

# Can we underwrite our surroundings?

The challenges and opportunities of environmental risk factors

Part 6 of our “Big Six” lifestyle factors research

A L&H Trend Spotlight



The **BIG 6** lifestyle factors



mental wellbeing



physical activity



**environment**



sleep



nutrition



substance use

**environment**



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## This report on environment is part of our series on The Big Six Lifestyle Factors.

When we talk about environment from an insurance perspective, we're talking about environmental risk factors. Environmental risks to health are typically defined as all the external physical, chemical, biological, and work-related components that affect a person's health. In a broader sense, these include factors such as pollution, light, radiation, noise, land use patterns, work environment, and climate change. Their impact on health is significant: in 2019, environmental risk factors, including air pollution, heat and cold waves, water pollution and occupational risk globally accounted for an estimated 11.3 million deaths or about 20% of all deaths in 2019<sup>1</sup>.

To make matters more complicated, the environment is ever-changing, and this is being accelerated by climate change. In addition, exposure to environmental risks is typically not assessed directly when underwriting applicants. Instead, it is often indirectly and partially accounted for by looking at other underwriting parameters, like occupation and avocations.

While risk factors like heat waves might be interesting, we focus this paper on the health implications of more prevalent, systemic risk factors. We zoom in on several topics insurers are already looking at – second-hand tobacco smoke, air pollution and sunlight exposure. Despite their challenges, these factors seem like better potential candidates for risk assessment (now and in the future) given they are relatively prevalent, easier to estimate and have shown causal impacts on mortality and morbidity.



## Section 1

### Environment

## Second-hand smoking

No level of exposure is safe

Passive smoking or second-hand smoking (SHS) is the inhalation of smoke by someone other than the active smoker. SHS is a serious health hazard. Approximately 2.3% of worldwide mortality (or 1.3 million deaths each year) is attributed to SHS, and these numbers are rising<sup>1</sup>. In comparison, active smoking is estimated to cause approximately 7.7 million deaths annually. This growing burden has been a major motivation for smoke-free laws in workplaces and indoor public places, as well as some outdoor public spaces<sup>2</sup>.

Adults and children alike are affected. According to a 2010 World Health Organization (WHO) report, 40% of children and approximately 33% of adults globally are exposed to SHS regularly. Differences in exposure between men (33%) and women (35%) are minimal, but certain regions showed discrepancies<sup>3</sup>. Studies also indicate that SHS exposure may disproportionately affect people with lower socioeconomic status, below poverty levels and lower education levels<sup>4,5,6</sup>.

There is no safe risk-free level of SHS exposure. Exposed individuals are subject to more than 250 carcinogens and toxic chemicals, some of which are known human carcinogens with a proven effect on the development of different types of cancer<sup>7,8</sup>.

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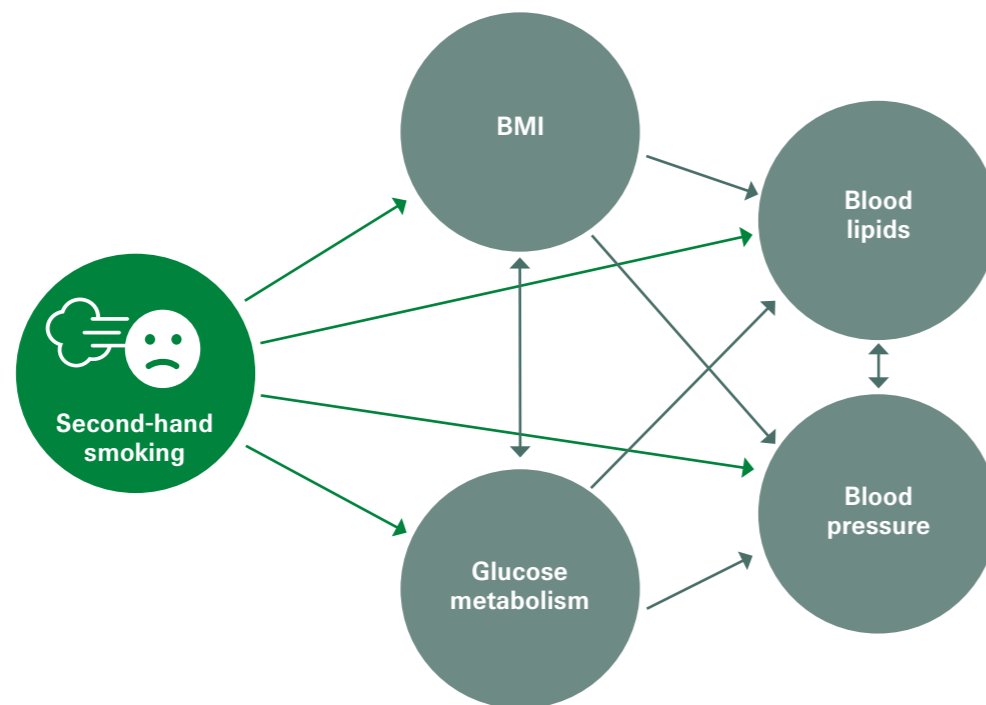
## Second-hand smoking

Clinical impacts are substantial

Similar to active tobacco smoking, SHS has been shown to affect traditional clinical risk factors such as blood pressure, body mass index (BMI), blood lipids and glucose metabolism (see Fig. 1). SHS exposure can increase blood pressure levels in children and adults, resulting in an increased risk of hypertension<sup>9,10</sup>. It is also suggested to cause imbalances in blood lipid profiles increasing the risk of experiencing cardiovascular events<sup>11,12</sup>. Finally, studies also suggest that, compared with non-smokers, second-hand smokers have higher BMIs and higher levels of fasting blood glucose and measure of insulin resistance, a condition that can lead to Type 2 diabetes<sup>13,14</sup>.

“There is no safe risk-free level of SHS exposure and the clinical impacts are substantial.”

**Figure 1**  
Interactions between Second-hand smoking and traditional clinical risk factors



## Second-hand smoking

Lifestyle factors are also impacted by second-hand smoke exposure, some more than others

SHS can have insidious effects on other aspects of our lives (see Fig. 2). Understanding these interactions and relationships are important for a more holistic picture of a person's health and for potential consideration in underwriting. We highlight two of the most interesting lifestyle factors.

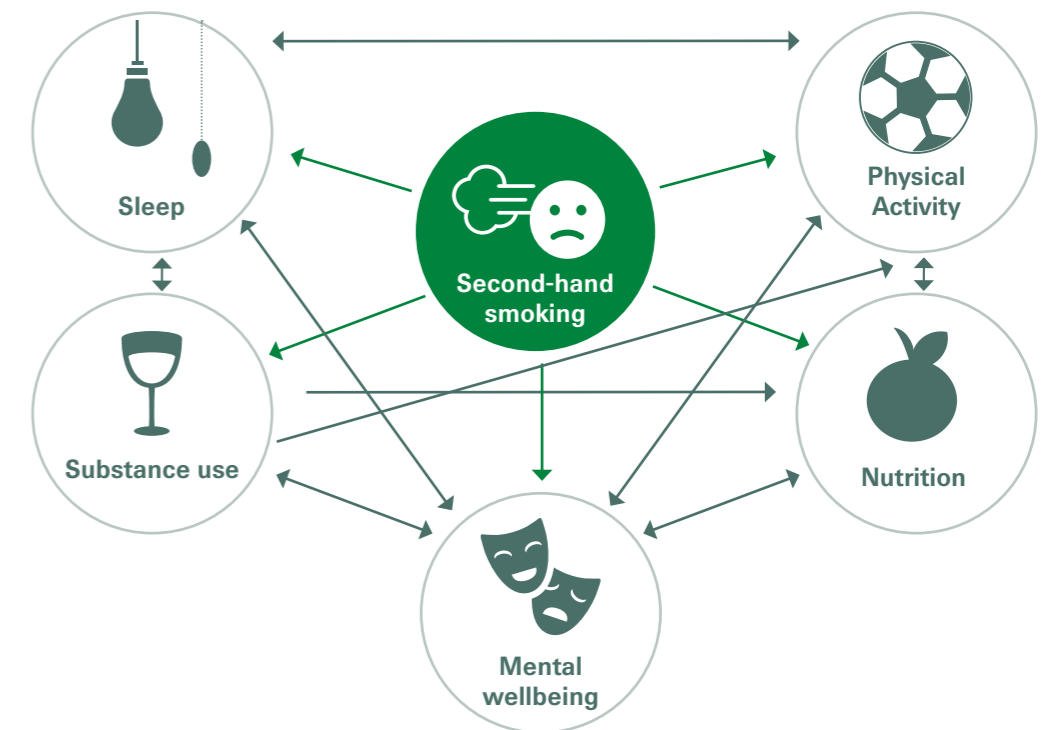
### Substance use

SHS has a direct, measurable impact on the brain – similar to what's seen in active smokers. Research has shown that SHS exposure increases the likelihood that children will become teenage smokers and makes it more difficult for adult smokers to quit<sup>15,16,17,18</sup>. Whereas active smoking and drinking alcohol have a positive correlation, there is currently less evidence that SHS exposure leads to increased alcohol consumption.

### Physical activity

Similar as in active smokers, exposure to SHS results in less oxygen being delivered to the heart and lungs which can reduce a person's physical endurance. Indeed, studies showed that chronic occupational SHS exposure among non-smokers deteriorates cardiorespiratory exercise performance and can affect immune responses<sup>19,20</sup>.

**Figure 2**  
Interactions between Second-hand smoking and lifestyle risk factors



## Second-hand smoking

### An underestimated danger?

In 2019, about 46% of global deaths from SHS exposure were caused by ischemic heart diseases (IHD) and stroke, followed by chronic obstructive pulmonary disease (COPD, 22%). Cancer, diabetes and kidney disorders as well as lower respiratory infections each contribute to about 10% of SHS related mortality, respectively.

A large meta-analysis from 2015 found that SHS exposure increased mortality risk by 18% and total cardiovascular disease (CVD) risk by 23%. The association of SHS exposure with CVD was markedly stronger among studies conducted in China than that in the US or in Europe (see Fig. 3)<sup>21</sup>. An explanation might be that dose and severity of SHS exposure in China is larger than in western countries. Also, national smoke-free legislations in public places or workplaces are less prevalent in China. A more recent study showed similar results and demonstrated that greater SHS exposure (intensity, amount, cumulative duration) is correlated with more CVD events<sup>22</sup>. Besides increased mortality risk, multiple studies have shown that individuals exposed to SHS were at higher risks for lung cancer (26–31%) than never smokers and higher risks for COPD (~56%)<sup>23,24,25,29</sup>.

Despite the negative health implications of SHS, it is rarely considered in risk assessment – unless it is captured via occupational risk. Just like insurers ask about active smoking, insurers might think about assessing an applicant’s SHS exposure at home or at the workplace, especially focusing on high levels of exposure to start. Measuring the magnitude and duration of the exposure would be the next evolution.

While it might be challenging for someone to limit their SHS exposure, especially at home or in the workplace, insurers can still educate customers on the increased risks and partner with public entities to advocate for smoke-free legislation.

Despite the negative health implications of SHS, it is rarely considered in risk assessment



**Figure 3**  
Second-hand smoking associations with all-cause and cause-specific mortality

		All-cause mortality	CVD	CHD	Stroke
Sex		RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
	Female	1.16 (1.06–1.27)	1.24 (1.14–1.35)	1.24 (1.12–1.38)	1.21 (1.08–1.37)
	Male	1.20 (1.10–1.31)	1.20 (1.11–1.30)	1.16 (1.08–1.26)	1.44 (1.14–1.82)
Region					
	China	1.34 (1.09–1.64)	1.65 (1.27–2.13)	1.83 (1.23–1.73)	1.56 (1.28–1.90)
	US	1.19 (1.03–1.37)	1.09 (1.03–1.16)	1.09 (1.00–1.19)	1.13 (0.99–1.28)
	Europe	1.08 (0.86–1.36)	1.31 (1.20–1.44)	1.31 (1.20–1.44)	1.00 (0.73–1.38)
	Others	1.16 (1.05–1.28)	1.28 (1.15–1.42)	1.21 (1.07–1.37)	1.46 (1.19–1.78)
Mean age (years)					
	<65	1.28 (1.00–1.64)	1.30 (1.18–1.43)	1.29 (1.15–1.44)	1.33 (1.06–1.68)
	≥65	1.34 (1.12–1.61)	1.21 (1.01–1.44)	1.37 (0.99–1.89)	1.43 (1.03–1.99)

Abbreviations: CVD: cardiovascular disease; CHD: coronary heart disease; RR: Relative Risk; CI: Confidence interval  
Adapted from Lu X, et. al. Int J Cardiol. 2015.



# Air pollution

Air pollution's impact on health: more than just the heart and lungs

Air pollution presents a considerable threat to health worldwide. According to the 2019 Global Burden of Disease Study, exposure to outdoor fine particulate matter (PM2.5) – small microscopic liquid or solid matter less than 2.5 micrometers that can be inhaled – can cause serious health problems. Household air pollution is the fourth leading risk factor for death worldwide, accounting for 210 million disability-adjusted life-years and 6.45 million deaths, with more than half occurring in emerging insurance markets such as China and India (see Fig. 4)<sup>1</sup>. It's estimated that 95% of the global population is exposed to particulate matters at levels exceeding WHO guidelines. In other words, almost every single one of us is exposed to more air pollution than deemed healthy. The impact of air pollution on mortality varies significantly across different geographies; sometimes by as much as a factor of ten times. For example, death rates attributable to air pollution are about 7 times higher in India than in Switzerland<sup>27</sup>.

Air pollution is also a risk factor for several causes of death, including cardiovascular disorders, chronic obstructive pulmonary disease (COPD), acute lower respiratory illness (ALRI), and lung cancer<sup>28</sup> (see Fig. 4).

In a recent meta-analysis, scientists found positive associations between cardiorespiratory hospitalisations and mortality, and exposure to air pollutants<sup>29</sup>. Similar results were found in a nationwide analysis in 272 main Chinese cities from 2013 to 2015, with stronger effects in northern China. This difference was possibly driven by variations in the chemical compositions and exposure patterns between regions<sup>30</sup>. Studies suggest that older individuals may be at a higher risk of premature mortality from air pollution than younger individuals, possibly due to accumulating exposure over their lifetimes.

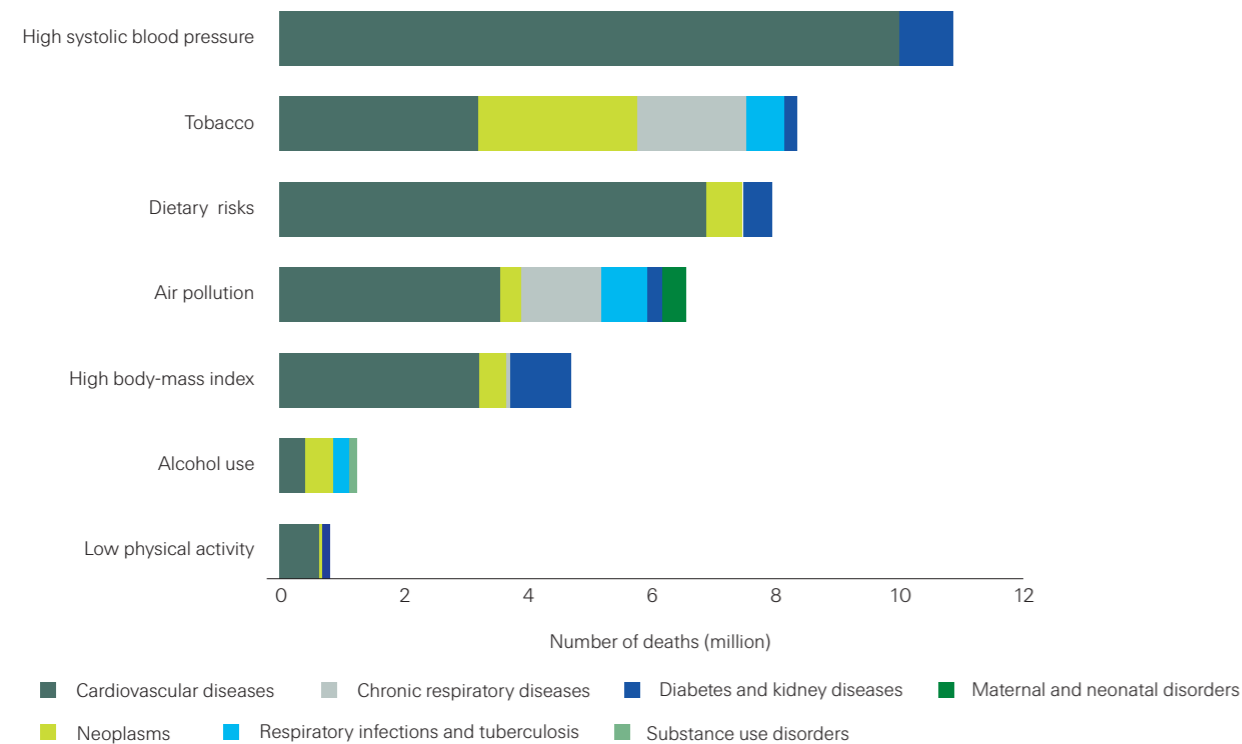
What about air pollution and [mental wellbeing](#)? The effect is less obvious but can be just as harmful. There is growing evidence that increasing concentrations of PM2.5 are correlated with higher risks of mental health symptoms and diagnoses<sup>32,33,34</sup>. Many researchers believe particulate matter can induce inflammation and oxidative stress in the brain that subsequently lead to depressive symptoms. It is also possible that air pollution and mental health are linked by other lifestyle choices, e.g. physical inactivity.

In addition to the heart and lungs, air pollution also negatively impacts other ["Big Six" lifestyle risk factors that we've covered previously](#). For instance, if you looked out the window and saw a smog-filled sky, would you feel encouraged to get out there and [log your daily step count](#)? Many of us are likely to hesitate before heading outdoors when there is visible air pollution, and scientists agree; increases in ambient PM2.5 concentration are generally associated with physical inactivity in adults, especially among those with respiratory conditions<sup>31</sup>.

Air pollution is still a challenging risk factor to consider in underwriting. Afterall, how much air pollution risk is already accounted for in the base rate for costing? Exposure to air pollutants predominantly depends on where one lives and works, which are difficult to modify. Focusing on increasing health awareness through wellness programs might be a better fit. Insurers could provide incentives to customers who actively protect themselves against air pollution by using smog alerts, mask wearing and indoor air filtration devices. On the preventative side, insurers can alert customers in real-time when they exposed to poor air quality and provide useful suggestions to mitigate exposure and risk.



**Figure 4**  
Global attributable deaths from selected risk factors for both sexes in 2019



Adapted from Institute for Health Metrics and Evaluation (IHME). GBD Compare



## Section 3

Environment

### Sun exposure

Sun exposure (or lack therefore): bad news for the skin, good news for the heart and mind?

Picture yourself outside enjoying a sunny day. Is this a healthy behaviour? Public health organizations are quick to remind us about the potential harms of ultraviolet (UV) light exposure<sup>35</sup>. It's estimated that 60–70% of cutaneous malignant melanomas are thought to be caused by UV radiation exposure<sup>36</sup>. But sunlight impacts more than just the skin – and it's not all negative! There is emerging data on the positive impact of sunlight on mortality, cardiovascular health and mental wellbeing.

A series of studies based on the Melanoma in Southern Sweden (MISS) cohort showed that low sunlight exposure in regions of low solar intensity may be a major risk factor for all-cause mortality. Women who were frequently exposed to sunlight actually had longer life expectancies (by 1–2 years) than women with minimal sunlight exposure<sup>37</sup>. In a more recent follow up study of the same MISS cohort, sun exposure was also associated with lower risk of hypertension.

Why does sunlight appear to lower your risk of all-cause mortality? Many believe vitamin D is the answer. On the other hand, it's possible that sun exposure in these studies acted as a surrogate marker for outdoor physical activity, which we know has a very positive impact on cardiovascular health and on mortality.

Sunlight may impact our physical health, but what about its impact on mental health? Seasonal affective disorder (SAD), also known as "winter depression," is a well-established mood disorder that peaks during fall and winter seasons. A reduction in sunlight, typical of winter seasons, alters levels of active biomarkers (vitamin D, serotonin, melatonin) that play critical roles in mood regulation. Not surprisingly, light therapy using blue light, a component of natural sunlight, is commonly prescribed to treat SAD<sup>38</sup>.

At this time, incorporating sun exposure (or lack thereof) into underwriting is challenging. Long-term robust evidence demonstrating a definitive causal connection to mortality is lacking and it's hard for insurers to accurately estimate an applicant's lifetime sun exposure. Plus, any mortality or disease differences (i.e. between countries for example) is likely already accounted for in existing costing methodologies. But insurers can still provide valuable and personalised health insights to customers about their sun exposure. As wearables and technology become more sophisticated, this might include reminders to wear sunscreen when on vacation or going for a walk on a sunny day when your mood seems low.



## Section 4

Environment

### What does this mean for insurers?

Environmental risk factors affect health outcomes, and some are more dangerous than others. In aggregate, assessing (and pricing) for these risk factors is still challenging.

But that doesn't mean insurers should sit still. Here are some practical consideration for insurers to reflect on now:

1

#### Start small.

The number of environmental risks is potentially limitless. Evaluate which risk factors are impactful and feasible to include, and not reflected in existing costing methodologies.

- Be mindful of the ever-changing nature of environmental risks; especially with the acceleration of climate change. As the world around us changes, so too will the risks and health implications.

2

#### Second-hand smoking might be the best starting point.

There is significant evidence that SHS causes severe health issues in children and adults. As a more easily quantifiable parameter, high SHS exposure could be assessed and incorporated into underwriting.

- Be mindful of under-disclosure risk but balance this against the value of moving to more personalised and holistic risk assessment.

3

#### Think broader than risk assessment.

Risk factors like air pollution and sun exposure may prove difficult to use in underwriting, but they still can add value when leveraged in creative ways.

- With wellness programs, insurers could send real-time personalised notifications to customers. For instance, sending a real-time mobile alert on the Air Quality Index to a habitual outdoor runner.
- Mobile and wearables will grow in sophistication. This can be another avenue to remind customers to steer away from second-hand smoke or air pollution when devices measure increased and sustained exposure to environmental risk factors.



Learn more  
at [swissre.com/  
TheBigSix](https://www.swissre.com/TheBigSix)

## Balancing the micro and macro for a comprehensive picture of health

The insurance industry has a wealth of research on the various clinical risk factors that come together to exert their influence. But we must also not forget the importance of an applicant's surrounding environment. All of us are surrounded by a unique set of environmental risk factors, which interact with our clinical and lifestyle risk factors and together, chart the path of our health. By combining the micro, clinical view with a macro, holistic perspective, we can have a more comprehensive understanding of risk and health.

Leading a healthy, fulfilling life is only possible under a nurturing environment. That's why Swiss Re is continuing our research into the impact of the environment on wellness to better support insurers and consumers alike. We have also embedded this 'Bix Six' research directly into Life Guide. Want to learn more? Get in touch with your local Swiss Re Underwriting Proposition Lead.

**We're smarter together**

## Conclusion

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