not available in many low- and some middle-income countries.

As we explained previously (please see respond to comment 8), the proportion of deaths due to preterm birth are lower in low-income countries than in high-income countries, but the cause-specific rates are much higher in low- and middle-income than in high-income countries, with a higher survival for babies depending on which country they are born.

We added an explanation in the Discussion, as follows:

> "Our hypothesis with the correlations for preterm births is that a larger sample size in 2013, 2014 and 2015 would show similar results. However, we did not find associations."

Bibliography consulted:

Roberts D, Brown J,Medley N, Dalziel SR. Antenatal corticosteroidsfor accelerating fetal lung maturation for women at risk of preterm birth. Cochrane Database of Systematic Reviews 2017, Issue 3. Art. No.: CD004454. DOI: 10.1002/14651858.CD004454.pub3.

Schoenwolf, Gary C., et al. *Larsen's Human Embryology E-Book*. Elsevier Health Sciences, 2014.

Howson CP, Kinney M V, McDougall L,et al. Born too soon: preterm birth matters. *Reproductive Health*. 2013;10(1):1. http://dx.doi.org/10.1186/1742-4755-10-S1-S1

Reviewer 2

This is an ecological study whose aim is to evaluate the association between tobacco control policies and preterm births and low birth weight in the European Union.

Main impressions: the association between smoking and low birth weight and preterm birth rates is interesting from a public health point of view. The study has several limitations that are correctly listed by the author in the discussion section. The most important one is that results are not adjusted for country-specific socio-economic levels.

The topic of the study is coherent with the principal aim of the Journal, which is assessing the effect of chemical pollutants on human health.

Thank you very much for the kind comments to our work.

Comments and suggestions

1. **Although data is retrievable from public sources on the internet, I strongly recommend to provide a table with a descriptive analysis of data, reporting: Tobacco Control Scale (TCS) 2010, 2013; TCS on public place bans 2010, 2013; prevalence of pre-term birth and low birth weight for each Country.**

Thank you very much for the recommendation. We have added a table reporting data about the Tobacco Control Scale (TCS) and the public place bans policy from TCS for 2010 and 2013. We have also added in this table the prevalence of preterm births (< than 37 weeks) and low birth weight (< than 2,500 grams) for the countries available for the years 2010, 2013, 2014 and 2015 (please see new table 1 in the manuscript).

We added in the Results section as follows:

> "Table 1 shows the data from the TCS and the public place bans policy for the years 2010 and 2013, with the available data on the prevalence of preterm births (<37 weeks) and low birth weight births (<2,500 grams) for European countries with data available for the years 2010, 2013, 2014 and 2015."

2. **Authors should find a way to adjust the correlation statistics using at least one country-specific socio-economic variable. It's up to the Authors decide which**

socioeconomic variable is more suitable for that. We may suggest the following variables: prevalence of graduates, health expenditure per capita or healthcare expenditure as percentage of GDP.

Thank you for the comment. We have answered it in the respond of comment #8 of the first reviewer (please see it).

3. **Statistical analysis should not be included in the "Variables" paragraph.**

We have added a subsection for statistical analysis.

4. **In table 1 Authors should add a foot note in order to explain why there are no figures in the category "less than 28 weeks", for preterm birth; "less than 2000G", and "less than 1000 g" for low birth weight. Authors reported reasons of that in the "methods" section, but they have to add an explanation also in the table.**

We have added an explanation in the table 2, as follows:

> "There is no data available from the source (EPHR) for Birth weight <2,000 g or birth weight <1,000 g."

5. **Authors could add two sentences in the "discussion" section a comment on the reason why only advertising bans are significantly correlated with prevalence of pre-term birth.**

We have added a comment about that in the discussion section, as follows:

> "Smoking restriction in public and workplaces, without belittling the other five policies from TCS, is especially relevant in our case, because it is a direct way of reducing SHS exposure in pregnant women and their children, reducing the risk of preterm delivery."

6. **In the "methods" section, paragraph 2.1.2, line 346-50, it is not clear the procedures for the estimation of the mean rate of preterm birth. You could re-phrase this sentence in order to clarify what you did.**

We have re-phrased this sentence as follows:

> "In addition, we estimated the mean rate of preterm birth for 2013, 2014 and 2015 using the data extracted from the calculation of the intervals of gestational age ranges according to the number of births in each country in the same years."

Reviewer 3

The article is well written and well documented. However, it would need one important clarification: there is a clear difference between tobacco control policies and smoke-free

policies. Smoke free policies are only a part of tobacco control policies. Smoke-free policies are 22% of the TCS score which measures tobacco control policies.

The TCS is tobacco control policy and smoking bans are smoke-free policies.

The confusion is all along the article: some examples.

Thank you so much for the comments. Tobacco control policies implemented at country level are based on the six policies described by the World Bank and implemented in the Tobacco Control Scale. One of these policies is the restriction on smoking in public and work places, which is achieved with smoke free legislation, smoke free environments.

In some paragraphs, we have exchanged the terms as they were synonymous, but we have corrected it.

Abstract methods line 71-72: TCS reflects the level of implementation of TOBACCO CONTROL POLICIES (only partially smoke-free policies)

Done.

Abtract conclusion line 92-93 these data support greater implementation of SMOKE-FREE policies AND TEND TO SUPPORT THE IMPLEMENTATION OF TOBACCO CONTROL POLICIES, BUT MORE RESEARCH IS NEEDED

Done.

Discussion: line 515 more studies are needed to confirm the real impact of TOBACCO CONTROL POLICIES in perinatal outcomes

Done.

Discussion: line 517 and 519: all the references in line 519 do refer to smoking bans and NOT to tobacco control policies as stated in line 517.

Done.

In addition, we have thoroughly revised the manuscript and modified the following paragraphs, so they do not mislead in the following section of the manuscript:

Highlights:

> “- Our data support greater implementation of smoke-free policies.”

Introduction:

> “In the last decade, many countries have implemented tobacco control legislation—particularly smoking bans in work and public places—to protect non-smokers from SHS exposure. Similarly,

numerous studies have assessed the impact of smoke-free policies and the benefits of such laws on the health of the population."

Methods:

"The TCS provides a score for each country reflecting the level of implementation of tobacco control policies according to six cost-effective policies."

ANEXO 1.4. Respuesta del Editor y segundos comentarios de los revisores de *Environmental Research*

De: Jose Domingo (Environmental Research) [mailto:EviseSupport@elsevier.com]
Enviado el: domingo, 15 de octubre de 2017 12:08
Para: jmmartinez@uic.es

Asunto: Invitation to revise manuscript ER_2017_1218_R1 (MINOR revision)

Ref:ER_2017_1218_R1

Title: Correlation between tobacco control policies and preterm births and low birth weight in Europe.

Journal: Environmental Research

Dear Dr.Martínez-Sánchez,

Thank you for submitting your manuscript to Environmental Research. We have completed the review of your manuscript. A summary is appended below. While revising the paper please consider the reviewers' comments carefully. We look forward to receiving your detailed response and your revised manuscript.

To submit your revised manuscript:

- Log Into EVISE® at: http://www.evise.com/evise/faces/pages/navigation/NavController.jspx?JRNL_ACR=ER
- Locate your manuscript under the header 'My Submissions that need Revisions' on your 'My Author Tasks' view
- Click on 'Agree to Revise'
- Make the required edits
- Click on 'Complete Submission' to approve

What happens next?
After approving your submission you will receive a notification that the submission is complete. To track the status of your paper throughout the editorial process, log into EVISE® at: http://www.evise.com/evise/faces/pages/navigation/NavController.jspx?JRNL_ACR=ER

Enrich your article to present your research with maximum impact. This journal supports the following Content Innovations:

- Explain your research in your own words and attract interest in your work using AudioSlides : 5-minute webcast-style presentations that are displayed next to your published article and can be posted on other websites. You will receive an invitation email to create an AudioSlides presentation within three weeks after your paper has been accepted.
- Interactive Plots: Interactive plot viewer providing easy access to the data behind plots. Please prepare a .CSV file with your plot data and test it online here before submitting as supplementary material.

I look forward to receiving your revised manuscript by the revision due date.

Kind regards,

Professor Domingo

Editor-in-Chief

Environmental Research

Comments from the editors and reviewers

Reviewer 1-The authors have successfully addressed most comments. I have some minor comments only:

- The authors still haven't addressed the fact that, in cross-sectional ecological analyses like the ones they have conducted, smoking prevalence may be an important factor which either confounds or mediates the association between tobacco control policies and perinatal outcomes. This needs to be mentioned in the limitations section.

- A couple of high-profile, potentially relevant papers have been recently published. The authors might wish to consider them for their introduction or/and discussion.

https://www.ncbi.nlm.nih.gov/pubmed/28975220

https://www.ncbi.nlm.nih.gov/pubmed/28944313

- Language in the newly added parts of the manuscript could be improved. Please review the text and make edits as appropriate.

Have questions or need assistance?

For further assistance, please visit our Customer Support site. Here you can search for solutions on a range of topics, find answers to frequently asked questions, and learn more about EVISE® via interactive tutorials. You can also talk 24/5 to our customer support team by phone and 24/7 by live chat and email.

<u>ANEXO 1.5.</u> Respuesta al Editor y a los segundos comentarios de los revisores de *Environmental Research*

ER_2017_1218_R1

Comments from the editors and reviewers:

Thank you very much for the useful comments.

Reviewer 1

The authors have successfully addressed most comments. I have some minor comments only:

1 . The authors still haven't addressed the fact that, in cross-sectional ecological analyses like the ones they have conducted, smoking prevalence may be an important factor which either confounds or mediates the association between tobacco control policies and perinatal outcomes. This needs to be mentioned in the limitations section.

Thank you very much for the comment. We agree with them, as the reviewer suggested, we have added it in limitations as follows:

> "Similarly, the study design does not permit adjustments for potential individual confounders such as the age of the mother, the smoking status during the pregnancy of the mother and other family members, the socioeconomic status of the family, or the use of assisted reproductive technology. These variables could be a confounder or mediates between tobacco control policies and perinatal outcomes."

2. A couple of high-profile, potentially relevant papers have been recently published. The authors might wish to consider them for their introduction or/and discussion.

https://www.ncbi.nlm.nih.gov/pubmed/28975220
https://www.ncbi.nlm.nih.gov/pubmed/28944313

Thank you very much for the recent references. They are clearly relevant. As the reviewer suggested, we have cited them in the introduction and included the following paragraph in the Discussion section:

> "Recently the same working group has updated the meta-analysis (26) including 35 studies to examine the effect of smoke-free legislation on perinatal and child health; this study shows that the

implementation of smoke-free legislation is associated with significant reductions in the rates of preterm births (26).”

3. Language in the newly added parts of the manuscript could be improved. Please review the text and make edits as appropriate.

Thank you very much for the comment. We have revised carefully the new text included with a native English speaker and make the corresponding edits. We have mentioned in the acknowledgment of the manuscript.

ANEXO 1.6. Carta de aceptación de *Environmental Research*

De: "Jose Domingo (Environmental Research)" <EviseSupport@elsevier.com>

Fecha: 19 de octubre de 2017, 16:33:25 CEST

Para: jmmartinez@uic.es

Asunto: Your manuscript ER_2017_1218_R2 has been accepted

Responder a: joseluis.domingo@urv.cat

Ref: ER_2017_1218_R2
Title: Correlation between tobacco control policies and preterm births and low birth weight in Europe.
Journal: Environmental Research

Dear Dr. Martínez-Sánchez,

I am pleased to inform you that your paper has been accepted for publication. My own comments as well as any reviewer comments are appended to the end of this letter. Now that your manuscript has been accepted for publication it will proceed to copy-editing and production.

Thank you for submitting your work to Environmental Research. We hope you consider us again for future submissions.

Kind regards,

Jose Domingo
Editor-in-Chief
Environmental Research

Comments from the editors and reviewers:

Have questions or need assistance?

For further assistance, please visit our Customer Support site. Here you can search for solutions on a range of topics, find answers to frequently asked questions, and learn more about EVISE® via interactive tutorials. You can also talk 24/5 to our customer support team by phone and 24/7 by live chat and email.

ANEXO 2: Correspondencia del artículo de la tesis: *Smoke-free homes and attitudes towards banning smoking in vehicles carrying children in Spain (2016)*

ANEXO 2.1. Carta de presentación al editor de *Environmental Research*

Barcelona (Spain), February 13th, 2017.

Prof. Jose L. Domingo
Editor-in-Chief
Environmental Research

Dear Prof. Domingo,

Please find enclosed our manuscript "Smoke-free homes and attitudes towards banning smoking in vehicles carrying children in Spain (2016)" for your consideration in Environmental Research as a Research Paper.
Private environments (homes and cars) are the main source of second-hand smoke (SHS) exposure among children. Currently, many children are still exposed to SHS in private settings. These places, where children spend much of their time, remain, somewhat controversially, unregulated. At present, there is an open debate on whether smoke-free legislation should be extended to private settings. Our results show that the Spanish population seems to overwhelmingly support regulating smoking in vehicles carrying children. In addition, a high percentage of homes have voluntarily implemented complete or partial smoking restrictions.
All the authors carefully read the manuscript and fully approve of it. In their name I also declare that the manuscript is original and it is not submitted anywhere other than your journal. The authors declare there are no conflicts of interest.

We would of course be ready to provide further information about our data and methods you desire. Correspondence about the manuscript should be addressed to me as indicated in the first page of the manuscript.

Thank you very much for your kind attention.
Yours sincerely,

Jose M Martínez-Sánchez, PhD, MPH, BSc
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ANEXO 2.2. Respuesta del Editor y comentarios de los revisores de *Environmental Research*

De: Jose Domingo (Environmental Research) [mailto:EviseSupport@elsevier.com]

Enviado el: sábado, 01 de abril de 2017 18:17

Para: jmmartinez@uic.es

CC: an2737@cumc.columbia.edu

Asunto: Invitation to revise manuscript ER_2017_257

Ref: ER_2017_257
Title: Smoke-free homes and attitudes towards banning smoking in vehicles carrying children in Spain (2016)
Journal: Environmental Research

Dear Dr. Martínez-Sánchez,

Thank you for submitting your manuscript to Environmental Research. We have completed the review of your manuscript. A summary is appended below. While revising the paper please consider the reviewers' comments carefully. We look forward to receiving your detailed response and your revised manuscript.

To submit your revised manuscript:

- Log into EVISE® at: http://www.evise.com/evise/faces/pages/navigation/NavController.jspx?JRNL_ACR=ER
- Locate your manuscript under the header 'My Submissions that need Revisions' on your 'My Author Tasks' view
- Click on 'Agree to Revise'
- Make the required edits
- Click on 'Complete Submission' to approve

What happens next?
After approving your submission you will receive a notification that the submission is complete. To track the status of your paper throughout the editorial process, log into EVISE® at: http://www.evise.com/evise/faces/pages/navigation/NavController.jspx?JRNL_ACR=ER

Enrich your article to present your research with maximum impact. This journal supports the following Content Innovations:

- Explain your research in your own words and attract interest in your work using AudioSlides : 5-minute webcast-style presentations that are displayed next to your published article and can be posted on other websites. You will receive an invitation email to create an AudioSlides presentation within three weeks after your paper has been accepted.
- Interactive Plots: Interactive plot viewer providing easy access to the data behind plots. Please prepare a .CSV file with your plot data and test it online here before submitting as supplementary material.

I look forward to receiving your revised manuscript by the revision due date.

Kind regards,

Professor Domingo
Editor-in-Chief
Environmental Research

Comments from the editors and reviewers:
-**Reviewer 1**

This is a simple and well-presented study. Results of this study are important for clinicians and policy makers. I have a few (minor) comments for the authors:

1 ABSTRACT:

When you state:

- "There were significant differences between groups by age group and smoking status with regards to the prevalence of smoke-free homes (p<0.05), with partial bans more prevalent in smoking" households."

- "Attitudes towards smoking regulation in cars (with or without children) varied significantly by age group and smoking status."

Please also specify which groups showed the highest/lowest prevalence.

2 METHODS:

2a Why did you include the category "neither agree nor disagree" into the "disagreed" group. Is there a lack of power to re-classify them into an additional category? Are results consistent if you include them into the "agreed" group?

2b I think you should change the reference for the DYM, so readers can access the English version: https://institutodym.es/en/our-history/

2c Why did you use a precision of 3.15% to estimate your sample size?

3 RESULTS:

3a Please decide whether to use one or two decimals (also in tables) and be consistent

3b When presenting results for table 1, please do not state that "the highest prevalence of smoke-free homes was seen among older adults" (86.1%). The prevalence is almost the same among younger adults (86.65%)! I think it would be better if you highlighted results stratified by compliance (complete/partial rules), as results vary much when taking into account this variable (highest prevalence of compete rules among oldest participants [and never-smokers]/lowest prevalence of partial rules among oldest [and never-smokers])

3c In table 2. Why are you using different reference categories in the analyses (i.e. age group 46-65 for complete rules vs 66-75 for partial rules)?

3d How is there a difference in the prevalence of smoke-free homes across age groups (table 3, p value 0.032)? How were p-values estimated? If, in the end, there are not differences across age groups, please modify discussion accordingly (Mons et al. found a higher prevalence of smoke-free homes among the older population, results that are consistent with our findings.)

3e Partial smoking bans were in place in 37.5% (95% CI: 34.56-40.52) of households, with significant differences by age group and smoking status (Tables 1 and 2). Again, please specify which groups showed the highest/lowest prevalence.

3f In page 9: What does the sentence "*Prevalence, crude odds ratios (ORc), and sex- and age-adjusted OR (ORa) of attitudes in favor of regulating smoking in common areas of MUH in Spain (2016)"* mean?

4 DISCUSION:

4a You start the discussion saying that youn have found a higher prevalence of smoke-free homes (complete or partial) in women. However this results is not presented in the results section, and looking at the tables I can see this is only true for partial rules. Please correct.

4b Please check that your results also indicate that the prevalence of smoke-free homes is higher among the older population (please see comment 3d above). Also, please check that your hypothesis is supported by your data (i.e. the prevalence of former or never-smokers is higher in the elderly than in the younger population).

4c Please change *"This pattern is consistent with previous studies carried out in various European countries and in the United States"* for *"This pattern is consistent with previous studies carried out in THE GENERAL POPULATION FROM various European countries and the United States"*

4d Please change "even hough smokers" for "even though smokers"

4e *"The prevalence of current smokers is highest in middle aged group"* Please check that this is true in your data. Don't you have any information regarding the presence/absence of children in the house?

4f You state that "nor did we find any differences by ethnicity, level of education, or region" Do you have information on these variables? If so, please include them in the tables

4g The following paragraph is redundant, please correct: "*Smoking while driving is another source of distraction on the road and there is growing evidence about the negative impact of such distractions on motor vehicles accidents. Smoking while driving has been widely recognized as an important driver distraction*. *In fact, smoking is the second most common cause of distraction while driving".*

4h Please change "*In our study, although the attitudes towards regulating smoking regulation in cars"* for "*In our study, although the attitudes towards smoking regulation in cars".*

4i In the limitations section, I don't understand the example you give (i.e. potential underreporting of the use certain substances, such as cocaine). Are you talking about social desirability bias? If so, please include a sentence about it but do not use this example (I feel it confusing as this study does not talk about cocaine use). Please expand on the telephone directory sampling bias if possible (how many houses have a landline in Spain? Would you expect any differences by age/ social class ?).

REFERENCES
I don't know if the journal limits the number of references, but I feel there are too many

-**Reviewer 2**

This is straightforward paper that describes the extent of smoke-free homes in Spain and attitudes towards the prohibition of smoking in cars. The paper is well written and the results and policy implications are clearly presented. However, the discussion would benefit from some further editing to make it more succinct – see for example paragraph beginning line 752. The following points also need to be addressed.

Lines 534 to 560 – The discussion is a little confusing here and needs a clearer explanation of why the Spanish study found the prevalence of completely smokefree homes to be half that of earlier US studies – was this because there were fewer older people in the survey?

Line 660 – I am puzzled by the reference to smoking in public places being completely prohibited (without exception) in England. A comprehensive ban on smoking in partially enclosed public places came into force in 2007 with a small number of exemptions. The 2015 DoH Regulations prohibit smoking in vehicles with children under 18 present – not a public place. The work 'likewise' on line 662, also seems inappropriate as the text goes on to refer to smoking bans on beaches and in parks in the US.

Lines 780 – 800 – Again I was a little puzzled. In general, internal validity of a study is discussed in the context of experimental designs when wanting to infer cause and effect, while information bias is mostly used when referring to measurement error or misclassification in epidemiological studies. I think what is really meant here is that 'response bias' poses a threat to 'questionnaire validity'. Also the use of cocaine as an example seems inappropriate. Instead, reference to the many studies that have found over reporting of completely smokefree homes (as exceptions are often made for friends or relatives who smoke) seems better.

Minor points

Line 554 – change 'even hough' to 'even though'

Line 625 – change 'entered into force' to 'came into force'

-**Reviewer 3**

This study describes the voluntary adoption of smoke-free homes and social attitudes towards restricting smoking in vehicles and multiunit housing in a representative sample of the adult Spanish population. Given the interest in smoke-free environments, this paper presents an interesting and important topic, however there are some concerns with the current presentation of this study that would require revision in order to appropriately address this topic. Some comments are detailed below.

Major Comments:

1. It is unclear why individuals aged 16 and 17 years were included in the study sample. The opinions and voluntary adoption of smoke-free policies would be different in 16 and 17 year olds compared to adults 18 and older. For example, they would not be able to purchase cigarette legally, they would have less decision-making in the smoking policy in the home, and in terms of smoking in motor vehicles with a minor they would be considered a minor.

2. Methods: Clarify if the computer-assisted telephone interviews were given in Spanish

3. Methods (Page 6, Smoke-free home): For smoking rules inside the home, did inside the home include connected outdoor areas (e.g., balcony, patio)?

4. Methods (Page 6, Attitudes towards smoking regulations in common areas): Were these questions restricted to participants that reported currently living in multiunit housing?

5. Methods (Page 6): For participants that responded with "don't know/no answer", were these participants excluded from the study sample or analysis?

6. Methods (Page 7): The response "neither agree nor disagree" would indicate a participant was neutral or has no preference with regard to the statement. This should not be combined with responses of disagreement ("disagree" or "totally disagree").

7. Methods (Page 7): It is unclear why these age group categories (16-45, 46-65, and 66-75) were used for the analysis.

8. Methods (Page 7): How were the social class categories created? It is unclear how information on education level and occupation were combined to generate high, medium and low categories.

9. Methods (Page 7): Is information available on number of people living in the household or information on if a household member smokes? For never smokers, the existence of a home smoking policy would differ depending on if a smoker lives in the home. Similarly opinions regarding smoking in cars could differ depending on if there is the possibility for smoking to occur in the vehicle.

10. Results (Page 8, line 443): In sentence "After adjusting for sex and age, the same patterns remained significant," was social class adjusted for in the model? Which patterns are being referred to: age adjusted for sex, smoking adjusted for age and sex…?

11. Results: Clarify how p-values were estimated. Some findings presented for differences in prevalences across subgroups conflicts with ORc and ORa findings comparing subgroups.

12. Results (Table 2): Reference groups are not consistent for any rule, complete and partial rules.

13. Discussion (Page 10): "In our study, the percentage of completely smoke-free homes was half that reported by King and colleagues for all sociodemographic variables". Given the lack of nationwide comprehensive smoke-free legislation in public places in the US compared to Spain, what do the authors hypothesize to explain the lower prevalence of smoke-free homes in their study?

14. Discussion (Page 10, line 580): "…nor did we find any differences by ethnicity, level of education, or region." Information on ethnicity or region are not included/presented in the manuscript. In the analysis, education was combined with occupation of the primary provider in the household into social class. Given that occupation, as defined, may not reflect the social status of the respondent and this effect could vary significantly by age group, did the authors consider using education level alone instead of combined with occupation?

15. When interpreting the opinions and adoption of policies presented in this manuscript, it is helpful to understand the context as it related to existing smoke-free legislation in Spain. Consider moving paragraph details presented on Page 11 (paragraph 2) to Introduction section.

Minor Comments:

1. Use same terminology consistently throughout manuscript: Secondhand smoke vs. passive tobacco exposure vs. SHS

2. Use same phrasing consistently throughout manuscript: United States vs. USA vs US

3. Introduction (Page 5, line 250): "These places, where children spend much of their time…." Is this referring mostly to younger children? As children age, more time may be spent at school

4. Introduction (Page 5, line 254): Typo, extra space between "open" and "debate"

5. Methods (Page 7, line 357): Typo, delete "the" in sentence "…of the MUH…"

6. Methods (Page 8, line 418): Typo, Orc should be "ORc"

7. Results (Page 9, lines 482-484): Error, delete sentence?

8. Results (Tables 2- 4): Indicate what variables were adjusted for in the adjusted model.

9. Discussion (Page 9, line 525): "In this study, we found higher prevalence of smoke-free homes (complete or partial) among women and never smokers". Although the prevalence of any rule was higher among women, this was due to a higher prevalence of partial rules, the prevalence of complete rules was higher in men. The findings among men vs. women for any ban was also not statistically significant.

10. Discussion (Page 10, line 554): Typo, "even though"

11. Discussion (Page 10, line 562): How was child-bearing age defined here?

12. Discussion (Page 14, line 787): For the present study, while under reporting of smoking is possible, it may be more problematic that social desirability could result in participants over reporting support for smoke-free policies or the existence of smoke-free rules in their homes.

13. Discussion (Page 14, paragraph 2): "In terms of the strengths, the main strength is the use of a representative sample…In addition, all analyses used weighted data to ensure representative estimates…" These sentences are highlighting the same strength—a study sample that is representative of Spanish population.

14. Review manuscript for typos

Have questions or need assistance?
For further assistance, please visit our Customer Support site. Here you can search for solutions on a range of topics, find answers to frequently asked questions, and learn more about EVISE® via interactive tutorials. You can also talk 24/5 to our customer support team by phone and 24/7 by live chat and email.

ANEXO 2.3. Respuesta al Editor y a comentarios de los revisores de *Environmental Research*

April 20th, 2017

Barcelona, Spain

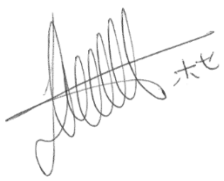
Jose L Domingo, PhD

Editor-in-Chief, Environmental Research

Dear Prof. Domingo,

We would like to thank you very much for the opportunity to resubmit our manuscript. We greatly appreciate the useful comments and suggestions of the Reviewers and we enclose a point-by-point response. The modifications in the text of the manuscript have been highlighted.

Thank you very much for your kind attention.
Sincerely yours,



Jose M Martínez-Sánchez, PhD, MPH, BSc

Ref: ER_2017_257

Title: Smoke-free homes and attitudes towards banning smoking in vehicles carrying children in Spain (2016)

We would like to thank to the reviewers for the useful comments.

Reviewer 1

This is a simple and well-presented study. Results of this study are important for clinicians and policy makers. I have a few (minor) comments for the authors:

Thank you very much for the kind comment to our work.

1 ABSTRACT:

When you state:

- **"There were significant differences between groups by age group and smoking status with regards to the prevalence of smoke-free homes (p<0.05), with partial bans more prevalent in smoking" households."**
- **"Attitudes towards smoking regulation in cars (with or without children) varied significantly by age group and smoking status."**

Please also specify which groups showed the highest/lowest prevalence.

As the reviewer suggested, we have added the highest and lowest prevalence, as follows:

> "*Results:* Most (83.04%) of the surveyed population had some type of smoking restriction in place at home (45.59% complete and 37.45% partial). There were significant differences between groups by age group (the highest prevalence was 86.14 % from 66 to 75 years and the lowest prevalence was 77.78% from 46 to 65 years) and smoking status (the highest prevalence was 89.35% in never smokers and the lowest prevalence was 74.99 % in current smokers) with regards to the prevalence of smoke-free homes (p<0.05)."

And

> "Attitudes towards smoking regulation in cars (with or without children) varied significantly by age group (the highest prevalence was 81.93% from 66 to 75 years and the lowest prevalence was 54.50% from 18 to 45 years) and smoking status (the highest prevalence was 71.41% in never smokers and the lowest prevalence was 46.02% in current smokers)."

2 METHODS:

2a Why did you include the category "neither agree nor disagree" into the "disagreed" group. Is there a lack of power to re-classify them into an additional category? Are results consistent if you include them into the "agreed" group?

We dichotomized the variable about attitudes in agree ("totally agree" and "agree") and disagree ("neither agree nor disagree", disagree" and "totally disagree") in order to make the interpretations of the results clearer. We have decided to add the category "neither agree nor disagree" in the disagreed group to avoid a potential bias of overestimate the prevalence of people who support the regulation. In this sense, the prevalences could be overestimated between 5% and 17% respectively (in our sample, 5.3% of participants answered "neither agree nor disagree" about the support of regulation in vehicles with children, 16.6% about regulation in vehicles with or without children, and 7.7% about the regulations smoking in common areas of houses).

Moreover, we have added this category in the agree category or created a new third category and the comparisons between socio-demographic did not change. For this reason, we have decided to maintain our results with the current category and explaining the potential limitation of our study to add this category (disagree group) in the Methods section of the manuscript as follows:

> "On the other hand, our results could partially underestimate the real support of smoking regulation in the vehicles and commons areas of house because we classified the answer 'neither agree nor disagree' in the 'disagree' category. However, we compared the attitudes adding the category in the "agree" group and we did not find differences in the comparison performed (data not shown)."

If the editor believes appropriate to create the new category, the authors would have no objection to do it.

2b I think you should change the reference for the DYM, so readers can access the English version: https://institutodym.es/en/our-history/

Done.

2c Why did you use a precision of 3.15% to estimate your sample size?

The ÓMNIBUS survey is a study conducted with the objective of studying more than one variable of interest. For this reason, the estimated prevalence is 50% to maximize the sample size and the power although the prevalence of the different variables could be higher or lower. In this sense, having more sample size maximizes the external validity of the estimation.

On the other hand, the error used by the ÓMNIBUS survey is 3.15% to increase the feasibility to perform the field work. However, this precision is higher than precision commonly used in the National Health Surveys (precision between 2% and 2.5%). In this sense, the increasing in the precision (from 2.5% to 3.15%) affects to the increase in the amplitude of the confidence interval.

We have introduced the following paragraph in the Methods section discussing the limitations and strengths of using this sample design:

> "The ÓMNIBUS survey is a cross-sectional study with more than one variable of interest. For this reason, the estimated prevalence is 50% to maximize the sample size and the power although the prevalence of the different variables could be higher or lower. In this sense, having more sample size maximizes the external validity of the estimation. However, the precision used (3.15%) is higher than precision commonly used in the National Health Surveys (precision between 2% and 2.5%) in order to increase the feasibility of the field work. In this sense, the increasing in the precision (from 2.5% to 3.15%) affects to the increase in the amplitude of the confidence interval."

3 RESULTS:

3a Please decide whether to use one or two decimals (also in tables) and be consistent

We have included two decimals in all percentages across the text and all tables.

3b When presenting results for table 1, please do not state that “the highest prevalence of smoke-free homes was seen among older adults” (86.1%). The prevalence is almost the same among younger adults (86.65%)! I think it would be better if you highlighted results stratified by compliance (complete/partial rules), as results vary much when taking into account this variable (highest prevalence of compete rules among oldest participants [and never-smokers]/lowest prevalence of partial rules among oldest [and never-smokers])

As the reviewer suggested, we have re-written this paragraph to clarify it as follows:

> “Statistically-significant differences were observed in the prevalence of smoke-free homes by age group and smoking status (Tables 1 and 2), with the highest prevalence of complete smoke-free homes among the oldest age group (ORc=2.10; 95%CI: 1.36-3.25) and between never-smokers (ORc=3.39; 95%CI: 2.38-4.83) comparing with partial rules (Table 2). After adjusting for sex, age, habitants, and social class, the same patterns remained significant.”

3c In table 2. Why are you using different reference categories in the analyses (i.e. age group 46-65 for complete rules vs 66-75 for partial rules)?

We have chosen as reference in the calculation of OR the category with the lowest prevalence in order to make easier the interpretation of the OR for the potential readers, although it does not correspond with the first category of the group.

We have added in the footnote of the tables the following sentence to clarify which was the reference category:

> “The reference category to calculate the OR was the category with the lowest prevalence.”

If the editor believes appropriate to use always the first category to calculate the OR, the authors would have no objection to do it.

3d How is there a difference in the prevalence of smoke-free homes across age groups (table 3, p value 0.032)? How were p-values estimated? If, in the end, there are not differences across age groups, please modify discussion accordingly (Mons et al. found a higher prevalence of smoke-free homes among the older population, results that are consistent with our findings.)

It was a mistake, thank you very much for notice it. We have modified it and the discussion section accordingly.

We performed the chi-square test to compare the prevalence and calculate the p-value. We have clarified it in the Methods section

3e Partial smoking bans were in place in 37.5% (95% CI: 34.56-40.52) of households, with significant differences by age group and smoking status (Tables 1 and 2). Again, please specify which groups showed the highest/lowest prevalence.

As the reviewer suggested, we have re-written this paragraph providing the highest and lowest prevalence as follows:

> “Partial smoking bans were in place in 37.45% (95% CI: 34.50-40.48) of households, with significant differences by age group. The highest was in

> the younger age group (18-45 years) with a 39.55 % (95%CI: 35.45-43.80) and the lowest was in oldest age group (66-75 years) with a 27.61 (95%CI: 20.10-36.56). Also significant differences for smoking status were found; being 48.99 % (95%CI: 42.96-55.05) in current smokers and 30.82 % (95%CI: 25.83-36.29) in former smokers."

3f In page 9: What does the sentence "Prevalence, crude odds ratios (ORc), and sex- and age-adjusted OR (ORa) of attitudes in favor of regulating smoking in common areas of MUH in Spain (2016)" mean?

This sentence was an error in the text, thank you for notice. We have deleted it.

4 DISCUSION:

4a You start the discussion saying that you have found a higher prevalence of smoke-free homes (complete or partial) in women. However this results is not presented in the results section, and looking at the tables I can see this is only true for partial rules. Please correct.

Thank you very much for the comment. As the reviewer suggested we have changed the starting of this paragraph of the Discussion section as follows:

> "In this study, we found a higher prevalence of smoke-free homes (complete or partial) among never-smokers."

4b Please check that your results also indicate that the prevalence of smoke-free homes is higher among the older population (please see comment 3d above). Also, please check that your hypothesis is supported by your data (i.e. the prevalence of former or never-smokers is higher in the elderly than in the younger population).

Thank you very much. We have checked it and modified it accordingly.

4c Please change "This pattern is consistent with previous studies carried out in various European countries and in the United States" for "This pattern is consistent with previous studies carried out in THE GENERAL POPULATION FROM various European countries and the United States"

Done.

4d Please change "even hough smokers" for "even though smokers"

Done.

4e "The prevalence of current smokers is highest in middle aged group" Please check that this is true in your data. Don't you have any information regarding the presence/absence of children in the house?

In our data, the prevalence of current smokers was high among people with 18-45 years old (29%). This pattern was similar that found in the Spanish National Health Survey conducted in 2011 We have added our data in the Discussion section as follows:

> "We found that in this group of age was high prevalence of smokers (29%). Moreover, this is especially remarkable in this age group, which also has the highest prevalence of current smokers in Spain (Sanidad 2011)."

Thank you very much for the comment. Unfortunately, we do not have information regarding the presence of children in homes. We have mentioned it in the Discussion section as follows:

> "It seems probable that this support for a partial ban is due to the presence of children, for whom SHS is most harmful. Unfortunately, we do not have information on the presence of children at home. However, previous study

> has demonstrated that presence of young children in the household was a strong predictor of home smoking ban with pronounced dose-response relationship with age of child (Mons et al. 2013)."

4f You state that "nor did we find any differences by ethnicity, level of education, or region" Do you have information on these variables? If so, please include them in the tables

We have information by geographical area of Spain, habitants, and educational level but not have information about ethnicity. We have only found statistically significant differences with the variables educational level in the support of regulations in common areas of the multihousing units. We have included these analyses in all tables such as independent variables and mentioned in statistical analysis, results and discussion.

4g The following paragraph is redundant, please correct: "Smoking while driving is another source of distraction on the road and there is growing evidence about the negative impact of such distractions on motor vehicles accidents. Smoking while driving has been widely recognized as an important driver distraction. In fact, smoking is the second most common cause of distraction while driving"

As the reviewer suggested, we have clarified this paragraph as follows:

> "Smoking while driving has been widely recognized as the second most common cause of distraction while driving and there is growing evidence about the negative impact of such distractions on motor vehicles accidents (Wang et al. 1995; Stutts et al. 2001; Mcevoy et al. 2007 Sullman 2012; Prat et al. 2015; Mangiaracina, G., Palumbo 2006; Wen et al. 2005; Martínez-Sánchez et al. 2012; Bakiri et al. 2013)."

4h Please change "In our study, although the attitudes towards regulating smoking regulation in cars" for "In our study, although the attitudes towards smoking regulation in cars"

Done.

4i In the limitations section, I don't understand the example you give (i.e. potential underreporting of the use certain substances, such as cocaine). Are you talking about social desirability bias? If so, please include a sentence about it but do not use this example (I feel it confusing as this study does not talk about cocaine use). Please expand on the telephone directory sampling bias if possible (how many houses have a landline in Spain? Would you expect any differences by age/ social class ?)

Thank you very much for the comment. We agree with the reviewer about the using of the example of cocaine could be confusing. As the reviewer suggested, we have deleted the example and clarified the paragraph as follows:

> "The use of a computerized questionnaire by telephone interview could potentially threaten the internal validity of the study due to information bias. We believe that this possible social desirability bias is minimal, because tobacco use in Europe and Spain is socially stigmatized, but we do not believe that this has resulted in an underreporting bias. However, our results could be partially overestimated the prevalence about complete rules when has punctually visit of smokers in houses with complete rules and allow smoking exceptionally.

According to the most recent data published by the National Commission of Markets and Competition (CNMC) in 2015 there were almost 13.5 million landline residential telephones. Unfortunately, we have not data about the social class and age according to the landline residential telephones. As the reviewer suggested, we have added the information of landline residential telephones numbers in Spain and the potential limitations about the social class and age as follows:

> "In Spain according to the "National Commission of Markets and Competition" (CNMC) in 2015 there were almost 13.5 million landline residential telephones. However, we do not have data stratified by social class or by age to evaluate. It could be possible that low social class have a lower percentage of landline."

____

We have added a new reference:

World Health Organization, Women's health. Available at: http://www.who.int/mediacentre/factsheets/fs334/en/.

REFERENCES

I don't know if the journal limits the number of references, but I feel there are too many

If the editor believes that it is convenient to reduce the number of references, the authors do not have any inconvenience to do it.

Reviewer 2

This is straightforward paper that describes the extent of smoke-free homes in Spain and attitudes towards the prohibition of smoking in cars. The paper is well written and the results and policy implications are clearly presented. However, the discussion would benefit from some further editing to make it more succinct – see for example paragraph beginning line 752. The following points also need to be addressed.

Thank you very much for the kind comments to our manuscript. As the reviewer suggested, we modified the beginning of this paragraph (please see also the response to the comment 4g of reviewer 1).

Lines 534 to 560 – The discussion is a little confusing here and needs a clearer explanation of why the Spanish study found the prevalence of completely smokefree homes to be half that of earlier US studies – was this because there were fewer older people in the survey?

Thank you for the comment. As the reviewer suggested, one possible explanation could be under representation of the older people in our study (around 10% of the sample) and the lack of information of people who more than 75 years old. Moreover, other potential explanation about the different figure between our study and the study of King at al. could be due to the different tradition of anti-tobacco legislation in the US in comparison with Spain, being more young in Spain (complete smoke-free legislation came into effect in 2011) than US (more than 20 years).

We have discussed these differences in the Discussion section as follows:

> "This could be partially explained because in our study the older population could be under estimated (around 10% of the sample and we have not information of people with more than 75 years old). On the other hand, other potential explanation could be due to the different tradition of anti-tobacco legislation in the US in comparison with Spain, being more young in Spain (complete smoke-free legislation came into effect in 2011) than US (more than 20 years)."

Line 660 – I am puzzled by the reference to smoking in public places being completely prohibited (without exception) in England. A comprehensive ban on smoking in partially

enclosed public places came into force in 2007 with a small number of exemptions. The 2015 DoH Regulations prohibit smoking in vehicles with children under 18 present – not a public place. The work 'likewise' on line 662, also seems inappropriate as the text goes on to refer to smoking bans on beaches and in parks in the US.

Thanks for the comment; it was a mistake that we have already corrected in the manuscript. We refer to the ban on smoking in vehicles in the presence of minors, established in the UK in 2015 and in this paragraph was totally inadequate. We have added it to the corresponding paragraph.

Lines 780 – 800 – Again I was a little puzzled. In general, internal validity of a study is discussed in the context of experimental designs when wanting to infer cause and effect, while information bias is mostly used when referring to measurement error or misclassification in epidemiological studies. I think what is really meant here is that 'response bias' poses a threat to 'questionnaire validity'. Also the use of cocaine as an example seems inappropriate. Instead, reference to the many studies that have found over reporting of completely smokefree homes (as exceptions are often made for friends or relatives who smoke) seems better.

Thanks for the comment, we agree so we have changed "information bias" for "response bias" in the text.

Moreover, we agree with the reviewer about the using of the example of cocaine could be confusing (as also mentioned the Reviewer 1). As the reviewer suggested, we have deleted the example and clarified the paragraph as follows:

> "The use of a computerized questionnaire by telephone interview could potentially threaten the internal validity of the study due to information bias. We believe that this possible social desirability bias is minimal, because tobacco use in Europe and Spain is socially stigmatized, but we do not believe that this has resulted in an underreporting bias. However, our results could be partially overestimated the prevalence about complete rules when has punctually visit of smokers in houses with complete rules and allow smoking exceptionally.

Minor points

Line 554 – change 'even hough' to 'even though'

Done.

Line 625 – change 'entered into force' to 'came into force'

Done.

Reviewer 3

This study describes the voluntary adoption of smoke-free homes and social attitudes towards restricting smoking in vehicles and multiunit housing in a representative sample of the adult Spanish population. Given the interest in smoke-free environments, this paper presents an interesting and important topic, however there are some concerns with the current presentation of this study that would require revision in order to appropriately address this topic. Some comments are detailed below.

Thanks, we appreciate the kind comments for the manuscript.

Major Comments:

1. It is unclear why individuals aged 16 and 17 years were included in the study sample. The opinions and voluntary adoption of smoke-free policies would be different in 16 and 17 year olds compared to adults 18 and older. For example, they would not be able to purchase cigarette legally, they would have less decision-making in the smoking policy in the home, and in terms of smoking in motor vehicles with a minor they would be considered a minor.

Thank you very much for the interesting comment, we completely agree with them. Following the comment of the reviewer, we have limited the analyses to adults (more than 18 years old). We have recalculated all data excluding minors (n=9) and we have explained it in the Methods section as follows:

> "This was a cross-sectional study of a representative sample of the Spanish adult population between 16 and 75 years of age (n=1045). For this study we have excluded the minor of 18 years old (n=9) because they would not be able to purchase cigarette legally, they would have less decision-making in the smoking policy in the home, and in terms of smoking in motor vehicles with a minor they would be considered a minor. The final sample for this study was 1036."

2. Methods: Clarify if the computer-assisted telephone interviews were given in Spanish

Done.

3. Methods (Page 6, Smoke-free home): For smoking rules inside the home, did inside the home include connected outdoor areas (e.g., balcony, patio)?

We have included inside the home the connected outdoor areas such as balcony or patio. In this sense, complete rules means that the smoking is prohibited in some places inside the home and connected outdoor areas. On the other hand, partial rule permits smoking in an inside room or connected outdoor areas of the house. We have clarified it in the Methods section as follows:

> "Based on the responses to this question, we defined household smoking rules as complete (smoking not allowed inside or connected outdoor areas of the house), partial (smoking allowed in some places inside or connected outdoor areas of the house), or absent (smoking allowed everywhere inside the house). Finally, we dichotomized this variable as 'rules' vs. "no rules" to indicate, respectively, the existence of some kind of smoking rules (complete or partial) or no smoking rules in the house."

4. Methods (Page 6, Attitudes towards smoking regulations in common areas): Were these questions restricted to participants that reported currently living in multiunit housing?

We consider multiunit housing as a building or flat, including private and common areas. We do not have detail if the participants lived in multiunit housing or building. For this reason, we did not restrict our analyses to people who lived in a multiunit housing. We have included this information in the Methods section.

5. Methods (Page 6): For participants that responded with "don't know/no answer", were these participants excluded from the study sample or analysis?

These participants were excluded from the analysis. We added this information in the Methods section.

6. Methods (Page 7): The response “neither agree nor disagree” would indicate a participant was neutral or has no preference with regard to the statement. This should not be combined with responses of disagreement (“disagree” or “totally disagree”).

Thank you very much for the comment. As we have responded to the reviewer #1 we have kept the category “neither agree nor disagree” in disagree or totally disagree category for not overestimate our result (please see comment 2a of the first Reviewer).

However, if the editor considers appropriate to aggregate this category in the authors would have no objection to do it.

7. Methods (Page 7): It is unclear why these age group categories (16-45, 46-65, and 66-75) were used for the analysis.

We used these categories to represented the young-adults, adults, and older populations because there are relationship of this age group with smoking status. Unfortunately, although our sample size is representative of the Spanish population, it is not as large as in previous studies which use more categories of the age group (Mons et al., 2013 and King et al., 2013). Our sample size is 1036 participants while the other ones were 4461 participants and more than 200000, respectively. Moreover, the first age group used in our study is the "childbearing age".

If the editor considers appropriate to aggregate more subgroups of age or regrouping, the authors would have no objection to do it.

8. Methods (Page 7): How were the social class categories created? It is unclear how information on education level and occupation were combined to generate high, medium and low categories.

The variable social class was created using the questions about the educational level of the person interviewed and the occupation of the person supporting the family. The DYM Institute has embargoed the information on occupation and the classification of social class so it has failed to provide in the manuscript. However, we have provided the information about the level of education in the manuscript.

For this reason, if the editor considers appropriate to delete information about social class of all manuscript and tables the authors would have no objection to do it.

9. Methods (Page 7): Is information available on number of people living in the household or information on if a household member smokes? For never smokers, the existence of a home smoking policy would differ depending on if a smoker lives in the home. Similarly opinions regarding smoking in cars could differ depending on if there is the possibility for smoking to occur in the vehicle.

Thank you very much for the interesting comment. We have information about smoking status of the participant in the study and our data show that prevalence of households with complete smoke-free rules decreases drastically when a current smoker answers and instead there is a considerable percentage of current smokers who say that they have partial rules in their homes. However, we have not collected information about smoking status of the other members of the family among never and former smokers. This lack of information is the same in the cases of vehicles. We have included this limitation in the Discussion section as follows:

> "On the other hand, smoking status of other members of the household could be affected in the voluntary adoption of smoke-free homes. Unfortunately, we have not information about that and future studies could address this topic."

10. Results (Page 8, line 443): In sentence "After adjusting for sex and age, the same patterns remained significant," was social class adjusted for in the model? Which patterns are being referred to: age adjusted for sex, smoking adjusted for age and sex…?

We have adjusted the OR for sex, age, habitants, and social class. We have clarified it across manuscript and in the footnote of the tables. We have decided to adjust for these variables for being the potential confounders. However, we have not found different before and after of adjusting.

If the editor considers more appropriate to adjust for other variables the authors would have no objection to do it.

11. Results: Clarify how p-values were estimated. Some findings presented for differences in prevalences across subgroups conflicts with ORc and ORa findings comparing subgroups.

We have used the chi squared to calculate the p-value. We have clarified the test used to calculate p-value in the Methods and in the footnote of the tables.

Thank you very much for the comment. As mentioned previous reviewers, we have detected some mistake in same data of the tables and we have corrected it (please see respond to reviewer #1 and #2). Moreover, we have recalculated all analyses to focus the analysis among respondents aged 18 or over (please see respond to the first comment) and we have solved all potential mistakes.

12. Results (Table 2): Reference groups are not consistent for any rule, complete and partial rules.

Please see response to comment number 3c of the reviewer #1.

13. Discussion (Page 10): "In our study, the percentage of completely smoke-free homes was half that reported by King and colleagues for all sociodemographic variables". Given the lack of nationwide comprehensive smoke-free legislation in public places in the US compared to Spain, what do the authors hypothesize to explain the lower prevalence of smoke-free homes in their study?

Please see response to comment 2 of the reviewer #2.

14. Discussion (Page 10, line 580): "…nor did we find any differences by ethnicity, level of education, or region." Information on ethnicity or region are not included/presented in the manuscript. In the analysis, education was combined with occupation of the primary provider in the household into social class. Given that occupation, as defined, may not reflect the social status of the respondent and this effect could vary significantly by age group, did the authors consider using education level alone instead of combined with occupation?

Thanks for the comment. As the reviewer suggested, we have included the information of educational level. Moreover, we have included information about the Spanish geographical area and habitants (please see respond to the comment 4f of the reviewer #1). However, we do not have information about ethnicity.

15. When interpreting the opinions and adoption of policies presented in this manuscript, it is helpful to understand the context as it related to existing smoke-free legislation in Spain. Consider moving paragraph details presented on Page 11 (paragraph 2) to Introduction section.

We agree with the reviewer comment and we have moved part of the paragraph on the current smoking legislation in Spain to the Introduction section to make the context more understandable.

Minor Comments:

1.Use same terminology consistently throughout manuscript: Secondhand smoke vs. passive tobacco exposure vs. SHS.

Done.

2. Use same phrasing consistently throughout manuscript: United States vs. USA vs US

Done.

3. Introduction (Page 5, line 250): "These places, where children spend much of their time…." Is this referring mostly to younger children? As children age, more time may be spent at school .

Thanks for the comment. We have clarified that after school private place are the places were children spend more time.

4. Introduction (Page 5, line 254): Typo, extra space between "open" and "debate"

Done.

5. Methods (Page 7, line 357): Typo, delete "the" in sentence "…of the MUH…"

Done.

6. Methods (Page 8, line 418): Typo, Orc should be "ORc"

Done.

7. Results (Page 9, lines 482-484): Error, delete sentence?

Done.

8. Results (Tables 2- 4): Indicate what variables were adjusted for in the adjusted model.

Done.

9. Discussion (Page 9, line 525): "In this study, we found higher prevalence of smoke-free homes (complete or partial) among women and never smokers". Although the prevalence of any rule was higher among women, this was due to a higher prevalence of partial rules, the prevalence of complete rules was higher in men. The findings among men vs. women for any ban was also not statistically significant.

We have modified it (please see responds to the reviewer #1).

10. Discussion (Page 10, line 554): Typo, "even though"

Done.

11. Discussion (Page 10, line 562): How was child-bearing age defined here?

The term child-bearing age was used as a synonym of "women of reproductive age" which according to the World Health Organization comprises from 15 to 44 years old. (World Health Organization n.d.)

Reference: World Health Organization, Women's health. Available at: http://www.who.int/mediacentre/factsheets/fs334/en/.

12. Discussion (Page 14, line 787): For the present study, while under reporting of smoking is possible, it may be more problematic that social desirability could result in participants over reporting support for smoke-free policies or the existence of smoke-free rules in their homes.

We have modified it according to the comment of the previous reviewer (please see response to comment 4 of the reviewer #2).

13. Discussion (Page 14, paragraph 2): "In terms of the strengths, the main strength is the use of a representative sample…In addition, all analyses used weighted data to ensure representative estimates…" These sentences are highlighting the same strength—a study sample that is representative of Spanish population.

Done.

14. Review manuscript for typos

We have revised carefully all manuscript to correct any typos.

ANEXO 2.4. Respuesta del Editor y segundos comentarios de los revisores de *Environmental Research*

De: Jose Domingo (Environmental Research) [mailto:EviseSupport@elsevier.com]

Enviado el: viernes, 02 de junio de 2017 15:27

Para: jmmartinez@uic.es

CC: an2737@cumc.columbia.edu

Asunto: Invitation to revise manuscript ER_2017_257_R1

Ref: ER_2017_257_R1

Title: Smoke-free homes and attitudes towards banning smoking in vehicles carrying children in Spain (2016)

Journal: Environmental Research

Dear Dr.Martínez-Sánchez,

Thank you for submitting your manuscript to Environmental Research. We have completed the review of your manuscript. A summary is appended below. While revising the paper please consider the reviewers' comments carefully. We look forward to receiving your detailed response and your revised manuscript.

To submit your revised manuscript:

- Log into EVISE® at: http://www.evise.com/evise/faces/pages/navigation/NavController.jspx?JRNL_ACR=ER
- Locate your manuscript under the header 'My Submissions that need Revisions' on your 'My Author Tasks' view
- Click on 'Agree to Revise'
- Make the required edits
- Click on 'Complete Submission' to approve

What happens next?

After approving your submission you will receive a notification that the submission is complete. To track the status of your paper throughout the editorial process, log into EVISE® at: http://www.evise.com/evise/faces/pages/navigation/NavController.jspx?JRNL_ACR=ER

Enrich your article to present your research with maximum impact. This journal supports the following Content Innovations:

- Explain your research in your own words and attract interest in your work using AudioSlides : 5-minute webcast-style presentations that are displayed next to your published article and can be posted on other websites. You will receive an invitation email to create an AudioSlides presentation within three weeks after your paper has been accepted.

- Interactive Plots: Interactive plot viewer providing easy access to the data behind plots. Please prepare a .CSV file with your plot data and test it online here before submitting as supplementary material.

I look forward to receiving your revised manuscript by the revision due date.

Kind regards,

Professor Domingo

Editor-in-Chief

Environmental Research

Comments from the editors and reviewers:

-**Editor**

One of the reviewers is not satisfied with the response provided. Please consider the recommendations of the reviewer thoroughly. The most important recommendation is to analyze and interpret the data careful. Do not over interpret the data and do not try to please the reviewers or to try to interpret the results beyond what is reasonable, especially do not try to interpret the data as what you think would be desirable or expected. The cautious and realistic interpretation of the results of a study is essential in the dissemination process of study findings. I hope these comments can help you prepare a better response and revised manuscript. Revise also the English for clarity and grammar. In addition to those general comments I have 2 suggestions:

1. Please report percentages only with 1 decimal. You do not really have precision to report 2 decimals, even one decimal might be too much. This change needs to be added to all percentages in the paper, tables and text.

2. In the conclusion, although you indicate that the % of households with a rule, complete or partial, is high, I believe it is more important to have a conclusion based solely on complete smoke-free rules in the home. We know partial rules are insufficient to protect children and household members from exposure to secondhand smoke. This is an important result of the study that needs to be highlighted indicating that additional efforts are needed to ensure that homes implement complete smoke-free rules at home in Spain.

-**Reviewer 1**

I am not a native speaker myself, but I´ve noticed several grammatical errors in the manuscript. For this same reason, some of the answers to the response document were difficult to understand. Having a native speaker carefully proofreading the manuscript is necessary.

Response to item 2a:

I still think that the item “neither agree nor disagree” cannot be included in a category named “disagree”. You should either create an additional category (strongly suggested) or use another name to define the “disagree” category

Response to item 3b:

It is not true that “the prevalence of complete smoke-free homes is higher amongst the oldest age group (ORc=2.10; 95%CI: 1.36-3.25) comparted to partial rules”. The reference category stated in the sentence is incorrect. The same applies to smokers.

Please check the grammar of the sentence.

Have you checked if the age-adjusted prevalence is still higher among never smokers? Looking at the tables it seems that current smokers are also the oldest. If so, please incorporate this information.

Response to item 3e:

Please correct: “the lowest was in oldest age group”

Response to item 4a:

Please change “among people who had never been smoker.” for ““among people who had never smoked”

Response to item 4b:

The authors state that they have modified the paragraph accordingly. However, I cannot find these changes.

Response to item 4e:

Why did you say that the prevalence was highest in the middle aged group and now change it to the youngest? Can you confirm that the real value is the one presented in this last version of the manuscript.

This sentence is grammatically incorrect: “Moreover, this is especially remarkable, which also has the highest prevalence of current smokers in this age group in Spain (Sanidad 2011).”

Regarding the inclusion of the variable “presence of children in homes”, please

avoid the term “demonstrated”, you can use “suggested” or “observed” instead.

Response to item 4f:

Why would you include this sentence “nor did we find any differences by ethnicity, level of education, or region” in the previous version of your manuscript if all your participants are Caucasians and if there is an association with educational level?

Moreover, you have answered to reviewer 2 (item 14) that “you do not have information about ethnicity”, but then you state in the discussion that “Unlike other studies you found no significant differences between social classes, nor did you find any differences by Ethnicity”.

Response to item 4i:

Please rephrase the sentence and include citations. A sentence like the following is not acceptable in objective writing: “We believe that this possible social desirability bias is minimal, because tobacco use in Europe and Spain is socially stigmatized, but we do not believe that this has resulted in an underreporting bias”

Something similar happens with the section on landline residential telephones. Also, why are you including a citation on hydrocarbons to support your data on the number of landline residential telephones?

The number on landline residential telephones might be easier to interpret if you also included the percentage of the Spanish population with fixed-telephone subscriptions.

-**Reviewer 3**

This is an interesting and well-written manuscript reporting on the voluntary adoption of smoke-free homes and social attitudes towards restricting smoking in vehicles and multiunit housing in a representative sample of the adult Spanish population. The authors have adequately addressed the concerns raised by the reviewers.

Have questions or need assistance?

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ANEXO 2.5. Respuesta al Editor y a los segundos comentarios de los revisores de *Environmental Research*

Ref: ER_2017_257_R1
Title: Smoke-free homes and attitudes towards banning smoking in vehicles carrying children in Spain (2016)

Respond to the editor's and reviewers' comments

We would like to thank to the useful comments.

Editor

One of the reviewers is not satisfied with the response provided. Please consider the recommendations of the reviewer thoroughly. The most important recommendation is to analyze and interpret the data careful. Do not over interpret the data and do not try to please the reviewers or to try to interpret the results beyond what is reasonable, especially do not try to interpret the data as what you think would be desirable or expected. The cautious and realistic interpretation of the results of a study is essential in the dissemination process of study findings. I hope these comments can help you prepare a better response and revised manuscript. Revise also the English for clarity and grammar.

We have followed all recommendations of the reviewer and changed the manuscript accordingly. We have also re-analysed the data according to the recommendation of the reviewer and we have a careful interpretation of the data. Finally, we have sent the last version of the manuscript to two native English speakers (please see the acknowledgment of the manuscript) to proofread the manuscript.

In addition to those general comments I have 2 suggestions:

1.Please report percentages only with 1 decimal. You do not really have precision to report 2 decimals, even one decimal might be too much. This change needs to be added to all percentages in the paper, tables and text.

As the editor suggested, we have provided across the manuscript all percentages only with 1 decimal.

2. In the conclusion, although you indicate that the % of households with a rule, complete or partial, is high, I believe it is more important to have a conclusion based solely on complete smoke-free rules in the home. We know partial rules are insufficient to protect children and household members from exposure to secondhand smoke. This is an important result of the study that needs to be highlighted indicating that additional efforts are needed to ensure that homes implement complete smoke-free rules at home in Spain.

We agree with the Editor's comment. We have changed the conclusion in the main text of the manuscript as follows:

> "In conclusion, the Spanish population seems to overwhelmingly support regulating smoking in vehicles carrying children. In addition, a non-negligible percentage of households (around half of the population) in

> Spain has a complete smoke free rule at home and more than 80% have either partially or completely smoke-free homes (37% partial rule). Although, the percentage of any kind of rule is high, partial rules are insufficient to protect children from SHS for this reason, additional efforts are needed to promote and implement complete rules in homes in Spain."

Moreover, we have modified the conclusion of the abstract as follows:

> "Approximately half of the adult population in Spain has implemented a complete smoke-free rule at home."

Reviewer 1

1) I am not a native speaker myself, but I´ve noticed several grammatical errors in the manuscript. For this same reason, some of the answers to the response document were difficult to understand. Having a native speaker carefully proofreading the manuscript is necessary.

Thank you for the comment, the manuscript has been reviewed by a native speaker to ensure that has not grammatical mistakes (please see the acknowledgment of the manuscript).

2a) Response to item 2a:

I still think that the item "neither agree nor disagree" cannot be included in a category named "disagree". You should either create an additional category (strongly suggested) or use another name to define the "disagree" category

Thank you for the suggestion. As the reviewer suggested, we have created a new category with item "neither agree nor disagree" and we have removed of the disagree group.

We have explained it in the Method section as follows:

> "Attitudes towards smoking regulations in common areas (i.e. elevator, stairs, walkways, etc.) of MUH. We measured attitudes towards smoking regulation in common areas using the following question: "Should smoking be prohibited within the common areas (i.e.:, elevator, stairs, lobby, walkways, etc.) of MUH, with six possible answers: "totally agree", "agree", "neither agree nor disagree", "disagree", "totally disagree", "don't know/no answer". We recoded this variable according to whether the respondents agreed with regulating smoking ("totally agree" and "agree"), disagreed (disagree" and "totally disagree"), and neither agree nor disagree ("neither agree nor disagree"). We asked all participants this question regardless of where they lived (flat, multiunit housing, house, etc.)."

And

> "Attitudes towards smoking regulations in vehicles. We assessed attitudes towards regulating smoking in cars in general and in cars carrying children (minors). Smoking "in the presence of a child" was defined as smoking

> inside a vehicle where a minor under 18 was present. We asked the following two questions: "Should smoking be prohibited inside cars in the presence of minors?" and "Should smoking be prohibited inside cars, without exception?". The possible answers for both questions were: "totally agree", "agree", "neither agree nor disagree", "disagree", "totally disagree", "don't know/no answer". Again, we recoded this variable according to whether the respondents agreed with regulating smoking ("totally agree" and "agree"), disagreed (disagree" and "totally disagree"), and neither agree nor disagree ("neither agree nor disagree")."

We have also added in the Results section information about the people who declared to be "neither agree nor disagree" as follows:

> "85.7% of participants declared to be in favor of banning smoking in common areas of buildings, while 6.6% disagree, and 7.7% responded to neither agree nor disagree. Table 3 shows the percentage of respondents in favor of banning smoking in common areas of buildings according to independent variables. There were statistically significant differences in the percentages of people who declared to be in favor of banning smoking in common areas of buildings according to educational level and smoking status (Table 3)."

And

> "90.1 % of participants declared to be in favor of banning smoking in cars with children on board, 4.6% of respondents disagree, and 5.3 % responded to neither agree nor disagree. Table 4 shows the percentage of respondents in favor of banning smoking in vehicles with children and in all cars (with or without children). No statistically significant differences in the percentages of people who declared to be in favor of banning smoking in presence of children were found among the various sociodemographic categories except smoking status and educational level (Table 4). The strongest support for this ban in cars with children was in never-smokers (92.0%; 95%CI: 88.9-94.2) and among people with high educational level (93.5%; 95%CI: 90.2-95.8). Additionally, 61.6% of participants declared to be in favor of banning smoking in cars without exceptions (with or without children on board), 22.0 % respondents disagree, and 16.4 % responded to neither agree nor disagree. Statistically significant differences of people who declared to be in favor of banning smoking in cars without exceptions were found by sex, age group and smoking status (Table 4). The strongest support for this ban in cars without exceptions was among women population (63.3%;95%CI: 59.0-67.6), the oldest population group (66-75 years old; 81.9%, 95%CI: 73.7-88.1) and never-smokers (71.4%; 95% CI: 67.0- 75.5)."

According to the new classification we have conducted a multinomial logistic regression model using as a reference the category "disagree". We have modified the tables accordingly and explained it in the Methods section as follows:

"We also calculated the crude odds ratios (ORc) with 95% confidence intervals (CI) and the adjusted OR (ORa) for sex, age, inhabitants, and social class. For the attitudes to the regulation we fitted a multinomial regression model using category of disagree as a reference in order to calculate the ORc and ORa"

3b) Response to item 3b:
It is not true that "the prevalence of complete smoke-free homes is higher amongst the oldest age group (ORc=2.10; 95%CI: 1.36-3.25) comparted to partial rules". The reference category stated in the sentence is incorrect. The same applies to smokers. Please check the grammar of the sentence.
Have you checked if the age-adjusted prevalence is still higher among never smokers? Looking at the tables it seems that current smokers are also the oldest. If so, please incorporate this information.

Thank you very much for the comment. We agree with the reviewer that the reference category was not correct. We have corrected it and clarified the sentence as follows:

"A 58.5 % (95% IC: 49.3-67.3) of participants in the older age group had complete rules versus a 27.6% (95% IC: 20.1-36.6) with partial rules. In addition, there is also a higher percentage of complete rules than partial among never smokers (54.4% *versus* 35%, $p<0.05$) (Table1)."

As the reviewer suggested, we have also calculated the age-adjusted prevalences according to smoking status using as reference the age distribution of Spain in 2015 and the prevalences were also higher among never smokers after adjusted (please see table 1 of the response). We have mentioned it in the Results section as follows:

"The differences according to smoking status in the age-adjusted prevalences were also higher among never smokers (data not shown)."

Table 1. Crude and age-adjusted prevalences according to smoking status.

	crude prevalence			**age-adjusted prevalence**		
	Total rule	Partial rule	Both (total + partial)	Total rule	Partial rule	Both (total + partial)
Never smokers	54.4	35.0	75.0	54.2	35.2	89.4
Former smokers	50.3	30.8	81.1	50.3	31.4	81.7
current smoker	26.0	49.0	89.4	27.0	48.1	75.1

3e) Response to item 3e: Please correct: "the lowest was in oldest age group"

When we explain that the lowest was in the oldest age group, we were referring to the partial ban not complete and any type of rule. As the reviewer mentioned, we believe that these sentences could be misinterpreted by potential readers. We have clarified it in the text as follows:

> "Partial smoking bans were implemented in 37.5% (95% CI: 34.5-40.5) of households, with significant differences according to age group. The highest prevalence of partial smoking ban was found in the younger age group (18-45 years) with a 39.6 % (95%CI: 35.5-43.8) and the lowest was found in the older age group (66-75 years) with a 27.6 % (95%CI: 20.1-36.6). Significant differences of partial smoking ban were also found for smoking status; being 49.0 % (95%CI: 43.0-55.1) in current smokers and 30.8 % (95%CI: 25.8-36.3) in former smokers (Tables 1 and 2)."

<u>4a) Response to item 4a: </u>Please change "among people who had never been smoker." for ""among people who had never smoked"

Done.

<u>4b) Response to item 4b:</u>
The authors state that they have modified the paragraph accordingly. However, I cannot find these changes.

In the previous version of the manuscript, we modified the following paragraph of the Discussion section:

> "In this study, we found a higher prevalence of smoke-free homes (complete or partial) among people who had never smoked. This pattern is consistent with previous studies carried out in general population from various European countries and the United States (US) (King et al. 2013; Mons et al. 2013; St. Claire et al. 2012). Mons et al. (Mons et al. 2013) found a higher prevalence of smoke-free homes among the older population, results that are only consistent with our findings for complete rules. This finding could be attributable to the fact that, in Europe and especially in Spain, the prevalence of former or never-smokers is higher in the elderly than in the younger population (Sanidad 2011)."

Moreover, we have clarified that the comparison in the elderly group was performed with partial or complete rules (please see comment 3e) to avoid misinterpretations.

<u>4e) Response to item 4e:</u>

Why did you say that the prevalence was highest in the middle aged group and now change it to the youngest? Can you confirm that the real value is the one presented in this last version of the manuscript?

Thank you very much for noticing the changes. We talked about the middle age group and youngest group to refer to the same group (between 18 and 45 years old). In the previous response to the reviewers' comments and the last version of the manuscript this aspect was not clear. Taking under consideration your previous comment and after discussing it with a native English speaker, we decided that the most adequate term to use was "child-bearing age" (both sexes) instead of "middle aged group". For this reason we used this term and we have detailed the range of this age group to avoid misinterpretations as follows:

> "The prevalence of partial smoke-free rules among respondents of child-bearing age, between 18 and 45 years old, was high in both sexes."

This sentence is grammatically incorrect: "Moreover, this is especially remarkable, which also has the highest prevalence of current smokers in this age group in Spain (Sanidad 2011)."

Thanks for the notice. We have modified the sentence as follows:

> "Moreover, this is especially remarkable, since it also has the highest prevalence of current smokers in this age group in Spain (Sanidad 2011)."

Regarding the inclusion of the variable "presence of children in homes", please avoid the term "demonstrated", you can use "suggested" or "observed" instead.

Done.

<u>4f) Response to item 4f:</u>

Why would you include this sentence "nor did we find any differences by ethnicity, level of education, or region" in the previous version of your manuscript if all your participants are Caucasians and if there is an association with educational level?
Moreover, you have answered to reviewer 2 (item 14) that "you do not have information about ethnicity", but then you state in the discussion that "Unlike other studies you found no significant differences between social classes, nor did you find any differences by Ethnicity".

Thanks for your comment. In the discussion we made a mistake and we corrected it, as follows:

> "Unlike other studies (King et al. 2013), we found no significant differences between social classes, nor did we find any differences by level of education or region."

Unfortunately we do not have data on ethnicity.

<u>4i) Response to item 4i:</u>
Please rephrase the sentence and include citations. A sentence like the following is not acceptable in objective writing: "We believe that this possible social desirability bias is minimal, because tobacco use in Europe and Spain is socially stigmatized, but we do not believe that this has resulted in an underreporting bias".

As the reviewer suggested, we have included a citation and rephrase the sentence as follows:

> "Although tobacco consumption in Europe and Spain could be partially socially stigmatized (Evans-Polce 2015), we consider that the social desirability bias could be minimal in our study."

We added a new citation:

Evans-Polce, R. J., Castaldelli-Maia, J. M., Schomerus, G., & Evans-Lacko, S. E. (2015). The downside of tobacco control? Smoking and self-stigma: a systematic review. *Social Science & Medicine*, *145*, 26-34.

Something similar happens with the section on landline residential telephones. Also, why are you including a citation on hydrocarbons to support your data on the number of landline residential telephones?

Thank you very much for the comment. This was a mistake made by the bibliographic manager (Mendeley). We have modified the reference as follows:

"Comisión Nacional de los Mercados y la Competencia (CNMC). Informe Económico Sectorial de las Telecomunicaciones y el Audiovisual. 2016. Available: http://data.cnmc.es/datagraph/files/Informe%20Telecos%20y%20Audiovisual%202016.pdf

The number on landline residential telephones might be easier to interpret if you also included the percentage of the Spanish population with fixed-telephone subscriptions.

We agree with the reviewer. We have calculated the percentage of landline residential telephones, and added this information in the Discussion section as follows:

> "In Spain, according to the "National Commission of Markets and Competition" (CNMC) (CNMC 2016) in 2015, there were almost 13.5 million landline residential telephones (around 74% of Spanish households)."

Reviewer 3

This is an interesting and well-written manuscript reporting on the voluntary adoption of smoke-free homes and social attitudes towards restricting smoking in vehicles and multiunit housing in a representative sample of the adult Spanish population. The authors have adequately addressed the concerns raised by the reviewers.

Thank you very much for your kind comment.

ANEXO 2.6. Carta de aceptación de *Environmental Research*

De: Jose Domingo (Environmental Research) [mailto:EviseSupport@elsevier.com]

Enviado el: miércoles, 05 de julio de 2017 10:05

Para: jmmartinez@uic.es

CC: an2737@cumc.columbia.edu

Asunto: Your manuscript ER_2017_257_R2 has been accepted

Ref: ER_2017_257_R2

Title: Smoke-free homes and attitudes towards banning smoking in vehicles carrying children in Spain (2016)

Journal: Environmental Research

Dear Dr.Martínez-Sánchez,

I am pleased to inform you that your paper has been accepted for publication. My own comments as well as any reviewer comments are appended to the end of this letter. Now that your manuscript has been accepted for publication it will proceed to copy-editing and production.

Thank you for submitting your work to Environmental Research. We hope you consider us again for future submissions.

Kind regards,

Jose Domingo

Editor-in-Chief

Environmental Research

Comments from the editors and reviewers:

- **Reviewer 1**

Have questions or need assistance?

For further assistance, please visit our Customer Support site. Here you can search for solutions on a range of topics, find answers to frequently asked questions, and learn more about EVISE® via interactive tutorials. You can also talk 24/5 to our customer support team by phone and 24/7 by live chat and email.

ANEXO 3: Correspondencia del artículo de la tesis: “*Update on Thirdhand Smoke: A Comprehensive Systematic Review*”

ANEXO 3.1. Carta de presentación al Editor de *Environmental Research*

Sant Cugat del Vallès (Spain), January 25th, 2018.

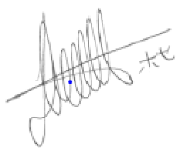
Prof. José L.Domingo
Editor
Enviromental Research

Dear Prof. Domingo,

Please find enclosed our manuscript **"Update on thirdhand smoke: A comprehensive systematic review"** for your consideration in Enviromental Research as an *Original Investigation*.
In last years, the evidence about Thirhand smoke (THS) has increased and gained importance due to the appearance of evidence of its adverse health effects. However, very little is known about the specific health implications of THS exposure. In this sense, there are some author reviews in the literature, but as far as our knowledge is concerned, this is the first systematic comprehensive review of this topic.
We have subdivided it into four subsections our review to focus all potential aspect of this topic.
We believe that our research is especially important because it can help clarify current knowledge about THS and show potential shortcomings for future research. Although our initial
intention was to perform a meta-analysis, it has not been possible, due to the heterogeneity of the studies.
All of the authors have read and approved the paper and it has not been published previously nor is it being considered by any other peer-reviewed journal. The authors declare there are no
conflicts of interest.

We would of course be ready to provide further information about our data and methods you desire. Correspondence about the manuscript should be addressed to me as indicated in the first page of the manuscript.

Thank you very much for your kind attention.
Yours sincerely,



Jose M Martínez-Sánchez, PhD, MPH, BSc
E-mail: jmmartinez@uic.es

ANEXO 3.2. Respuesta del Editor y comentarios de los revisores de *Environmental Research*

De: "ER (ELS)" <eesserver@eesmail.elsevier.com>

Fecha: 10 de marzo de 2018, 12:01:24 GMT+2

Para: jmmartinez@uic.es

Cc: joseluis.domingo@urv.cat

Asunto: ER-18-183: Interim Decision

Responder a: "ER (ELS)" <er@elsevier.com>

Ms. No.: ER-18-183

Title: Update on thirdhand smoke: A comprehensive systematic review

Corresponding Author: Dr. Jose M Martínez-Sánchez

Authors: Ana Díez-Izquierdo, MD; Pia Cassanello-Peñarroya, MD; Cristina Lidón-Moyano, PhD; Nuria Matilla-Santander, MPH; Albert Balaguer, MD,PhD;

Dear Dr. Martínez-Sánchez,

Thank you for submitting your manuscript to Environmental Research. The reviewers have made suggestions which the Editor feels would improve your manuscript. The Editor encourages you to consider these comments and make an appropriate revision of your manuscript. The reviewers' comments are below.

Please submit your revision online within 60 days by logging onto the Elsevier Editorial System for Environmental Research:

1. Go to this URL: https://ees.elsevier.com/er/

2. Log in %BLINDED USERNAME%

If you need to retrieve password details, please go to: http://ees.elsevier.com/ER/automail_query.asp.

NOTE: Upon submitting your revised manuscript, please upload the source files for your article. For additional details regarding acceptable file formats, please refer to the Guide for Authors at: http://www.elsevier.com/journals/environmental-research/0013-9351/guide-for-authors

When submitting your revised paper, we ask that you include the following items:

Manuscript and Figure Source Files (mandatory)

REVISED Manuscript (Marked-up with changes)

REVISED Manuscript (Clean version)

We cannot accommodate PDF manuscript files for production purposes. We also ask that when submitting your revision you follow the journal formatting guidelines. Figures and tables may be embedded within the source file for the submission as long as they are of sufficient resolution for Production. For any figure that cannot be embedded within the source file (such as *.PSD Photoshop files), the original figure needs to be uploaded separately. Refer to the Guide for Authors for additional information.

http://www.elsevier.com/journals/environmental-research/0013-9351/guide-for-authors

Highlights (mandatory)

Highlights consist of a short collection of bullet points that convey the core findings of the article and should be submitted in a separate file in the online submission system. Please use 'Highlights' in the file name and include 3 to 5 bullet points (maximum 85 characters, including spaces, per bullet point). See the following website for more information

http://www.elsevier.com/highlights

3. Click (Author Log-in)

This takes you to the Author main menu.

You can find the manuscript record listed under "Submissions Needing Revisions." Click "Revise" when you are ready to submit your revision. (If you have forgotten your password, please click the "Forget your password" link located on the log-in screen.) For guidelines on how to submit your revised manuscript please go the following address: http://help.elsevier.com/app/answers/detail/p/7923/a_id/91

When submitting your revised paper, please include a separate document uploaded as "Response to Reviews" that carefully addresses the issues raised in the below comments, point by point. You should also include a suitable rebuttal to any specific request for change that has not been made.

To facilitate the electronic publication of your manuscript (should it be accepted), we request that your manuscript text, tables and figure legend be submitted in an editable format (Word, WordPerfect, or LaTex only), and all figures uploaded individually as TIF or EPS files.

Environmental Research features the Interactive Plot Viewer, see: http://www.elsevier.com/interactiveplots. Interactive Plots provide easy access to the data behind plots. To include one with your article, please prepare a .csv file with your plot data and test it online at http://authortools.elsevier.com/interactiveplots/verification before submission as supplementary material.

Include interactive data visualizations in your publication and let your readers interact and engage more closely with your research. Follow the instructions here: https://www.elsevier.com/authors/author-services/data-visualization to find out about available data visualization options and how to include them with your article.

Thank you, and we look forward to receiving your revised manuscript.

With kind regards,

Jose L. Domingo, PhD

Editor-in-Chief
Environmental Research

Editorial Office Elsevier

E-mail: er@elsevier.com

Reviewers' comments:

Reviewer #1: This is a very valuable and timely review article addressing a topic of increasing visibility: thirdhand smoke (THS). The authors have covered most of the existing literature on the topic, and organized the material under very reasonable general areas that include chemistry and indoor fate, impacts on health, beliefs and behaviours associated with THS. I recommend publication in Environmental Research after minor revisions are implemented, primarily related with inclusion of additional material that is currently not covered.

I suggest incorporating to the review mention of the following studies, grouped by topics (following the same structure as in the manuscript):

1) COMPONENTS AND CONCENTRATION OF THS This very recent paper addresses the persistence of THS components indoors for a worst-case scenario for THS: a casino that goes smoke-free

Matt GE, Quintana PJE, Hoh E, Zakarian, J, Chowdhury, Z, Jacob, P, Watanabe, K, Theweney, T, Flores, V, Nguyen, A, Dhaliwal, N, Hayward, G. Casino goes smoke free: a longitudinal study of secondhand and thirdhand smoke pollution and exposure. (2018) Tob Control in press doi:10.1136/tobaccocontrol-2017-054052

This study covers analytical methods used to detect THS constituents on surfaces: tobacco-specific nitrosamines

Sleiman M, R.L. Maddalena, L.A. Gundel and H. Destaillats. Rapid and sensitive gas chromatography-ion-trap tandem mass spectrometry method for the determination of tobacco-specific N-nitrosamines in secondhand smoke. J. Chromatography A 1216, (2009), 7899-7905.

This study covers analytical methods used to detect THS constituents in aerosols: reactive oxygen species

Sleiman M, Destaillats H, Gundel LA. (2013) Solid-phase supported profluorescent nitroxide probe for the determination of aerosol-borne reactive oxygen species. Talanta, 2013, 116, 1033-1039

This study covers the indoor chemistry of THS. In particular, the reaction of nicotine and the THS mixture with ozone, a common atmospheric pollutant often found indoors and sometimes released to remove tobacco odors. This study precedes the Petrick study from 2011 by the same group, which is cited in the review:

Sleiman M, H. Destaillats, J.D. Smith, C.-L. Liu, M. Ahmed, K.R. Wilson and L.A. Gundel. Secondary organic aerosol formation from ozone-initiated reactions with nicotine and secondhand tobacco smoke. Atmos. Environ. 44, (2010), 4191-4198.

2) IMPACT OF THS ON HEALTH This is an area of high productivity and very recent activity. The authors may have missed the following papers because they have all been released in the past few months:

BIOMARKERS

Schick SF, Blount BC, Jacob P III, Saliba NA, Bernert JT, El Hellani A, Jatlow P, Pappas RS, Wang L, Foulds J, Ghosh A, Hecht SS, Gomez JC, Martin JR, Mesaros C, Srivastava S, St Helen G, Tarran R, Lorkiewicz PK, Blair IA, Kimmel HL, Doerschuk CM, Benowitz NL, Bhatnagar A. (2017) Biomarkers of exposure to new and emerging tobacco delivery products. Am J Physiol Lung Cell Mol Physiol. 2017 Sep 1;313(3):L425-L452. doi: 10.1152/ajplung.00343.2016.

DERMAL UPTAKE

Mahabee-Gittens EM, Merianos AL, Matt GE (2017). Preliminary evidence that high levels of nicotine on children's hands may contribute to overall tobacco smoke exposure. Tob Control. Epub 2017/04/01. doi: 10.1136/tobaccocontrol-2016-053602. PubMed PMID: 28360145.

Bekö B, G. Morrison, C. Weschler, H. Koch, C. Palmke, T. Salthammer, T. Schripp, A. Eftekhari, J. Toftum and G. Clausen. Dermal uptake of nicotine from air and clothing: experimental verification. Indoor Air in press. doi: 10.1111/ina.12437, (2018),

ANIMAL STUDIES

Adhami N, Y. Chen and M. Martins-Green (2017). Biomarkers of disease can be detected in mice as early as 4 weeks after initiation of exposure to third-hand smoke levels equivalent to those found in homes of smokers. Clinical Sciences 131:2409-2426. DOI: 10.1042/CS20171053.

Hang B, A. M. Snijders, Huang Y, Schick SF, Wang P, Xia Y, Havel C, Jacob III P, Benowitz N, H. Destaillats H, Gundel LA, Mao J-H. Early exposure to thirdhand cigarette smoke affects body mass and the development of immunity in mice. Scientific Reports, 7, article number: 41915 (2017), DOI: 10.1038/srep41915, PMID: 28001376.

Hang B, Pin Wang, Yue Zhao, Altaf Sarker, Ahmed Chenna, Yankai Xia, Antoine M. Snijders, and Jian-Hua Mao. Adverse Health Effects of Thirdhand Smoke: From Cell to Animal Models, Int. J. Mol. Sci. 2017, 18(5), 932; doi:10.3390/ijms18050932.

Hang B, Y. Wang, Y. Huang, P. Wang, S.A Langley, L. Bi, A.H Sarker, S.F Schick, C. Havel, P. Jacob III, N. Benowitz, H. Destaillats, X. Tang, Y. Xia, L.A Gundel, J.-H. Mao and A.M Snijders, Short-term early exposure to thirdhand cigarette smoke increases lung cancer incidence in mice, Clinical Science (Lond), 2018, Feb 12.

BELIEFS AND BEHAVIOURS ABOUT THS

I suggest to expand the title to include in this category also POLICIES (which include not only regulation but also self-imposed practices such as those described on this recent paper for hotel room management:

Zakarian J, P.E.J Quintana, Carl H. Winton, Georg E. Matt, Hotel smoking policies and their implementation: a survey of California hotel managers, Tobacco Induced Diseases (2017) 15:40 (9pp). DOI 10.1186/s12971-017-0147-6.

Reviewer #2: This manuscript attempts to review the literature on thirdhand smoke. The authors have done a careful and well documented job performing a literature review. However, the manuscript needs to be revised before it is acceptable.

Major concerns:

1. Descriptions of studies should include important technical details, in the text as well as the tables. For example, line 50 p12 "In addition, Hang analyzed THS in short- and long-term cells showing structural changes in DNA (Hang et al.,2013)." It is important to note the type of cells in the text (human), the type of exposure (dilutions of THS extract) and in the table give the actual cell line and the genotoxicity assay. Likewise when describing the matrix, in the table, details are needed. For example, details about whether the dust was collected per a known surface area with HVs3 or 4 vacuum or not is needed, as a. these give different particle sizes from vacuum bag and b. allow toxic components to be expressed as loading as well as concentration.

2. Careful descriptions and referencing is needed, where the citations match the statement. e.g., line 35, p5," There are two recently published author reviews (Quintana et al., 2013; Jacob et al.,2017) showing the chemical changes, the concentrations of different components of THS, and the effects of THS on cells and animals." This is incorrect, as the the Quintana paper merely reviews a technique for determining surface levels of nicotine.

3. The English is very poor - it seems as though many errors (incorrect capitalizations in the middle of sentences, words like mices, etc., could have been caught by Microsoft Word grammar and spell check .The authors are encouraged to use these or similar tools.

4. The discussion could be shortened, as could the tables.

5. If the paper is revised, a new search is needed, as papers are coming out fairly often in this new field.

Reviewer #3: Review of manuscript ER-18-183 for Environmental Research, entitled "Update on thirdhand smoke: A comprehensive systematic review"

Reviewer's summary:

This manuscript provides a useful summary of research on THS since the the term "thirdhand smoke" attracted widespread media attention in 2009, again in 2010, and continuing to the present. The authors structured the review using guidelines based on PRISMA, a structure developed for review of clinical trials and other activities in medical research. They performed a literature review based on peer-reviewed publications on thirdhand smoke. They pruned their list to 63 articles and sorted them into four categories: Components and concentration of THS, health impacts, beliefs and behaviors about THS, and other aspects of THS such as use of hookahs and electronic cigarettes. The manuscript has a table for each of these categories. The tables provide concise summaries of each publication. The results introduced by category and the number of publication on each topics before a discussion of what has been learned about THS from about 2009 through Oct 2017.

Reviewer's general comments and recommendations:

1) The article is worth publishing with revisions.

2) From the perspective of a researcher in environmental and health science, rather than an expert in information science, the Results section is too terse and difficult to absorb because the statistics outweigh the content. Reading the Results section is similar to scanning a Table of Contents: topics are listed without findings.

a) This reviewer suggests incorporating the numeric distribution of the 63 papers into the four tables, and/ or adding a one page summary table with the "big picture" main findings for each category. Preparing such a table would entice readers to dig into the current four information-rich tables. This organization would also shorten the length of the Results section.

b) Another approach to making the article more useful and easier to absorb is to merge the Results and Discussion sections. This would enable incorporating the statistics with the main findings on each topic. Merging would also shorten the paper and decrease what appears to be redundancy. The present structure does not successfully link the number of papers with the significance of the findings.

3) Content lacks sufficient mention of the work published in the first decade of the century before the terms thirdhand smoke and THS were used as search terms.

a) The authors should not call the Quintana 2013 article a review (p 5, line 32). However, that article does have a well-written summary of the knowledge base on which that group based their seminal research on THS. This reviewer suggests mentioning that section of Quintana 2013 as a source for earlier work that explains the persistence of nicotine on many types of surfaces of all kinds, including skin.

b) The seminal article by Schick and Glantz (2007) should definitely be included because it motivated research that demonstrated formation of carcinogens TSNAs as SHS aged and thus spurred investigation of the health effects of THS.

4) Substantial attention must be paid to improving English grammar, word usage and sentence structure throughout the manuscript. There are dozens of sentences that are unclear and confusing because of insufficient editing. This reviewer recommends that the authors engage an expert to improve the usage of English. This will certainly strengthen the usefulness of the article to a broad range of readers, regardless of their native languages.

Reviewer #4: This is a valuable manuscript providing a systematic review of recently published scientific literature on thirdhand smoke. The review covers various aspects of THS: from Components and concentrations of THS, to Impact of THS in health, and Beliefs and behaviours of THS. Despite the intention and efforts to perform a meta-analysis of the published studies, the manuscript fails to provide a comprehensive overview and clear discussion and conclusions. This was due mainly to the heterogeneity of the original studies included and the difficulty to synthesize their results. I recommend publication of the manuscript although I'm not sure what would be the value of the review and how it can help construct an opinion about the research field and the science behind it. It's maybe early to provide such review given the lack of consistency and heterogeneity of the data published. But I think the review can help by identifying the issues behind such heterogenity and what is yet need to be done to have a better understanding of THS composition, health impacts and behaviors.

<u>ANEXO 3.3.</u> Respuesta a los comentarios del Editor y de los revisores de *Environmental Research*

April, 2018

Sant Cugat del Vallès, Spain

Jose L Domingo, PhD

Editor-in-Chief, Environmental Research

Dear Prof. Domingo,

We would like to thank you very much for the opportunity to resubmit our manuscript. We greatly appreciate the useful comments and suggestions of the Reviewers and we enclose a point-by-point response. The modifications in the text of the manuscript have been highlighted.

Thank you very much for your kind attention.
Sincerely yours,

Jose M Martínez-Sánchez, PhD, MPH, BSc

Ref: ER-18-183

Title: Update on thirdhand smoke: A comprehensive systematic review

We would like to thank to the Editor and the reviewers for the useful comments. We provide a new version of the manuscript according to the reviewers' comments (with the changes highlighted) and our point-by-point response to all those comments.

Moreover, we have updated the search to the 3th of April of 2018, including 68 articles in the systematic review.

Reviewer #1:

This is a very valuable and timely review article addressing a topic of increasing visibility: thirdhand smoke (THS). The authors have covered most of the existing literature on the topic, and organized the material under very reasonable general areas that include chemistry and indoor fate, impacts on health, beliefs and behaviours associated with THS. I recommend publication in Environmental Research after minor revisions are implemented, primarily related with inclusion of additional material that is currently not covered.

Thank you very much for the kinds comments to our work and the suggestions. As the reviewer suggested, we have updated the search and added some of the suggested items as we detailed as follows:

I suggest incorporating to the review mention of the following studies, grouped by topics (following the same structure as in the manuscript): 1) COMPONENTS AND CONCENTRATION OF THS

This very recent paper addresses the persistence of THS components indoors for a worst-case scenario for THS: a casino that goes smoke-free

Matt GE, Quintana PJE, Hoh E, Zakarian, J, Chowdhury, Z, Jacob, P, Watanabe, K, Theweney, T, Flores, V, Nguyen, A, Dhaliwal, N, Hayward, G. Casino goes smoke free: a longitudinal study of secondhand and thirdhand smoke pollution and exposure. (2018) Tob Control in press doi:10.1136/tobaccocontrol-2017-054052

Thank you very much for the suggestion, we have added this paper.

This study covers analytical methods used to detect THS constituents on surfaces: tobacco-specific nitrosamines

Sleiman M, R.L. Maddalena, L.A. Gundel and H. Destaillats. Rapid and sensitive gas chromatography-ion-trap tandem mass spectrometry method for the determination of tobacco-specific N-nitrosamines in secondhand smoke. J. Chromatography A 1216, (2009), 7899-7905.

We have not included this article because it does not include the term "thirdhand smoke", criteria of inclusion of our search. The objective of this paper is the aging of SHS. However, as the reviewer suggested, we have included this article in the Discussion section when we discussed the appropriate methods for THS determination, as follows:

> "However, we find common points for the samples collections in the preparation and the analysis of the THS; being mainly dust samples collected with cotton wipes and

> also, in the method used for the analysis; being chromatography the most used method alone or with mass spectrometry. The results provided by these studies are adequate and it would be necessary to carry out comparative methodological studies to show if different instruments are appropriated for the analysis. In fact, gas-chromatography-ion trap tandem mass spectrometry has been widely used in the analysis of TSNAs in SHS samples (103)."

This study covers analytical methods used to detect THS constituents in aerosols: reactive oxygen species.

-Sleiman M, Destaillats H, Gundel LA. (2013) Solid-phase supported profluorescent nitroxide probe for the determination of aerosol-borne reactive oxygen species. Talanta, 2013, 116, 1033-1039

This article objective is also the aging of SHS but does not meet the search criteria of the systematic review by not including the term "thirdhand smoke". As the reviewer suggested, we have included it in the introduction when we referred to ETS or aging SHS, as follows:

> "The term Environmental tobacco smoke encompasses second hand smoke (SHS) and third hand smoke (THS). Before the introduction and extension the term THS in the scientific literature, there are other therms introducing this topic on aging SHS or ETS, being in the majority difficult the differentiation between SHS and THS (102–106).

This study covers the indoor chemistry of THS. In particular, the reaction of nicotine and the THS mixture with ozone, a common atmospheric pollutant often found indoors and sometimes released to remove tobacco odors. This study precedes the Petrick study from 2011 by the same group, which is cited in the review:

-Sleiman M, H. Destaillats, J.D. Smith, C.-L. Liu, M. Ahmed, K.R. Wilson and L.A. Gundel. Secondary organic aerosol formation from ozone-initiated reactions with nicotine and secondhand tobacco smoke. Atmos. Environ. 44, (2010), 4191-4198.

Thank you very much for the reference. This article did not appear in our search because this article does not cite the term "thirhand smoke" in the abstract or in the title (the term is only mentioned in the introduction). For this reason, we had previously excluded it. We have read it and we have decided to exclude it because it is a study of SHS and its interaction with ozone.

2) IMPACT OF THS ON HEALTH

This is an area of high productivity and very recent activity. The authors may have missed the following papers because they have all been released in the past few months:

BIOMARKERS

Schick SF, Blount BC, Jacob P III, Saliba NA, Bernert JT, El Hellani A, Jatlow P, Pappas RS, Wang L, Foulds J, Ghosh A, Hecht SS, Gomez JC, Martin JR, Mesaros C, Srivastava S, St Helen G, Tarran R, Lorkiewicz PK, Blair IA, Kimmel HL, Doerschuk CM, Benowitz NL, Bhatnagar A. (2017) Biomarkers of exposure to new and emerging tobacco delivery products. Am J Physiol Lung Cell Mol Physiol. 2017 Sep 1;313(3):L425-L452. doi: 10.1152/ajplung.00343.2016.

Thank you for the suggestion; this article is an important review of biomarkers in tobacco delivery products. Despite being from 2017, it does not analyse biomarkers on surfaces in any case. Due to the relevance of the article, we have quoted it, as the reviewer suggested, in the Introduction and Discussion section, as follows:

Introduction:

> "However, despite the research carried out in recent years, there is no established marker for THS in the literature (158), although the surface wipe sampling for nicotine has been proposed as a technique for THS collection (108)."

Discussion:

> "The nicotine on surfaces could be a useful tool for determining THS, there is a study that defends the surface wipe sampling for nicotine is a reliable, valid, and relatively simple method to quantify THS (108). In addition, there are methods to determine biomarkers of exposure to tobacco delivery products in urine or air (158)."

DERMAL UPTAKE

Mahabee-Gittens EM, Merianos AL, Matt GE (2017). Preliminary evidence that high levels of nicotine on children's hands may contribute to overall tobacco smoke exposure. Tob Control. Epub 2017/04/01. doi: 10.1136/tobaccocontrol-2016-053602. PubMed PMID: 28360145.

Thank you very much for the suggestion. This article was previously included in the systematic review (please see Table 2).

Bekö B, G. Morrison, C. Weschler, H. Koch, C. Palmke, T. Salthammer, T. Schripp, A. Eftekhari, J. Toftum and G. Clausen. Dermal uptake of nicotine from air and clothing: experimental verification. Indoor Air in press. doi: 10.1111/ina.12437, (2018),

Thank you very much for the suggestion. As this article doesn´t mention the term "thirdhand smoke" nor in the title nor in the abstract, it did not appear in our search). However, although the article cites the term "thirdhand smoke" in the introduction, we have decided to exclude it because the exposure studied in this article is to a nicotine preparation, without being able to consider it as "thirdhand smoke".

ANIMAL STUDIES

Adhami N, Y. Chen and M. Martins-Green (2017). Biomarkers of disease can be detected in mice as early as 4 weeks after initiation of exposure to third-hand smoke levels equivalent to those found in homes of smokers. Clinical Sciences 131:2409-2426. DOI: 10.1042/CS20171053.

Thank you very much for the suggestion. This article was previously included in the systematic review (please see Table 3).

Hang B, A. M. Snijders, Huang Y, Schick SF, Wang P, Xia Y, Havel C, Jacob III P, Benowitz N, H. Destaillats H, Gundel LA, Mao J-H. Early exposure to thirdhand cigarette smoke affects body mass and the development of immunity in mice. Scientific Reports, 7, article number: 41915 (2017), DOI: 10.1038/srep41915, PMID: 28001376.

Thank you very much for the suggestion. This article was previously included in the systematic review (please see Table 3).

Hang B, Pin Wang, Yue Zhao, Altaf Sarker, Ahmed Chenna, Yankai Xia, Antoine M. Snijders, and Jian-Hua Mao. Adverse Health Effects of Thirdhand Smoke: From Cell to Animal Models, Int. J. Mol. Sci. 2017, 18(5), 932; doi:10.3390/ijms18050932.

Thank you very much for the suggestion. We had previously excluded this article for being an author review**.** However, we have quoted this article, as the reviewer suggested, in the Introduction section, when we refer to author's reviews.

Hang B, Y. Wang, Y. Huang, P. Wang, S.A Langley, L. Bi, A.H Sarker, S.F Schick, C. Havel, P. Jacob III, N. Benowitz, H. Destaillats, X. Tang, Y. Xia, L.A Gundel, J.-H. Mao and A.M Snijders, Short-term early exposure to thirdhand cigarette smoke increases lung cancer incidence in mice, Clinical Science (Lond), 2018, Feb 12.

Thank you very much for the suggestion. As the reviewer suggested, we have added it.

BELIEFS AND BEHAVIOURS ABOUT THS

I suggest to expand the title to include in this category also POLICIES (which include not only regulation but also self-imposed practices such as those described on this recent paper for hotel room management:

Zakarian J, P.E.J Quintana, Carl H. Winton, Georg E. Matt, Hotel smoking policies and their implementation: a survey of California hotel managers, Tobacco Induced Diseases (2017) 15:40 (9pp). DOI 10.1186/s12971-017-0147-6.

Thank you very much for the suggestion and comment. As the reviewer suggested, we have expanded the title of the category and added this article.

Reviewer #2:

This manuscript attempts to review the literature on thirdhand smoke. The authors have done a careful and well documented job performing a literature review. However, the manuscript needs to be revised before it is acceptable.

Thank you very much for the kind comment to our work.

Major concerns:

1. Descriptions of studies should include important technical details, in the text as well as the tables. For example, line 50 p12 "In addition, Hang analysed THS in short- and long-term cells showing structural changes in DNA (Hang et al.,2013)." It is important to note the type of cells in the text (human), the type of exposure (dilutions of THS extract) and in the table give the actual cell line and the genotoxicity assay. Likewise when describing the matrix, in the table, details are needed. For example, details about whether the dust was collected per a known surface area with HVs3 or 4 vacuum or not is needed, as a. these give different particle sizes from vacuum bag and b. allow toxic components to be expressed as loading as well as concentration.

Thank you very much for the comment. As the reviewer suggested, we have added details about the cell type and the exposure type in the "Impact of Health" (please see the Result section of the manuscript). In addition, we have added the cell lines, type of exposure, genotoxicity assay and matrix details in the table, when the data was available (please see new Table 3).

2. Careful descriptions and referencing is needed, where the citations match the statement. e.g., line 35, p5," There are two recently published author reviews (Quintana et al., 2013; Jacob et al.,2017) showing the chemical changes, the concentrations of different components of THS, and the effects of THS on cells and animals." This is incorrect, as the Quintana paper merely reviews a technique for determining surface levels of nicotine.

Thank you very much for the comment. As the reviewer suggested, we have reviewed and corrected it, as follows:

> "Recently an author's review was published (Jacob et al., 2017) showing the chemical changes, and the concentrations of the different components of THS. Together with this, another author's review (120) show the effects of THS in cells and animals. However, despite the research carried out in recent years, there is no established marker for THS in the literature (158), although the surface wipe sampling for nicotine has been proposed as a technique for collection THS, the surface wipe sampling for nicotine (108)."

3. The English is very poor - it seems as though many errors (incorrect capitalizations in the middle of sentences, words like mices, etc., could have been caught by Microsoft Word grammar and spell check .The authors are encouraged to use these or similar tools.

We have carefully revised the English of the manuscript with a native English speaker.

4. The discussion could be shortened, as could the tables.

In order to short the Result and Discussion section we have added a summary table (please see response to comment #2 of the third reviewer). As the reviewer suggested, we have shortened the discussion.

5. If the paper is revised, a new search is needed, as papers are coming out fairly often in this new field.

As the reviewer suggested, we have updated the search including 68 articles in the systematic review.

Reviewer #3:

Reviewer's general comments and recommendations:

1) The article is worth publishing with revisions.

Thank you very much for the kind comment to our work.

2) From the perspective of a researcher in environmental and health science, rather than an expert in information science, the Results section is too terse and difficult to absorb because the statistics outweigh the content. Reading the Results section is similar to scanning a Table of Contents: topics are listed without findings.

a) This reviewer suggests incorporating the numeric distribution of the 63 papers into the four tables, and/ or adding a one page summary table with the "big picture" main findings for each category. Preparing such a table would entice readers to dig into the current four information-rich tables. This organization would also shorten the length of the Results section.

Thank you very much for the suggestion. As the reviewer suggested, we have added a new Table summarizing each category of all the included articles, the main characteristics, and the main results of each category (please see Table 1). Thanks to this, as the reviewer mentioned, we have shortened some paragraphs of the results section to avoid duplicity of the data (please see new Result section).

b) Another approach to making the article more useful and easier to absorb is to merge the Results and Discussion sections. This would enable incorporating the statistics with the main findings on each topic. Merging would also shorten the paper and decrease what appears to be redundancy. The present structure does not successfully link the number of papers with the significance of the findings.

Thank you very much for the comment. We agree with the reviewer comment that merging the Result and Discussion sections would shorten the manuscript. However, we believe that it is easier to understand the content of the manuscript by providing Result and Discussion sections separately. However, if the editor considers more appropriate to merge those sections, we do not have any inconvenience in doing so.

3) Content lacks sufficient mention of the work published in the first decade of the century before the terms thirdhand smoke and THS were used as search terms.

Thank you very much for the comment. We have added it in the introduction, as follows:

> "Before the introduction and extension in the scientific literature of the term THS, there are important articles on aging SHS or ETS, introducing the topic, being in the majority difficult the differentiation (102–106)"

Moreover, as the first reviewer suggested (see response to first reviewer), we have added the following new articles:

Schick, S. F. and Glantz, S. (2007) 'Concentrations of the carcinogen 4-(methylnitrosamino)-1-(3-pyridyl)-1- butanone in sidestream cigarette smoke increase after release into indoor air: Results from unpublished tobacco industry research', *Cancer Epidemiology Biomarkers and Prevention*, 16(8), pp. 1547–1553. doi: 10.1158/1055-9965.EPI-07-0210.

Sleiman, M., Destaillats, H. and Gundel, L. A. (2013) 'Solid-phase supported profluorescent nitroxide probe for the determination of aerosol-borne reactive oxygen species', *Talanta*. Elsevier, 116, pp. 1033–1039. doi: 10.1016/j.talanta.2013.08.024.

Sleiman, M., Maddalena, R. L., Gundel, L. A. and Destaillats, H. (2009) 'Rapid and sensitive gas chromatography-ion-trap tandem mass spectrometry method for the determination of tobacco-specific N-nitrosamines in secondhand smoke', *Journal of Chromatography A*, 1216(45), pp. 7899–7905. doi: 10.1016/j.chroma.2009.09.020.

a) The authors should not call the Quintana 2013 article a review (p 5, line 32). However, that article does have a well-written summary of the knowledge base on which that group based their seminal research on THS. This reviewer suggests mentioning that section of Quintana 2013 as a source for earlier work that explains the persistence of nicotine on many types of surfaces of all kinds, including skin.

Thank you very much for the comment. We have modified it (please see response to the comment # 2 from reviewer # 2).

b) The seminal article by Schick and Glantz (2007) should definitely be included because it motivated research that demonstrated formation of carcinogens TSNAs as SHS aged and thus spurred investigation of the health effects of THS.

Thank you very much for the comment. As the reviewer suggested, we have added it in the Introduction section when we detailed ETS. However, we have excluded it from our systematic review because it does not include the term “thirdhand smoke”.

4) Substantial attention must be paid to improving English grammar, word usage and sentence structure throughout the manuscript. There are dozens of sentences that are unclear and confusing because of insufficient editing. This reviewer recommends that the authors engage an expert to improve the usage of English. This will certainly strengthen the usefulness of the article to a broad range of readers, regardless of their native languages.

We have carefully revised the English grammar of the manuscript and improve the English with the help of a native English speaker.

Reviewer #4:

This is a valuable manuscript providing a systematic review of recently published scientific literature on thirdhand smoke. The review covers various aspects of THS: from Components and concentrations of THS, to Impact of THS in health, and Beliefs and behaviours of THS. Despite the intention and efforts to perform a meta-analysis of the published studies, the manuscript fails to provide a comprehensive overview and clear discussion and conclusions. This was due mainly to the heterogeneity of the original studies included and the difficulty to synthesize their results. I recommend publication of the manuscript although I'm not sure what would be the value of the review and how it can help construct an opinion about the research field and the science behind it. It's maybe early to provide such review given the lack of consistency and heterogeneity of the data published. But I think the review can help by identifying the issues behind such heterogeneity and what is yet need to be done to have a better understanding of THS composition, health impacts and behaviors.

Thank you very much for the kind comments to our work. As the reviewer suggested and following the recommendation of the other three reviewers, we have tried to make the revision more clear. Moreover, we have added a new summary table of the reviewed papers in order to help to clarify concepts. However, although our initial objective was to perform a meta-analysis, we were unable to do it, due to the heterogeneity of the articles about this topic. Even so, we think that our systematic review may be useful to focus future research on THS.

ANEXO 3.4. Respuesta del Editor y segundos comentarios de los revisores de *Environmental Research*

De: "ER (ELS)" <eesserver@eesmail.elsevier.com>

Fecha: 8 de junio de 2018, 12:47:00 CEST

Para: jmmartinez@uic.es

Cc: joseluis.domingo@urv.cat

Asunto: ER-18-183R1: Interim Decision

Responder a: "ER (ELS)" <er@elsevier.com>

Ms. No.: ER-18-183R1

Title: Update on Thirdhand Smoke: a Comprehensive Systematic Review

Corresponding Author: Dr. Jose M Martínez-Sánchez

Authors: Ana Díez-Izquierdo, MD; Pia Cassanello-Peñarroya, MD; Cristina Lidón-Moyano, PhD; Nuria Matilla-Santander, MPH; Albert Balaguer, MD,PhD;

Dear Dr. Martínez-Sánchez,

Thank you for submitting your revised R1-manuscript to Environmental Research. The reviewers have still made suggestions which the Editor feels would improve your manuscript. The Editor encourages you to consider these comments and make an appropriate revision of your manuscript. The reviewers' comments are below.

Please submit your revision online within 45 days by logging onto the Elsevier Editorial System for Environmental Research:

1. Go to this URL: https://ees.elsevier.com/er/

2. Log in %BLINDED USERNAME%

If you need to retrieve password details, please go to http://ees.elsevier.com/ER/automail_query.asp.

NOTE: Upon submitting your revised manuscript, please upload the source files for your article. For additional details regarding acceptable file formats, please refer to the Guide for Authors at: http://www.elsevier.com/journals/environmental-research/0013-9351/guide-for-authors

When submitting your revised paper, we ask that you include the following items:

Manuscript and Figure Source Files (mandatory)

REVISED Manuscript (Marked-up with changes)

REVISED Manuscript (Clean version)

We cannot accommodate PDF manuscript files for production purposes. We also ask that when submitting your revision you follow the journal formatting guidelines. Figures and tables may be embedded within the source file for the submission as long as they are of sufficient resolution for Production. For any figure that cannot be embedded within the source file (such as *.PSD Photoshop files), the original figure needs to be uploaded separately. Refer to the Guide for Authors for additional information.

http://www.elsevier.com/journals/environmental-research/0013-9351/guide-for-authors

Highlights (mandatory)

Highlights consist of a short collection of bullet points that convey the core findings of the article and should be submitted in a separate file in the online submission system. Please use 'Highlights' in the file name and include 3 to 5 bullet points (maximum 85 characters, including spaces, per bullet point). See the following website for more information http://www.elsevier.com/highlights

3. Click (Author Log-in)

This takes you to the Author main menu.

You can find the manuscript record listed under "Submissions Needing Revisions." Click "Revise" when you are ready to submit your revision. (If you have forgotten your password, please click the "Forget your password" link located on the log-in screen.) For guidelines on how to submit your revised manuscript please go the following address: http://help.elsevier.com/app/answers/detail/p/7923/a_id/91

When submitting your revised paper, please include a separate document uploaded as "Response to Reviews" that carefully addresses the issues raised in the below comments, point by point. You should also include a suitable rebuttal to any specific request for change that has not been made.

To facilitate the electronic publication of your manuscript (should it be accepted), we request that your manuscript text, tables and figure legend be submitted in an editable format (Word, WordPerfect, or LaTex only), and all figures uploaded individually as TIF or EPS files.

Environmental Research features the Interactive Plot Viewer, see: http://www.elsevier.com/interactiveplots. Interactive Plots provide easy access to the data behind plots. To include one with your article, please prepare a .csv file with your plot data and test it online at http://authortools.elsevier.com/interactiveplots/verification before submission as supplementary material.

Include interactive data visualizations in your publication and let your readers interact and engage more closely with your research. Follow the instructions here: https://www.elsevier.com/authors/author-services/data-visualization to find out about available data visualization options and how to include them with your article.

Thank you, and we look forward to receiving your revised manuscript.

With kind regards,

Jose L. Domingo, PhD

Editor-in-Chief

Environmental Research, Editorial Office

Elsevier

E-mail: er@elsevier.com

Reviewers' comments:

Reviewer #2: This paper is much better but still needs revisions. It is an important paper that should be published.

1. Table 3 -a. This table is titled Impact of THS on health, but contains studies of exposure (e.g. Mahabee-Gittens (2018) . Either remove exposure only articles or re-title Table. On a related note the abstract says 5 health studies in children - these are not all health studies

b. The Table 3 should be organized by a. in vitro studies, then b. in vivo studies in rodents, then c. human studies, instead of all mixed together.

c. Adhami 2017 in Table 3 says 'In vitro exposure' but this is in vivo exposure, please fix this.Table 1 and others Study descriptions could be significantly shortened. Also the format should be the same. Some of the study descriptions start " This study deals with the effect of aging on THS components and evaluates possible exposure levels and remediation measures."some start " Support the hypothesis of a resuspension from the cigarette particles to indoor air in a closed room" and most start with "to"To detect THS in a real environment, choosing a marker for sampling is needed. Such marker should ideally be specific to tobacco smoke, stable and easily obtainable. "

2. When reviewers suggested including articles, one response of the authors was that they did not include this paper because the paper did not mention thirdhand smoke. This seems like a circular argument - if an important paper would be mentioned by researchers in THS, it should be cited in the review article. Searching on the term 'thirdhand smoke' is not adequate to find the literature on this topic. At the very least the authors should include ALL the papers suggested by the reviewers, even if they have a paragraph saying that the following articles are seminal articles in the field of THS but do not contain the words thirdhand smoke (e.g. Sleiman M, H. Destaillats, J.D. Smith, C.-L. Liu, M. Ahmed, K.R. Wilson and L.A. Gundel. Secondary organic aerosol formation from ozone-initiated reactions with nicotine and secondhand tobacco smoke. Atmos. Environ. 44, (2010), 4191-4198.)

Highlights need revision.

Highlights read currently"

-THS consists of pollutants that remain on surfaces and dust after tobacco has been smoked. (SUGGEST SPELL OUT THS - THIRDHAND SMOKE CONSISTS OF TOBACCO POLLUTANTS THAT REMAIN IN DUST, IN AIR AND ON SURFACES -THS gained importance due to a growing body of evidence of the health implications. SUGGEST THIRDHAND SMOKE EXPOSURE RESULTS IN TOXICITY

- Systematic review of all the literature about THS was done. THIS SHOULD GO AS SECOND BULLET POINT - A SYSTEMATIC LITERATURE REVIEW WAS DONE FOR THIRDHAND SMOKE AS A TERM

-Long-term effects of THS exposure remain unknown and more research is needed.

ANEXO 3.5. Respuesta al Editor y a los segundos comentarios de los revisores de *Environmental Research*

7 July, 2018

Sant Cugat del Vallès, Spain

Jose L Domingo, PhD

Editor-in-Chief, Environmental Research

Dear Prof. Domingo,

We greatly appreciate the useful comments and suggestions of the Reviewer and we enclose a point-by-point response. The modifications in the text of the manuscript have been highlighted.

Thank you very much for your kind attention.

Sincerely yours,

Jose M Martínez-Sánchez, PhD, MPH, BSc

ER-18-183R1

Title: Update on thirdhand smoke: A comprehensive systematic review

We would like to thank to the Editor and the reviewer for the useful comments

Reviewer #2: This paper is much better but still needs revisions. It is an important paper that should be published.

Thank you very much for the kind comment to our work.

1. Table 3 –
a. This table is titled Impact of THS on health, but contains studies of exposure (e.g. Mahabee-Gittens (2018) . Either remove exposure only articles or re-title Table. On a related note the abstract says 5 health studies in children - these are not all health studies.

Thank you very much for the comment. We agree with the reviewer about the article by Mahabee-Gittens et al., 2018 evaluates the exposure in children and not specifically the impact on health. As recommended the reviewer, we have re-titled the table. Moreover, we have also modified the abstract as recommended.

b. The Table 3 should be organized by a. in vitro studies, then b. in vivo studies in rodents, then c. human studies, instead of all mixed together.

Thank you very much for the comment. We have reorganized the table following the suggestion of the reviewer and also try to order alphabetically (when it is possible).

c. Adhami 2017 in Table 3 says 'In vitro exposure' but this is in vivo exposure, please fix this.

Thank you very much for noticing, we have modified it.

Table 1 and others
Study descriptions could be significantly shortened. Also the format should be the same. Some of the study descriptions start: " This study deals with the effect of aging on THS components and evaluates possible exposure levels and remediation measures." some start: " Support the hypothesis of a resuspension from the cigarette particles to indoor air in a closed room" and most start with "to”"To detect THS in a real environment, choosing a marker for sampling is needed. Such marker should ideally be specific to tobacco smoke, stable and easily obtainable. "

Thank you very much for the comment, we have carefully reviewed all tables and tried to shorten them according to the recommendation of the reviewer.

2. When reviewers suggested including articles, one response of the authors was that they did not include this paper because the paper did not mention thirdhand smoke. This seems like a circular argument - if an important paper would be mentioned by researchers in THS, it should be cited in the review article. Searching on the term 'thirdhand smoke' is not adequate to find the literature on this topic. At the very least the authors should include ALL the papers suggested by the reviewers, even if they have a paragraph saying that the following articles are seminal articles in the field of THS but do not contain the words thirdhand smoke (e.g. Sleiman M, H. Destaillats, J.D. Smith, C.-L. Liu, M. Ahmed, K.R. Wilson

and L.A. Gundel. Secondary organic aerosol formation from ozone-initiated reactions with nicotine and secondhand tobacco smoke. Atmos. Environ. 44, (2010), 4191-4198.)

Thank you very much for the comment. As the reviewer suggested, we have included all articles recommend by the reviewers in our manuscript.

Highlights need revision.
Highlights read currently"
-THS consists of pollutants that remain on surfaces and dust after tobacco has been smoked. (SUGGEST SPELL OUT THS - THIRDHAND SMOKE CONSISTS OF TOBACCO POLLUTANTS THAT REMAIN IN DUST, IN AIR AND ON SURFACES

-THS gained importance due to a growing body of evidence of the health implications. SUGGEST THIRDHAND SMOKE EXPOSURE RESULTS IN TOXICITY .

- Systematic review of all the literature about THS was done. THIS SHOULD GO AS SECOND BULLET POINT A SYSTEMATIC LITERATURE REVIEW WAS DONE FOR THIRDHAND SMOKE AS A TERM
-Long-term effects of THS exposure remain unknown and more research is needed.

Thank you very much for the suggestion. We have not spelled out thirdhand smoke because the rules of the highlights of the Environmental Research not allow more than 85 characters with spaces. We have tried to change the highlights according to all recommendations of the reviewer and following the rule of the Journal. The new highlights are:

- THS consists of tobacco pollutants that remain in dust, air and on surfaces.

- A systematic literature review was done for thirdhand smoke as a term.

- Thirdhand smoke exposure results in toxicity.

-Long-term effects of THS exposure remain unknown and more research is needed.

ANEXO 3.6. Carta de aceptación de *Environmental Research*

De: "ER (ELS)" <eesserver@eesmail.elsevier.com>

Asunto: ER-18-183R2: Final Decision

Fecha: 9 de julio de 2018, 16:48:07 CEST

Para: jmmartinez@uic.es

Cc: joseluis.domingo@urv.cat

Responder a: "ER (ELS)" <er@elsevier.com>

Ms. No.: ER-18-183R2

Title: Update on Thirdhand Smoke: A Comprehensive Systematic Review

Corresponding Author: Dr. Jose M Martínez-Sánchez

Authors: Ana Díez-Izquierdo, MD; Pia Cassanello-Peñarroya, MD; Cristina Lidón-Moyano, PhD; Nuria Matilla-Santander, MPH; Albert Balaguer, MD,PhD;

Dear Dr. Martínez-Sánchez,

We are pleased to inform you that your manuscript referenced above has been accepted for publication in Environmental Research.

Your accepted manuscript will now be transferred to our production department and work will begin on creation of the proof. If we need any additional information to create the proof, we will let you know. If not, you will be contacted again in the next few days with a request to approve the proof and to complete a number of online forms that are required for publication.

Your article will appear on Elsevier's online journal database ScienceDirect as an "Article in Press" within approximately 4-6 weeks of acceptance. Articles in Press for Environmental Research can be viewed at http://www.sciencedirect.com/science/journal/00139351.

An Article in Press may be cited prior to its publication by means of its unique digital object identifier (DOI) number, which does not change throughout the publication process. At the same time, Medline/PubMed will list the article in its database, linking to the full text of the paper in ScienceDirect. Medline/PubMed is freely accessible to researchers across the world.

You can track the status of your article via the Author Gateway at http://www.elsevier.com/trackarticle. Once you have registered as a user, you will receive e-mail alerts when the publication status of your paper changes, including when the paper is published.

Many thanks for submitting your fine paper to Environmental Research. We look forward to receiving additional papers from you in the future.

With kind regards,

Jose L. Domingo, PhD

Editor-in-Chief

Environmental Research

Elsevier

E-mail: er@elsevier.com

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ANEXO 4: Correspondencia del artículo de la tesis: “*Knowledge and attitudes toward thirdhand smoke among parents with children under 3 years in Spain*”

<u>ANEXO 4.1</u>. Carta de presentación al Editor de *Pediatric Research*

Sant Cugat del Vallès (Spain), February 12th, 2018.

Prof. **Cynthia Bearer**

Editor

Pediatric Research

Dear Prof.Bearer,

Please find enclosed our manuscript "Knowledge and attitudes towards Thirdhand smoke among parents with children under 3 years in Spain" for your consideration in Pediatric Research as a ***regular article.***

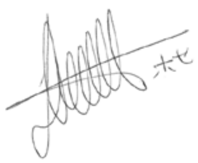
In the last few years, the knowledge about thirdhand smoke (THS) has increased and there is some evidence about adverse health effects, with the pediatric population being most vulnerable to exposure to THS. This is the first study in Europe,that we know of, that assesses the knowledge and belief of THS among parents of children under 3 years of age. What's more, our data show that the majority of parents who receive information about the existence of THS, understand that exposure to THS could be harmful for their children

All the authors carefully read the manuscript and fully approve of it. In their name I also declare that the manuscript is original and it is not submitted anywhere other than your journal. The authors declare there are no conflicts of interest and the manuscript is not previously published.

We would of course be ready to provide further information about our data and methods you desire. Correspondence about the manuscript should be addressed to me as indicated in the first page of the manuscript.

Thank you very much for your kind attention.

Yours sincerely,



Jose M Martínez-Sánchez, PhD, MPH, BSc

E-mail: jmmartinez@uic.es

ANEXO 4.2. Respuesta del Editor y comentarios de los revisores de *Pediatric Research*

From: **Pediatric Research** onbehalfof@manuscriptcentral.com

Date: jue., 5 abr. 2018 a las 14:34

Subject: Pediatric Research - Decision on Manuscript ID PR-2018-0088

To: jmmartinez@uic.es

Cc: <anadiezizquierdo@gmail.com>, <mariapiacassanello@gmail.com>, <acartanya@uic.es>, <nmatilla@uic.es>, <abalaguer@uic.es>, <jmmartinez@uic.es>

05-Apr-2018

Dear Dr. Martínez-Sánchez:

Manuscript ID PR-2018-0088 entitled "Knowledge and attitudes towards Thirdhand smoke among parents with children under 3 years in Spain" that you submitted to the Pediatric Research, has been peer reviewed. The comments from reviewers are included at the bottom of this letter.

The reviewers have requested extensive and critical revisions to your submitted manuscript. In its current form, the paper is deemed “Rejected” for possible publication in Pediatric Research.

However, it has been determined that the technical contents of your manuscript may be suitable with additional work in accordance with the peer reviewers comments. We do encourage you to return the paper as a resubmission and it will be reconsidered for possible publication when it has been improved according to the peer reviewers comments.

Your resubmitted manuscript will then be considered like a “new submission” and will be sent for peer-review once again but not necessarily to the same peer reviewers. If you choose to resubmit, your manuscript would be due in 6 months, 05-Oct-2018. This will provide you the additional time necessary to improve the paper without the pressure of a rapid and more pressing turnaround. We welcome you to consider this available option.

Therefore, you are invited to respond to the reviewers' comments and resubmit your manuscript. Please note that resubmitting your manuscript does not guarantee eventual acceptance for publication.

Once you have thoroughly revised your manuscript, please log into https://mc04.manuscriptcentral.com/prjournal and enter your Author Center, where you will find your manuscript title listed under "Manuscripts with Decisions." Under "Actions," click on "Create a Revision." Your manuscript number has been appended to denote a revision and the Editorial Office will note that your manuscript is a resubmission to the editors.

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You will be unable to make your revisions on the originally submitted version of the manuscript. Instead, revise your manuscript using a word processing program and save it on your computer.

Prior to uploading your manuscript files, you will need to save two versions of the manuscript text: (1) the tracked changes version showing your edits (termed 'Main Document, tracked-changes version' in the file-type menu), as well as (2) a "clean" version of the revised manuscript that does not show the tracked changes ('Main Document, clean version' in the menu). Both files should then be uploaded to the submission system.

Once your revised manuscript files are prepared, you can upload them and submit through your Author Center.

When submitting your revised manuscript, you will be able to respond to the comments made by the reviewer(s) in the space provided. You can use this space to document any changes you make to the original manuscript. In order to expedite the processing of the revised manuscript, please be as specific as possible in your response to the reviewer(s).

IMPORTANT: Your original files are available to you when you upload your revised manuscript. Please delete any redundant files before completing the submission.

Once again, thank you for submitting your manuscript to Pediatric Research. We look forward to receiving your resubmission.

Sincerely,

Cynthia Bearer, MD, PhD

Editor-in-Chief, Pediatric Research

Eleanor Molloy, MB, PhD

Associate-Editor-in-Chief, Pediatric Research

Editorial Office email: info@pedres.org

Section Editor

Comments to the Author:is an interesting paper but requires significant revision according to the reviewers comments.

Editor Comments to the Author:

The reviewers have raised significant issues with the manuscript. While interesting, I believe that to address the reviewers' comments, the authors wil require more time than a revision.

Reviewer(s)' Comments to Author:

Reviewer: 1

Comments to the Author

The authors do provide novel data on knowledge about thirdhand smoke in Spain. They are correct in stating that this is novel information.

General comments.More needs to be done describing the population from which this survey was drawn. The authors state that was from another study. The authors should describe more about the other study, including, was this part of the overall study or a recontact? How many times were subjects contacted? They should also describe the characteristics of the respondents. How do these compare to demographics of the region? The authors should better describe the question used to ascertain smoking status under Methods: variables (Page 4 line 42). How was smoking status ascertained? What if the father smoked but the mother responded to the questionnaire? Was smoking ban status in the homes asked as a question? Details are needed about how smoking status was defined and recorded. The authors should also pay close attention to significant figures in the results. Are two decimal points justified? On Table two, is there a line missing for data corresponding to 'never smokers? Page 13 line 19 OR and 95% CI The English grammar is poor and needs assistance on writing correctly. Also, the survey questions should be stated as originally given (I assume in Spanish and Catalan?) and then translated in methods (or provided as supplemental material online) in case translations are subject to different interpretations.

Reviewer: 2

Comments to the Author

Thank you for this paper that describes parents' beliefs about thirdhand smoke in Spain. This is the first assessment of thirdhand smoke beliefs in Europe according to the authors. While this is a worthwhile effort to describe the thirdhand smoke beliefs of parents in Spain, this paper would benefit from providing more details about the methodology used to select this sample and a more complete description of the study's limitations.

Major issues:

Major issue #1:

Page 7, Line 54 – The most obvious result of this study is most parents were not familiar with the term "thirdhand smoke". Since the definition of thirdhand smoke was presented to parents immediately before they were asked if they believed thirdhand smoke was harmful, it is not clear how this influenced parents' responses. The authors do acknowledge this as a limitation in the discussion section. The authors assertion that the written information about THS had minimal impact on parents' responses is not strongly supported in the discussion section. The authors write: "However, we believe this is likely to be minimal because the results in the knowledge of THS is also low in other studies carried out in different continents (13,14)." Both of the studies cited were conducted among low-income populations, so they may not be generalizable. It is also not clear why studies that have established low knowledge about THS would support the notion that the written THS description would have minimal impact on parents. In fact, the results of this study could be interpreted that the definition of THS may have had a large impact since knowledge about the term "thirdhand smoke" was low prior to the definition of THS being given to parents. Unfortunately, this study is not able to determine if the delivery of brief educational messages about thirdhand smoke are beneficial because the harm belief was not assessed prior to giving the definition to parents so there is no way to compare a change in harm beliefs before and after the delivery of the written description. I would advise the authors to provide more detail in describing these limitations of this study.

Major issue #2:

A major limitation of this paper is that it lacks an adequate description of the sampling strategy used to obtain the respondents for the survey. As the paper is currently written it is difficult for a reader to make a judgement about what population this paper's results should apply to. I recommend clearly outlining the steps taken to obtain the sample and describing in the discussion section to what degree the results can be applied to the larger population.

In online surveys, the sampling methods can make a large difference in the results obtained. The authors present a list of methods that were used to recruit respondents but it would be useful to know additional details about the methods used and the proportion of respondents that were recruited using each method. Please specify the inclusion and exclusion criteria used to determine the sample and the methods by which those criteria were applied. The paper mentions that the data was collected from parents. How was it determined if the respondents were parents? How are the authors certain all the respondents to the survey were from Spain if the survey was conducted online? Was an incentive given to people who completed the survey? These types of details would greatly improve the paper so that the reader understands the strengths and limitations of the methods used to select this sample.

Minor issues:

Abstract:

It is important to state in the abstract that a definition of THS was provided to parents after asking them if they had heard of THS. This piece of information would clarify how it was possible that 26.96% of respondents had heard about THS and 85.99% of respondents believed that THS is harmful to their children.

The final sentence of the conclusions section of the abstract should be strengthened. This study does not help establish the conclusion that the pediatric population is the most vulnerable to THS exposure. For that reason, I would recommend instead focusing the conclusion sentence in the abstract on the results of the present paper by perhaps pointing out that the majority of parents were not aware of THS but after being provided brief information about THS most parents agreed that exposure was harmful to children.

Introduction:

Page 3, Line 21 - The number of studies on the health effects of THS is limited when compared to the amount of research conducted on SHS, but I would not go as far as to say that the data on THS is scarce anymore. There are a number of high quality studies that have been recently conducted that demonstrate health risks from THS.

Two recent review articles on THS research outline many of the most recent studies on health risks posed by THS. The authors might find these reviews helpful to strengthen their introduction section with a brief description of what is currently known about the health risks posed to children from THS exposure to strengthen the rationale of why it is important to study parent's beliefs about THS.

Comprehensive review article on THS science:

Jacob P, Benowitz NL, Destaillats H, et al. Thirdhand smoke: new evidence, challenges, and future directions. Chem Res Toxicol. 2017;30:270–94.

Review article that outlines THS risk studies specific to children:

Drehmer JE, Hipple Walters B, Nabi-Burza E, Winickoff JP. (2017) Guidance for the Clinical Management of Thirdhand Smoke Exposure in the Child Healthcare Setting. Journal of Clinical Outcomes Management, 24(12):551-559.

On Page 3, Line 50 the authors wrote:

"To the best of our knowledge, there are few descriptive studies describing the knowledge and beliefs of THS in adults related to the pediatric population…" It would be helpful for the readers to cite the "few descriptive studies" here. It would also be helpful to describe how the current study is both similar and different to the few descriptive studies that have been done so far on the topic of THS beliefs of parents. Please state what unique contribution this paper makes to advance the science on thirdhand smoke beliefs.

Below are some initial studies have been done on the topic of thirdhand smoke beliefs of parents that the authors could consider citing as initial work done on this topic.

Drehmer JE, Ossip DJ, Rigotti NA, et al. Pediatrician interventions and thirdhand smoke beliefs of parents. Am J Prev Med. 2012;43:533–6.

Roberts, Christopher et al. Environmental Tobacco Smoke: Public Perception of Risks of Exposing Children to Second- and Third-Hand Tobacco Smoke. Journal of Pediatric Health Care. Volume 31 , Issue 1 , e7 - e13.

Drehmer JE, Ossip DJ, Nabi-Burza E, et al. Thirdhand smoke beliefs of parents. Pediatrics. 2014;133:e850–6.

It would be helpful to clarify in the introduction section if the authors are aware of any public education campaigns or programs for the healthcare setting within Spain to help parents protect their children from exposure to tobacco smoke. Are there any programs or prevention efforts that were happening in Spain prior to this assessment that could have influenced the results in this paper?

Methods:

It is important for readers to understand what respondents were told about how the personal information they provided on the survey would be used. Even though the authors state that the data was treated as if it was anonymous for this analysis, it is important to understand how respondents may have been influenced by social desirability bias or out of concern for privacy. Please state what personal information respondents were asked to provide and what they were told about how their personal information would be used before they started the online survey.

It is not clear to me why questions about thirdhand smoke were included into a survey about the "quality of the dream"? Please explain more about the topic of this online survey. Additional details about the topic of the larger survey and the ordering of the questions in the larger survey might also be relevant. Could the topic of the larger survey have influenced the responses to the questions about thirdhand smoke?

The journal is published in English but it might be useful to readers to also have the Spanish version of the written THS definition that was given to parents in this study so that it can be shared with Spanish-speaking readers free from translation bias. To replicate the study in a Spanish-speaking country, this would be particularly helpful.

How was the written definition of THS developed? Was this definition created by the researchers or was it taken from some other source? The mention of "food" as a surface in which the THS waste is deposited on is an interesting choice. Was there particular research that informed the decision to include food as one of the surfaces that THS will deposit on? If so, this background information would be helpful to readers and would strengthen the case that the definition used in this study is valid.

Was the website where parents took the survey known to the respondents as being hosted by a trusted source of medical information? Was the website that hosted the survey on a hospital website or was there some indication that the survey was being conducted by a hospital, medical center or a university? The reason this is important is because a definition of THS that comes from a trusted medical source may be interpreted differently than if this definition was provided by to parents by a less trusted source. Was any information presented to parents to reinforce the notion that the source of the definition of THS was from a valid source?

Results:
It is an important finding that smoking status was related to THS harm belief. Did the authors collect any data to explore how the amount of smoking (heavy vs. light) among parents is related to THS harm beliefs? There is some data from a prior US study on parents that suggests heavier smokers were less likely to believe that THS is harmful to children than lighter smokers.

Discussion

Page 7, Line 24 – The author should specify the year and location of the small study they cited that showed no awareness of THS. It appears that this study was done in 2012 in California.

In the "Variables" sub-section of the Methods section the authors state that the knowledge question about THS was asked first and then followed up with the definition of THS. Then a question was asked to assess the beliefs of the effects of THS on children's health. The order of how the questions were asked on the survey as stated in the Methods section appears to contradict what is stated on Page 7, Line 34 in the Discussion section: "The fact that in the survey, written information about THS was given, followed by two questions on THS itself, could have overestimated our data regarding THS knowledge and also promoted answers about the harmful effect of THS." Please clarify the order that the questions and the definition of THS were presented to respondents.

Page 7, Line 28 – The authors wrote, "This is the first study, with a higher sample size, showing a population prevalence of THS knowledge." Please describe further the specific population that this study characterizes here.

Page 7, line 47 – The authors mention that the dissemination was carried out in only one hospital and cite this as a limitation to the study methods, Do the authors mean the dissemination of recruitment materials was done in only one hospital?

Thank you for this paper. This study will be useful to help establish a baseline metric of awareness of thirdhand smoke among parents in Spain. This study suggests awareness of the term is low. Parent education on the topic of thirdhand smoke might increase awareness within Spain.

ANEXO 4.3. Respuesta a los comentarios del Editor y de los revisores de *Pediatric Research*

Sant Cugat del Vallès (Spain), July 30th, 2018.

Prof. **Cynthia Bearer**

Editor-in-Chief, Pediatric Research

Prof. **Eleanor Molloy**,

Associate-Editor-in-Chief, Pediatric Research

Dear Prof.Bearer and Prof. Molloy,

We would like to thank you very much for the opportunity to resubmit our manuscript. We greatly appreciate the useful comments and suggestions of the reviewers and we enclose a point-by-point response. The modifications in the text of the manuscript have been highlighted.

All the authors carefully read the new version of the manuscript and fully approve of it. In their name I also declare that the manuscript is original, and it is not submitted anywhere other than your journal. The authors declare there are no conflicts of interest and the manuscript is not previously published.

We would of course be ready to provide further information about our data and methods you desire. Correspondence about the manuscript should be addressed to me as indicated in the first page of the manuscript.

Thank you very much for your kind attention.

Sincerely yours,

Jose M Martínez-Sánchez, PhD, MPH, BSc

E-mail: jmmartinez@uic.es

Reference: ID PR-2018-0088

Title: "Knowledge and attitudes towards Thirdhand smoke among parents with children under 3 years in Spain"

Section Editor

Comments to the Author: is an interesting paper but requires significant revision according to the reviewers comments.

Editor

Comments to the Author:

The reviewers have raised significant issues with the manuscript. While interesting, I believe that to address the reviewers' comments, the authors wil require more time than a revision.

We would like to thank the Editor for the kind comment to our work. We greatly appreciate the useful comments and suggestions of the Reviewers. We have carefully reviewed the manuscript following the recommendations of the reviewers and we enclose a point-by-point response.

Reviewer: 1

Comments to the Author

The authors do provide novel data on knowledge about thirdhand smoke in Spain. They are correct in stating that this is novel information.

Thank you very much for the kind comments to our work.

General comments.

- More needs to be done describing the population from which this survey was drawn. The authors state that was from another study. The authors should describe more about the other study, including, was this part of the overall study or a recontact? How many times were subjects contacted? They should also describe the characteristics of the respondents. How do these compare to demographics of the region?

This study is part of a study based on the sleeping epidemiology among infant called EpiSon study. The main objective of the study is to analyse the relationship between sleep quality and the adherence to sleep hygiene routines in families with children between 3 to 36 months according to sociodemographic variables. Moreover, it is a cross-sectional study, so there is no follow-up of the participants or re-contact. We also included an independent section about thirdhand smoke in the questionnaire carried out by the families with the objective of this study. As the reviewer suggested, we have clarified it and provided more information about the population and the study in the Methods section as follows:

> “We used the data from a study about the quality of the sleep of the children called EpiSon conducted via online questionnaires to parents or caregivers with children between 3 to 36 months. The objective of the EpiSon study was to analyze the relationship between sleep quality in children and the adherence to sleep hygiene

> routines in families according to sociodemograhic variables. The questionnaire of EpiSon study also included a section about THS."

And

> "The surveys were conducted in Spanish from March to November of 2017 with a duration of approximately 15 minutes for all questions (questions regarding the study of sleep patterns and a section about thirdhand smoke). Even though respondents filled in personal information, the data was treated anonymously."

Moreover, as the reviewer suggested, we have added a new table with the characteristics of the respondents (please see table 1). We have also compared our results with the population data of the National Statistics Institute (INE) of Spain and we have justified them in the Discussion and limitations section, as follows:

> "We have compared the characteristics of respondents with the latest data of 2017 published by the National Institute of Statistics in Spain (INE) to test the representativeness of the sample, finding certain limitations of our sample (35). Firstly, 94% of the respondents were mothers, so our data is not representative of the attitudes and believes of fathers about THS. However, the average age of the mothers is similar to the INE Spanish average. Secondly, children under one year are less represented (26%) in our sample than the average of Spain; otherwise, the percentage of siblings (62%) was higher than in the Spanish population. Finally, in our sample, smokers are underrepresented and parents with university studies are overrepresented compared to the INE Spanish data. For this reason, the result of our study could be some bias to infer to fathers."

- The authors should better describe the question used to ascertain smoking status under Methods: variables (Page 4 line 42). How was smoking status ascertained? What if the father smoked but the mother responded to the questionnaire? Was smoking ban status in the homes asked as a question? Details are needed about how smoking status was defined and recorded.

Thanks for the comment. The smoking status recorded in our study was of respondent of the questionnaire (mother, father or other relatives of the child). Unfortunately, we did not register information about the smoking status of other members of the family who lived with the child. Moreover, we registered information about the adoption of voluntary smoking bans at home (smoke-free rules) and the beliefs about harmful effects of SHS exposure at home for the child. This part of the questionnaire, without information of THS, is currently reported in other manuscript under review in another journal. As the reviewer suggested, we have provided more information about the questions used and the analysis in the Methods section as follows:

> "We gathered information about the smoking status, the secondhand smoke exposure of their children, the voluntary regulation of tobacco consumption at their home and their knowledge and beliefs regarding THS harmful effects for their children. First, we asked about the smoking status of the respondent using the following question: "¿Do you smoke?" with 3 possible answers: "Yes, currently", "No, but I smoked", "No, I have never smoked". Then, we asked about the secondhand smoke exposure of the children

with the following questions: "During the past 2 weeks, ¿Has your child been exposed to secondhand smoke in your home" with a possible dichotomous answer (Yes or No) and "¿Has your child been exposed to second-hand smoke in another place different from your home?" with a possible dichotomous answer (Yes or No). In addition, we asked about the voluntary regulation of tobacco consumption at homes with the following question: "Which situation describes better the "rules" of smoking INSIDE your home?" with 4 possible answers: "Nobody can smoke (smoke is not allowed)", "You can only smoke in some places inside the house", "You can smoke anywhere (there are no rules)", "Don't know/no answer".

And

"We calculated the percentages for responses about: THS knowledge and beliefs of the effects of THS on children, SHS exposure at home among those respondents who previously knew THS. THS knowledge and beliefs responses were stratified by the following categories: sex of the child; age of the child (categorized as less than 1 year, 1 to 2 years, more than 2 years); siblings (categorized as yes or no); relationship of the child with the respondent (categorized as mother, father, other); smoking status (categorized as smokers, former smokers, never smokers); level of education of respondent (categorized as primary or less, secondary, university); age of respondent (categorized as less than 25 years old, among 25 and 35 years old, more than 35 years old). For the belief of the effects of THS, we stratified according to the previous knowledge of THS (categorized as yes or no). We also calculated the adjusted Odds Ratio (ORa) with 95% confidence intervals"

We have provided, in the new version of the manuscript, the relationship between SHS exposure in children and the prior knowledge on THS, and also, the relationship between smoke-free rules at home and the prior knowledge on THS. We have added in the Results section, as follows:

"We did not find statistically significant differences in SHS exposure at home from children among those respondents who previously knew THS (ORa=0.9; 95% CI: 0.6-1.6). We also did not find statistically significant differences in smoke-free rules at home between those respondents who previously knew THS against those who did not (ORa=0.7; 95% CI: 0.5-1.1)."

Moreover, we have also discussed it in the Discussion section, as follows:

"Previous studies showed a statistically significant relationship between those parents who believe that THS has an impact on the health of their children and home smoking ban (21,24,25). Because of this, we expected to find differences among those participants who knew THS previously, in tobacco smoke exposure in their children and in the percentage of smoke-free rules at home, as opposed to those who did not know. However, we have not found statistically significant differences, so we believe that more educational and training measures should be emphasized on the risks of exposure to SHS and THS."

New reference added in the manuscript:

Baheiraei A, Shirazi MG, Dehkordi ZR, Rahimi A. Prevalence of Home Smoking Bans and its

Determinants in Families with Infants. Int J Pediatr. 2018;6(1):6987–97. doi:10.22038/ijp.2017.27748.2404

-The authors should also pay close attention to significant figures in the results. Are two decimal points justified?

Thank you very much for the suggestion. We have placed decimal in the figures and text, in exception for the p-values for which we used three decimals.

-On Table two, is there a line missing for data corresponding to 'never smokers? Page 13 line 19 OR and 95% CI.

Thank you very much, we have carefully reviewed the tables and corrected them. It was a mistake when transferring the table from Excel to Word.

-The English grammar is poor and needs assistance on writing correctly.

The text has been carefully reviewed by a native English speaker.

Also, the survey questions should be stated as originally given (I assume in Spanish and Catalan?) and then translated in methods (or provided as supplemental material online) in case translations are subject to different interpretations.

Thank you very much for the comment. The survey was conducted in Spanish. As the reviewer suggested, we have provided the originally and translated questions of the questionnaire in an appendix and in the Methods section. Please see Appendix 1: Questions about THS, smoking, smoke-free rules and SHS belief extracted from the original questionnaire of EpiSon study (in Spanish and translated in English).

<u>**Reviewer: 2**</u>

Comments to the Author

Thank you for this paper that describes parents' beliefs about thirdhand smoke in Spain. This is the first assessment of thirdhand smoke beliefs in Europe according to the authors. While this is a worthwhile effort to describe the thirdhand smoke beliefs of parents in Spain, this paper would benefit from providing more details about the methodology used to select this sample and a more complete description of the study's limitations.

Thank you very much for the kind comments. We have given more details about the methodology used and the study's limitations as suggests.

Major issues:

Major issue #1:

Page 7, Line 54 – The most obvious result of this study is most parents were not familiar with the term "thirdhand smoke". Since the definition of thirdhand smoke was presented to parents immediately before they were asked if they believed thirdhand smoke was harmful,

it is not clear how this influenced parents' responses. The authors do acknowledge this as a limitation in the discussion section. The authors assertion that the written information about THS had minimal impact on parents' responses is not strongly supported in the discussion section. The authors write: "However, we believe this is likely to be minimal because the results in the knowledge of THS is also low in other studies carried out in different continents (13,14)." Both of the studies cited were conducted among low-income populations so they may not be generalizable. It is also not clear why studies that have established low knowledge about THS would support the notion that the written THS description would have minimal impact on parents. In fact, the results of this study could be interpreted that the definition of THS may have had a large impact since knowledge about the term "thirdhand smoke" was low prior to the definition of THS being given to parents. Unfortunately, this study is not able to determine if the delivery of brief educational messages about thirdhand smoke are beneficial because the harm belief was not assessed prior to giving the definition to parents so there is no way to compare a change in harm beliefs before and after the delivery of the written description. I would advise the authors to provide more detail in describing these limitations of this study.

Thank you very much for the comments. We agree with them. As the reviewer suggested, we have clarified the first question in the limitations, as follows:

> "The fact that in the survey written information about THS was given followed by a question about the belief of harmful effect of THS could have overestimated the perception of harmful effects of THS exposure. However, we believe this overestimation is minimal because the parents who did not know the term THS had lower perception of harmful effects than parents who knew THS (83% *vs.* 94%, table 3)"

Moreover, it is true that being the definition of THS an informative message, it could be understood as an educational message, as the reviewer suggests. Unfortunately, the objective of our study is to describe the knowledge of THS in our population, without an appropriate design to evaluate a brief educational intervention, and we could not evaluate it from the point of view of public health. We clarified in the discussion section as follows:

> "Two studies assessed the impact of brief educational interventions on THS (i.e.: motivational video or brief education) on the smoking behaviour of parents or caregivers of children who come to the emergency room or are hospitalized for respiratory illnesses (23,24). Both studies show that a greater knowledge of THS increases the smoking ban in houses and cars (23,24). In our study, explaining the definition of THS could be interpreted as a population educational message although it was not the objective of the study. Moreover, the design of our study is not adequate to evaluate a brief educational intervention from the point of view of public health."

On the other hand, we believe that the THS definition does not overestimate the real knowledge of THS in our population because the definition was given after the question regarding THS knowledge. Moreover, we have compared our prevalence with the prevalence available in other studies from the knowledgement of THS, and clarified it in the discussion section, as follows:

> "At present, there are few studies on THS knowledge among general populations and as far all have been carried out in low-income communities (27,28). One of them refers most of its 39 participants do not know what THS was, although after defining the

> concept some perceived risk in the exposure to THS in children (27). In another study, conducted in 2012 in Los Angeles, California with 24 participants recruited in a low-income neighbourhood, none of the participants knew the definition of THS (28). This is the first study, with a large sample size showing the prevalence of the knowledge of THS."

Major issue #2:

A major limitation of this paper is that it lacks an adequate description of the sampling strategy used to obtain the respondents for the survey. As the paper is currently written it is difficult for a reader to make a judgement about what population this paper's results should apply to. I recommend clearly outlining the steps taken to obtain the sample and describing in the discussion section to what degree the results can be applied to the larger population.

In online surveys, the sampling methods can make a large difference in the results obtained. The authors present a list of methods that were used to recruit respondents but it would be useful to know additional details about the methods used and the proportion of respondents that were recruited using each method. Please specify the inclusion and exclusion criteria used to determine the sample and the methods by which those criteria were applied.

Thank you for the comment. The parents were recruited voluntarily when they went to follow-up visit in the pediatric consultations of the HUGC. While they waiting to be visited, a staff member explained the project to them and they were offered to participate voluntarily. In addition, ballots were made as a form of dissemination explaining the project briefly and the link to participate. It was left in the waiting room for pediatric consultations and in the consultations. Some of these ballots were distributed by the physician staff after the medical visit. To promote participation, promotional messages were made explaining briefly the EpiSon project, who supported and the link to participate, as well as the voluntariness of it and distributed on social networks (i.e: facebook and twitter), and through applications mobile. A list of kindergarten located in Catalonia region was searched and a personalized informative email was sent to each one of them, offering the parents or caregivers the participation. All the surveys were done online. Prior to the beginning of the questionnaire, they signed an informed consent. Unfortunately, since the surveys were conducted online, we do not have data available on how many participants were recruited through ballots, or through social media.

As suggested the reviewers, we have clarified it in Methods section, as follows:

> "The recruitment of the participants was done through ballots distributed in the waiting room of the pediatric consultation of HUGC. The ballots explained briefly the EPISON project and offered the voluntary participation through a link to the website to complete the survey. In addition, digital media such as social network, private emails, and kindergarten emails were used, mobile applications explaining with the same text as the ballot the purpose of the study and requesting participation. To gain access to completing the survey, participants filled in the informed consent online. The participants did not receive an economic incentive or a gift. To carry out the study, approval from the Ethics Comittee of the HUGC and the Ethics Committee of Research (CER) of the Universitat Internacional de Catalunya (UIC-Barcelona) was obtained."

We have compared our sample wih the general Spanish statistic data and we have also discussed the potential limitations of our sample. Please see the answer to the first question of reviewer #1 for more detail of the characteristics of the respondents.

Finally, as recommend the reviewer, we have detailed in the Methods section the inclusion and exclusion criteria as follows:

> "The inclusion criteria from the study were all those parents or caregivers with a child from 3 to 36 months of age who spoke Spanish and agreed to participate. The exclusion criteria from the study were all those parents or caregivers with a child from less than 3 months or more than 36 months of age, or parents or caregivers who didn't speak Spanish."

The paper mentions that the data was collected from parents. How was it determined if the respondents were parents?

We have registered information about respondents of the questionnaire with the following question: "Specify the relationship with the child" with the possible answers: "Father", "Mother", "Grandfather or grandmother", "Other, specify:" Only, 0.6% of the sample was not fathers or mothers (please see new table 1 with the baseline information).

Moreover, we have added the information of the question in a new Appendix (please see appendix 1).

On the other hand, we cannot avoid some type of information bias due to the using an online survey. We have added this potential limitation in the Discussion section as follows:

> "The most important limitations of our study are those derived from the use of an online survey that it could create an information bias, although being an online survey and not having an interviewer present, the unacceptability bias would be lower. Moreover, there is a limitation because the population without internet access is underrepresented."

How are the authors certain all the respondents to the survey were from Spain if the survey was conducted online?

Thank you very much for the comment, when asking about the personal data and after informing the participants that the data was subject to the confidentiality stated in the informed consent document, information about the zip code of their address home was requested or they could provide their address home. Moreover, we cannot avoid any type of information bias. We have included this limitation in the discussion section (please see the answer to the previous comment).

Was an incentive given to people who completed the survey? These types of details would greatly improve the paper so that the reader understands the strengths and limitations of the methods used to select this sample.

The participants did not receive any economic incentive or gift. We have clarified it in the Methods section, as follows:

> "The participants did not receive an economic incentive or a gift."
>
> **Minor issues:**
>
> **Abstract:**

It is important to state in the abstract that a definition of THS was provided to parents after asking them if they had heard of THS. This piece of information would clarify how it was possible that 26.96% of respondents had heard about THS and 85.99% of respondents believed that THS is harmful to their children.

Thank you for the comment. We have clarified it, as follows:

> "Methods: A cross-sectional study (n=1,406 parents) conducted online between March and November 2017. We collected information about the knowledge of THS giving after, written information with the definition of THS and asking about beliefs of the effects of THS on children's health."

The final sentence of the conclusions section of the abstract should be strengthened. This study does not help establish the conclusion that the pediatric population is the most vulnerable to THS exposure. For that reason, I would recommend instead focusing the conclusion sentence in the abstract on the results of the present paper by perhaps pointing out that the majority of parents were not aware of THS but after being provided brief information about THS most parents agreed that exposure was harmful to children.

Thank you for the comment. We have modified it, as follows:

> "Currently, the majority of parents were not aware of THS but after providing brief information about it most of them agreed that THS exposure is harmful to their children."

Introduction:

Page 3, Line 21 - The number of studies on the health effects of THS is limited when compared to the amount of research conducted on SHS, but I would not go as far as to say that the data on THS is scarce anymore. There are a number of high quality studies that have been recently conducted that demonstrate health risks from THS.

Thank you very much for the comment. We have modified it, as follows:

> "Numerous studies showed the adverse health consequences of secondhand smoke (SHS), with no minimum safe level to tobacco smoke exposure (4,5) In fact, there are some components of SHS that adhere to indoor surfaces, or are reissued back into the indoor air and may react with atmospheric species creating other pollutants that are not present in the original fresh smoke (6,7). Therefore it has been postulated that some of the components of THS could have greater toxicity than tobacco smoke or SHS due to the oxidation and reconstitution processes that occur on the surfaces when deposited (8–10). Some of the components of THS found in indoor dust, and surfaces could be ingested, inhaled or even absorbed through the skin (11–13) Moreover, some of the components of THS are kept in the fibers of the clothes up to 19 months (14). Recently, some author's review have been published summarizing the effects of THS on cells, animals and humans (10,15,16). Also, THS has been related/associated with an increase in mortality risk due to living with a smoker (7)."

New references added to the manuscript:

Ferrante G, Simoni M, Cibella F, Ferrara F, Liotta G, Malizia V, et al. Third-hand smoke exposure and health hazards in children. Monaldi Arch chest Dis. 2013;79(1):38–43.

Northrup TF, Khan AM, Jacob III P, Benowitz NL, Hoh E, Hovell MF, et al. Thirdhand smoke contamination in hospital settings: assessing exposure risk for vulnerable paediatric patients. Tob Control. 2016;25:619–23. Available from: http://dx.doi.org/10.1136/tobaccocontrol-2015-052506

Becquemin, M. H.; Bertholon, J. F.; Bentayeb, M.; Attoui, M.; Ledur, D.; Roy F. et al. Third-hand smoking: indoor measurements of concentration and sizes of cigarette smoke particles after resuspension. Tob Control. 2010;19(4):347–8. Available from: http://dx.doi.org/10.1136/tc.2009.034694

-Two recent review articles on THS research outline many of the most recent studies on health risks posed by THS. The authors might find these reviews helpful to strengthen their introduction section with a brief description of what is currently known about the health risks posed to children from THS exposure to strengthen the rationale of why it is important to study parent's beliefs about THS.

Comprehensive review article on THS science:

Jacob P, Benowitz NL, Destaillats H, et al. Thirdhand smoke: new evidence, challenges, and future directions. Chem Res Toxicol. 2017;30:270–94.

Review article that outlines THS risk studies specific to children:

Drehmer JE, Hipple Walters B, Nabi-Burza E, Winickoff JP. (2017) Guidance for the Clinical Management of Thirdhand Smoke Exposure in the Child Healthcare Setting. Journal of Clinical Outcomes Management, 24(12):551-559.

Thank you very much for the references. We have strengthened the manuscript introduction with them.

We have also added the following references:

- U.S. Department of Health and Human Services. The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General. US Dep Heal Hum Serv Centers Dis Control Prev Coord Cent Heal Promot Natl Cent Chronic Dis Prev Heal Promot Off Smok Heal. 2006;709

- Oberg M, Jaakkola MS, Woodward A, Peruga A, Pruss-Ustun A. Worldwide burden of disease from exposure to second-hand smoke: A retrospective analysis of data from 192 countries. Lancet. Elsevier Ltd; 2011;377(9760):139–46. Available from: http://dx.doi.org/10.1016/S0140-6736(10)61388-8

- Sleiman M, Gundel L a, Pankow JF, Jacob P, Singer BC, Destaillats H. Formation of carcinogens indoors by surface-mediated reactions of nicotine with nitrous acid, leading to potential thirdhand smoke hazards. Proc Natl Acad Sci U S A. 2010;107(15):6576–81. Available from: http://dx.doi.org/10.1073/pnas.0912820107

- Sleiman M, Logue JM, Luo W, Pankow JF, Gundel LA, Destaillats H. Inhalable constituents of thirdhand tobacco smoke: Chemical characterization and health impact considerations. Environ Sci Technol. 2014;48(22):13093–101. Available from: http://dx.doi.org/10.1021/es5036333

- Hang B, Wang P, Zhao Y, Sarker A, Chenna A, Xia Y, et al. Adverse health effects of thirdhand smoke: From cell to animal models. Int J Mol Sci. 2017;18(5). Available from: http://dx.doi.org/ 10.3390/ijms18050932

- Jacob P, Benowitz NL, Destaillats H, Gundel L, Hang B, Martins-Green M, et al. Thirdhand Smoke: New Evidence, Challenges, and Future Directions. Chem Res Toxicol. 2017;30(1):270–94. Available from: http://dx.doi.org/10.1021/acs.chemrestox.6b00343

- Roberts C, Wagler G, Carr MM. Environmental Tobacco Smoke: Public Perception of Risks of Exposing Children to Second- and Third-Hand Tobacco Smoke. J Pediatr Heal Care. Elsevier Inc; 2017;31(1):e7–13. Available from: http://dx.doi.org/10.1016/j.pedhc.2016.08.008

- Drehmer JE, Walters BH, Nabi-Burza E, Winickoff JP. Guidance for the Clinical Management of Thirdhand Smoke Exposure in the Child Health Care Setting. J Clin Outcomes Manag. 2017;24(12):551–9. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5716630/pdf/nihms923008.pdf

- Mahabee-Gittens EM, Merianos AL, Matt GE. Preliminary evidence that high levels of nicotine on children's hands may contribute to overall tobacco smoke exposure. Tob Control. 2018;27(2):217–9. Available from: http:/dx.doi.org/10.1136/tobaccocontrol-2016-053602.

- Díez-Izquierdo A, Cassanello-Peñarroya P, Lidón-Moyano C, Matilla-Santander N, Balaguer A, Martínez-Sánchez JM. Update on Thirdhand Smoke: A Comprehensive Systematic Review. Environ Res. 2018; Available from: https://doi.org/10.1016/j.envres.2018.07.020

On Page 3, Line 50 the authors wrote:

"To the best of our knowledge, there are few descriptive studies describing the knowledge and beliefs of THS in adults related to the pediatric population…" It would be helpful for the readers to cite the "few descriptive studies" here. It would also be helpful to describe how the current study is both similar and different to the few descriptive studies that have been done so far on the topic of THS beliefs of parents. Please state what unique contribution this paper makes to advance the science on thirdhand smoke beliefs.

Below are some initial studies have been done on the topic of thirdhand smoke beliefs of parents that the authors could consider citing as initial work done on this topic.

Drehmer JE, Ossip DJ, Rigotti NA, et al. Pediatrician interventions and thirdhand smoke beliefs of parents. Am J Prev Med. 2012;43:533–6.

Roberts, Christopher et al. Environmental Tobacco Smoke: Public Perception of Risks of Exposing Children to Second- and Third-Hand Tobacco Smoke. Journal of Pediatric Health Care. Volume 31 , Issue 1 , e7 - e13.

Drehmer JE, Ossip DJ, Nabi-Burza E, et al. Thirdhand smoke beliefs of parents. Pediatrics. 2014;133:e850–6.

Thank you very much for the comment. As the reviewer suggests, we have cited the articles recommended.

Furthermore, we have added in the introduction section why this paper is unique, as follows:

> "This is the first study in which parents and caregivers of children are asked about their knowledge of THS, and after explaining briefly about the THS term, they are asked again if they believe that THS is harmful to the health of their children."

New references added to the manuscript:

- Kayser JW, Semenic S. Smoking motives, quitting motives, and opinions about smoking cessation support among expectant or new fathers. J Addict Nurs. 2013;24(3):149–57. Available from: http://dx.doi.org/10.1097/JAN.0b013e3182a4caf1

- Winickoff JP, Friebely J, Tanski SE, Sherrod C, Matt GE, Hovell MF, et al. Beliefs about the health effects of "thirdhand" smoke and home smoking bans. Pediatrics . 2009;123(1):74–9. Available from: http://dx.doi.org/10.1542/peds.2008-2184

- Walley SC hu, Chime C, Powell J, Walker K, Burczyk-Brown J, Funkhouser E. A Brief Inpatient Intervention Using a Short Video to Promote Reduction of Child Tobacco Smoke Exposure. Hosp Pediatr. 2015;5(10):534–41. Available from: http://dx.doi.org/10.1542/hpeds.2015-0042

- Patel S, Hendry P, Kalynych C, Butterfield R, Lott M, Lukens-Bull K. The impact of third-hand smoke education in a pediatric emergency department on caregiver smoking policies and quit status: A pilot study. Int J Disabil Hum Dev. 2012;11(4):335–42. Available from: http://dx.doi.org/10.1515/ijdhd-2012-0052

- Drehmer JE., Ossip DJ., Nabi-Burza E, Rigotti NA., Hipple B, Woo H, et al. Thirdhand Smoke Beliefs of Parents. Pediatrics. 2014;133(4):e850–6. Available from: http://dx.doi.org/10.1542/peds.2013-3392

- Baheiraei A, Shirazi MG, Dehkordi ZR, Rahimi A. Prevalence of Home Smoking Bans and its Determinants in Families with Infants. Int J Pediatr. 2018;6(1):6987–97. Available from: http://dx.doi.org/10.22038/ijp.2017.27748.2404

It would be helpful to clarify in the introduction section if the authors are aware of any public education campaigns or programs for the healthcare setting within Spain to help parents protect their children from exposure to tobacco smoke. Are there any programs or prevention efforts that were happening in Spain prior to this assessment that could have influenced the results in this paper?

Thank you for the comment. To the best of our knowledge, no recent new public education campaigns or programs for the healthcare settings are being carried out in Spain.

In 2011, a law was published (Law 42/2010) that regulated the consumption of tobacco in restaurants, bars and some outdoor spaces such as hospitals or schools in Spain. Unlike other countries such as the United States or other European countries, in Spain, there is no regulation in favour of smoke-free homes.

We have clarified in the discussion section, as follows:

> "In 2011, the Law 42/2010 that prohibits the tobacco consumption in bars, restaurants and some outdoor spaces such as around hospitals or schools (29), came into force in Spain. With the support of the anti-smoking legislation, a greater social awareness of the effects of exposure to tobacco smoke has been created, with almost an 83% of households having any type of prohibition on tobacco consumption (30). In recent years, smoke-free multiunit housing, completely smoke-free buildings, including both private and common areas, has proliferated in the US and several European countries (31–33) but in Spain, there are not yet specific policies."

____

New references added to the manuscript:

-Gobierno de España. Ley 42/2010, de 30 de diciembre, por la que se modifica la Ley 28/2005, de 26 de diciembre, de medidas sanitarias frente al tabaquismo y reguladora de la venta, el suministro, el consumo y la publicidad de los productos del tabaco. Boletín Of Del Estado. 2010;308:31.

- Díez-Izquierdo A, Lidón-Moyano C, Martín-Sánchez JC, Matilla-Santander N, Cassanello-Peñarroya P, Balaguer A, et al. Smoke-free homes and attitudes towards banning smoking in vehicles carrying children in Spain (2016). Environ Res. Elsevier Inc.; 2017;158:590–7. Available from: http://dx.doi.org/10.1016/j.envres.2017.07.012

- U.S. Department of Health and Human Services., Prevention C for DC and. Healthy Homes Manual. Smoke-Free Policies in Multiunit Housing National Center. Atlanta, GA; 2011. Available from: http://www.cdc.gov/healthyhomes/Healthy_Homes_Manual_WEB.pdf.

- Snyder K, Vick JH, King BA. Smoke-free multiunit housing: a review of the scientific literature. Tob Control. 2015;(December 2013):tobaccocontrol-2014-051849. Available from: http://dx.doi.org/10.1136/tobaccocontrol-2014-051849

- Koster B, Brink A-L, Clemmensen IH. "Neighbour smoke"--exposure to secondhand smoke in multiunit dwellings in Denmark in 2010: a cross-sectional study. Tob Control. 2013;22:190–3. Available from: http://dx.doi.org/10.1136/tobaccocontrol-2011-050393

Methods:

It is important for readers to understand what respondents were told about how the personal information they provided on the survey would be used. Even though the authors state that the data was treated as if it was anonymous for this analysis, it is important to understand how respondents may have been influenced by social desirability bias or out of concern for privacy. Please state what personal information respondents were asked to provide and what they were told about how their personal information would be used before they started the online survey.

Thank you for the question. When asking about the personal data, a note was added stating: "all these data are subject to the confidentiality stated in the informed consent document"**.**

In the informed consent document, it was written:

"VOLUNTARY PARTICIPATION: Your collaboration is voluntary. You can decide at any time to stop participating in it. Your personal data will not be released at any time and under any circumstances. You can choose to participate in other successive studies related to the dream or end your participation today after answering this form.

CONFIDENTIALITY: The treatment of demographic, clinical and treatment data will be handled according to current legislation, maintaining the confidentiality of medical information collected through the assignment of codes (correlative numbers beginning with cases 1 and anonymization). of the records in paper and in the database, which will be prepared anonymously without any data that could identify the patients, Excel program will be used, only the main investigators will have access, the Law of Biomedical Research will be respected, the Oviedo Convention and the Data Protection Law 15/1999."

The personal data requested were the following: Name of the interviewee; name of the child; date of birth of the child; sex of the child (Male or Female); order of this son among the brothers, if he has them (he is the oldest, he is the middle son, he is the little one); Date of birth of both parents (Father, Mother), place of birth of both parents (Father, Mother), ¿could you indicate your level of education? (Primary, Secondary, University); ¿Does the child lives at home with both parents? ; If not, ¿ Does the child live with you?; How many people live at the same address?; Please specify your postal code: (If you do not remember, specify your address); ¿Would you be interested in participating again later in another study? (No, I just want to participate today on time, Yes, you can contact me Email or Phone).

We detailed in the Methods section, as follows:

"In the informed consent document was specified the voluntariness, confidentiality, and anonymization of personal data."

It is not clear to me why questions about thirdhand smoke were included into a survey about the "quality of the dream"? Please explain more about the topic of this online survey. Additional details about the topic of the larger survey and the ordering of the questions in the larger survey might also be relevant. Could the topic of the larger survey have influenced the responses to the questions about thirdhand smoke?

Thank you very much for the comment. We have included more information about that (please see answer of the first comment of the reviewer #1). Briefly, the questionnaire consisted of 31 questions. The firsts questions are about sleep habits in children. From questions, 24 to 28 were the questions of the section about smoking, secondhand smoke, smoke-free rules, and THS, and from question 29 to 31 are about sleep habits in parents. We believe that the answers have not been influenced because the main theme of the questionnaire was the quality of sleep in children.

We detailed in the Discussion section, as follows:

> "Although the main topic of the survey was about sleep habits in children, we do not believe that this has influenced our results."

The journal is published in English but it might be useful to readers to also have the Spanish version of the written THS definition that was given to parents in this study so that it can be shared with Spanish-speaking readers free from translation bias. To replicate the study in a Spanish-speaking country, this would be particularly helpful.

Thanks for the comment. We have added an appendix with the original survey questions in Spanish and an English translation (please see Appendix 1).

How was the written definition of THS developed? Was this definition created by the researchers or was it taken from some other source? The mention of "food" as a surface in which the THS waste is deposited on is an interesting choice. Was there particular research that informed the decision to include food as one of the surfaces that THS will deposit on? If so, this background information would be helpful to readers and would strengthen the case that the definition used in this study is valid.

The definition of thirdhand smoke was adapted from a consensus of authors published in 2011 by Matt et al. (Matt GE, Quintana PJE, Destaillats H, Gundel LA, Sleiman M, Singer BC, et al. Thirdhand tobacco smoke: Emerging evidence and arguments for a multidisciplinary research agenda. Environ Health Perspect. 2011;119(9):1218–26. Available from: http://dx.doi.org/10.1289/ehp.1103500).

In the current literature on THS, there is still no published data on the deposit in food, so we have decided to add this in the THS definition by our personal experience, when we smell it and notice it in the flavor in some foods. Moreover, we have applied for a national grant to the Spain Government to carry out a project that will evaluate the deposit of thirdhand smoke in food and other surfaces and how it affects to the pediatric population. We are awaiting the resolution of the grants call for starting the project, but it is a working hypothesis in which we firmly believe.

Was the website where parents took the survey known to the respondents as being hosted by a trusted source of medical information? Was the website that hosted the survey on a hospital website or was there some indication that the survey was being conducted by a hospital, medical center or a university? The reason this is important is because a definition of THS that comes from a trusted medical source may be interpreted differently than if this definition was provided by to parents by a less trusted source. Was any information presented to parents to reinforce the notion that the source of the definition of THS was from a valid source?

Thank you for the question. The website (www.epison.es) was created specifically to carry out this study. The study was approved by the Ethics Committee of the Hospital Universitari General de Catalunya (HUGC) and the Ethics Committee of Research (CER) of the International University of Catalonia (UIC-Barcelona).

The website was not linked to the hospital's website, but on the study website the link was indicated when the HUGC logo and the UIC-Barcelona University appeared.

Unfortunately, the parents were not informed of where the THS definition was obtained.

Results:

It is an important finding that smoking status was related to THS harm belief.Did the authors collect any data to explore how the amount of smoking (heavy vs. light) among parents is related to THS harm beliefs? There is some data from a prior US study on parents that suggests heavier smokers were less likely to believe that THS is harmful to children than lighter smokers.

Thank you very much for the comment. Moreover, Drehmer et al. in 2014 published that those parents who believed that the THS is harmful were 1.70 times more likely to have reporting using cessation compared with those who did not hold the THS harm belief.

We have detailed in the discussion section, as follows:

> "Furthermore, those parents who believed that THS was harmful used cessation assistance more frequently, up to 1.7 times more compared with parents who did not believe and were more likely to have a strictly enforced smoke free home and car policies (25,26). "

Unfortunately, in our case, the number of cigarettes per day was not asked, so we do not have that information.

Discussion

Page 7, Line 24 – The author should specify the year and location of the small study they cited that showed no awareness of THS. It appears that this study was done in 2012 in California.

Thank you for the comment. We have added in the discussion section, as follows:

> "In another study, conducted in 2012 in Los Angeles, California with 24 participants recruited in a low-income neighbourhood, none of the participants knew the definition of THS (28)."

In the "Variables" sub-section of the Methods section the authors state that the knowledge question about THS was asked first and then followed up with the definition of THS. Then a question was asked to assess the beliefs of the effects of THS on children's health. The order of how the questions were asked on the survey as stated in the Methods section appears to contradict what is stated on Page 7, Line 34 in the Discussion section: "The fact that in the survey, written information about THS was given, followed by two questions on THS itself, could have overestimated our data regarding THS knowledge and also promoted answers about the harmful effect of THS." Please clarify the order that the questions and the definition of THS were presented to respondents.

Thank you for the comment. We have clarified it in the methods section, as follows:

> "We gathered information about their smoking status and their knowledge and beliefs regarding THS harmful effects for their children (Appendix 1). First, we asked about the smoking status using the following question: "¿Do you smoke?" with 3 possible answers: "Yes, currently", "No, but I smoked", "No, I have never smoked". Then, we asked about general knowledge of THS using the following question: "Have you heard about "Thirdhand smoke" before?" with a possible dichotomous answer (Yes or No). Just after, written information about the concept of THS was given to all the participants with the following sentence: "Thirdhand smoke" (or third-hand smoke) is the smoke generated by tobacco and deposited in the form of waste on surfaces such as furniture, textiles or food". We then asked about the beliefs of the effects of THS on children's health using the following question: "Do you think exposure to Thirdhand smoke is harmful to children?" with 6 possible answers: "Yes, totally agree", "Yes, agree", "Neither agree, nor disagree", "Disagree", "Strongly disagree", "Don't know/no

answer". We recoded this variable according to whether the respondents agreed with THS being harmful to their children ("Yes, totally agree", "Yes, agree") and disagreed ("Neither agree, nor disagree", "Disagree", "Strongly disagree", "Don't know/no answer")."

Moreover, we have added in Appendix 1, the questions in the same order as in the survey in Spanish and English.

Page 7, Line 28 – The authors wrote, "This is the first study, with a higher sample size, showing a population prevalence of THS knowledge." Please describe further the specific population that this study characterizes here.
Thank you very much for the comment. We have now further described our sample (please see answer of comment 1 of the reviewer #1. We have also added a table (Table 1) with the characteristics of the respondents.

Page 7, line 47 – The authors mention that the dissemination was carried out in only one hospital and cite this as a limitation to the study methods, Do the authors mean the dissemination of recruitment materials was done in only one hospital?

Thank you very much for the comment. We have provided more information about the dissemination of the questionnaire for the recruitment of the participants (please see the response from the major issue 2 of reviewer #2).

Thank you for this paper. This study will be useful to help establish a baseline metric of awareness of thirdhand smoke among parents in Spain. This study suggests awareness of the term is low. Parent education on the topic of thirdhand smoke might increase awareness within Spain.

Thank you very much for the nice comment to our work. We also appreciate all interesting comments and suggestions given by the reviewer to improve our work.

ANEXO 4.4. Carta de aceptación de *Pediatric Research*

From: **Pediatric Research** onbehalfof@manuscriptcentral.com
Date: vie., 10 ago. 2018 a las 14:19
Subject: Pediatric Research - Decision on Manuscript ID PR-2018-0088.R1
To: jmmartinez@uic.es
RE: Manuscript ID PR-2018-0088.R1
Dear Dr. Martínez-Sánchez:
It is our pleasure to accept your manuscript entitled "Knowledge and attitudes towards Thirdhand smoke among parents with children under 3 years in Spain" for publication in Pediatric Research.
IMPORTANT: To ready your files for publication, please make the changes noted below and E-MAIL final files (for only those files that are changed) to lauren.overbey@pedres.org.
In the subject line, please write "Final files attached: Ms. [INSERT NO.] ([INSERT AUTHOR LAST NAME])".

CHANGES NEEDED TO FINAL FILES:
n/a--
Once your final files have been received, they will be processed and sent to the publisher, Nature Publishing Group (NPG). The following publication schedule will then go into effect:

1. Your paper will be uploaded to NPG's 'Accepted Article Preview' section of Pediatric Research shortly after receipt in their office. More information can be found at: http://www.nature.com/pr/about_aap.html
2. Approximately one month later, you will receive author's proofs of your article with queries to the author. These must be returned in 48-72 hours. Following receipt of your corrected author's proof, the final version of your paper will appear in NPG's 'Advance Online Publication' section of Pediatric Research. More information can be found at: http://www.nature.com/pr/about_aop.html
3. Approximately 4 months after your final files have been received by the publisher, the paginated, final version of your paper will appear in a 'current issue' of Pediatric Research, in print and online. The journal is published online at http://www.nature.com/pr/index.html. You will also receive an invoice from Pediatric Research for page charges. More information about page charges can be found in the attached Instructions for Authors.

Pediatric Research is also implementing a new series to highlight an Early Career Investigator (ECI). Please see the attached file for more details. Reply to info@pedres.org to nominate an author for the ECI. It is our intention to continue to do all we can to speed the publication of important research, and provide the best possible forum for the presentation of research finding in the study of childhood disease and development.
Thank you for submitting your interesting and important work to Pediatric Research. We encourage you to share this news with your institution's Public Relations department. We look forward to the publication of your manuscript.
Sincerely,
Cynthia Bearer, MD, PhD
Editor-in-Chief, Pediatric Research
Eleanor Molloy, MB, PhD
Associate-Editor-in-Chief, Pediatric Research
Editorial office email: info@pedres.org

ANEXO 5: Recortes de prensa derivados del artículo "*Correlation between tobacco control policies and preterm births and low birth weight in Europe*"

Diario de Almería

PAÍS: España
PÁGINAS: 54
TARIFA: 320 €
ÁREA: 125 CM² - 13%

FRECUENCIA: Diario
O.J.D.: 1522
E.G.M.: 16000
SECCIÓN: SALUD

18 Noviembre, 2017

SALUD PÚBLICA

El control del tabaquismo reduce el número de prematuros

Redacción

Cuanto mayores son las medidas de control del tabaquismo en los países europeos, menores son las tasas de nacimientos prematuros, según un estudio de la Universitat Internacional de Catalunya.

"El estudio muestra que aquellos países que tienen mayor implementación de las medidas de control del tabaquismo presentan un menor porcentaje de nacimientos prematuros. En este sentido, hemos podido observar que las medidas de control del tabaquismo también han tenido un impacto en indicadores perinatales", ha señalado el responsable del Grupo de investigación de evaluación de determinantes de salud y políticas sanitarias de UIC Barcelona, José Martínez–Sánchez.

El alcance de las medidas afecta a indicadores perinatales

Los resultados de la investigación revelan el impacto positivo que tienen las políticas para regular el consumo de tabaco sobre la disminución de nacimientos prematuros y con bajo peso.

Por este motivo, los autores del estudio aconsejan seguir trabajando en el control de la epidemia del tabaco reforzando la implementación de políticas de control del tabaquismo, favoreciendo así el buen desarrollo de los embarazos, mejorando la salud de las mujeres gestantes y repercutiendo positivamente en el sistema sanitario público.

DIARIO DE CADIZ
CÁDIZ

PAÍS: España
PÁGINAS: 56
TARIFA: 979 €
ÁREA: 156 CM² - 14%

FRECUENCIA: Diario
O.J.D.: 13328
E.G.M.: 73000
SECCIÓN: SALUD

18 Noviembre, 2017

SALUD PÚBLICA

El control del tabaquismo reduce el número de prematuros

Redacción

Cuanto mayores son las medidas de control del tabaquismo en los países europeos, menores son las tasas de nacimientos prematuros, según un estudio de la Universitat Internacional de Catalunya.

"El estudio muestra que aquellos países que tienen mayor implementación de las medidas de control del tabaquismo presentan un menor porcentaje de nacimientos prematuros. En este sentido, hemos podido observar que las medidas de control del tabaquismo también han tenido un impacto en indicadores perinatales", ha señalado el responsable del Grupo de investigación de evaluación de determinantes de salud y políticas sanitarias de UIC Barcelona, José Martínez–Sánchez.

El alcance de las medidas afecta a indicadores perinatales

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Por este motivo, los autores del estudio aconsejan seguir trabajando en el control de la epidemia del tabaco reforzando la implementación de políticas de control del tabaquismo, favoreciendo así el buen desarrollo de los embarazos, mejorando la salud de las mujeres gestantes y repercutiendo positivamente en el sistema sanitario público.

Diario de Jerez

PAÍS: España
PÁGINAS: 51
TARIFA: 492 €
ÁREA: 112 CM² - 13%

FRECUENCIA: Diario
O.J.D.: 4109
E.G.M.: 20000
SECCIÓN: SALUD

18 Noviembre, 2017

SALUD PÚBLICA

El control del tabaquismo reduce el número de prematuros

Redacción

Cuanto mayores son las medidas de control del tabaquismo en los países europeos, menores son las tasas de nacimientos prematuros, según un estudio de la Universitat Internacional de Catalunya.

"El estudio muestra que aquellos países que tienen mayor implementación de las medidas de control del tabaquismo presentan un menor porcentaje de nacimientos prematuros. En este sentido, hemos podido observar que las medidas de control del tabaquismo también han tenido un impacto en indicadores perinatales", ha señalado el responsable del Grupo de investigación de evaluación de determinantes de salud y políticas sanitarias de UIC Barcelona, José Martínez–Sánchez.

El alcance de las medidas afecta a indicadores perinatales

Los resultados de la investigación revelan el impacto positivo que tienen las políticas para regular el consumo de tabaco sobre la disminución de nacimientos prematuros y con bajo peso.

Por este motivo, los autores del estudio aconsejan seguir trabajando en el control de la epidemia del tabaco reforzando la implementación de políticas de control del tabaquismo, favoreciendo así el buen desarrollo de los embarazos, mejorando la salud de las mujeres gestantes y repercutiendo positivamente en el sistema sanitario público.

Diario de Sevilla

PAÍS: España
PÁGINAS: 44
TARIFA: 673 €
ÁREA: 103 CM² - 12%

FRECUENCIA: Diario
O.J.D.: 13572
E.G.M.: 96000
SECCIÓN: SALUD

18 Noviembre, 2017

SALUD PÚBLICA

El control del tabaquismo reduce el número de prematuros

Redacción

Cuanto mayores son las medidas de control del tabaquismo en los países europeos, menores son las tasas de nacimientos prematuros, según un estudio de la Universitat Internacional de Catalunya.

"El estudio muestra que aquellos países que tienen mayor implementación de las medidas de control del tabaquismo presentan un menor porcentaje de nacimientos prematuros. En este sentido, hemos podido observar que las medidas de control del tabaquismo también han tenido un impacto en indicadores perinatales", ha señalado el responsable del Grupo de investigación de evaluación de determinantes de salud y políticas sanitarias de UIC Barcelona, José Martínez–Sánchez.

> El alcance de las medidas afecta a indicadores perinatales

Los resultados de la investigación revelan el impacto positivo que tienen las políticas para regular el consumo de tabaco sobre la disminución de nacimientos prematuros y con bajo peso.

Por este motivo, los autores del estudio aconsejan seguir trabajando en el control de la epidemia del tabaco reforzando la implementación de políticas de control del tabaquismo, favoreciendo así el buen desarrollo de los embarazos, mejorando la salud de las mujeres gestantes y repercutiendo positivamente en el sistema sanitario público.

el Día DE CÓRDOBA
18 Noviembre, 2017
PAÍS: España
PÁGINAS: 46
TARIFA: 305 €
ÁREA: 103 CM² - 12%
FRECUENCIA: Diario
O.J.D.: 1006
E.G.M.: 14000
SECCIÓN: SALUD

SALUD PÚBLICA

El control del tabaquismo reduce el número de prematuros

Redacción

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"El estudio muestra que aquellos países que tienen mayor implementación de las medidas de control del tabaquismo presentan un menor porcentaje de nacimientos prematuros. En este sentido, hemos podido observar que las medidas de control del tabaquismo también han tenido un impacto en indicadores perinatales", ha señalado el responsable del Grupo de investigación de evaluación de determinantes de salud y políticas sanitarias de UIC Barcelona, José Martínez–Sánchez.

El alcance de las medidas afecta a indicadores perinatales

Los resultados de la investigación revelan el impacto positivo que tienen las políticas para regular el consumo de tabaco sobre la disminución de nacimientos prematuros y con bajo peso.

Por este motivo, los autores del estudio aconsejan seguir trabajando en el control de la epidemia del tabaco reforzando la implementación de políticas de control del tabaquismo, favoreciendo así el buen desarrollo de los embarazos, mejorando la salud de las mujeres gestantes y repercutiendo positivamente en el sistema sanitario público.

EuropaSur

PAÍS: España
PÁGINAS: 40
TARIFA: 345 €
ÁREA: 112 CM² - 13%

FRECUENCIA: Diario
O.J.D.: 2156
E.G.M.: 13000
SECCIÓN: SALUD

18 Noviembre, 2017

SALUD PÚBLICA

El control del tabaquismo reduce el número de prematuros

Redacción

Cuanto mayores son las medidas de control del tabaquismo en los países europeos, menores son las tasas de nacimientos prematuros, según un estudio de la Universitat Internacional de Catalunya.

"El estudio muestra que aquellos países que tienen mayor implementación de las medidas de control del tabaquismo presentan un menor porcentaje de nacimientos prematuros. En este sentido, hemos podido observar que las medidas de control del tabaquismo también han tenido un impacto en indicadores perinatales", ha señalado el responsable del Grupo de investigación de evaluación de determinantes de salud y políticas sanitarias de UIC Barcelona, José Martínez–Sánchez.

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Granada Hoy

PAÍS: España
PÁGINAS: 41
TARIFA: 467 €
ÁREA: 129 CM² - 12%

FRECUENCIA: Diario
O.J.D.: 2075
E.G.M.: 13000
SECCIÓN: SALUD

18 Noviembre, 2017

SALUD PÚBLICA

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Huelva Información

PAÍS: España
PÁGINAS: 40
TARIFA: 432 €
ÁREA: 113 CM² - 13%

FRECUENCIA: Diario
O.J.D.: 4774
E.G.M.: 45000
SECCIÓN: SALUD

18 Noviembre, 2017

SALUD PÚBLICA

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Málaga hoy

PAÍS: España
PÁGINAS: 48
TARIFA: 587 €
ÁREA: 101 CM² - 14%

FRECUENCIA: Diario
O.J.D.: 5736
E.G.M.: 22000
SECCIÓN: SALUD

18 Noviembre, 2017

SALUD PÚBLICA

El control del tabaquismo reduce el número de prematuros

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Diario de Pontevedra

PAÍS: España
PÁGINAS: 1,57
TARIFA: 1351 €
ÁREA: 602 CM² - 61%

FRECUENCIA: Diario
O.J.D.: 4718
E.G.M.: 30000
SECCIÓN: PORTADA

17 Noviembre, 2017

VIVIR AQUÍ El 14% de los cánceres de pulmón afecta a quienes nunca fumaron >49

Diario de Pontevedra

PAÍS: España
PÁGINAS: 1,57
TARIFA: 1351 €
ÁREA: 602 CM² - 61%

FRECUENCIA: Diario
O.J.D.: 4718
E.G.M.: 30000
SECCIÓN: PORTADA

17 Noviembre, 2017

El 14% de los cánceres de pulmón afecta a quienes nunca fumaron

▶ El Registro de Tumores Torácicos constata que casi la mitad de las personas que tuvieron el hábito y lo han dejado padecen la patología

EUROPA PRESS
MADRID. El 14 por ciento los casos de cáncer de pulmón detectados en España corresponden a personas que no han fumando nunca, mientras que un 44,6 por ciento, se da en exfumadores, según el Registro de Tumores Torácicos presentados ayer por el Grupo Español del Cáncer de Pulmón.

El registro incluye datos de 2.200 pacientes diagnosticados en España desde 2004, procedentes de 53 centros hospitalarios. Unos 1.500 pertenecen a Madrid, Cataluña y Comunidad Valenciana.

El presidente del GECP, Mariano Provencio, destacó que Madrid registra el mayor porcentaje de exfumadores, hasta un 51 por ciento de los casos notificados en esta comunidad, mientras que la Comunidad Valenciana tiene más diagnósticos en población fumadora (43%, frente al 39,5% a nivel nacional).

Unas diferencias en lo que podrían influir los niveles de contaminación en las grandes ciudades, reconocidos por la Organización Mundial de la Salud (OMS) como un factor de riesgo para cáncer de pulmón.

MUJERES. El registro muestra el incremento que se ha producido en la incidencia en mujeres. A pesar de que la mayoría de casos corresponde a hombres (un 73,6%), las mujeres ya representan uno de cada cuatro (26,3%).

En la mayoría de casos se trata de cáncer de pulmón no microcítico (87%) seguido del cáncer de pulmón microcítico (9,7%) y el 63 por ciento de los casos son menores de 70 años. Además, tos, dolor, disnea y en ocasiones pérdida de peso son los principales síntomas.

Asimismo, de media los pacientes tardan entre uno y tres meses en comenzar a ser tratados desde que son diagnosticados y la opción terapéutica más utilizada sigue siendo la quimioterapia, utilizada en un 36,7 por ciento de los pacientes, seguida de la radioterapia (18,6%) y la cirugía (un 11,6%).

No obstante, la introducción creciente de los biomarcadores y su determinación ha permitido una medicina más individualizada. De hecho, se ha analizado la supervivencia de más de 1.000 pacientes y se observa como el 75% de los pacientes sigue vivo después de 12 meses; el 60 por ciento, después de 24 y hasta un 45 por ciento, a los 60 meses.

'TRAIDORA'. El cáncer de pulmón es una enfermedad 'traidora' porque apenas da síntomas hasta que ya se encuentra en una fase avanzada, que es cuando se diagnostican al 80% de los pacientes, aunque en la mayoría de los casos la principal causa que lo provoca se puede evitar: el tabaco.

Se puso de manifiesto los expertos que han participado en el III Foro sobre Cáncer de Pulmón organizado por la asociación española de afectados por esta enfermedad (AEACap) y la Fundación Más que Ideas, en el que hicieron hincapié en la importancia de dejar de fumar para prevenir esta patología, que se lleva cerca de 20.000 vidas al año en España.

La mujeres afectadas por cáncer de pulmón son ya la cuarta parte. EP

Menos prematuros en países rigurosos con el tabaquismo

Los países más restrictivos con el consumo de tabaco, que han prohibido fumar en locales públicos y centros de trabajo, tienen un menor número de nacimientos prematuros y con bajo peso, según un estudio que ha liderado la Universidad Internacional de Cataluña (UIC), que fue presentado ayer con motivo de la celebración, el domingo, del Día Mundial del Prematuro.

Mortalidad

El responsable del grupo de investigación de salud y políticas sanitarias de la UIC, José M. Martínez Sánchez, aseguró que los nacimientos prematuros son todavía la principal causa de mortalidad infantil incluso en los países más desarrollados.

Martínez Sánchez recordó que el consumo de tabaco o la exposición pasiva a este durante el embarazo tiene numerosos efectos negativos que influyen en el desarrollo del feto, y en su nacimiento antes de tiempo.

Estudio

Partiendo de estas premisas, los investigadores elaboraron un estudio que resulta pionero en el conjunto de Europa que ha evaluado la correlación entre las medidas de control del tabaquismo implementadas en los diferentes países de la Unión Europea y el porcentaje de nacimientos prematuros y con bajo peso. «Además de ver que aquellos países con más medidas de control del tabaquismo presentan un menor porcentaje de nacimientos prematuros, hemos podido observar que las medidas de control del tabaquismo también han tenido un impacto en indicadores perinatales», señaló Martínez Sánchez.

Diario de Teruel

PAÍS: España
PÁGINAS: 42
TARIFA: 193 €
ÁREA: 100 CM² - 12%

FRECUENCIA: Diario
O.J.D.:
E.G.M.: 12000
SECCIÓN: SALUD

17 Noviembre, 2017

Menos nacimientos prematuros en los países más antitabaco

EFE·
Barcelona

Los países más restrictivos con el consumo de tabaco, que han prohibido fumar en locales públicos y centros de trabajo, tienen un menor número de nacimientos prematuros y con bajo peso, según un estudio que ha liderado la Universidad Internacional de Cataluña (UIC).

El estudio, en el que también han participado el Instituto Catalán de Oncología (ICO) y el Instituto de Salud Carlos III, y que publica la revista 'Environmental Research', se ha presentado hoy con motivo de la celebración, el próximo día 19, del Día Mundial del Prematuro.

El trabajo demuestra una correlación inversa entre el control del tabaco los nacimientos prematuros después de analizar diferentes países europeos y concluye que cuanto mayores son las medidas de control del tabaquismo, menores son las tasas de prematuros.

Según el responsable del grupo de investigación de salud y políticas sanitarias de la UIC, José M. Martínez-Sánchez, los nacimientos prematuros (antes de las 37 semanas de gestación) son todavía la principal causa de mortalidad infantil incluso en los países más desarrollados.

Martínez-Sánchez recuerda que el consumo de tabaco o la exposición pasiva a éste durante el embarazo tiene numerosos efectos negativos que influyen en el desarrollo del feto, y en su nacimiento antes de tiempo.

PAÍS: España
PÁGINAS: 32
TARIFA: 240 €
ÁREA: 114 CM² - 10%
FRECUENCIA: Diario
O.J.D.: 13369
E.G.M.: 144000
SECCIÓN: SOCIEDAD
17 Noviembre, 2017

NACIMIENTOS

El efecto del tabaco en los prematuros

●●●Los países más restrictivos con el consumo de tabaco, que han prohibido fumar en locales públicos y centros de trabajo, tienen un menor número de nacimientos prematuros y con bajo peso, según un estudio que ha liderado la Universidad Internacional de Cataluña (UIC). El estudio se presentó ayer con motivo de la celebración, el próximo día 19, del Día Mundial del Prematuro.

Salut
Diari de Girona

23 Noviembre, 2017

PAÍS: España
PÁGINAS: 1,3
TARIFA: 1984 €
ÁREA: 504 CM² - 45%

FRECUENCIA: Semanal
O.J.D.: 5139
E.G.M.: 31000
SECCIÓN: PORTADA

INVESTIGACIÓ

A menys tabac, menys nadons prematurs

Un estudi de la UIC i l'ICO vincula la reducció dels naixements preterme a les polítiques de control del tabaquisme > PÀG 3

Salut
Diari de Girona
23 Noviembre, 2017
PAÍS: España
PÁGINAS: 1,3
TARIFA: 1984 €
ÁREA: 504 CM² - 45%
FRECUENCIA: Semanal
O.J.D.: 5139
E.G.M.: 31000
SECCIÓN: PORTADA

A menys tabac, menys nadons prematurs

▶Un estudi de la Universitat Internacional de Catalunya i l'ICO assenyala que el percentatge de naixements preterme a Europa és menor en els països que han adoptat mesures per regular el consum de cigarretes als espais públics i a la feina

DdG GIRONA

■ El percentatge de naixements prematurs és més baix en els països europeus que han adoptat mesures de control del tabac, com ara la regulació del consum als llocs de feina o espais públics. Aquesta és la principal conclusió d'un estudi liderat per la Universitat Internacional de Catalunya juntament amb investigadors de l'Institut Català d'Oncologia (ICO) i l'Institut de Salut Carlos III de Madrid. El treball publicat a la revista *Environmental Research* mostra una correlació inversa entre el control del tabac els naixements prematurs. Així, analitzant els països europeus, s'observa que com més grans són les mesures de control del tabaquisme, menors són les taxes de prematuritat.

Encara que al llarg de les últimes dècades s'han realitzat importants avenços en aquest àmbit, els naixements prematurs (abans de les 37 setmanes de gestació) són encara la principal causa de mortalitat infantil fins i tot als països més desenvolupats.

Així mateix, el consum de tabac o l'exposició passiva a aquest durant l'embaràs té nombrosos efectes negatius que influeixen en el desenvolupament del fetus, i en el seu naixement abans d'hora.

La recerca és pionera a mostrar l'impacte positiu de les lleis antitabac sobre la salut perinatal

Partint d'aquestes premisses, els investigadors han realitzat un estudi pioner a Europa, que avalua la correlació entre les mesures de control del tabaquisme implementades en els diferents països de la Unió Europea i el percentatge de naixements prematurs i amb baix pes.

En paraules del doctor José M. Martínez-Sánchez, responsable del Grup d'investigació d'avaluació de determinants de salut i polítiques sanitàries de UIC Barcelona, «el nostre estudi mostra que aquells països que tenen major implementació de les mesures de control del tabaquisme presenten un percentatge més baix de naixements prematurs. En aquest sentit, hem pogut observar que les mesures de control del tabaquisme també han tingut un impacte en indicadors perinatals».


Els especialistes recomanen reforçar les polítiques contra el tabac. UIC

Els resultats del treball mostren l'impacte positiu que tenen les polítiques per regular el consum de tabac sobre la disminució de naixements prematurs i amb baix pes.

Per aquest motiu, els autors de la investigació aconsellen seguir treballant en el control de l'epidèmia del tabac reforçant la implementació de polítiques de control del tabaquisme, afavorint així el bon desenvolupament dels embarassos, millorant la salut de les dones gestants i repercutint positivament en el sistema sanitari públic.

Anexo 6: Recortes de prensa derivados del artículo "*Smoke-free homes and attitudes towards banning smoking in vehicles carrying children in Spain (2016)*"

TABACO

El 90% de los españoles, a favor de prohibir el consumo de tabaco en coches cuando se viaja con niños

Los niveles de contaminantes del tabaco en el interior de los coches son muy superiores a los encontrados en otros espacios debido a sus dimensiones.

Europa Press. Madrid Actualizada 27/07/2017 a las 11:53

Etiquetas Salud España Universidad Cataluña Tabaco Investigación Infancia

Con motivo de la operación salida de las vacaciones estivales, la UIC Barcelona ha dado a conocer las principales conclusiones de un estudio sobre la regulación del consumo de tabaco en los coches. | Pixabay

El hogar y el coche son los principales espacios donde debe protegerse a los menores de los efectos nocivos del tabaco. Es una de las conclusiones del **estudio realizado por la Universidad Internacional de Cataluña** y que ha sido publicado en la prestigiosa **revista 'Environmental Research'**. El artículo describe la opinión de la población española sobre la **regulación del consumo de tabaco en coches donde viajan menores**, así como la adopción voluntaria de hogares libres de humo.

Con motivo de la operación salida de las vacaciones estivales, **la Universidad Internacional de Cataluña (UIC Barcelona) ha dado a conocer las principales conclusiones** obtenidas de un estudio elaborado por un equipo de investigadores de la Facultad de Medicina y Ciencias de la Salud, centrado en analizar las actitudes de los españoles sobre la prohibición del consumo de tabaco en coches. El trabajo también recoge la adopción voluntaria de normas por parte de la población española para tener hogares libres de humo. El estudio acaba de ser publicado en la revista 'Environmental Research'.

LO MÁS LEÍDO AHORA

http://www.heraldo.es/noticias/suplementos/salud/2017/07/27/el-los-espanoles-favor-prohibir-consumo-tabaco-coches-cuando-viaja-con-ninos-1188961-1381024.html

Inicio > Actualidad > El 90% de los españoles está a favor de prohibir el consumo...

El 90% de los españoles está a favor de prohibir el consumo de tabaco en coches cuando se viaja con niños

31 julio, 2017

Compartir Me gusta 0 Tweet

Publicado en Médicos y Pacientes

Con motivo de la operación salida de las vacaciones estivales, la Universitat Internacional de Catalunya (UIC Barcelona) ha dado a conocer las principales conclusiones obtenidas de un estudio elaborado por un equipo de investigadores de la Facultad de Medicina y Ciencias de la Salud, centrado en analizar las actitudes de los españoles sobre la prohibición del consumo de tabaco en coches. El trabajo también recoge la adopción voluntaria de normas por parte de la población española para tener hogares libres de humo. El estudio acaba de ser publicado en la revista Environmental Research. Aunque la legislación española prohíbe fumar en espacios públicos y centros de trabajo cerrados, áreas comunes y zonas abiertas destinadas a uso infantil, deja desprotegidos los espacios privados como los hogares y el interior de los vehículos. Se trata de dos zonas donde los menores de edad pasan gran parte de su tiempo, convirtiéndose así en potenciales fumadores pasivos.

http://isanidad.com/94744/el-90-de-los-espanoles-esta-a-favor-de-prohibir-el-consumo-de-tabaco-en-coches-cuando-se-viaja-con-ninos/

farmaventas

28 Jul
2017

El 90% de los españoles está a favor de prohibir el consumo de tabaco en coches cuando se viaja con niños

Es una de las conclusiones del estudio realizado por la Universitat Internacional de Catalunya y que ha sido publicado en la prestigiosa revista 'Environmental Research'. El artículo describe la opinión de la población española sobre la regulación del consumo de tabaco en coches donde viajan menores, así como la adopción voluntaria de hogares libres de humo.

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Aunque la legislación española prohíbe fumar en espacios públicos y centros de trabajo cerrados, áreas comunes y zonas abiertas destinadas a uso infantil, deja desprotegidos los espacios privados como los hogares y el interior de los vehículos. Se trata de dos zonas donde los menores de edad pasan gran parte de su tiempo, convirtiéndose así en potenciales fumadores pasivos.

Según revela el estudio liderado por el profesor José M. Martínez-Sánchez, responsable del grupo de investigación de evaluación de determinantes de salud y políticas sanitarias de UIC Barcelona, "los resultados nos muestran que la población española es consciente de las consecuencias nocivas que tiene el tabaco sobre la salud de los fumadores pasivos, especialmente entre los menores. Esto se traduce en el hecho de que alrededor del 90% de los adultos españoles están a favor de prohibir el consumo de tabaco en coches cuando se viaja con menores, y más del 80% de los españoles aplica algún tipo de regulación voluntaria del tabaco en sus hogares".

http://www.farmaventas.es/noticias-del-sector/otras-noticias/6507-el-90-de-los-espanoles-esta-a-favor-de-prohibir-el-consumo-de-tabaco-en-coches-cuando-se-viaja-con-ninos.html europa press

europapress / comunicados / comunicados sociedad

COMUNICADO: El 90% de los españoles está a favor de prohibir el consumo de tabaco en coches cuando se viaja con niños

Publicado 27/07/2017 10:42:56 CET

El hogar y el coche son los principales espacios donde debe protegerse a los menores de los efectos nocivos del tabaco.

Es una de las conclusiones del estudio realizado por la Universitat Internacional de Catalunya y que ha sido publicado en la prestigiosa revista 'Environmental Research'.

El artículo describe la opinión de la población española sobre la regulación del consumo de tabaco en coches donde viajan menores, así como la adopción voluntaria de hogares libres de humo.

Barcelona, 27 de julio de 2017.- Con motivo de la operación salida de las vacaciones estivales, la Universitat Internacional de Catalunya (UIC Barcelona) ha dado a conocer las principales conclusiones obtenidas de un estudio elaborado por un equipo de investigadores de la Facultad de Medicina y Ciencias de la Salud, centrado en analizar las actitudes de los españoles sobre la prohibición del consumo de tabaco en coches. El trabajo también recoge la adopción voluntaria de normas por parte de la población española para tener hogares libres de humo. El estudio acaba de ser publicado en la revista de primer cuartil Environmental Research.

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http://www.europapress.es/comunicados/sociedad-00909/noticia-comunicado-90-espanoles-favor-prohibir-consumo-tabaco-coches-cuando-viaja-ninos-20170727104256.html

El 90% de los españoles a favor de prohibir fumar en los coches cuando viajan niños

27/07/2017 - 12:10

MADRID, 27 (SERVIMEDIA)

El 90% de los españoles está a favor de prohibir el consumo de tabaco en los coches cuando se viaja con niños, según el estudio realizado por la Universitat Internacional de Catalunya (UIC Barcelona), dado a conocer este jueves y publicado en la revista 'Environmental Research'.

El estudio ha sido elaborado por un equipo de investigadores de la Facultad de Medicina y Ciencias de la Salud y está centrado en analizar las actitudes de los españoles sobre la prohibición del consumo de tabaco en coches.

Según destacó este estudio, aunque la legislación española prohíbe fumar en espacios públicos y centros de trabajo cerrados, áreas comunes y zonas abiertas destinadas a uso infantil, deja desprotegidos los espacios privados como los hogares y el interior de los vehículos. Se trata de dos zonas donde los menores de edad pasan gran parte de su tiempo, convirtiéndose así en potenciales fumadores pasivos.

El profesor José M. Martínez-Sánchez, responsable del grupo de investigación de evaluación de determinantes de salud y políticas sanitarias de UIC Barcelona, "los resultados nos muestran que la población española es consciente de las consecuencias nocivas que tiene el tabaco sobre la salud de los fumadores pasivos, especialmente entre los menores. Esto se traduce en el hecho de que alrededor del 90% de los adultos españoles están a favor de prohibir el consumo de tabaco en coches cuando se viaja con menores, y más del 80% de los españoles aplica algún tipo de regulación voluntaria del tabaco en sus hogares.".

http://ecodiario.eleconomista.es/sociedad/noticias/8523154/07/17/El-90-de-los-espanoles-a-favor-de-prohibir-fumar-en-los-coches-cuando-viajan-ninos.html

JANO.es
MEDICINA Y HUMANIDADES

Últimas noticias

PUBLICADO EN 'ENVIRONMENTAL RESEARCH'

El 90% de los españoles aboga por la prohibición del tabaco en vehículos privados cuando se viaja con niños

JANO.es · 27 julio 2017 11:59

El dato corresponde a un estudio de la Universitat Internacional de Catalunya que muestra, asimiso, que más del 80% de los españoles aplica algún tipo de regulación voluntaria en sus hogares.

La Universitat Internacional de Catalunya (UIC Barcelona) ha dado a conocer las principales conclusiones de un estudio elaborado por un equipo de investigadores de la Facultad de Medicina y Ciencias de la Salud, centrado en analizar las actitudes de los españoles sobre la prohibición del consumo de tabaco en coches. El trabajo también recoge la adopción voluntaria de normas por parte de la población española para tener hogares libres de humo. El trabajo se publica en *Environmental Research*. Aunque la legislación española prohíbe fumar en espacios públicos y centros de trabajo cerrados, áreas comunes y zonas abiertas destinadas a uso infantil, deja desprotegidos los hogares y el interior de los vehículos.

Según revela el estudio, liderado por el profesor José M. Martínez-Sánchez, responsable del grupo de investigación de evaluación de determinantes de salud y políticas sanitarias de UIC Barcelona, "la población española es consciente de las consecuencias nocivas que tiene el tabaco sobre la salud de los fumadores pasivos, especialmente entre los menores. Esto se traduce en el hecho de que alrededor del 90% de los adultos españoles están a favor de prohibir el consumo de tabaco en coches cuando se viaja con menores, y más del 80% de los españoles aplica algún tipo de regulación voluntaria del tabaco en sus hogares".

Los niveles de contaminantes del tabaco en el interior de los coches son muy superiores a los encontrados en otros espacios donde hay fumadores, debido a sus reducidas dimensiones. Además, los coches y hogares son las principales fuentes de exposición al tabaco entre la población infantil que es muchos más vulnerable a los efectos nocivos de la exposición pasiva al tabaco. En este sentido, el estudio muestra que un porcentaje importante de la población, sea fumadora o no, está a favor de regular el consumo de tabaco en los automóviles donde viajen niños.

http://www.jano.es/noticia-el-90-los-espanoles-aboga-28074

TABAQUISMO

EL 90% DE LOS ESPAÑOLES A FAVOR DE PROHIBIR FUMAR EN LOS COCHES CUANDO VIAJAN NIÑOS

MADRID| 27/07/2017 - 12:10

Etiquetas Universitat Internacional de Catalunya, Tabaquismo, Legislación, Investigación Médica, Política De Atención De Salud.

El 90% de los españoles está a favor de prohibir el consumo de tabaco en los coches cuando se viaja con niños, según el estudio realizado por la Universitat Internacional de Catalunya (UIC Barcelona), dado a conocer este jueves y publicado en la revista 'Environmental Research'.El estudio ha sido elaborado por un equipo de investigadores de la Facultad de Medicina y Ciencias de la Salud y está centrado en analizar las actitudes de los españoles sobre la prohibición del consumo de tabaco en coches. Según destacó este estudio, aunque la legislación española prohíbe fumar en espacios públicos y centros de trabajo cerrados, áreas comunes y zonas abiertas destinadas a uso infantil, deja desprotegidos los espacios privados como los hogares y el interior de los vehículos. Se trata de dos zonas donde los menores de edad pasan gran parte de su tiempo, convirtiéndose así en potenciales fumadores pasivos. El profesor José M. Martínez-Sánchez, responsable del grupo de investigación de evaluación de determinantes de salud y políticas sanitarias de UIC Barcelona, "los resultados nos muestran que la población española es consciente de las consecuencias nocivas que tiene el tabaco sobre la salud de los fumadores pasivos, especialmente entre los menores. Esto se traduce en el hecho de que alrededor del 90% de los adultos españoles están a favor de prohibir el consumo de tabaco en coches cuando se viaja con menores, y más del 80% de los españoles aplica algún tipo de regulación voluntaria del tabaco en sus hogares.". Cabe destacar que los niveles de contaminantes del tabaco en el interior de los coches son muy superiores a los encontrados en otros espacios donde hay fumadores, debido a sus reducidas dimensiones. Además, los coches y hogares son las principales fuentes de exposición al tabaco entre la población infantil que es muchos más vulnerable a los efectos nocivos de la exposición pasiva al tabaco. En este sentido, el estudio muestra que un porcentaje importante de la población, sea fumadora o no, está a favor de regular el consumo de tabaco en los automóviles donde viajen niños. Además, hay que recordar que el consumo de tabaco mientras se conduce es una fuente de distracción que aumenta el riesgo de accidentes de tráfico.

Noticias

Sociedad

27/07/2017 13:58

El 90% de los españoles a favor de prohibir fumar en los coches cuando viajan niños

Compartir Twittear Linkedin

El 90% de los españoles está a favor de prohibir el consumo de tabaco en los coches cuando se viaja con niños, según el estudio realizado por la Universitat Internacional de Catalunya (UIC Barcelona), dado a conocer este jueves y publicado en la revista 'Environmental Research'.

http://www.servimedia.es/Noticias/Detalle.aspx?n=712709&s=23

EL 90% DE LOS ESPAÑOLES A FAVOR DE PROHIBIR FUMAR EN LOS COCHES CUANDO VIAJAN NIÑOS

27/07/2017 - www.teinteresa.es, MADRID

El 90% de los españoles está a favor de prohibir el consumo de tabaco en los coches cuando se viaja con niños, según el estudio realizado por la Universitat Internacional de Catalunya (UIC Barcelona), dado a conocer este jueves y publicado en la revista 'Environmental Research'.

El estudio ha sido elaborado por un equipo de investigadores de la Facultad de Medicina y Ciencias de la Salud y está centrado en analizar las actitudes de los españoles sobre la prohibición del consumo de tabaco en coches.

Según destacó este estudio, aunque la legislación española prohíbe fumar en espacios públicos y centros de trabajo cerrados, áreas comunes y zonas abiertas destinadas a uso infantil, deja desprotegidos los espacios privados como los hogares y el interior de los vehículos. Se trata de dos zonas donde los menores de edad pasan gran parte de su tiempo, convirtiéndose así en potenciales fumadores pasivos.

http://www.teinteresa.es/espana/ESPANOLES-PROHIBIR-COCHES-VIAJAN-NINOS_0_1840016359.html

La Voz de Almería

PAÍS: España
PÁGINAS: 43
TARIFA: 389 €
ÁREA: 132 CM² - 15%

FRECUENCIA: Diario
O.J.D.: 4919
E.G.M.: 62000
SECCIÓN: VIVIR

6 Agosto, 2017

Tabaco

El 90% de los españoles está a favor de prohibir el consumo de tabaco en coches cuando se viaja con niños

● Con motivo de la operación salida de las vacaciones estivales, la Universitat Internacional de Catalunya (UIC Barcelona) ha dado a conocer las principales conclusiones obtenidas de un estudio elaborado por un equipo de investigadores de la Facultad de Medicina y Ciencias de la Salud, centrado en analizar las actitudes de los españoles sobre la prohibición del consumo de tabaco en coches.

Aunque la legislación española prohíbe fumar en espacios públicos y centros de trabajo cerrados, áreas comunes y zonas abiertas destinadas a uso infantil, deja desprotegidos los espacios privados como los hogares y el interior de los vehículos. Se trata de dos zonas donde los menores de edad pasan gran parte de su tiempo, convirtiéndose así en potenciales fumadores pasivos.

Según revela el estudio liderado por el profesor José M. Martínez-Sánchez, "los resultados nos muestran que la población española es consciente de las consecuencias nocivas que tiene el tabaco sobre la salud de los fumadores pasivos, especialmente entre los menores. Esto se traduce en el hecho de que alrededor del 90% de los adultos españoles están a favor de prohibir el consumo de tabaco en coches cuando se viaja con menores, y más del 80% de los españoles aplica algún tipo de regulación voluntaria del tabaco en sus hogares.".

Cabe destacar que los niveles de contaminantes del tabaco en el interior de los coches son muy superiores a los encontrados en otros espacios donde hay fumadores.

ANEXO 7: Difusión de los artículos en congresos científicos

En Junio de 2017 fue defendida por la doctoranda la comunicación oral con el título: "*Influence of tobacco control policies on preterm births and low birth weight in Europe*" que mostraba los resultados correspondientes al primer artículo de la tesis en el 8th Europaediatrics Congress en Rumania (Anexo 7.1.).

Disponible en:

Díez-Izquierdo A, Balaguer A, Lidón-Moyano C*, et al.* OC-46 Influence of tobacco control policies on preterm births and low birth weight in Europe. *Archives of Disease in Childhood* 2017;102:A17. DOI: 10.1136/archdischild-2017-313273.46

En Junio de 2017 fue defendida por la doctoranda la comunicación oral con el título: "*Voluntary Adoption of Smoke-free homes and attitudes towards extending the ban in vehicles carrying children in Spain (2016*)" que mostraba los resultados correspondientes al segundo artículo de la tesis en el 8th Europaediatrics Congress en Rumania (Anexo 7.2.).

Disponible en:

Díez-Izquierdo A, Lidón-Moyano C, Martín-Sánchez JC*, et al.* OC-12 Voluntary adoption of smoke-free homes and attitudes towards extending the ban in vehicles carrying children in spain (2016). *Archives of Disease in Childhood* 2017;102:A5. DOI: 10.1136/archdischild-2017-313273.12

En Junio de 2018 fue defendida por la doctoranda la comunicación libre presentada en formato poster con defensa en la sección de Neumología pediátrica del 66 Congreso de la Asociación Española de Pediatría (AEPED) celebrado en Zaragoza, correspondiente a los resultadfos del tercer artículo de la tesis con titulada: "Exposición pasiva al tabaco en el hogar en niños menores de 3 años en España"(Anexo 7.3.) .

En Junio de 2018 fue defendida por la doctoranda la comunicación libre presentada en formato oral en la sección de Neumología pediátrica del 66 Congreso de la AEPED celebrado en Zaragoza, mostrando los resultados del quinto artículo de la tesis con titulada: "¿Qué Es El Humo De Tercera Mano? Conocimientos y Percepciones En Los Padres"(Anexo 7.5.).

Esta comunicación fue ganadora del Premio Mención Especial Mejores Comunicaciones del 66 Congreso de la AEPED.

En septiembre de 2018 fue defendida por la doctoranda la comunicación presentada en formato oral en el Congreso Internacional de la European Respiratory Society (ERS) celebrado en Paris del 15 al 19 de septiembre, correspondiente al cuarto artículo de la tesis con el título "*Update the evidence about thirdhand smoke: a systematic review*" OA3807 (Anexo 7.5.).

<u>ANEXO 7.1</u>. *Influence of Tobacco Control Policies on preterm births and low birth weight in Europe*

8th Europaediatrics Congress. Rumanía

Influence of Tobacco Control policies on preterm births and low birth weight in Europe

Ana Díez-Izquierdo
Albert Balaguer
Cristina Lidón-Moyano
Juan Carlos Martín-Sánchez
Iñaki Galán
Esteve Fernández
Jose M Martínez-Sánchez

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8th Europaediatrics Congress
jointly held with
The 13 National Congress of Romanian Pediatrics Society

Declaration of conflict of interest

I have no commercial disclosure

Introduction

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Preterm birth → ↑ morbidity & mortality

SHS→ Carcinogen type I (IARC)

Active smoking during pregnancy →

effects on placenta and fetal growth

complications such as:
- *preterm labour,*
- *intrauterine growth restriction,*
- *LBW...*

Active smoking during pregnancy ↔ ↑preterm births ↔ dose-response

SHS during pregnancy →↑ LBW & preterm

Introduction (2)

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↑ % Countries → Tobacco control legislation

Smoking bans at **work** and **public places**

Benefits of such laws on the health of **adult** population

↓ studies on **children**

Legislative smoking bans for reducing harms from secondhand smoke exposure, smoking prevalence and tobacco consumption (Review)

Cochrane Library

Cochrane Database of Systematic Reviews

Frazer K, Callinan JE, McHugh J, van Baarsel S, Clarke A, Doherty K, Kelleher C

Objective

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To assess the **correlation** between **Tobacco Control Policies** and the prevalence of **preterm births** and **low birth weight** in the E.U.

¿Correlated?

Methods

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Ecological study → **country** (unit of analysis)

Variables: Tobacco control policies, Gestational Age, Birth Weight

Data obtained → *3 ≠ sources.*

Tobacco control policies →

Tobacco Control Scale – 2010 &2013

Prevalence of preterms & LBW →

2010 – *EPHR* **25** countries

2013 & 2014 – *Eurostat* **12** countries

Results (1)

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Correlation TCS & Prevalence of preterm

	TCS from 2010 and data of prevalence from 2010*		TCS from 2013 and data of prevalence from 2013*		TCS from 2013 and data of prevalence from 2014**	
Terms of birth	**TCS**	**Public place bans**	**TCS**	**Public place bans**	**TCS**	**Public place bans**
<37 weeks	-0.460 (-0.732; -0.013)	-0.499 (-0.742; -0.124)	-0.313 (-0.852; 0.376)	-0.629 (-0.951; -0.074)	-0.189 (-0.743; 0.518)	-0.547 (-0.909; 0.018)
p-value	**0.024**	**0.013**	0.322	**0.028**	0.555	0.065
<32 weeks	-0.325 (-0.680; 0.106)	-0.316 (-0.685; 0.156)	-0.466 (-0.882; 0.208)	-0.690 (-0.943; -0.185)	-0.392 (-0.755; 0.344)	-0.626 (-0.872; -0.153)
p-value	0.121	0.133	0.126	**0.013**	0.207	**0.029**
< 28 weeks	-	-	-0.112 (-0.693; 0.486)	-0.003 (-0.700; 0.578)	-0.528 (-0.930; 0.096)	-0.162 (-0.769; 0.454)
p-value	-	-	0.728	0.991	0.077	0.614

*rsp: Spearman Rank-correlation coefficients *25 countries ** 12 countries*

Results (2) Correlation TCS & Prevalence of LBW

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	TCS from 2010 and data of prevalence from 2010*		TCS from 2013 and data of prevalence from 2013**		TCS from 2013 and data of prevalence from 2014**	
Birth weight	TCS	Public place bans	TCS	Public place bans	TCS	Public place bans
<2,500g	-0.325	-0.392	-0.151	-0.323	-0.056	-0.253
p-value	*0.113*	***0.052***	*0.640*	*0.306*	*0.862*	*0.428*
<2,000g	-	-	-0.340	-0.488	-0.285	-0.351
p-value	*-*	*-*	*0.279*	*0.108*	*0.370*	*0.263*
<1,500g	-0.306	-0.269	-0.298	-0.407	-0.273	-0.361
p-value	*0.137*	*0.193*	*0.346*	*0.189*	*0.391*	*0.249*
< 1,000g	-	-	-0.167	-0.206	-0.301	-0.167
p-value	*-*	*-*	*0.603*	*0.521*	*0.341*	*0.603*

*rsp: Spearman Rank-correlation coefficients *25 countries ** 12 countries*

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Weak points

- **Ecological** design

- Study design: **confounders**

i.e: age of the mother, socieconomic status, reproductive technology, socieconomic level of the country

- Data from 2013 & 2014 – **limited countries** (Eurostat)
  → ↓ ***Results***

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To sum up…

1st study → Pediatric Outcome → Europe

*previous studies – single country**

Results

→ **Consistent** with previous individual studies

*Mackay 2012, Fantuzzi 2007, Crane 2011, Jaakkola 2001, Cox 2013, Been 2014,Vicedo-Cabrera 2016, El- Mohandes 2010, Bharadwaj 2012.

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Conclusions

The implementation of **tobacco control policies** are inversely **related** with **perinatal outcomes** *(preterm births)* - **At ecological level**

- Preterm births *(< 37 w &< 32 w)* → ↓ with a ↑ TCS → public places smoking bans

*Cox 2013**

- Negative **correlation**: TCS & LBW →**p>0.05**

*Bharadwaj 2012** & Mackay 2012****

*Cox B, Martens E, Nemery B, Vangronsveld J, Nawrot TS et al. Impact of a stepwise introduction of smoke-free legislation on the rate of preterm births: analysis of routinely collected birth data. *BMJ*. 2013;346:f441.
**Bharadwaj P, Johnsen J, Løken K. Smoking bans, maternal smoking and birth outcomes. *IZA Discuss Pap* No 7006. 2012;(7006):1–21
***Mackay DF, Nelson SM, Haw SJ, et al. Impact of scotland's smoke-free legislation on pregnancy complications: Retrospective cohort study. PLoS Med. 2012;9(3),e1001175.

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Conclusions (2)

The level of **smoke-free legislation** (European Countries)
is **correlated**
↓ in prevalence of **preterms** *(ecological level)*

Thanks for your attention

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<u>ANEXO 7.2</u>. *Voluntary adoption of Smoke Free Homes & attitudes towards. Extending the ban in vehicles carrying children in Spain (2016)*

8th Europaediatrics Congress. Rumanía

VOLUNTARY ADOPTION of Smoke Free Homes & attitudes towards extending the ban in VEHICLES carrying CHILDREN IN SPAIN (2016)

Ana Díez-Izquierdo*,**
Cristina Lidón-Moyano*
Juan Carlos Martín-Sánchez*
Nuria Matilla-Santander*
Pia Cassanello-Peñarroya*,**
Albert Balaguer*,**
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Introduction

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- SHS → Harmful consequences → **non**-smokers exposed.
- **Children**

More vulnerable → *developing immune system*
faster breathing rate
inability to avoid the source.

SHS:
↑ Risk of sudden infant death syndrome
↑ Respiratory diseases
↑ Otitis media

Introduction (2): SHS & Law

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- **No** safe level of SHS exposure
  - ↑ *Governments implemented laws to protect non-smokers→ indoor workplaces and public places.*

- *Anti-smoking legislation →*

↓ **children's SHS exposure**
↑ **% smoke-free homes**

↑ Impact in paediatrics:
↓ *hospital admission asthma-related*
↓ *rate of preterm births*

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Introduction (3)

Many children are still **exposed**

Specially → homes and cars



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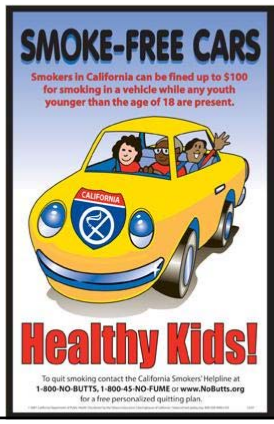
Objective:

- To describe the prevalence of **voluntary adoption of smoke-free homes**

&

- **The social attitudes** towards **banning smoking** in **vehicles with children** on board



Methods

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- Cross-sectional study. Adult population (n=1036).
- Conducted in March - April, 2016 - telephone interviews.

Variables:

- ***Smoke free home:***
  → *smoking rules as complete, partial or absent.*
- ***Attitudes towards smoking regulations in common areas of buildings***
- ***Attitudes towards smoking regulations in vehicles***

Results (1) Prevalence of Smoke Free Homes (Spain)

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		Any type of rules (complete and partial)		Complete rules		Partial rules	
	n	%	p-value	%	p-value	%	p-value
Overall	1036	**83.04**	-	45.59	-	37.45	-
Sex			0.362		0.203		0.037
Men	515	81.97		47.67		34.20	
Women	521	84.19		43.53		40.65	
Age group [1]			0.004		0.002		0.048
18-45	547	85.87		46.32		**39.55**	
46-65	367	77.78		40.20		37.58	
66-75	105	**86.14**		58.52		27.61	
Social class*			0.751		0.128		0.077
Educational level*			0.113		0.676		0.552

*low, medium, high **Results adjusted for sex, age, habitants and social class
1: King et al 2013, Mont et al 2013, St Claire et al.2012

Results (2) Prevalence of Smoke Free Home (Spain)

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		Any type of rules (complete and partial)		Complete rules		Partial rules	
	n	%	p-value	%	p-value	%	p-value
Habitants			0.899		0.210		0.128
< 20.000	329	82.33		45.90		36.43	
20.000-250.000	380	83.09		48.51		34.58	
> 250.000	327	83.68		41.89		41.79	
Geographic area			0.158		0.176		0.160
North	327	84.02		49.82		34.21	
Center	494	84.29		43.86		40.42	
South	215	78.66		43.13		35.53	
Tobacco smoking			< 0.001		< 0.001		< 0.001
Current smokers	275	74.99		26.00		**48.99**	
Former smokers	315	81.13		50.31		30.82	
Never-smokers	446	89.35		54.35		35.00	

**Results adjusted for sex, age, habitants and social class

Results (3): Prevalence of supporting regulations to ban smoking in common areas of buildings (Spain)

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	N	%	95% CI	p-value	ORc	ORa
Overall	1045	**85.71**	83.39 – 87.75	-	-	-
Sex				0.721		
Age group				0.458		
Social class				0.133		
Educational level				**0.003**		
Low	317	80.27	75.37 – 84.42		ref.	ref.
Medium	374	87.02	83.09 – 90.02		1.80	1.94
High	344	**89.28**	85.40 – 92.24		1.92	1.96
Habitants				0.157		
Zone				0.073		
Tobacco smoking				**0.023**		
Current smokers	275	81.01	75.77 – 85.37		ref.	ref.
Former smokers	315	86.30	81.89 – 89.80		1.46	1.37
Never-smokers	446	**88.18**	84.73 – 90.96		1.80	1.82

*low, medium, high

Results (4): In favor of regulating smoking in vehicles +/- children

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		In cars with children						In all cars (with or without children)				
	n	%	95% CI	p-value	ORc	ORa		%	95% CI	p-value	ORc	ORa
Overall	1045	**90.09**	88.07 – 91.81	-	-	-		**61.63**	58.59 – 64.59	-	-	-
Sex				0.702						0.197		
Age group				0.269						**<0.001**		
18-45	547	89.15	86.17 – 91.57		ref.	ref.		54.50	50.22 – 58.72		ref.	ref.
46-65	367	90.55	86.97 – 93.25		1.29	1.31		65.50	60.36 – 70.31		1.75	1.74
66-75	105	92.91	86.43 – 96.56		1.77	1.98		**81.93**	73.71 – 88.08		3.93	4.06
Social class*				0.161						0.798		
Educational level*				0.062						0.162		
Habitants				0.907						0.596		
Zone				0.073						0.154		
Tobacco smoking				**0.017**						**<0.001**		
Current smokers	275	85.53	80.69 – 89.36		ref.	ref.		46.02	40.04 – 52.10		ref.	ref.
Former smokers	315	91.43	87.64 – 94.18		1.79	1.65		61.44	55.79 – 66.79		1.84	1.58
Never-smokers	446	**91.95**	88.93 – 94.23		1.91	1.90		**71.41**	66.93 – 75.52		2.91	2.90

*low, medium, high

Main Results

Europaediatrics Congress
jointly held with
The 13 National Congress of Romanian Pediatrics Society

83 % → **Smoke-free rule at home**

45.59% complete ban & 37.45 % partial ban

with p<0.05 → age group & tobacco smoking

In Spain, ±% of **smoke –free rules at home** such as previous data (US) 1

85.71 % → in favor of **banning** smoking in **common areas of buildings**

with p<0.05 → educational level& tobacco smoking

61.63 % → in favor of **regulating** smoking in *vehicles (±children)*

with p<0.05 → age group & tobacco smoking

90.03 % → in favor of **regulating** smoking in *vehicles* (*+children*)

with p<0.05 by age group and tobacco smoking

% in favour of **regulating smoking in vehicles** with children were similar to those in US, Canada, UK **implementing the ban 2.**

1 King, B. a, Dube, S.R. & Homa, D.M., 2013. Smoke-free rules and secondhand smoke exposure in homes and vehicles among US adults, 2009-2010. Preventing chronic disease, 10 (December 2012)

2 Hitchman, S.C. et al., 2011. Support and correlates of support for banning smoking in cars with children: Findings from the ITC Four Country Survey. European Journal of Public Health, 21(3), pp.360–365.

8th Europaediatrics Congress
jointly held with
The 13 National Congress of Romanian Pediatrics Society

Conclusions

- Spanish **population** → ↑**supports** regulating **smoking in vehicles carrying children**.
- ↑% of **homes** have **voluntarily** implemented **smoking restrictions**.
- Governments should prioritise the *creation of smoke-free policies*
    - *To protect children*
- ↑ **studies** are needed → **economic** and **public health impact**.

8th Europaediatrics Congress
jointly held with
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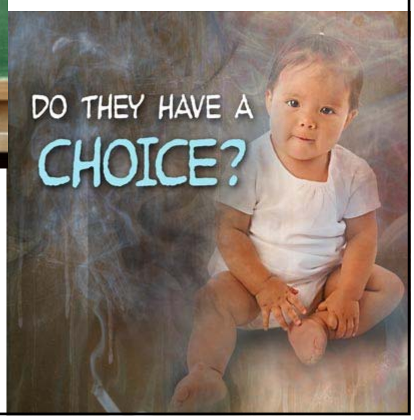
Thanks for your attention



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ANEXO 7.3. Exposición pasiva al Tabaco en el hogar en España en niños menores de 3 años en España

66 Congreso de la AEPED. Zaragoza

66 Congreso AEP Zaragoza
7, 8 y 9 de junio 2018

ANEXO 7

Exposición pasiva al tabaco en el hogar en niños menores de 3 años en España

Ana Díez Izquierdo [1,2], Maria Pia Cassanello Peñarroya [1,2], Irene Ruiz Botia [1,2], Nuria Gorina Ysern[1], Jose M Martinez Sánchez[2], Albert Balaguer Santamaria [1,2]

1 Hospital Universitari General de Catalunya
2 UIC barcelona

Introducción:

Los **efectos de la exposición pasiva al tabaco** → >90 años → ↑ **morbimortalidad.**

La **población pediatrica** → Características propias:
↑ **Frecuencia respiratoria,** Sistema inmune en desarrollo, **incapacidad** para **evitar la fuente.**

La exposición pasiva al tabaco → ↑ de enf. respiratorias, **alteraciones en el crecimiento** y desarrollo pulmonar, ↑ del riesgo, OMA, **muerte súbita**, **prematuridad** o **RCIU.**

No hay nivel **libre de riesgo** → **Políticas antitabaco** → ↑**salud población (pediatría).** ↓ **crisis asmáticas** y RNPT

En España: Ley 42/2010 → ↓ **RNPT** y **ingresos** 2ª crisis **asma**.

Hogares→ remanentes de la exposición pasiva → ↑pediatría.

Legislación antitabaco → **≠ desplazado el consumo** a los hogares → ↑ **Hogares libres de humo** + ↑**abandono del tabaco**

Objetivo: evaluar y describir la **prevalencia de hogares libres de humo** (con regulación total o parcial) y la **prevalencia de exposición pasiva en niños** (<3 años) en hogares y en otros ambientes en España.

Métodos:

- Estudio transversal. Marzo-noviembre 2017.
- 1406 padres ± cuidadores de niños de 3 a 36 meses.
  (1112 de Cataluña,168 ≠CA y 128 no info. de CA)

- Reclutados: voluntariamente→ medios digitales y papeletas distribuidas CCEE HUGC
Estudio **EpiSon** *"Estudi sobre l'epidemiologia del son"*→ cuestionarios en línea.

Recogida de información
- Hábito tabáquico del encuestado
- Exposición pasiva del niño
- Normas de consumo de tabaco en el hogar

Se calcularon los **porcentajes de las respuestas** y la **ORa** con IC al 95% para el sexo, la edad, el nivel educativo y el tabaquismo de los encuestados → Reg**resión logística**.

Resultados:

HOGARES LIBRES DE HUMO con niños de 3 a 36 meses:

		Regulación total			Regulación parcial o sin regulación		
	n	%	p-valor	OR*	%	p-valor	OR*
Total	1406	85,06%			12,02%		
Sexo del niño			0,448			0,714	
masculino	726	84,29%		1	12,40%		1
femenino	680	85,88%		1,10	11,62%		0,91
Edad del niño			0,694			0,904	
<1 año	368	86,41%		1	11,41%		1
De 1 a 2 años	984	84,55%		0,95	12,20%		1,05
Más de 2 años	54	85,19%		0,70	12,96%		1,43
Hermanos/as			0,759			0,773	
No	539	85,35%		1	12,43%		1
Si	867	84,60%		1,02	11,76%		0,98
Relación con el encuestado			0,006			0,109	
madre	1326	**84,92%**		1	12,44%		1
padre	72	**91,67%**		3,09	4,17%		0,32
otra	8	**50,00%**		0,50	12,50%		1,99
Consumo de Tabaco			<0,001			<0,001	
Fumador	252	**73,02%**		1	**25,79%**		1
Exfumador	480	**85,21%**		2,17	**11,67%**		0,46
Nunca fumador	666	**89,94%**		3,71	**7,21%**		0,27
Nivel educativo del encuestado			<0,001			<0,001	
Primaria o <	109	**72,49%**		1	**20,18%**		1
Secundaria	378	**78,31%**		1,04	**18,78%**		0,96
Superiores	896	**89,51%**		2,26	**8,04%**		0,44
Edad del encuestado			0,959			0,548	
< 25	45	86,67%		1	11,11%		1
De 25 a 35	720	85,14%		0,69	12,92%		1,43
> de 35	523	85,09%		0,82	10,90%		1,21

* ajustado por sexo, edad, consumo de tabaco y nivel educativo del encuestado.

EXPOSICIÓN PASIVA AL TABACO en niños de 3 a 36 meses:

		Expuestos en casa			Expuestos en ≠ambientes		
	n	%	p-valor	OR*	%	p-valor	OR*
Total	1406	5,26%			14,22%		
Sexo del niño			0,305			0,787	
masculino	726	5,92%		1	13,91%		1
femenino	680	4,56%		1,35	14,56%		0,984
Edad del niño			0,438			0,160	
<1 año	368	5,98%		1	13,86%		1
De 1 a 2 años	984	5,18%		1,13	14,84%		0,966
> de 2 años	54	1,85%		2,95	5,56%		2,754
Hermanos/as			0,132			0,013	
No	539	6,49%		1	17,25%		1
Si	867	4,50%		1,48	12,34%		1,433
Relación con el encuestado			0,082			0,464	
madre	1326	5,51%		1	14,40%		1
padre	72	0,00%		-	12,50%		1,162
otra	8	12,50%		0,22	0,00%		-
Consumo de Tabaco			0,009			<0,001	
Fumador	252	**9,13%**		1	22,62%		1
Exfumador	480	**5,00%**		1,73	12,92%		1,871
Nunca fumador	666	**4,05%**		2,95	12,02%		1,989
Nivel educativo del encuestado			0,006			0,097	
Primaria o <	109	**9,17%**		1	14,68%		1
Secundaria	378	**7,41%**		1,2	17,46%		0,791
Superiores	896	**3,91%**		2,05	12,83%		0,993
Edad del encuestado			0,007			<0,001	
< 25	45	**15,56%**		1	22,22%		1
De 25 a 35	720	**5,00%**		3,30	16,94%		1,352
> 35 años	523	**4,78%**		3,33	9,75%		2,588

* ajustado por sexo, edad, consumo de tabaco y nivel educatico del encuestado.

España → ↑ de hogares libres de humo.

Factores predictores de exposición pasiva en niños →
- Hábito tabáquico familiar
- Bajo nivel educativo o económico
- Padres < 25a
- Familia monoparental

Legislaciones E.U y algunos países europeos →
-Edificios libres de humo ("smoke-free MUH")
-Prohibición fumar parques o playas o vehículos con niños a bordo

→ Cambios en la aceptabilidad y concienciación social.

Políticas antitabaco → han ↑ hogares libres de humo

Profesionales sanitarios → Papel clave educativo
En 2006→ Encuesta padres de niños asmáticos→ casi 50% convivían con fumador.
<60% niños asmáticos con difícil control ↔ hogares libres de humo
↑ detección en la exposición pasiva ≠ ↑ formación asesorar en el abandono (pediatra).

Limitaciones principales:
-Utilización de encuestas
-Muestra puede no ser representativa de toda la población española

Conclusión

Aunque existe un **85% de hogares libres de humo** en España → **No** es suficiente – **No** existe umbral **mínimo libre de riesgo** para la exposición al tabaco → Estimular creación> **políticas antitabaco** en España **Formación sanitaria**→↑**asesoramiento familias**

<u>ANEXO 7.4</u>. ¿Qué es el Humo de Tercera Mano? Conocimientos y percepciones en los padres

66 Congreso de la AEPED. Zaragoza

66 Congreso AEP Zaragoza
7, 8 y 9 de junio 2018

Asociación Española de Pediatría AEP

¿Qué es el humo de tercera mano? conocimientos y percepciones en los padres

Ana Díez Izquierdo [a,b]
Maria Pia Cassanello Peñarroya [a,b]
Àurea Cartanyà Hueso [a]
Nuria Matilla Santander [a]
Jose M Martinez Sanchez [a]
Albert Balaguer Santamaria [a,b]

[a] UIC barcelona
[b] Hospital Universitari General de Catalunya Grupo quironsalud

66 Congreso AEP Zaragoza
7, 8 y 9 de junio 2018

Declaración de conflicto de interés

No existe ningún potencial **conflicto de interés.**

Introducción- ¿Qué es el **humo de tercera mano**?

66 Congreso AEP Zaragoza
7, 8 y 9 de junio 2018

↑ **Gobiernos** implementado leyes → para **proteger** a los **no fumadores**[1]

Aún hay muchos niños expuestos
Especialmente → Ambientes privados (**Hogares**)

Exposición pasiva al tabaco en pediatría[2]:

↑ Riesgo de muerte súbita
↑ Enfermedades respiratorias
↑ Otitis media aguda

1.Gobierno de España, 2010. Ley 42/2010, de 30 de diciembre, por la que se modifica la Ley 28/2005, de 26 de diciembre, de medidas sanitarias frente al tabaquismo y reguladora de la venta, el suministro, el consumo y la publicidad de los productos del tabaco. *Boletín Oficial Del Estado*, 308, p.31.
2.U.S. Department of Health and Human Services, 2006. The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General. *U.S. Department of Health and Human Services*,, p.709.

Introducción- ¿Qué es el **humo de tercera mano**?

66 Congreso AEP Zaragoza
7, 8 y 9 de junio 2018

Antes de hablarse de **Humo de tercera mano** o "***Thirdhand smoke***"

Otros términos:
"*Aging Secondhand smoke*" o "*Enviromental tobacco exposure*" o Exposición al humo ambiental del Tabaco.

Exposición pasiva al Tabaco ≠ Tabaquismo o Humo de tercera mano

El **Tabaquismo o humo de tercera mano** consiste en los **contaminantes residuales del humo de tabaco** que **permanecen en las superficies y en el polvo después de haber fumado**.
Se pueden **reemitir** en la fase gas o **reaccionar** con oxidantes y otros compuestos en el ambiente para producir contaminantes secundarios[1]

1. Matt, G.E. et al., 2011. Thirdhand tobacco smoke: Emerging evidence and arguments for a multidisciplinary research agenda. *Environmental Health Perspectives*, 119(9), pp.1218–1226. http://dx.doi.org/10.1289/ehp.1103500.

Introducción- ¿Qué es el **humo de tercera mano**?

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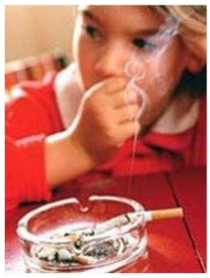
Algunos componentes del HTM ↔ **Reemiten** o **Interaccionan** con ambiente (aire, polvo) ↔ más toxicidad



Ingerir **Absorber** a través de la **piel** **Inhalar**

- **Pediatria** ↔ **Imposibilidad** de evitar la fuente de exposición.
- Características propias de la infancia: ↑ FR, sistema inmune en desarrollo.
  Lactantes: gateo y llevarse cosas a la boca.

Matt, G.E. et al., 2011. Thirdhand tobacco smoke: Emerging evidence and arguments for a multidisciplinary research agenda. *Environmental Health Perspectives*, 119(9), pp.1218–1226..

Introducción- ¿Qué es el **humo de tercera mano**?

66 Congreso AEP Zaragoza 7, 8 y 9 de junio 2018

Beliefs About the Health Effects of "Thirdhand" Smoke and Home Smoking Bans

Jonathan P. Winickoff, MD, MPH[a,b], Joan Friebely, EdD[a], Susanne E. Tanski, MD[b,c], Cheryl Sherrod[a], Georg E. Matt, PhD[d], Melbourne F. Hovell, PhD, MPH[e], Robert C. McMillen, PhD[b,f]

PEDIATRICS
OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

ABSTRACT

OBJECTIVE. There is no safe level of exposure to tobacco smoke. Thirdhand smoke is residual tobacco smoke contamination that remains after the cigarette is extinguished. Children are uniquely susceptible to thirdhand smoke exposure. The objective of this study was to assess health beliefs of adults regarding thirdhand smoke exposure of children and whether smokers and nonsmokers differ in those beliefs. We hypothesized that beliefs about thirdhand smoke would be associated with household smoking bans.

METHODS. Data were collected by a national random-digit-dial telephone survey from September to November 2005. The sample was weighted by race and gender within Census region on the basis of US Census data. The study questions assessed the level of agreement with statements that breathing air in a room today where people smoked yesterday can harm the health of children.

RESULTS. Of 2000 eligible respondents contacted, 1510 (87%) completed surveys, 1478 (97.9%) answered all questions pertinent to this analysis, and 273 (18.9%) were smokers. Overall, 95.4% of nonsmokers versus 84.1% of smokers agreed that secondhand smoke harms the health of children, and 65.2% of nonsmokers versus 43.3% of smokers agreed that thirdhand smoke harms children. Strict rules prohibiting smoking in the home were more prevalent among nonsmokers: 88.4% vs 26.7%. In multivariate logistic regression, after controlling for certain variables, belief that thirdhand smoke harms the health of children remained independently associated with rules prohibiting smoking in the home. Belief that secondhand smoke harms the health of children was not independently associated with rules prohibiting smoking in the home and car.

CONCLUSIONS. This study demonstrates that beliefs about the health effects of thirdhand smoke are independently associated with home smoking bans. Emphasizing that thirdhand smoke harms the health of children may be an important element in encouraging home smoking bans. *Pediatrics* 2009;123:e74–e79

Winickoff, J.P. et al., 2009. Beliefs about the health effects of "thirdhand" smoke and home smoking bans. *Pediatrics*, 123(1), pp.74–79.

Objetivo de nuestro estudio

66 Congreso AEP Zaragoza 7, 8 y 9 de junio 2018

- Describir el **conocimiento** y **percepciones** sobre el **humo de tercera mano** en padres o cuidadores de niños menores de 3 años en España.

Métodos

66 Congreso AEP Zaragoza 7, 8 y 9 de junio 2018

Estudio **Transversal.**
Padres /madres/ cuidadores (n=1.406) con niños de 3 a 36 meses en España
(1.112 de Cataluña, 168 de otras comunidades, 126 sin información de la región)

Datos extraídos del estudio **EpiSon**
- Proyecto sobre la calidad del sueño en los niños
- A través de **cuestionarios online**
- Marzo a noviembre de 2017

Criterios de Inclusión:
Padres o cuidadores con niños de 3 a 36 meses de edad que hablen Español y acepten participar.

Criterios de Exclusión:
Padres o cuidadores con niños de 3 a 36 meses de edad que no hablen Español.

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Métodos

Variables:

- Conocimientos y creencias o percepciones del Humo de tercera mano (HTM):
  "¿Habías oído hablar sobre el "tabaquismo de tercera mano?"

Se proporcionó información escrita con la frase:
"El "tabaquismo de tercera mano" (o humo de tercera mano) es el humo generado por el tabaco que se deposita en forma de residuos en superficies como muebles, tejidos o comida."

- Creencias de los efectos de la exposición del HTM en la salud de los niños:
  "¿Crees que la exposición a este "tabaquismo de tercera mano" puede ser perjudicial para los niños?"

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Resultados

	n	%	p-valor	OR*
Total	**1406**	**26.96**		
Sexo del niño			0.413	
Edad del niño			0.489	
<1 año	368	26.36		1
De 1 a 2 años	984	27.54		1.04
Más de 2 años	54	20.37		0.71
Hermanos			0.226	
Relación con el encuestado			0.520	
madre	1326	27.22		1
padre	72	23.61		0.81
otra	8	12.50		0.69
Consumo de tabaco			**0.001**	
Fumadores	252	35.32		1
Exfumadores	480	22.71		0.56
Nunca fumadores	666	27.03		0.70
Nivel educativo del encuestado			**0.053**	
Primary o inferior	109	34.86		1
Secundaria	378	28.57		0.74
Universidad	896	24.89		0.65
Edad del encuestado			0.168	

Conocimiento sobre el *humo de tercera mano* en **padres** con hijos de 3 a 36 meses

***Ajustado** por sexo, edad, consumo de tabaco, y nivel educativo del encuestado.

Resultados

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	n	%	p-valor	OR*
Total	1406	**85.99%**		
Sexo del niño			0.339	
Edad del niño			0.810	
Hermanos			0.633	
No	539	86.64%		1
Yes	867	85.58%		0.839
Relación con el encuestado			0.091	
madre	1326	86.35%		1
padre	72	81.94%		0.558
otra	8	62.50%		-
Consumo de tabaco			**<0.001**	
Fumadores	252	81.35%		1
Exfumadores	480	82.92%		1.090
Nunca fumadores	666	90.39%		2.642
Nivel educativo del encuestado			0.190	
Edad del encuestado			0.220	
Conocimiento del humo de tercera mano previo			**<0.001**	
No	1014	83.43%		1
Si	379	93.93%		2.087

Creencias o percepciones de que el *humo de tercera mano* es **dañino** para la salud de sus hijos.

***Ajustado** por sexo, edad, consumo de tabaco, y nivel educativo del encuestado.

Resultados

66 Congreso AEP Zaragoza
7, 8 y 9 de junio 2018

	n	%	p-valor	OR*
Total	1406	**85.99%**		
Sexo del niño			0.339	
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***Ajustado** por sexo, edad, consumo de tabaco, y nivel educativo del encuestado.

Limitaciones

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- Derivadas del uso de **encuestas**[1].
- Preguntas **en serie** tras la definición del humo de tercera mano ↔ **sobreestimado** los datos

  Escoffery et al. 2013: *n=39, US,low-income participants, most do not know what THS was* [2].
  Delgado-Rendón et al.2017: n=24; California in 2012, low-income participants, none knew the definition of THS [3].

- **No** se puede interpretar como **intervención educacional**.

1. de Rada, V. D. (2004). Problemas de representatividad en las encuestas con muestreos probabilísticos. *Papers: revista de sociologia*, (74), 45-66.
2.Escoffery C, Bundy L, Carvalho M, Yembra D, Haardörfer R, Berg C, et al. Third-hand smoke as a potential intervention message for promoting smoke-free homes in low-income communities. Health Educ Res. 2013;28(5):923–30.
3. Delgado Rendón A, Unger JB, Cruz T, Soto DW, Baezconde-Garbanati L. Perceptions of Secondhand and Thirdhand Smoke Among Hispanic Residents of Multiunit Housing. J Immigr Minor Heal. 2017;19(1):162–9.

Limitaciones– Características encuestados

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	n	%
Sexo del niño		
Masculino	726	48.36
Femenino	680	51.63
Edad del niño		
< de 1 año	368	*26.17*
Entre 1 y 2 años	984	69.99
Mayor de 2 años	54	3.84
Hermanos		
No	539	38.34
Si	867	61.66
Relación con el niño		
Madre	1326	*94.31*
Padre	72	5.12
Otra	8	0.57
Hábito tabáquico		
Fumadores	252	18.03
Exfumadores	480	34.33
Nunca fumadores	666	47.64
Nivel educativo		
Primaria o inferior	109	7.88
Secundaria	378	27.33
Universidad	896	64.79
Edad del encuestado (madre y padre)		
< de 25 años	44	3.44
Entre 25 y 35 años	719	56.17
> de 35 años	517	40.39

- Muestra **puede no ser representativa** de toda la población española.

Comparado con los últimos datos publicados por el Instituto Nacional de Estadística :

- > madres
- Poco representados < de 1 año y > 2 años
- Pocos fumadores
- > Estudios universitarios

En resumen

- <u>**1er estudio en Europa**</u> → **Conocimientos, creencias y percepciones del HTM** en padres con niños menores de 3 años.
- <u>Casi **3/10 padres** habían oído a hablar</u> previamente del HTM.
- **87% padres** creen que la **exposición al humo de tercera mano** es **perjudicial para sus hijos**.
  Solo existen p <0,05 → según el consumo de tabaco (> nunca fumadores)

Estudios previos → <u>Padres</u> creen que el <u>HTM</u> es <u>dañino</u> para la <u>salud de sus hijos</u>:
US – 91% [1] *Iran – 42,2% [2]*

- ↑ de la <u>solicitud</u> de <u>medios para abandonar el hábito tabáquico</u>
- p< 0,05 ↔ <u>Hogares libres de humo</u>

1.Drehmer, J.E.. et al., 2014. Thirdhand Smoke Beliefs of Parents. *Pediatrics*, 133(4), pp.e850–e856.
2.Baheiraei, A. et al., 2018. Prevalence of Home Smoking Bans and its Determinants in Families with Infants. *International Journal of Pediatrics*, 6(1), pp.6987–6997.

En resumen (2)

En España ↔ Ley 42/2010 → ↑ **regulaciones voluntarias para el consumo de tabaco** en los **hogares** [1]

<u>Algunos países</u> europeos o Estados Unidos ↔ <u>Legislaciones</u> que <u>favorecen edificios libres de humo</u>
"Smoke-free multiunit housing"[2,3]

1. Díez-Izquierdo, et al. (2017). Smoke-free homes and attitudes towards banning smoking in vehicles carrying children in Spain (2016). *Environmental research*, *158*, 590-597.
2.Koster, et al.2013. "Neighbour smoke"--exposure to secondhand smoke in multiunit dwellings in Denmark in 2010: a cross-sectional study. *Tobacco Control*, 22, pp.190–193.
3.Snyder, et al. 2015. Smoke-free multiunit housing: a review of the scientific literature. *Tobacco Control*, (December 2013), p.tobaccocontrol-2014-051849.

Conclusión

66 Congreso AEP Zaragoza 7, 8 y 9 de junio 2018

En la actualidad el **conocimiento sobre el Humo de tercera mano** es **escaso** pero tras conocerlo, la mayoría de los padres cree que es dañino para la salud de sus hijos.

Se deben **promocionar el conocimiento sobre el humo de tercera mano** y facilitar la **implementación de hogares libres de humo.**

Muchas Gracias por su atención

66 Congreso AEP Zaragoza 7, 8 y 9 de junio 2018

Anexo 7.5. ***Update the evidence about thirdhand smoke: a systematic review*.**

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Update the evidence about **thirdhand smoke**: a systematic review

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ERS
INTERNATIONAL CONGRESS 2018
PARIS France, 15-19 September

Declaration of conflict of interest

I have **no** commercial disclosure

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Introduction

No safe level of **tobacco** smoke exposure

Governments → laws → protect non-smokers

Many children are still **exposed**

Specially → homes & cars

Second Hand Smoke (SHS) exposure ≠ Thirdhand smoke (THS)

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Introduction - Thirdhand smoke (THS)

Review 2011

ehp ENVIRONMENTAL HEALTH PERSPECTIVES

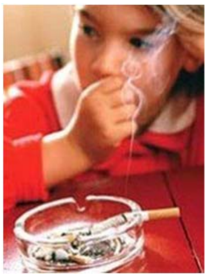
Thirdhand Tobacco Smoke: Emerging Evidence and Arguments for a Multidisciplinary Research Agenda

Georg E. Matt,[1] Penelope J. E. Quintana,[2] Hugo Destaillats,[3] Lara A. Gundel,[3] Mohamad Sleiman,[3] Brett C. Singer,[3] Peyton Jacob III,[4] Neal Benowitz,[4] Jonathan P. Winickoff,[5] Virender Rehan,[6] Prue Talbot,[7] Suzaynn Schick,[4] Jonathan Samet,[8] Yinsheng Wang,[9] Bo Hang,[10] Manuela Martins-Green,[11] James F. Pankow,[12] and Melbourne F. Hovell[2]

"THS consists of residual tobacco smoke pollutants that remain on surfaces and in dust after tobacco has been smoked, are re-emitted into the gas phase, or react with oxidants and other compounds in the environment to yield secondary pollutants"

Introduction- ¿What is Thirdhand smoke?

Some components of THS ↔ Re-*emitted* o **React with oxidants** ↔ ↑ Toxicity

Ingested

Inhaled

Absorbed through the skin

Thirdhand smoke exposure

- *Specific **health implications** are **not well understood**.*

  Contains mutagenic and carcinogenic substances

  Detrimental effect in asthma exacerbations

- ***Children***

  ↑ Time in private setting *(more sensitive)*

  Special Characteristics : ↑ *respiratory rate, developing of respiratory and immune systems*

  Infants: *hand-to-mouth ingesting, crawling, sucking.*

Thirdhand smoke

↑ ***studies** carried out in **recent years***

2 Recent authors reviews:

→ *Chemical changes and C of THS components*

Jacob, P. et al., 2017. *Chemical research in toxicology*.

→ *Showed the effect of THS in cells & animals*

Hang, B. et al., 2017. *International Journal of Molecular Sciences*.

***No** systematic review has been conducted to evaluate **all available published scientific** literature **on THS**.*

Objective

To perform a **comprehensive systematic review** about THS

Methods

PRISMA TRANSPARENT REPORTING OF SYSTEMATIC REVIEWS AND META-ANALYSES

Study protocol: PROSPERO CRD42018083619

Search strategy: *Databases searched*

Updated **April 2018**

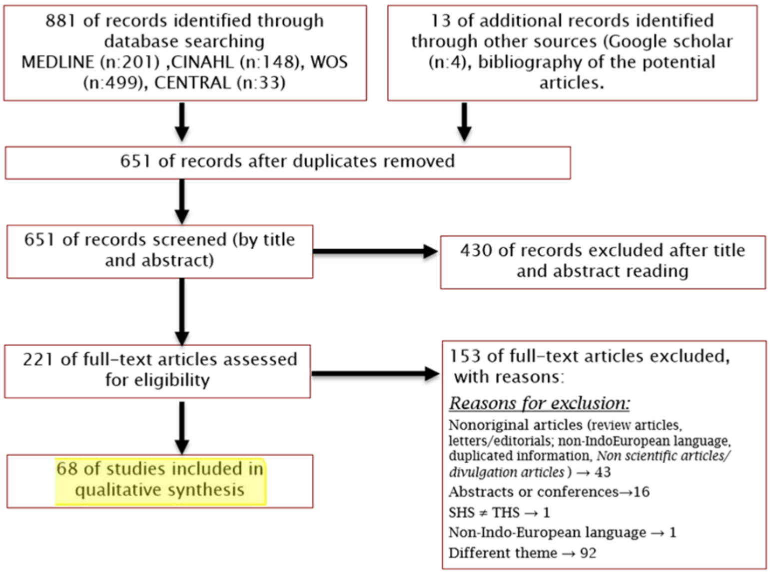
MEDLINE
EMBASE
CENTRAL
WOS

Clinicaltrials.gov, controlled-trials.com, International Clinical Trials Registry Platform
The first 200 hits of Google Scholar^{TM}.

Data Collection & Analysis: 2 independent authors - *Indoeuropean languages*

Inclusion & Exclusion criteria

Results



Flow diagram: study retrieval and selection (adapted from PRISMA)

Main Results

68 studies

1. **Components and concentrations of THS**
   28 studies
2. **Impact of THS on Health**
   21 studies
3. **Beliefs, behaviours and policies of THS**
   16 studies
4. **Other aspects of THS**
   3 studies

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Results- 1.Components and concentrations of THS

Author (year)	
Bahl (2014)	Northrup (2016)
Becquemin (2010)	Peng (2017)
Cheng (2016)	Petrick (2011)
Figueiro (2016)	Petrick and Svidovsky (2011)
Fortmann (2010)	Purio (2015)
Hoh (2012)	Ramirez (2012)
Kuki (2015)	Ramirez (2015)
Lewinson (2015)	Santos e Silva (2016)
Matt (2011)	Schick (2014)
Matt (2013)	Sleiman (2010)
Matt (2014)	Sleiman (2014)
Matt (2016)	Thomas (2011)
Matt (2018)	Thomas(2014)
Noguchi (2016)	Ueta (2010)

28 studies

Objectives

10 studies → <u>THS pollutants</u>

(*5 in houses, 2 in cars, 1 in a hotel, 1 in a casino and 1 in a university campus*)

4 studies→ Method for determining THS

3 studies →THS markers

Location of the analysis of THS:

Laboratory → 11 studies

Houses → 11 studies

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1.Components and concentrations of THS

Author (year)	
Bahl (2014)	Northrup (2016)
Becquemin (2010)	Peng (2017)
Cheng (2016)	Petrick (2011)
Figueiro (2016)	Petrick and Svidovsky (2011)
Fortmann (2010)	Purio (2015)
Hoh (2012)	Ramirez (2012)
Kuki (2015)	Ramirez (2015)
Lewinson (2015)	Santos e Silva (2016)
Matt (2011)	Schick (2014)
Matt (2013)	Sleiman (2010)
Matt (2014)	Sleiman (2014)
Matt (2016)	Thomas (2011)
Matt (2018)	Thomas(2014)
Noguchi (2016)	Ueta (2010)

The most analysed <u>component</u> to detect THS :

1. Surface Nicotine (18 studies)
2. Nitrosamines (10 studies)
3. Cotinine (10 studies)

Comparative methodological studies are needed

Techniques for sample collection:

1- Cotton wipes (Dust samples)

Techniques for sample analysis:

1. Chromatography ± mass spectrometry

Fabrics → *Greater deposit* of smoker-related chemicals **natural fibers** (cotton & wood).

Considered reservoirs of THS

Results - 2.Impact of THS on Health

Author (year)	
Adhami (2016)	Hang (2018)
Adhami (2017)	Jung (2012)
Bahl, Johnson (2016)	Karim (2015)
Bahl, Shim (2016)	Leung (2018)
Bahl, Weng (2016)	Mahabee-Gittens (2018)
de la Riva-Velasco(2012)	Martins-Green (2014)
Dhall (2016)	Northup (2016)
Figueiró (2018)	Ramirez (2014)
Hammer (2011)	Rehan (2011)
Hang (2013)	Xu (2015)
Hang (2017)	

21 studies

Effect of THS

Cells→ 11 studies (*1 in human cells, 4 in animal cells and 6 in animal and human cells)*

Animals → 4 studies

Children → 5 studies

Components to detect THS:

Nicotine→ 9 studies

Nitrosamines → 7 studies

Cotinine → 5 studies

Outcomes: Cytotoxicity of THS 6 studies, Cell damage 4 studies

For THS analysis:

Chromatography (gas or liquid) →7 studies

± spectrometry →7 studies

2.Impact of THS on Health

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Author (year)	
Adhami (2016)	Hang (2018)
Adhami (2017)	Jung (2012)
Bahl, Johnson (2016)	Karim (2015)
Bahl, Shim (2016)	Leung (2018)
Bahl, Weng (2016)	Mahabee-Gittens (2018)
de la Riva-Velasco(2012)	Martins-Green (2014)
Dhall (2016)	Northup (2016)
Figueiró (2018)	Ramirez (2014)
Hammer (2011)	Rehan (2011)
Hang (2013)	Xu (2015)
Hang (2017)	

Genotoxic & Cytotoxic cellular damage

Mice exposed THS:

- Alterations in *liver metabolism*, *thrombosis*, *angiogenesis*
- Number of *eosinophils*, *platelets* and *B cells*
- Hyperactive *behaviour*

- **Dose- response relationship**
- ↑ Respiratory symptoms

Children exposed to THS

- ↑ doses per kg of body weight than adults
- Mitochondrial stress
- ↓ Proliferation of neural stem cells

↑ **Studies** → To characterize **mid & long term consequences of THS.**

3. Beliefs, behaviours and policies of THS

Author (year)	
Baheiraei (2018)	Kayser (2013)
Chen (2016)	Patel (2012)
Darlow (2017)	Roberts (2017)
Delgado-Rendon (2017)	Samet (2015)
Delgado-Rendon (2017)	Walley (2015)
Drehmer (2014)	Wilbur (2015)
Escoffery (2013)	Winickoff (2009)
Haardörfer (2017)	Zakarian (2017)

16 studies

Objectives:
9 studies → The beliefs/the concerns about THS
1 in healthcare professionals.

Population groups:
Adults: *healthcare professionals, hotel managers, caretakers, realtors or low-income people* → 9 studies
Parents, expectant fathers or caregivers → 5 studies
Children → 1 study

3. Beliefs, behaviours and policies of THS

Author (year)	
Baheiraei (2018)	Kayser (2013)
Chen (2016)	Patel (2012)
Darlow (2017)	Roberts (2017)
Delgado-Rendon (2017)	Samet (2015)
Delgado-Rendon (2017)	Walley (2015)
Drehmer (2014)	Wilbur (2015)
Escoffery (2013)	Winickoff (2009)
Haardörfer (2017)	Zakarian (2017)

Risk perceptions of THS → 5 studies

- *Realtors & car dealers → try to eliminate THS* (negative impact value)

- Multi UnitHousing (MUH) → almost all respondents prohibit smoking inside their homes

Marijuana smoke exposure:
2 studies
Systematic review → SHS & THS
For long term exposure → ↑ research in needed

4.Other aspects of THS

3 studies

Author (year)
Bush (2015)
Goniewicz (2015)
Kassem (2014)

Objectives
2 studies → Examine the nicotine residues deposited by the **e-cig**
1 study → Examine the nicotine residues deposited by the **hookah.**

The method of measurement→ Chromatography.
Outcome → Nicotine levels.

To sum up – Where are we going?

- Included **all the original studies on THS** published until **April of 2018**

- **Heterogeneity** of included studies ≠ Meta-analysis
Inability to have a risk of bias

- Confirm the **negative health effect** of THS exposure, *especially in children*
No data available of **long term exposure effects**

- General **population** ↔ **poor knowledge** of what THS is and its **effects on health**

↑ *Social awareness* & *involve governments* – Protective policies against exposure
Smoke-free homes

To sum up – Where are we going?

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Future studies:

- **Unify criteria** *(recollection, analysis)*
- Using **samples** from **real**-world **environments** ↔ **Private houses** ↔ *continue with this location*

- **The components most analyzed to determine THS:**

  Nicotine (30 studies), **nitrosamines** (17 studies), and **cotinine** (15 studies)

  Cost-effective aproach

  Most relevant *component in organic fluid* : *Pending*

Confirm the **harmful effects of THS on health**.
More **observational** studies are needed to evaluate **mid- to long-term consequences of THS exposure.**

Thank you for your attention

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Review article

Update on thirdhand smoke: A comprehensive systematic review

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