

## **Impact**

*A regulatory impact analysis must accompany every economically significant federal rule or regulation. The Office of Policy Development and Research performs this analysis for all U.S. Department of Housing and Urban Development rules. An impact analysis is a forecast of the annual benefits and costs accruing to all parties, including the taxpayers, from a given regulation. Modeling these benefits and costs involves use of past research findings, application of economic principles, empirical investigation, and professional judgment.*

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# **Instituting Smoke-Free Public Housing: An Economic Analysis**

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*The views expressed in this article are those of the authors and do not necessarily represent the official positions or policies of the Office of Policy Development and Research, the U.S. Department of Housing and Urban Development, or the U.S. government.*

## **Background**

The U.S. Department of Housing and Urban Development (HUD) promulgated a smoke-free regulation to require public housing agencies (PHAs) to implement a policy that all PHA-owned indoor areas and all areas within 25 feet of public housing be free from lit tobacco products.<sup>1</sup> PHAs may exercise their discretion to include a prohibition of electronic nicotine delivery systems (ENDS) in their individual smoke-free policies if they deem such a prohibition beneficial. If successful, the rule will eliminate public housing residents' exposure to secondhand smoke (SHS) while at home and eliminate any adverse effects of smoking on the property.<sup>2</sup>

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<sup>1</sup> "Instituting Smoke-Free Public Housing: Final Rule." 24 CFR Parts 965–966. *Federal Register* 81 (233) December 5, 2016.

<sup>2</sup> Pizacani et al. (2012) studied changes in behavior due to smoke-free policies in public housing in Portland, Oregon, and found that the change in frequent exposure to SHS (exposure multiple times per week) as a result of the rule was a significant decline from 41 to 17 percent of nonsmokers.

HUD's Office of Public and Indian Housing (PIH) has already issued several notices since 2009 encouraging and guiding PHAs to adopt smoke-free policies.<sup>3</sup> More than 570 of the 3,090 PHAs had implemented their own voluntary smoke-free policies by the time the final rule was issued (HUD, 2016). However, federal policy is necessary to ensure that all public housing residents are equally protected. PHAs cannot capture all the benefits of a smoke-free environment—improved health and fewer lives lost due to catastrophic fires—and so will underprovide the optimal level of protection to its tenants. HUD's smoke-free policy will realize indoor environmental benefits for tenants, a gain for society that would not occur otherwise. Furthermore, a HUD-imposed smoke-free rule will reduce the policy uncertainty facing PHAs willing, but hesitant, to institute their own smoke-free regulations. A mandatory rule provides a strong signal that HUD will support actions to enforce a smoke-free policy.

In this article, we assess the costs and benefits of instituting smoke-free housing in public housing. We conclude that the implementation of a smoke-free policy would improve the health outcomes of public housing residents, and provide other tangible benefits such as reducing the risk of catastrophic fires, and lowering maintenance costs. Implementation of the smoke-free policy in public housing will generate some regulatory, compliance, and enforcement costs, which are estimated to be lower than the expected benefits of the rule.

## Tenants' Benefits

SHS creates a negative externality by causing and exacerbating serious health problems through passive smoking (HHS, 2006; Öberg et al., 2010). According to the U.S. Surgeon General, no level of exposure to SHS is risk free (HHS, 2006). SHS has been proven to increase the likelihood of strokes and coronary heart disease among adults and of asthma attacks, lower respiratory infection, ear infection, and sudden infant death syndrome among children (HHS, 2014). One common source of exposure is in the home. Studies have shown SHS can travel from hallways into apartments and between neighboring units (King et al., 2010). Residual nicotine on indoor surfaces ("thirdhand" smoke) aggravates the health hazard of indoor smoking (Ramirez et al., 2014; Thomas et al., 2014). Controlling for socioeconomic variables, a child's exposure to tobacco smoke is greater in multiunit housing than in attached or single-family homes (Wilson et al., 2011). Reducing the prevalence of adverse health events and conditions will result in benefits stemming from longevity, reduced medical costs, and health improvements.

## Approaches to Monetizing Health Benefits

The variability in the estimates of the social costs of environmental tobacco smoke (Gruber and Koszegi, 2008) is considerable. This variability may be due to differences in researchers' approaches and assumptions, evidence used, and even implicit interests of researchers (Chaloupka and Warner, 2000). One common approach is to approximate the difference in medical costs between individuals exposed to SHS and those without SHS exposure (Waters et al., 2009). Although

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<sup>3</sup> See Notice PIH-2009-21 at [https://www.hud.gov/program\\_offices/administration/hudclips/notices/pih/09pihnotices](https://www.hud.gov/program_offices/administration/hudclips/notices/pih/09pihnotices); Notice PIH-2010-21 at <portal.hud.gov/hudportal/documents/huddoc?id=10-21hsgn.pdf>; Notice PIH 2012-22 at <portal.hud.gov/hudportal/documents/huddoc?id=12-22hsgn.pdf>; and Notice PIH-2012-25 at <portal.hud.gov/hudportal/documents/huddoc?id=12-25pihn.pdf>.

such a method does not provide an estimate of the consumer surplus derived from a longer and healthier life, it does serve as a useful proxy of the minimum willingness to pay to avoid negative health consequences. One Centers for Disease Control and Prevention (CDC) report (King, Patel, and Babb, 2014) estimated that the annual reduction in medical costs per PHA resident from a smoking ban would be \$91 (2012 U.S. dollars), or \$94 million in aggregate medical cost savings for PHA residents.<sup>4</sup> Another study (Mason et al., 2015), which relies on World Health Organization morbidity and mortality data, estimated annual direct medical cost savings ranging from \$110 million to \$150 million (2011 U.S. dollars).

Indirect costs to society could include the lost value of wages, fringe benefits, and services through SHS-related morbidity (Chaloupka and Warner, 2000). Productivity losses represent a significant addition beyond the medical costs in the CDC studies referenced. Gravelle and Zimmermann's (1994) calculation of the health effects yields estimates of costs ranging from \$0.01 to \$0.21 per pack of cigarettes consumed. Under similar assumptions, Viscusi (1994) found the social costs of SHS to be \$0.27 per pack. Chaloupka and Warner (2000) assumed a broader range of health consequences and placed the cost at about \$1.20 per pack or greater. On a per-pack basis, Behan, Eriksen, and Lin's (2005) approximation of \$10 billion cost estimate translates to roughly \$0.76 per pack. Sloan et al. (2004) estimated the damages borne by a smokers' family, through increased health costs and reduced income, to be \$7.50 per pack (2015 U.S. dollars). For example, applying a central estimate of \$1.45 per pack would give us an aggregate annual benefit of \$68 million of benefits across the affected PHA population.<sup>5</sup> Instead of relying on this estimate, we turned to the economic theory of housing markets.

## **Willingness To Pay**

Rather than counting every individual impact—a task virtually impossible when considering secondary and tertiary effects—a measure of the willingness to pay for a smoke-free environment isolates the global net benefit to tenants of smoke-free housing. We do not need to know why someone is willing to pay more, but only that they have expressed a preference. A tenant would value smoke-free housing for many reasons: health benefits from limiting the exposure to SHS in terms of length of life, quality of health, and medical expenses; and quality of life effects in terms of living in a more agreeable indoor environment, reduced risk of fire, and spending less time reacting to the negative side effects of SHS. Even smokers may favor smoke-free housing if their households include nonsmokers. A willingness-to-pay approach simplifies the estimate of benefits; we do not need to know anything about the exposure to smoke while at home relative to other locations during the day or how SHS filters from one unit to another. We do not suggest that every tenant of public housing has an excellent understanding of the relative risk of SHS. Instead, individuals are expected to value a smoke-free environment as if they were participants in the private housing market. Two common ways exist of uncovering the valuation of any nontraded goods: stated preference (surveys) or revealed preference (regression analysis of market price data on property characteristics).

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<sup>4</sup> King, Peck, and Babb (2014) estimated the annual savings associated with banning smoking in public housing to be \$152.91 million. Healthcare costs accounted for \$94.01 million of the total.

<sup>5</sup> \$68 million avoided damage per year = \$1.45 avoided damage per pack x 182.5 packs per year per smoker x 257,258 smokers living in housing with no smoke-free rule.

## Revealed Preference

Surveys of renters' valuation demonstrate that tenants of multiunit housing are willing to pay more for smoke free units (King et al., 2010). Residents say that they are willing to give up other amenities and/or pay a rent premium to live in smoke-free units. Other surveys of renters show that residents tend to "support" smoke-free policies (Henrikus et al., 2003). A study of vacation rental properties finds that the rental rates for smoke-free properties is 11 percent greater than for comparable ones, controlling for other indicators of quality (Benjamin, Jud, and Winkler, 2001).<sup>6</sup> The empirical result is not incontestably applicable, because it is derived from the demand of higher income renters for vacation properties. An imbalance with supply may also affect the estimated premium; at the time of the hedonic research, only a minority of the stock was smoke free, as compared to the present, when smoke-free housing is the norm for vacation rentals. The study provides convincing evidence that, in general, renters value smoke-free housing. Unpublished estimates by HUD researchers of the smoke-free premium ranges from 3 to 8 percent of monthly housing costs for otherwise comparable units.

## Contingent Valuation/Stated Preferences

Real estate appraisers find that the stated preference method is a reliable alternative if available market data are insufficient to complete a rigorous hedonic analysis (Mundy and McClean, 1998). The Public Health Advocacy Institute reported the results of a survey of 1,304 residents of multiunit properties concerning smoke-free housing (Massachusetts Smoke-Free Housing Project, 2009). Two-thirds of residents consider SHS to be "very harmful" and one-fourth "somewhat harmful." Specific results from the report include the finding that 43 percent of residents are willing to pay more to live in a smoke-free building. Of the residents who are willing to pay more for smoke-free housing, 26 percent are willing to pay 20 percent more, and 63 percent are willing to pay 10 percent more. Another study (Hewett et al., 2007) found that nearly one-half of all households surveyed would be extremely or very interested in living in smoke-free buildings. All types of households stated a preference for smoke-free housing; a large proportion stated that they would be willing to pay more to live in smoke-free housing.

## Dollar Value of Premium

The dollar value of the smoke-free rent premium can be calculated from one of two bases for tenants of public housing: the rent that the subsidized tenant pays or the total cost of providing the unit. The total cost approximates the market rent, so using that as a base would provide an estimate of the market value of smoke-free policies. The alternative approach of using the tenants' payment as a base provides a potentially better measure of what public housing residents could afford to pay for the benefit of smoke-free housing. Both approaches are relevant to understanding the regulatory impact.

On average, public housing tenants pay \$275 a month for their units. The federal government spends \$512 on average per month per unit for operating expenses. The market rent for an equivalent apartment would be \$787 (\$275 + \$512). The intensity of desire for a smoke-free

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<sup>6</sup> The tradition is long established of using this approach to value environmental quality (for example, see Chay and Greenstone, 2005). For a description of the economic theory underlying hedonic analyses, see Rosen (1974).

policy will vary by tenant, but on average we assume households are willing to pay 5 percent more for smoke-free housing.<sup>7</sup> The annual per-household net benefit of smoke-free housing units would range from \$165 to \$472. We estimate that 732,000 units in PHAs are without a smoke-free policy. Tenants would therefore realize a surplus of between \$121 million and \$346 million if those units converted to smoke free. This range (\$100 million to \$300 million) of benefits is similar to estimates of the benefits calculated using other methods. Our high estimate of tenant benefits is greater than other studies because our hedonic estimate implicitly includes valuation of comfort and reduced risk of fire to tenants.

### **Accounting for Smokers**

Some smokers (and potentially nonsmokers) may prefer to live in housing where smoking is *allowed*. This preference may stem from a low valuation of health benefits and the perception that smoke-free rules impose high inconvenience costs. A survey of public housing residents in Washington state found that nonsmokers are more supportive of smoke-free policies; 82 percent of nonsmokers agree with a nonsmoking policy compared with 41 percent of smokers (Ballor, Henson, and MacGuire, 2013). For the portion of smokers who support smoke-free housing, we assume that the net benefit is captured by the estimate of the rent premium, which was estimated across all households, both smokers and nonsmokers. However, those individuals who were surveyed did not have the option of stating a willingness to pay to avoid smoke-free housing.

We assume that the benefit for those smoker households against smoke-free housing (59 percent) is \$0. The impact of the smoke-free rule is measured only by the compliance cost for smokers. This formulation provides a conservative estimate of net benefits because most smokers will derive some benefit from smoke-free housing even if outweighed by costs. Our approach allows for negative net benefits for a significant portion (59 percent) of the smoking population.

### **Encouraging Cessation**

Additional health benefits will arise if smokers are encouraged to quit or reduce smoking.<sup>8,9</sup> A previous cost-benefit analysis by HUD (the regulatory impact analysis of the proposed rule) was criticized for counting the compliance costs to smokers but not any of the potential benefits to smokers. The rent premium approach solves this difficult issue by including pro-smoking ban smokers among the beneficiaries.

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<sup>7</sup> The premium of 5 percent was developed from information available in Massachusetts Smoke-Free Housing Project (2009). The premium corresponds to our own unpublished hedonic model estimates.

<sup>8</sup> A meta-study by Levy et al. (2004) summarizes empirical findings concerning the effects of tobacco control policies. Vijayaraghavan et al. (2013) studied the effects of voluntary smoke-free regimens on quit rates of smokers of different income levels.

<sup>9</sup> Such estimates of health gains can be complicated by having to confront the controversial issue of estimating “lost pleasure” of no longer smoking. For a discussion, see Chaloupka, Gruber, and Warner (2015) and Jin et al. (2015).

## Compliance Costs: Smokers

Multiple methods of compliance are available to PHA smokers; they will choose the option (or combination of options) with the lowest net cost, given their preferences and circumstances.<sup>10</sup> Most obviously, smokers can comply by smoking in designated areas. Smokers can also reduce the number of cigarettes they smoke at home; studies show that smoking bans reduce the prevalence of smoking. Another option would be to switch to a different means of nicotine delivery (for example, a nonprohibited tobacco product such as ENDS). Empirical studies provide evidence of substitution between cigarettes and ENDS, although the cross-price elasticity can be very low or not statistically significant (Grace et al., 2014; Huang et al., 2014; Zheng et al., 2016). Despite the current lack of both health and economic estimates of the impacts of active ENDS use, we believe that allowing ENDS could substantially lower the cost of compliance to smokers.

Smokers with a high opportunity cost of time, who have mobility limitations,<sup>11</sup> live farthest from areas where smoking is permitted, or who face harsh weather or dangers (such as traffic or crime) in outdoor areas would be more likely to comply with the rule by quitting smoking or switching to an alternative means of nicotine delivery. The simplest approach of estimating the burden on smokers is to estimate the inconvenience cost as the opportunity cost of the time spent travelling to a designated area, disregarding alternative compliance options. This method gives us an idea of the maximum compliance cost of the rule because [we assume] smokers will adjust their behavior to the lowest cost alternative. The compliance costs for smokers may be calculated as time lost per cigarette. The average HUD-subsidized resident lives in a three-story building with a working elevator. The round-trip travel time should be no more than 2 minutes on average or 3 minutes for those residents with impaired movement. It is difficult to measure the inconvenience of smoking outside versus inside. Many will respond by smoking cigarettes faster if smoking at the designated area is a burden. The lost utility could be measured as the adjustment burden: a differential of 2 minutes for smoking a cigarette slowly versus quickly is reasonable. We add those 2 minutes to the 2 to 3 minutes of travel time. Recipients of housing assistance consume, on average, 10 cigarettes per day at home,<sup>12</sup> resulting in a compliance burden of 40 to 50 minutes per day. Estimating the opportunity cost of time of unemployed smokers is discussed in detail in the Regulatory Impact

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<sup>10</sup> An implicit distinction is made between the utility of a smoker and of a nonsmoker. The Surgeon General concluded in 1988 that “cigarettes and other forms of tobacco are addictive.” Subsequent reports of the Surgeon General have documented the mechanisms by which smoking is addictive, including for youth (HHS, 2014, 2006, 1988).

<sup>11</sup> The survey of the Portland, Oregon PHA (Pizacani et al., 2012) found that those tenants with mobility impairments are less likely to comply with smoking restrictions.

<sup>12</sup> Recipients of housing assistance consume, on average, between 12 and 14 cigarettes per day (National Health Interview Survey, 2013). Not all cigarettes are smoked at home, and this rule will have no incremental impact on those cigarettes consumed by the smoker away from home. In keeping with standard measures, it is safe to assume that at least 2 to 3 cigarettes will be smoked away from home. A resulting measure would therefore result in approximately 10 cigarettes smoked per day at home. The unemployed, with more leisure time, may have more opportunities to smoke away from the building.

Analysis of the HUD Smoke-Free Final Rule. The average annual cost of compliance for smokers is \$729.<sup>13</sup> Applying this cost, measured across the 139,000 affected smokers<sup>14</sup> in PHAs nationwide against smoke-free policy results in an aggregate cost of \$101 million.

## **Public Housing Agency Benefits**

Indoor smoking increases the cost of maintaining the quality of housing unit and rehabilitating it at turnover. The costs of extra cleaning, painting, flooring, and repair of damaged items at unit turnover can add up quickly for units previously occupied by smokers. Studies find that operators of multiunit housing with smoke-free policies report a reduction in costs (Snyder et al., 2015). One private manager of 4,500 units in the southeastern United States estimated a reduction of costs of \$100 per unit at turnover (HUD, 2014). This manager also noted that in previous years, two fires related to smoking cost the company more than \$1 million. One PHA interviewed priced the turnover cost-savings of smoke-free units at \$700 for a three-bedroom unit (HUD, 2014). Estimates provided by the Smoke-Free Housing Coalition of Maine (2008) based on data from two PHAs indicate renovation costs of a smoking unit can be two to five times that of a smoke-free unit.<sup>15</sup> The same organization released data from subsidized housing facilities in New England showing that such benefits could be even greater for units occupied by heavy smokers (Smoke-Free Housing Coalition of Maine, n.d.).

The incremental cost of a smoking tenant depends on the extent to which a PHA reacts to damage. This cost will vary by the building: for example, many PHAs have chosen linoleum floors to promote indoor health, because such floors are easier to clean. Repainting a unit at turnover is standard practice regardless of whether a unit was occupied by a smoker. Comparing public housing with all other subsidized housing may overestimate the operational benefits of a PHA smoke-free policy. Much of subsidized housing competes on the private market (housing choice vouchers or low-income housing tax credits) or is in mixed-income developments (such as HOPE VI developments), for which property standards are high. However, for this rule, our estimates should be relevant to PHAs. Using data from HUD's 2014 report and from the Smoke-Free Housing Coalition of Maine (n.d.), moderated by considering only light smokers and without floor replacement for the units, we estimate a range of \$350 to \$700 per turnover.

To calculate the savings in maintenance costs from a national smoke-free policy, we used the estimated turnover rate in public housing of 9 percent (HUD Picture of Subsidized Housing data, 2009 updated to 2013), and the 732,000 units of public housing not covered by a PHA smoke-free

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<sup>13</sup> This cost is calculated from an average of employed households (28 percent) and those households with income from another source (72 percent). The percentage shares are derived from survey data collected for the 2015 "Quality Control for Rental Assistance Subsidies Determinations" report. The daily burdens are 40 and 50 minutes, respectively. The opportunity costs per hour are \$5.00 and \$1.58, respectively, for an average cost of \$2.54 per hour.

<sup>14</sup> Not all smokers will be affected by this rule. A large proportion already smokes outside. King, Patel, and Babb (2014) report that the "national prevalence of smoke-free home rules increased from 56.7% to 91.4% among households with no adult cigarette smokers and from 9.6% to 46.1% among households with at least one adult smoker." The affected proportion would be 53.9 percent of the estimated 257,000 smoking adults residing in PHAs without any smoke-free rules.

<sup>15</sup> From the Maine data, one group of researchers (King, Peck, and Babb, 2014) estimated renovation costs were \$1,674 per turnover.

policy, resulting in 66,000 turnover units annually that would be affected by the final rule. Smokers will inhabit approximately one-third (32.7 percent) of these units, or 21,545.<sup>16</sup> To adjust for the fact that not all smokers of a household smoke indoors, we further multiply the number of turnover units inhabited by smokers by the percentage of smokers' homes without their own self-imposed smoke-free rule (53.9 percent), to arrive at a base of 11,600 units. Using the per-unit benefit estimates, we arrive at an aggregate estimate of \$4 million to \$8.1 million in annual renovation-related cost savings compared with the CDC's estimate of \$21 million using the data from Maine (King, Peck, and Babb, 2014).

## Benefits From Reduced Risk of Fires

Smoking-related fire is the leading cause of fire deaths in multiunit properties.<sup>17</sup> The damages from the fires caused by smoking in multiunit housing are disproportionately high compared with other causes of fires. Smoking causes 6 percent of all fires but 15 percent of all property damage, 31 percent of all civilian deaths, and 11 percent of all civilian injuries in fires in multiunit housing (NFPA, 2013: table 5B).<sup>18</sup> Smoke-free policies would reduce fire risk. Correspondingly, fire and hazard insurance would be less expensive. Chaloupka and Warner (2000) reported that fire and hazard insurance premiums paid by landlords is higher for every smoker in a building. Our own research found insurance discounts of as much as 10 percent for properties with a smoke-free policy.

The units in public housing without a PHA smoke-free rule comprise approximately 2.6 percent of the U.S. multiunit housing stock.<sup>19</sup> We assume that the risk and damage from fires caused by smoking in public housing are the same as for all multiunit housing.<sup>20</sup> Thus, a rigorously enforced smoke-free rule would avert approximately 170 fires, 3.4 civilian deaths, 12 injuries, and \$3 million in property damages annually.<sup>21</sup> For the value of a statistical life, we use a standard estimate of \$8 million. The total gain from preventing an expected 3.4 deaths annually is \$27.2 million (\$8 million x 3.4). NFPA (2014) suggested an injury cost equal to 60 percent of a U.S. Consumer Product Safety Commission estimate equal to \$166,000 (1993 U.S. dollars). In 2014 U.S. dollars, the National Fire Protection Association cost per injury would be \$163,000. The value of the

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<sup>16</sup> The CDC calculated the percentage of smokers in subsidized housing (not the percentage of units with at least one adult smoker) at 32.7 percent (King, Peck, and Babb, 2014).

<sup>17</sup> The causes of fire leading to fire death in multiunit housing are (in descending order): smoking materials, cooking equipment, electrical distribution and lighting equipment, intentional, heating equipment, candles, and playing with heat source (U.S. Fire Administration, 2008).

<sup>18</sup> The annual average for all fires in multiunit housing for which the cause was known was 102,000 fires, 380 civilian deaths, and \$1 billion in damages (calculated by HUD from Table 5B). The data from the National Fire Protection Association concerning fire damage to multifamily housing do not include the costs to firefighters.

<sup>19</sup> We calculated this percentage of 2.6 percent by dividing the 732,086 units with no official smoke-free policy by the estimated 28.1 million occupied units in structures with 2 or more units (2015 American Housing Survey).

<sup>20</sup> This analysis follows that of the CDC (King, Peck, and Babb, 2014) but uses data for multifamily housing, which are similar but more appropriate.

<sup>21</sup> We calculated these numbers by taking 2.6 percent of 6,400 fires, 130 civilian deaths, 480 injuries, and \$116 million in damage.

averted damages caused by injuries would be approximately \$2 million (12 injuries x \$163,000). We assume that the harm to consumers from a reduced risk is already captured by the rent premium.

## **Compliance Costs: Public Housing Agencies**

Administrative costs consist of public hearings, training for staff and residents, revisions of leases, installation of no-smoking signs, and time costs of enforcement. These costs will likely be larger during the first year, when all households are briefed in person. After the first year of implementation, only new admissions (9 percent of public housing households)<sup>22</sup> would need to be counseled on the requirement. Based on public housing administrative data, 1.4 million residents would be briefed in the first year, and 126,000 residents would be briefed in succeeding years. A discussion of the smoke-free rule as an addendum to a lease would likely take a maximum of 15 minutes. The aggregate time burden would be an additional 350,000 hours in the first year of implementation and 31,500 afterward. BLS data of total compensation for government office workers<sup>23</sup> yields a cost to employers of approximately \$30 per hour. Notification of residents would cost PHAs approximately \$10 million in the first year and \$1 million for each year afterward.<sup>24</sup> The cost of notification is only one of the compliance costs facing PHAs. Other costs include infrastructure, enforcement, and eviction proceedings costs.<sup>25</sup> The total compliance cost to all PHAs during a typical year is expected to be \$7.7 million. Additional upfront costs are expected during the first year of implementation.

## **Conclusion**

The implementation of a smoke-free policy in public housing will improve the health of public housing residents, reduce the risk of catastrophic fires, and lower overall maintenance costs. Nevertheless, the implementation of the smoke-free policy in public housing will generate some regulatory, compliance, and enforcement costs. Tenants are expected to gain a surplus between \$121 million and \$346 million but pay a compliance cost of \$101 million. Such a high compliance cost is unlikely given the potential of adjusting behavior. Benefits are likely to be greater if any smokers cease smoking as a result of the rule. Net benefits for residents of public housing range from \$20 million to \$245 million. PHAs will gain from reduced maintenance costs ranging from \$4 million to \$8.1 million and reduced fire damage costs of \$3 million. Recurring compliance costs for PHAs are estimated to be \$7.7 million annually, for annual net benefits of -\$0.7 million to \$3.4 million. First-year costs to PHAs are likely to be higher, by as much as \$9 million, but will be offset by the gains to the tenants.

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<sup>22</sup> Turnover rate measured by the variable “Percent moved in past year” from Picture of Subsidized Households Data, U.S. Department of Housing and Urban Development, <https://www.huduser.gov/portal/datasets/assthsgh.html>.

<sup>23</sup> <http://www.bls.gov/news.release/ecec.t04.htm>.

<sup>24</sup> This equation is only one example of the compliance cost on PHAs. To see a detailed description of public housing burden, please see HUD’s Smoke-Free Final RIA.

<sup>25</sup> Pizacani et al. (2012) interviewed 11 property managers of smoke-free public housing and found that 10 of them found enforcement to be extremely difficult. Nonetheless, 8 of the managers were in favor of the policy and noted few tenant complaints.

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