

# Tobacco control interventions for populations living in subsidised, low-income housing: a scoping review

Germaine Lai<sup>a,e</sup>, Kylie Morphett<sup>a</sup>, Driss Ait Ouakrim<sup>b</sup>, Kate E Mason<sup>b,c</sup>, Samantha Howe<sup>b</sup>, Vaughan W Rees<sup>d</sup>, Stephen Li<sup>a</sup> and Coral Gartner<sup>a</sup>

<sup>a</sup> NHMRC Centre of Research Excellence on Achieving the Tobacco Endgame, School of Public Health, Faculty of Medicine, University of Queensland, Brisbane, Australia

<sup>b</sup> Melbourne School of Population and Global Health, University of Melbourne, Victoria, Australia

<sup>c</sup> NHMRC Centre of Research Excellence in Healthy Housing, Centre for Health Policy, Melbourne School of Population and Global Health, University of Melbourne, Victoria, Australia

<sup>d</sup> Department of Social and Behavioral Sciences, Harvard TH Chan School of Public Health, Boston, Massachusetts, US

<sup>e</sup> Corresponding author: [g.lai@uq.edu.au](mailto:g.lai@uq.edu.au)

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## Key points

- People living in subsidised housing are more likely to smoke or experience secondhand smoke compared to the general population
- Our review of the literature on tobacco control interventions in subsidised housing found that smoke-free housing policies were the most evaluated intervention, followed by smoking cessation-focused interventions
- Findings suggest interventions implemented in subsidised housing have positive effects on smoking and secondhand smoke exposure

## Abstract

**Objectives:** People living in subsidised low-income housing are more likely to smoke and experience secondhand smoke exposure compared to the general population. While tobacco control interventions have yielded substantial population health benefits, people living in subsidised housing experience a greater burden of tobacco-related harms. We synthesised existing peer-reviewed and grey literature to determine tobacco control interventions that have been implemented in subsidised housing globally, and to understand their impact on smoking and secondhand smoke exposure.

**Methods:** We searched five databases for peer-reviewed research, and Google Advanced for grey literature. We adhered to the JBI Scoping Review Methodology and Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist.

**Results:** Fifty-seven sources met the eligibility criteria. The most common type of intervention was mandatory smoking bans covering all indoor spaces ( $n = 32$ ), followed by cessation-focused interventions ( $n = 19$ ). Interventions that indirectly addressed smoking were the least common ( $n = 6$ ). Our findings suggest smoking bans can increase smoking cessation and reduce secondhand smoke exposure, especially if implemented alongside cessation support strategies.

**Conclusion:** Tobacco control interventions targeting subsidised housing demonstrate positive effects on tobacco-related outcomes for residents and provide an important opportunity to address health disparities. Future research should examine the long-term impacts of the interventions, including potential unintended consequences, in varied subsidised housing contexts.

## Key points (continued)

- Most interventions were implemented in the US, and effects in other countries and contexts are unknown

## Introduction

Tobacco smoking is a leading cause of preventable death globally and a major driver of health inequity.<sup>1,2</sup> Globally, 8.7 million deaths are caused by smoking and 1.3 million deaths are from secondhand smoke (SHS) each year.<sup>3</sup> People experiencing socioeconomic disadvantage have higher risks of tobacco-related harms, such as cancer and asthma, than the overall population.<sup>4-6</sup> Higher smoking prevalence is associated with lower income, unemployment and not owning a residential property<sup>7-9</sup>, which are common eligibility criteria for publicly subsidised, low-income housing (also known as social, public or community housing). Several studies show that subsidised housing residents are more likely to smoke than those living in other housing types.<sup>10-12</sup> Additionally, SHS exposure is disproportionately concentrated among children and people living in subsidised housing<sup>13</sup>, with home environments being a key site of SHS exposure.<sup>14</sup>

Smoking in or around homes not only affects those within the household but also neighbours, especially in multi-unit dwellings.<sup>15,16</sup> Studies measuring airborne nicotine concentrations and fine particulate matter (PM<sub>2.5</sub>) show that SHS incursions occur in homes and common areas located adjacent to smoking households within multi-unit buildings.<sup>15,17</sup> Common mitigation strategies (opening windows, using fans or air purifiers) do not eliminate SHS.<sup>18</sup> This poses significant health risks to those involuntarily exposed to SHS, including children, older residents, and those with pre-existing health conditions.<sup>19</sup>

Article 8 of the World Health Organization (WHO) *Framework Convention on Tobacco Control* (FCTC)<sup>20</sup> requires Parties to implement smoke-free legislation to provide protection from SHS.<sup>21</sup> In 2018, the US Department of Housing and Urban Development (HUD) instituted a federal rule requiring public housing authorities (PHAs) to prohibit tobacco smoking inside units, indoor common areas and within 25 feet (7.62 metres) of buildings.<sup>22</sup> As of December 2023, this is the only nationally coordinated smoke-free housing policy (SFHP) in publicly managed subsidised housing that we identified. In countries where SFHPs have not been adopted, the proposal to mandate such policies is debated, due to the ethical challenges associated with regulating private spaces<sup>23</sup> and potential unintended consequences, such as the risk of homelessness for residents who fail to comply with SFHPs.<sup>24</sup> We conducted a scoping review to answer the following questions:

- 1) What types of tobacco control interventions have been implemented or evaluated in subsidised housing contexts?
- 2) What is the impact of these interventions on smoking and SHS exposure?
- 3) What are the key research gaps on tobacco control interventions in subsidised housing?

## Methods

This review adhered to the JBI Scoping Review Methodology<sup>25</sup> and the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist<sup>26</sup> (See Supplementary file 1, available from: [osf.io/gyhvw](https://osf.io/gyhvw)) and was pre-registered in Open Science Framework.<sup>27</sup>

### Inclusion criteria

We included peer-reviewed original research and grey literature (e.g., reports) that detailed tobacco control interventions in subsidised housing. Interventions were defined as strategies aimed at reducing smoking or SHS. Publicly subsidised, low-income housing (subsidised housing) was defined as rental housing for low-income households, provided or subsidised by the government or a related agency. Subsidised housing with healthcare services or that addressed specific care needs were excluded. No publication date or language restrictions were applied.

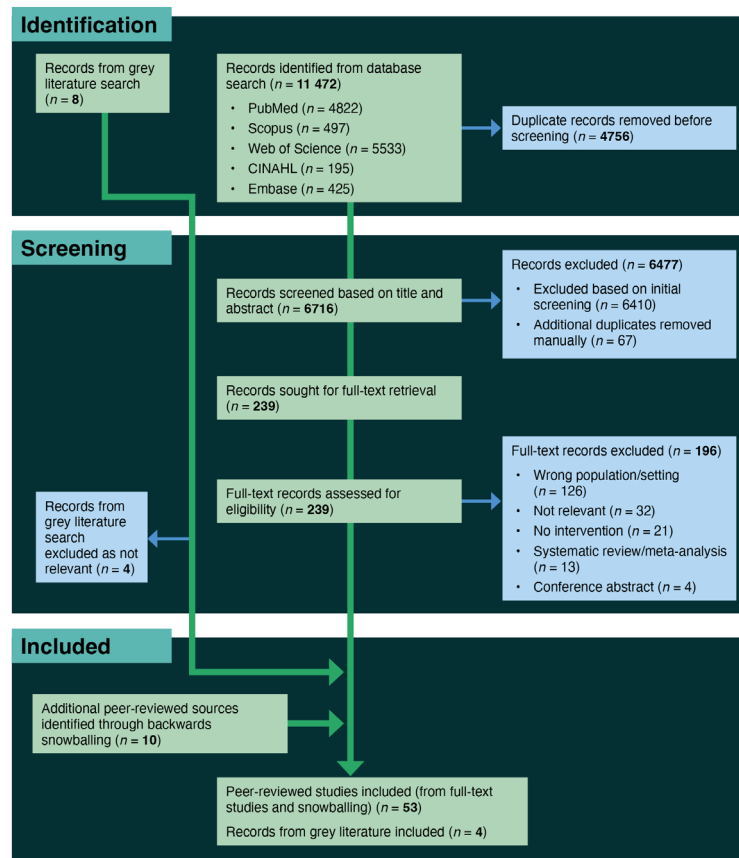
### Search strategy

We searched PubMed, Scopus, Web of Science, CINAHL and EMBASE on 9 July 2023, and Google Advanced on 14 September 2023 (See Supplementary file 2, available from: [osf.io/azgc2](https://osf.io/azgc2)). Backwards snowballing was used to identify additional studies.

### Evidence selection and data extraction

Titles and abstracts were independently screened by two of seven reviewers (GL and another reviewer). Following initial screening, full-text articles were independently assessed by two of seven reviewers (GL and another reviewer). Conflicts were resolved through discussion with an additional reviewer (KMo). The senior author (CG) checked the included sources against the inclusion criteria. The screening was conducted in Covidence review software.<sup>28</sup> Three reviewers (GL, SH, SL) independently extracted data, such as intervention description and methodology, using Microsoft Excel.<sup>29</sup>

**Figure 1.** Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram



(See Supplementary file 3, available from: [osf.io/rgjcf](https://osf.io/rgjcf)), with all reviewed by GL. A post-hoc decision was made to extract additional data on intervention acceptability and implementation experiences, as most of the studies included this as part of their results, especially for SFHPs. A summary of these results was reported, with the full results for the acceptability and implementation of SFHPs provided in Supplementary file 4 (available from: [osf.io/5m3s8](https://osf.io/5m3s8)). Included sources were charted according to the intervention type and intervention effects.

## Results

After the removal of duplicates and screening, 57 sources (53 peer-reviewed, 4 grey literature) met the eligibility criteria (Figure 1). Policy interventions were classified as SFHP ( $n = 32$ ), cessation-focused ( $n = 19$ ), or “other” interventions ( $n = 6$ ). Full study details are in Supplementary file 5 (available from: [osf.io/2dch5](https://osf.io/2dch5)). Details of references for included studies (S1–S57) are in Supplementary file 6 (available from: [osf.io/6mhrv](https://osf.io/6mhrv)).

### Smoke-free housing policies

Property-wide smoking bans were classified as SFHPs. Details of SFHPs evaluated by studies are outlined in Table 1.

### Impact on smoking cessation behaviours

Nine studies measured impact on cessation behaviours.<sup>S5,S11,S12,S18,S20,S23,S28,S31,S32</sup> All found positive short-term (< 6 months)<sup>S12,S18,S20</sup> and longer-term (> 6 months) changes to smoking behaviour.<sup>S5,S23,S28,S32</sup> One study measured outcomes up to 2 years post-policy implementation.<sup>S32</sup>

One longitudinal study found non-statistically significant decreases in self-reported quit attempts at 6-months post-policy, although residents reported reductions in cigarette consumption and increased interest in quitting due to the SFHP.<sup>S18</sup>

Among five studies that involved repeated cross-sectional analyses, three found increased self-reported quitting<sup>S28</sup>, increased quit attempts<sup>S23</sup>, and reduced amount smoked<sup>S5,S23</sup> at 12 months post-policy. One study observed no changes in self-reported quitting 2 years post-policy.<sup>S32</sup> Another study investigated the effects of the US Department of Housing and Urban Development (HUD) SFHP on e-cigarette initiation among people who smoked tobacco.<sup>S11</sup> While the HUD policy does not prohibit e-cigarette use, the study found a low initiation rate (5.6%) post-implementation.

Two cross-sectional studies examined self-reported quitting behaviour. Those who indicated thinking about quitting because of the SFHP were significantly more likely to try quitting compared to those who did not report

**Table 1. Smoke-free housing policies evaluated in studies**

Country	Policy description	Studies
US	<ul style="list-style-type: none"> <li>Implemented by PHAs</li> <li>Federal rule</li> <li>Prohibits tobacco smoking inside units, indoor common areas and within 25 feet (7.62 metres) of buildings</li> </ul>	<ul style="list-style-type: none"> <li>Six studies evaluated SFHPs in New York City<sup>S1-S6</sup>, four in Boston<sup>S7-S10</sup>, three in the District of Columbia<sup>S11-S13</sup>, two in Massachusetts<sup>S14,S15</sup>, two in both North Carolina and Georgia<sup>S16,S17</sup>, and one each in Minnesota<sup>S18</sup>, Norfolk<sup>S19</sup>, Milwaukee<sup>S20</sup>, Michigan<sup>S21</sup>, Philadelphia<sup>S22</sup>, and Colorado<sup>S23</sup></li> <li>One study evaluated SFHPs implemented by PHAs in general<sup>S24</sup></li> </ul>
	<ul style="list-style-type: none"> <li>Implemented by privately managed subsidised housing providers</li> <li>Prohibits tobacco smoking inside units, indoors in common areas and within 25 feet (7.62 metres) of buildings</li> </ul>	<ul style="list-style-type: none"> <li>Five studies evaluated the SFHPs implemented in North Carolina and Georgia<sup>S25</sup>, San Diego<sup>S26</sup>, San Francisco<sup>S27</sup>, and Portland<sup>S28,S29</sup></li> </ul>
	<ul style="list-style-type: none"> <li>Implemented by the Richmond City Government, California</li> <li>City-wide ordinance</li> <li>Prohibits smoking of any tobacco or cannabis in all multi-unit housing, including subsidised housing</li> </ul>	<ul style="list-style-type: none"> <li>One study evaluated the SFHP in Richmond, California<sup>S30</sup></li> </ul>
Canada	<ul style="list-style-type: none"> <li>Implemented by Waterloo Region Housing in the Waterloo Municipality, Ontario</li> <li>Prohibits smoking property-wide and within 5 metres from the building perimeter in regionally-owned subsidised housing</li> <li>Only applies to new leases on and after 1 April 2010</li> </ul>	<ul style="list-style-type: none"> <li>Two studies evaluated the SFHP in Waterloo, Ontario<sup>S31,S32</sup></li> </ul>
	<ul style="list-style-type: none"> <li>Implemented by Yukon Housing Corporation in the Yukon Territory</li> <li>Prohibits smoking property-wide but private outdoor balconies and patios were exempted</li> </ul>	<ul style="list-style-type: none"> <li>One study evaluated the SFHP in Yukon<sup>S31</sup></li> </ul>

PHAs = public housing authorities; SFHP = smoke-free housing policy.

the policy as an influence on quit intentions.<sup>S12</sup> For actions attributed to the policy, 55.6% attempted quitting, 48.8% reduced smoking, and 6.4% quit smoking.<sup>S20</sup>

In one qualitative study conducted after policy implementation, residents reported difficulties maintaining cessation despite multiple quit attempts.<sup>S31</sup>

### Cessation support

Two cross-sectional surveys assessed the availability of cessation services for residents impacted by SFHPs.<sup>S12,S20</sup> In one study, 18.7% of residents reported “receiving a lot of cessation support” – those residents who reported receiving support were significantly more likely to consider quitting because of the policy, compared to those who reported “receiving no support”.<sup>S12</sup> The majority who smoked wanted quitting assistance (e.g., onsite cessation support, incentives, free cessation medicines).<sup>S20</sup>

One study surveyed PHA staff about services offered to residents, and found commonly offered cessation services were telephone Quitline information, cessation materials (e.g., brochures), and referrals to external cessation services (e.g., counselling).<sup>S24</sup> Another study interviewed residents and held focus groups with health practitioners and housing staff, and found that free

cessation services from external providers were available but most residents were unaware of them.<sup>S31</sup>

### Impact on secondhand smoke exposure

Thirteen sources evaluated the impact of SFHPs on SHS exposure.<sup>S1,S3,S5,S7,S9,S10,S18-S20,S22,S23,S26,S28</sup> Eight measured indoor air quality (airborne nicotine, fine particulate matter; PM<sub>2.5</sub>)<sup>S1,S3,S7,S9,S10,S19,S22,S26</sup>, seven used self-reported exposure to SHS<sup>S5,S10,S18,S20,S22,S23,S28</sup>, and one measured exposure biomarker (salivary cotinine: a stable metabolite of nicotine).<sup>S10</sup>

Five were longitudinal studies. Two air monitoring studies compared longitudinal changes in airborne nicotine between subsidised housings with and without SFHP, and did not find significant differences within homes<sup>S10</sup> or common areas<sup>S3,S10</sup> at 12 months post-policy. Another longitudinal air monitoring study did not find significant reductions in airborne nicotine within households and stairwells but did find significant reductions in hallways at 36-month follow-up.<sup>S1</sup> One longitudinal study reported reductions in PM<sub>2.5</sub> and airborne nicotine in indoor common areas within the first month of policy implementation, although both returned close to baseline levels 12 months later.<sup>S19</sup> Another two studies measured self-reported exposure to SHS.<sup>S10,S18</sup>

One compared subsidised housing with and without SFHP and did not find significant differences in the reductions in exposure, but did find that cotinine levels in residents of housing with SFHP increased at 12 months post-implementation (decreased for the comparison group).<sup>S10</sup> Another study found significant reductions in indoor exposure among residents who did not smoke at the 6-month follow-up but non-significant reductions in outdoor exposure, despite smoking also being prohibited in outdoor areas.<sup>S18</sup>

Six studies used repeated cross-sectional data. One air monitoring study found that PM<sub>2.5</sub> in common areas of housing with SFHP decreased significantly more than in housing without SFHP, 1 year post-policy implementation.<sup>S7</sup> Another study without a control site found significant reductions in airborne nicotine in common areas at 9 months post-implementation.<sup>S22</sup> Two studies assessed self-reported exposure. They found significantly reduced indoor exposure at 12 months<sup>S23</sup>, as well as significantly reduced indoor and outdoor exposure at 5 months.<sup>S28</sup> Another study found decreased self-reported exposure in common areas 9-11 months post-policy, and SHS incursions into units were significantly less likely at follow-up.<sup>S5</sup> One study compared self-reported SHS exposure with a control site and did not find significant reductions in indoor exposure at 12 months post-policy.<sup>S10</sup>

Among three were cross-sectional studies. One air monitoring study compared subsidised housing complexes with and without SFHP and found significantly lower household PM<sub>2.5</sub> in SFHP buildings.<sup>S9</sup> Another study examined the distribution of thirdhand smoke (THS; tobacco smoke residue accumulated on surfaces), and compared households with or without SFHP, with or without residents or visitors that smoked.<sup>S26</sup> Households without SFHP, and households with SFHP but residents or visitors who smoked, had higher THS than other households.<sup>S26</sup> This study did not account for baseline THS. One study reported that residents perceived lower daily SHS incursions after the implementation of an SFHP.<sup>S20</sup>

### Impact on health outcomes

Two studies measured the impact of SFHPs on health outcomes.<sup>S4,S23</sup> One quasi-experimental study assessed paediatric health using public insurance claims data and found significant increases in upper respiratory tract infections among children 17 months post-policy.<sup>S4</sup> However, a repeated cross-sectional study reported non-significant decreases in self-reported health problems such as allergies and asthma symptoms at 12 months post-policy.<sup>S23</sup>

### Acceptability/resident support and policy implementation experiences

Eight studies examined resident support for SFHPs<sup>S2,S6,S8,S15,S20,S22,S23,S29</sup>, and 18 studies reported on policy implementation experiences such as

implementation and enforcement challenges<sup>S2,S5,S6,S8,S13-S17,S20-S22,S24,S25,S27,S28,S30,S31</sup> (see Supplementary file 4, available from: [osf.io/5m3s8](https://osf.io/5m3s8)). Overall, resident support for SFHPs was high (50% to 89%)<sup>S8,S15,S22,S23,S29</sup>, especially among those who did not smoke.<sup>S29,S20</sup> Enforcement strategies ranged from verbal or written warnings, violation notices, fines, and, less commonly, eviction.<sup>S13,S17,S24,S25,S31</sup> There were also reported unintended outcomes, including vandalism and damaged smoke alarms or air monitoring devices, likely because residents wanted to smoke undetected.<sup>S2</sup>

### Cessation-focused interventions

Eighteen studies focused on cessation interventions were conducted in the US<sup>S33-S50</sup> and one in England, UK.<sup>S51</sup> The interventions targeted smoking cessation using a range of strategies (Table 2), and most commonly, a combination of behavioural counselling with cessation pharmacotherapy and social support.<sup>S33-S40</sup>

**Table 2. Cessation-focused intervention components in included sources**

Intervention component (number of studies)	Description
Behavioural counselling (n = 16)	Generally provided onsite by trained health professionals to help residents quit smoking. <sup>S33-S44,S46,S48,S49,S51</sup>
Social support (n = 14)	Usually involved trained community advocates who had previously quit smoking to support residents in quitting. <sup>S33-S40,S45-S49,S51</sup>
Pharmacotherapy (n = 11)	Free nicotine replacement therapy (NRT) products, such as nicotine gum. <sup>S33-S44,S46,S48,S49,S51</sup>
Smoking cessation educational resources (n = 7)	Resources e.g., booklets or videos. <sup>S41,S43-S48</sup>
Environmental changes (n = 1)	Building renovations (e.g., exterior wall sealing, window and door replacements) to improve ventilation. <sup>S49</sup>

### Impact on smoking cessation behaviours

Ten studies measured impact on cessation behaviours.<sup>S36,S38-S41,S44-S46,S48,S50</sup> All found positive short-term (< 6 months) effects<sup>S36,S38,S36,S40,S41,S44-S46,S48,S50</sup> and longer-term (> 6 months) effects on smoking behaviour.<sup>S36,S39</sup> No studies investigated effects beyond 12 months.

Four of these studies were cluster-randomised trials that compared intervention effects in subsidised housing complexes with and without an intervention.<sup>S36,S39,S41,S44</sup> In three of the studies, intervention groups had significantly higher quit attempts compared to control at 6-months follow-up<sup>S44</sup>, and significantly higher biochemically



validated abstinence rates compared to control at 6-month<sup>S36,S44</sup> and 12-month follow-ups.<sup>S36,S39</sup> One study did not find significant differences in biochemically validated abstinence between groups at 8-week and 6-month follow-ups.<sup>S41</sup> Another was a quasi-experimental study and did not find significant differences between groups at 3-month follow-up.<sup>S38</sup>

A randomised controlled trial compared a smoking cessation program with a version enhanced with an educational component, and did not find significantly higher biochemically validated abstinence for the enhanced program at 12 weeks.<sup>S46</sup> One feasibility study did not find significantly higher biochemically-validated cessation post-intervention, although 30.7% of participants achieved smoking abstinence at week 4.<sup>S40</sup> Another feasibility study achieved 38.8% self-reported quit rate at 6 months post-intervention.<sup>S50</sup>

One cross-sectional study found that 11% of participants who attended at least one cessation class reported quitting.<sup>S45</sup> Another study reported that of residents who enrolled in a community cessation clinic, 49% attempted quitting.<sup>S48</sup>

One study had an onsite cessation clinic that also provided information on cessation pharmacotherapy to residents.<sup>S50</sup> Following the intervention, 74.4% of participants reported using at least one form of pharmacotherapy to attempt quitting.

## Impact on overall health

One study assessed the impact of an onsite health intervention with services such as motivational interviewing and vouchers to replace cigarettes with e-cigarettes, and found significant improvements in overall health-related behaviours (e.g., smoking and exercising frequency), at 6 months.<sup>S51</sup>

## Cessation intervention implementation experiences

Six sources examined the intervention implementation processes, including participant experiences and implementation strategies.<sup>S38,S40,S45-S48</sup> One study found that 56.9% of residents attended up to four sessions of a cessation program facilitated by peer mentors, with 50% retention of mentors.<sup>S38</sup> Another study reported low participation rates in the cessation class offered.<sup>S45</sup> Two studies reported qualitative findings that most participants liked peer-led group sessions.<sup>S38,S46</sup> Participants and mentors suggested incentives to encourage participation<sup>S38</sup>, and targeting of younger people.<sup>S46</sup> Two studies described participant difficulties with NRT use<sup>S38,S40</sup>, with one reporting less than 20% of participants using nicotine gum correctly.<sup>S40</sup> Two sources described implementation strategies for smoking cessation programs (e.g., virtual mentoring and collaboration with external partners) and factors that could be improved,

including enhanced staff training and tailoring resident engagement.<sup>S47,S48</sup>

## Other types of intervention

Five studies of other interventions were conducted in the US<sup>S52-S56</sup> and one in Singapore.<sup>S57</sup> Three studies evaluated the impact of building renovations.<sup>S52-S54</sup> One simulation modelling study found decreased SHS infiltration, with magnitude and direction influenced by seasonality, location to a smoking unit, and resident behaviour (e.g., window opening).<sup>S52</sup> A quasi-experimental study examining 'green renovations' included an indoor smoking ban, with significantly fewer residents reporting smelling tobacco smoke at 1 year.<sup>S53</sup> Another longitudinal assessment of the impact of building renovations, which included a smoking ban in common areas, found reduced SHS infiltration from pre-renovation to immediate post-renovation, but non-significant reductions 1 year later.<sup>S54</sup> There were significantly fewer self-reported respiratory problems for adults from pre-renovation to immediate post-renovation, and decreased non-asthma problems remained significant at 1 year.<sup>S54</sup> For children, reported asthma problems remained unchanged but non-asthma respiratory problems reduced significantly immediately post-renovation.

One longitudinal study examined a health intervention targeting health screening and found significant increases in screening rates, but also increases in smoking rates over a 5-year follow-up period.<sup>S5</sup> The authors noted that people who smoked were over-represented in the sample, and survey participation decreased over time, so findings may reflect changes in sample characteristics.

One study examined the impact of the Rental Assistance Demonstration program in the US after the adoption of the HUD SFHP.<sup>S55</sup> It found significant reductions in self-reported SHS exposure at 1 year, but non-significant reductions in smoking frequency and no changes in cessation attempts.<sup>S55</sup>

One study analysed secondary data and estimated that prohibiting smoking in all US subsidised housing would yield annual cost savings of US\$496.82 million (A\$751.5 million).<sup>S56</sup>

## Key research gaps

Recommendations for future research by authors of reviewed studies included: exploring the tension between enforcing SFHPs (e.g., eviction, lease terminations) and achieving public health goals<sup>S17</sup>; how punishment avoidance impacts compliance<sup>S19</sup>; and development of community-tailored strategies to minimise unintended effects of interventions in subsidised housing.<sup>S13,S14</sup> Authors also recommended considering use of cannabis, e-cigarettes and use of alternative tobacco products in the context of SFHPs.<sup>S11-S13,S16</sup> Other research recommendations included continued monitoring of compliance with and enforcement of SFHPs.<sup>S8,S16,S25</sup>

For cessation-focused interventions, authors recommended further research considering the affordability of cessation pharmacotherapy for residents, funding of subsidised products, and monitoring residents' transitions within and out of subsidised housing.<sup>550</sup> Other recommendations were to develop culturally relevant interventions<sup>538</sup> and investigate whether findings are replicable across settings.<sup>539</sup>

## Discussion

This review synthesised findings on tobacco control interventions implemented in subsidised housing contexts, including experiences of implementing interventions and effects. Overall, evidence suggests that the interventions can increase smoking cessation, reduce SHS exposure, and potentially reduce smoking-related health conditions in subsidised housing populations. Implementation experiences indicate that the interventions were generally supported by residents but there were potential unintended consequences when implementing mandatory SFHPs that should be monitored and addressed.

Our findings suggest that SFHPs could increase cessation behaviours and reduce SHS exposure in the short term. However, there is uncertainty about long-term adherence to SFHPs. Conflicting findings, where SHS or airborne nicotine levels in-home and outdoors changed in opposite directions were observed, potentially due to residents misunderstanding the rules, or adapting smoking behaviour, for example, switching from smoking on balconies to inside homes. Evidence also suggests the availability of cessation services could boost the effectiveness of SFHPs as residents were more likely to quit if these services were available (see Supplementary file 4, available from: [osf.io/5m3s8](https://osf.io/5m3s8)). Evidence on support among residents for SFHPs was consistent with a previous review on attitudes and perceptions of smoke-free housing<sup>30</sup>, where people who did not smoke tended to support the policy for health reasons while many of those who smoked opposed it due to perceived unfairness. Our review also points to potential unintended effects of SFHPs, including higher turnover of some populations living in subsidised housing, and property damage.

We found that cessation programs and interventions targeting residents in subsidised housing have a positive effect on cessation behaviours. There were a limited number of studies, but positive findings for resident SHS exposure and health outcomes. Onsite interventions were favoured by residents and acceptability was higher when social support and/or free pharmacotherapy were provided. The use of trained peer mentors to deliver cessation support to residents is a promising strategy.<sup>31</sup> While pharmacotherapy such as NRT is effective for cessation<sup>32</sup>, our findings highlight the importance of demonstrating appropriate NRT use to increase

adherence.<sup>33</sup> Consistent with previous findings<sup>19</sup>, evidence indicates that renovations to improve building structure and ventilation have minimal effects on reducing SHS exposure.

Comprehensive smoke-free interventions in subsidised housing provide an important opportunity to address health disparities. However, regulating behaviour in private spaces raises complex ethical issues. While the "right" to smoke in one's own home is asserted by some, the right of people to smoke-free air in their homes must also be considered, particularly for those with limited housing options. From a public health perspective, the collective benefits of reduced health burden may outweigh concerns about limiting individual autonomy.<sup>34</sup> This ethical tension should be considered in the context of prevailing social and cultural norms. Our findings suggest that support for and adherence to SFHPs could be improved with culturally relevant, evidence-informed implementation strategies, including sustained resident engagement and cessation support (See Supplementary file 4, available from: [osf.io/5m3s8](https://osf.io/5m3s8)). Future research should focus on employing rigorous methodology, including modelling studies, to ascertain both the short-term and long-term effects of policies and interventions implemented in heterogeneous subsidised housing contexts.

## Limitations

The majority of studies were conducted in the US, where there has been early SFHP adoption<sup>35</sup>, and care should be taken in generalising findings across contexts. In addition, most studies were published after 2015 ( $n = 42$ ), which coincided with increased adoption of SFHPs in the US. Some studies on cessation interventions conducted in the US could have been implemented in subsidised housing that had an SFHP, but this may not have been reported. Furthermore, the implementation of SFHPs was commonly supplemented with cessation services, but this may not have been well-documented in all studies, making it difficult to determine whether the effects were a result of SFHPs or additional cessation support.

Due to the heterogeneity of sources included, meta-analysis was not possible. We only included housing that was at least partially government-funded and this limits generalisability to nongovernment-funded housing (e.g., funded by non-government organisations). As high-income countries are more likely to have subsidised housing schemes, all included sources were from high-income countries. This limits applicability to low-income countries where subsidised housing may not be well-established, or different models of housing assistance may exist. Additionally, few studies reported information on building structure. This is important because residents' ease of leaving the building or property to smoke depends on accessibility and safety factors, which may present greater challenges for some residents, including the elderly or those with a disability. Future studies should report information about building structure, variations in

smoke-free housing rules, as well as length and intensity of interventions, for rigorous assessment of intervention outcomes.

## Conclusion

SFHPs are the most commonly evaluated tobacco control intervention in subsidised housing, followed by cessation-focused interventions. These interventions demonstrated positive effects on tobacco use and exposure in structurally disadvantaged resident populations, at least in the short term. Future research should employ rigorous evaluation approaches to inform tailored implementation strategies across varied subsidised housing contexts.

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## Peer review and provenance

Externally peer reviewed, invited.

## Competing interests

None declared.

## Author contributions

CG, DAO, KMo, KMa, GL, SH were responsible for the study conception. GL conducted literature searches and drafted the manuscript. GL, KMa, SH and DAO were responsible for active screening, and GL, SH and SL conducted data extraction. KMo and CG were responsible for project supervision. All authors reviewed and edited the manuscript and approved the final version.

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