There’s No Smoke, But Is There Fire? 
Addressing Electronic Nicotine Delivery Systems In China’s Guandong Province

The Emory Global Health Institute Student Advisory Committee 
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All characters described within the case are fictional and bear no direct reflection to existing organizations or individuals. The case background and history, however, are meant to portray an accurate representation of the e-cigarette industry and e-cigarette usage in China. The case scenario is complex and does not necessarily have a correct or perfect solution, and thus encourages a judicious balance of creative yet perceptive approaches. The authors have provided informative facts and figures within the case and appendices to help teams. The data provided are derived from independent sources, may have been adapted for use in this case, and are clearly cited such that teams can verify or contest the findings within their recommendations, if it is pertinent to do so. Teams are responsible for justifying the accuracy and validity of all data and calculations that they use in their presentations, as well as defending their assertions in front of a panel of knowledgeable judges representing different stakeholders.
The Situation

In 2016, the Chinese government approved the Healthy China 2030 plan (31,32). This plan set a goal to reduce the population of adults that smoke by 20%. Tasked with developing provincial plans of action to achieve this goal, the governor of the Guangdong Province faces a conundrum -- the rapid rise of e-cigarette production and use in his province, notably in Shenzhen. Some in the governor's administration hail e-cigarettes and other Electronic nicotine delivery systems (ENDS) as an innovative solution to achieve tobacco cessation and the 2030 goals, while others argue they are a gateway to increased tobacco use, especially among youth. Meanwhile economic advisors caution the governor against heavy-handedness with ENDS, citing the industry’s contributions to economic development in the region.

To guide his decision-making, the governor has convened a multidisciplinary panel of experts to review the economic, health, and social impacts of ENDS and devise a strategy for how to address ENDS in Guangdong’s Healthy China 2030 Provincial plan. The administration is willing to commit 0.1% of the provincial gross domestic product over the next five years on the ENDS strategy.

Prompt for Teams

Your team has been asked to serve on this multidisciplinary panel, and your objective is to determine the best strategy to address ENDS in Guangdong’s Healthy China 2030 Provincial plan. You will need to prioritize and justify all of the decisions that you make toward reaching this goal, and you must be prepared to explain all of the aspects involved in your choices. You will also need to consider the different groups and stakeholders affected by your decisions.

Case Background Materials

Tobacco Use as a Global Problem
Tobacco use is the leading cause of preventable illness and premature death worldwide and one of the biggest public health threats the world has ever faced. It kills more than 7 million people a year; more than 6 million of those deaths are the result of direct tobacco use while around 890,000 are the result of non-smokers’ exposure to secondhand smoke. Around 80% of the 1.1 billion smokers worldwide live in low- and middle-income countries, where the burden of tobacco-related illness and death is heaviest. (27)
The Rise of E-Cigarettes

Since 2005, the global e-cigarette industry has grown to an estimated US$3 billion global business with 466 brands, a market in which the tobacco industry is taking a greater stake. (25) Electronic nicotine delivery systems (ENDS) or e-cigarettes are marketed as aids to quit smoking or as healthier alternatives to tobacco.(27) Invented by Hon Lik, a Chinese medical researcher in 2003, electronic cigarettes are battery powered devices that allow users to simulate the work of a traditional cigarette by vaporizing liquid nicotine (among other additives). They contain no tobacco but rather simulate tobacco smoke to provide the feeling of smoking and satisfy the smoker's craving for nicotine. Therefore, they can serve as substitutes for traditional cigarettes to some extent. E-cigarettes can be flavored: over 800 different fruit, candy-like, and alcohol-drink flavors have been developed and marketed to date. Recent research from the US Centers for Disease Control indicates such flavors make them attractive to children and adolescents. Young adults, particularly those who have engaged with e-cigarette marketing, perceived e-cigarettes as less harmful than cigarettes; such beliefs are in turn associated with higher e-cigarette use. (35)

However, there is insufficient evidence to determine whether e-cigarettes help users quit smoking or not. The World Health Organization (WHO) recommends that smokers should first use a combination of already-approved treatments, behavioural self-help guidance, and nicotine replacement therapies such as the transdermal patch or nicotine gum. (36) While e-cigarettes are likely to be less toxic than conventional cigarettes, they still contain nicotine, which most likely poses health risks to adolescents and fetuses of pregnant mothers using these devices. Such risk factors include birth, miscarriage, and in adolescents, it can harm the parts of the brain that control attention, learning, mood, and impulse control.

Health Consequences of Tobacco & E-Cigarettes

Smoking and tobacco use have been highly correlated with various cancers, lung diseases, cardiovascular diseases, as well as increased incidences of flu, colds, pneumonia, and tuberculosis.

A third of the world’s lung cancer cases occur in China. Though women have a significantly lower rate of smoking, secondhand smoke has greatly contributed to the higher rates of lung cancer found in Chinese women. In addition to lung cancer, China has one of the highest prevalences and worst outcomes in smoking-related pulmonary diseases such as chronic obstructive pulmonary disease (COPD). (19)

Of the men aged 30 to 44 years in China who die from cardiovascular diseases, 46% of those deaths are attributed to tobacco use. This includes diseases such as heart attacks, strokes, and coronary and peripheral artery diseases.

For women, smoking while pregnant harms the fetus. It is correlated with low birth weight and increased risk of sudden infant death syndrome (SIDS). (25)

There has been controversy and debate regarding e-cigarettes’ potential adverse health effects, particularly for youth. Potential negative health effects include nicotine addiction,
developmental effects of nicotine exposure on growing brains, the influence of the use of e-cigarettes on traditional cigarette use and illicit drug use, and accidental overdose of nicotine. (23)

In addition to known risks of nicotine use in youth, e-cigarettes have unique adverse consequences related to the toxic chemicals in its aerosol. There are several toxic chemicals including diacetyl, benzene, and heavy metals such as nickel, tin, and lead. Diacetyl, which is used for flavoring, has been linked to serious lung diseases such as bronchiolitis obliterans. (30) Benzene is found in car exhaust. In addition, e-cigarette batteries are at risk for fires and explosions, putting the user at risk for serious injuries. (23) (*See Appendix I for more information.*)

**Tobacco & E-Cigarette Consumption in China**

Recent studies show that China is home to a third of the world's smokers and lung cancer cases. It can be difficult to collect representative data of the country, due to the massive diversity in wealth, education, and urbanization within China. However, the WHO Adult Tobacco 2010 Survey reported that overall, the smoking rate in China was 28.1% in all adults. Out of the general population, 52.9% of men smoke, whereas only 2.4% of women smoke (a male-to-female ratio of 22:1). (19)

Tobacco use was highly correlated with educational level, with the lowest rates among those with college and postgraduate education. The survey also found that 85.6% of smokers smoked every day, at an average of 14.2 cigarettes per day. According to the WHO, approximately one million deaths every year in China are caused by tobacco, and if the prevalence of tobacco use is not reduced, the number will rise to three million by 2050. (20)

E-cigarette use in China is a small, but growing market. In a study conducted in late 2014, the prevalence of e-cigarette usage among smokers in China was estimated to be 3.4%. (10) It is estimated that there are between 1.5 to 2 million e-cigarette smokers in the country, substantially lower than the number of cigarette users.

**Tobacco Use & E-Cigarette and Youth**

In 2014, the WHO, China CDC, and the China National Health and Family Planning Commission conducted a Global Youth Tobacco Survey with responses of students in China aged 13-15. They found that 19.9% of all students have used tobacco before. Of those, 30.1% were boys and 8.7% were girls. (22)

They found that 6.9% of all students were actively using tobacco at the time of the survey. Of those, 11.2% were boys and 2.2% were girls. Overall, 72.9% of the students were exposed to secondhand smoke at home or in public. (22)

Though it has been noted that the use of e-cigarettes is popular among youth in China, few statistics are available regarding its use and consumption. In a brief China Global Youth Tobacco Survey in 2014, it was found that 1.2% of 155,117 junior high students (age 13-15)
had used e-cigarettes in the last 30 days. (22) In another study, 26.4% of 2042 adolescents between the ages 12 and 18 had used e-cigarettes. (24)

The adverse effects of e-cigarette use can be especially harmful to the developing brains of kids, teenagers, and young adults. According to a report from U.S. Department of Health and Human Services (2016), in addition to the risks of nicotine use, e-cigarettes are unique in that the aerosols containing toxic chemicals can potentially cause pathological changes. (23)

**Tobacco Use and Women**

Women in China have a significantly lower prevalence of tobacco use, 2.4%, compared to men. The rates of tobacco use between rural and urban women were found to be comparable. However, higher rates of tobacco use were found in rural to urban migrant women in subgroups such as commercial sex workers, hospitality workers, and restaurant workers. Issues arising from self-report bias and social desirability bias need to be considered when interpreting the prevalence of women.

Overall, rates of ever smoking in women has declined steadily through the years from 10% for those born in the 1930s. Despite the significant difference in the prevalence of tobacco use between men and women, second-hand smoke exposure seems to have disproportionately increased tobacco-related mortality in women. (19)

There are currently few studies on e-cigarette use by women.

**Tobacco and Health Care Costs**

The economic costs of smoking attributable-disease can be defined as either 'direct costs' such as hospital fees or 'indirect costs' representing the productivity loss from morbidity and mortality. (33) In 2000, the economic costs of smoking in China amounted to $5 billion (measured in 2000, US$) in total and $25.43 per smoker (≥ age 35). The share of the economic costs was greater for men than women, and greater in rural areas than in urban areas. Of the $5 billion total costs, direct costs were $1.7 billion (34% of the total), indirect morbidity costs were $0.4 billion (8%), and indirect mortality costs were $2.9 billion (58%). The direct costs of smoking accounted for 3.1% of China’s national health expenditures in 2000. (34)

**Common Tobacco Products in China**

Though there are several forms of tobacco used in China, such as cigars and smokeless tobacco, cigarettes remain the most popular with the greatest health implications.

Meanwhile, with the increased efforts on tobacco restriction, the use of e-cigarettes have risen in popularity. Much controversy has surrounded its regulation, especially with increased marketing efforts focusing on the youth population. (21)
China at a Glance (1)

- July 2018 Population Estimate: 1.38 billion
- Geographical Area: 9.6 square kilometers (5th largest country by area)
- Religious Composition: 52.2% unaffiliated, 21.9% folk religion, 18.2% Buddhist, 5.1% Christian

China’s Governance
The Communist Party of China (CPC), led by party leader Xi Jin Ping, is the only political party in mainland China and has held power since 1949. All other parties, referred to as the United Front, are essentially smaller branches of the CPC. Though the political party is not formally integrated in the governmental structure, it exerts governmental influence through the political bureau (politburo). This bureau, governed by a Standing Committee consisting of the highest ranking members of the CPC, meets to discuss policy changes and decide ways forward on national issues. (2)

The authority of the Politburo, specifically the Standing Committee, is so strong because all of the members have key positions in the national and local governments. Importantly, power in the Chinese government lies in three main governmental entities: the legislative body called the National People’s Congress (NPC), the President, and the executive branch named the State Council. (3) Chinese citizens elect the members of NPC through elections, the NPC then elects the president, and the president appoints members of the state council. (1,3)

China’s Economy
China has the highest GDP (adjusted for PPP) in the world at 23.21 trillion USD in 2017. It has also been one of the fastest growing economies in the world, with real growth rates slightly below 7% in each of the last three years. China is also a net exporter, with 2.2 trillion USD worth of goods being exported in comparison to the 1.7 trillion imported into the country. USA and Hong Kong are the primary destinations for their productions and they primarily receive goods from South Korea, Japan, and USA. (1)

In 2017, although services (51.6%) and industry (40.5%) generated a majority of China’s GDP in comparison to agriculture (7.9%), the 800 million person labor force has disproportionately more agriculture workers (27.7%) than the share of GDP it brings. Regardless, China is a leading producer of tobacco. Meanwhile, 28.8% of the workers are in industry and 43.5% are in service. (1)

Shenzhen, Guangdong Province at a Glance
Shenzhen has been one of the fastest growing cities in the last 40 years since it became the first-ever special economic zone (SEZ). A SEZ is a business area that has different business and trade laws than those stipulated for the rest of the country with the goal of boosting economic growth, development, and innovation. Some important facts (4):

- Population has grown from 30,000 in 1979 to 12.5 million in 2018 (4)
- Life expectancy was 78 years old in 2010, up from 76 in 2005. (5)
Religious Composition: 37% folk religion, 26% Buddhist, 15% unaffiliated. (5)

GDP has grown from 197 million yuan in 1979 to 2.2 trillion yuan in 2017. It grew by 8.8% in the last year alone. (4)

In 2016, the Nanshan district within Shenzhen was home to 125 listed technology firms valued at nearly 400 billion USD. (6)

Over 11,000 state-level technology companies operate in Shenzhen, with 3,193 being set up in 2017. (4)

Self branded as a city of innovation, in 2017 received 51 international patent applications. This is almost equivalent to the rest of the country. (4)

A Coastal town that covers 2000 square kilometers. It geographically separates the Chinese mainland and Hong Kong. (4)

**Health Infrastructure in China (37)**

In China, The National Health Commission (NHC) is primarily responsible for healthcare delivery while other ministries are responsible for health financing, food safety, and pharmaceuticals, and medical devices. Regarding service delivery, China has a largely hospital-based delivery system managed through the NHC and the local governments.

Traditional Chinese medicine is an integral part of the national health-care system. In 2009, the Government launched an ambitious health-care reform initiative, and by 2015, 95% of the population had health insurance.

In 2016, the Party and Government also issued a high-level policy directive, Healthy China 2030. Under the initiative, health is recognized as a pre-condition for continued growth—“necessary for promoting the all-round development of human beings and the fundamental conditions for economic and social development.” Healthy China 2030 outlines a plan to promote healthy living, optimize health services, improve health protection, build a healthy environment, develop health industries, improve supportive and enabling systems, and strengthen leadership and implementation. Health is also integrated in China’s 13th Five-Year Plan For Economic and Social Development (2016–2020).

Looking ahead, China faces two key challenges: the need to address major health disparities and inequities; and the coming rise of non-communicable diseases largely due to changing dietary and lifestyle factors.

**Selected Health Statistics**

- WHO region: Western Pacific
- World Bank income group: Upper-middle-income
- Life expectancy at birth (years) (2015):
  - 77.6 (Female)
- Health systems Total expenditure on health as a percentage of gross domestic product (2014): 5.55%
- Private expenditure on health as a percentage of total expenditure on health (2014): 44.21%
- General government expenditure on health as a percentage of total government expenditure (2014): 10.43%
- Physicians density (per 1000 population) (2015): 3.625
- Nursing and midwifery personnel density (per 1000 population) (2015): 2.342

**Economics of Tobacco and E-Cigarettes in China**

**Tobacco vs E-Cigarette Production**
Tobacco has long been a major market in China. As stated briefly above, China is the world’s leading producer of tobacco, producing about 40% (2.5 trillion) of the world’s cigarettes and over 3 million metric tons of tobacco leaf in 2012. (7,8) This production and manufacturing generates over two trillion USD in annual revenue. (8) On the other hand, tobacco consumerism has cost the economy as well: the WHO released a 2014 report estimating that direct healthcare costs treating issues related to tobacco in China were at $9 billion per year. (8a)

The growth of technology and innovation, specifically in Shenzhen, can especially be seen in e-cigarette production. According to a 2016 report, Shenzhen produces over 80% of the entire world’s e-cigarettes and exports them globally, with the United States being the top global consumer. (9) In the same year, global e-cigarette sales were estimated at 10 billion USD. This growth of development may partly be attributed to the fact that China currently still has no major regulatory policies governing the manufacturing of e-cigarettes. (10)

**Tobacco Use vs E-Cigarette Use**
China is the largest consumer of combustible tobacco products in the world. 2017 data from the WHO indicate that 52.1% of adult men (44.8% smoke daily) and 2.7% of adult women (2.0% smoke daily) smoke tobacco. Additionally, 11.2% of boys and 2.2% of girls younger than age 15 report tobacco use. Considering these data are self-reported, it is likely this underestimates the real values. (11) Though population level data in Shenzhen is scarce, a study of 4,800 migrant factory workers in Shenzhen revealed a smoking prevalence of 27.3% in adult men and 0.7% in adult women, suggesting that smoking levels may be lower in Shenzhen than nationally. (12) Importantly, in 2016 China reported that tobacco consumption dropped for the first time in 20 years, a drop of 2.4%. (13) This was linked to the fact that taxation on cigarettes was increased from 5% to 11% in 2015.

There are less data on e-cigarette use in China and even less so in Shenzhen specifically, but generally the market in China is small but growing quickly. In late 2014, the prevalence of e-cigarette usage among smokers in China was estimated at 3.4%, which represents a small but growing market. (10) Other sources estimate that as of 2016, there were approximately 1 million regular e-cigarette users (<0.1% of the total population). (14) In the same year, the
domestic e-cigarette market in China was estimated at 175 million USD. Sales of e-cigarettes and the number of users had also both increased by over 250% in the same time period. (14)

Trade and Tax policies

E-Cigarettes
The Chinese government holds different attitudes toward different types of electronic cigarettes since the cigarette industry can bring huge tax revenue. Currently it does not regulate vapes or e-cigarettes. It does prohibit the import and sale of heat-not burn electronic cigarettes given the similarities with traditional cigarettes and is concerned about its potential competition with traditional cigarettes. (25)

While China accounts for over 90% of the global electronic cigarette production by producing over 1.6 billion units, over 90% of china-made cigarettes are exported.(25) Future trade deals and wars will affect China’s export of e-cigarettes, particularly in USA.

Specifically, the ongoing trade war between the US and China may significantly impact the growth of this industry from Q3 of 2018 onward, when tariffs impacting e-cigarettes are expected to take effect. (10a) Although there are not concrete data readily available yet on the impact, it would be reasonable to assume that increasing the taxation on e-cigarette related products from 10% to 25% will discourage exports of e-cigarettes to the US. Such a shift in the market could lead to widespread changes such as promotion of local e-cigarette markets or other international markets instead. (10b)

Tobacco
Two important trade and tax policies may influence tobacco production and consumption in China. The first is the 2015 increase in cigarette taxes from 5%-11%, which was associated with a decrease in tobacco consumption. (13) The second is the current trade dispute between US and China, its widespread effects have also influenced the tobacco industry. As part of the retaliatory tariffs China imposed on the US after the initial round of tariffs encompassing 50 billion dollars of US goods, China decided to tax US-produced tobacco being imported into China. This will likely reduce the amount of tobacco exported from the US to China, which means that US farmers will suffer and may either cause cigarette smoking in China to decrease or local tobacco growing to increase. (13b)

Employment in Tobacco and E-Cigarettes

China plays a major role as both a tobacco leaf grower and manufacturer. First, China cultivates the most tobacco leaves over the largest geographical area (1.4 million hectares) with approximately 1.2 million farmers dedicated to the cultivation of tobacco.(15) Demand for tobacco farming in recent years, however, has decreased because the surplus of tobacco has led to reduced income for farmers; farmers make on average 49,100 Chinese yuan per year. In response, the government of China in 2017 announced a plan to subsidize farmers with 1 Chinese yuan per 0.07 hectares of land being used to grow tobacco. (15) On the manufacturing side, China employs approximately 203,000 people in tobacco manufacturing as of 2013. This is a decrease from the 268,500 employed in 2000. (7)
There is less information regarding employment in the e-cigarette industry. It is likely that most e-cigarette jobs in China are in Shenzhen to manufacture e-cigarettes for both large companies such as JUUL and smaller local companies. Local news coverage in Shenzhen suggests that because the regulation surrounding e-cigarettes is more relaxed and it is becoming more popular (especially among youth), many people are choosing to open in-person and online retailers for e-cigarettes. (13)

**Accessing Tobacco and E-Cigarettes**

In general, the widespread use of tobacco in China may be related to how affordable it is. In 2018, the cost to buy a pack of Marlboro (an average priced cigarette brand) is 2.75 USD (this is less than half the cost in the United States). The World Bank reports that while in 2000 China had one of the lowest cigarette affordability rates in the world, the affordability of cigarettes since then has increased at a rapid rate because citizens’ disposable income has grown at a much faster rate than cigarette prices. (16) Even with the 2015 tax hikes, cigarettes were two times more affordable in 2016 than 2001, with a model predicting that a 10% increase in cigarette affordability results in a 6% increase in cigarette consumption. (16)

E-cigarettes can be highly variable on cost depending on the quality and type, but in general are more expensive than cigarettes. There are two major types of vape pen, one that is rechargeable and refillable and one that is disposable. The disposable vape pens can sell for as low as 8 USD and have nicotine quantities roughly equivalent to 2.5 packs of cigarettes. The rechargeable ones that need to be refilled can go as high as 450 USD, but can also be found rather inexpensively as well. (13) On top of that initial purchase, it is necessary to continuously purchase the liquid nicotine that the pen converts into a mist that can be inhaled. One cartridge is roughly comparable to one pack of cigarettes and can cost much less. (13)

**Point of Purchase of Tobacco & E-Cigarettes**

Purchase of tobacco in China likely occurs primarily through retail stores and convenience stores. This is due to the fact that in order to sell cigarettes online you must first obtain a tobacco monopoly manufacturer license, tobacco monopoly wholesale enterprise license, or a special tobacco monopoly operation enterprise license. In addition, most types of advertisements for tobacco in China are banned. (17)

E-cigarettes, however, are not currently subject to as much regulation and are not specifically categorized as a tobacco product. This means that when opening e-cigarette retail stores, the person applying for a permit can categorize the store many different ways (13). Despite the leniency of opening physical stores, it may be easier to sell on the internet: 80% of e-cigarettes in China are distributed online. The regulations mentioned above on tobacco products do not apply to e-cigarettes, and as such, they are widely available on the internet. Additionally, the limited amount of regulations allow manufacturers to claim many health benefits of e-cigarette smoking in comparison to cigarettes, even when those health claims may not be substantiated by any reliable evidence. (17b) The only relevant piece of recent legislation was that in mid-
2018 China banned minors under the age of 15 from buying e-cigarettes. (18)

**Agricultural and Environmental Impact of Tobacco & E-Cigarettes production**

China produces more than 2.5 trillion cigarettes and has invested in 1.5 million hectares of agricultural land to harvest 3.2 tons of tobacco leaves. (26) Using so much land and water has its costs as this land and water could have been used to grow crops to help fight China’s malnutrition problems and the fresh water used could be used to fight water scarcity. As a mono-crop, tobacco farmers spray the plants with pesticides that harm both the environment and human health. Using so many chemicals for pesticides and other form of fertilizers contribute to rapid depletion of soil health.

China also struggles with poor air quality due to large-scale industrial and urban emissions, with tobacco agricultural practices contributing as well. Individual smoking and other tobacco industry generated by factories, transportation, and farming all contribute to the increasing air pollution. (26)

**Summary**

The objective of each team is to provide a clear and justifiable e-cigarette control strategy to the Governor of Guangdong Province to be included in Guangdong’s Healthy China 2030 Provincial plan. You are permitted to request a maximum of 0.1% of the provincial gross domestic product over the next five years on the END strategy to accomplish your goals. The strategy should be sustainable, financially justifiable, and acceptable. The objective of your strategy should be to decrease the health, socioeconomic, and environmental burdens associated with e-cigarettes and ENDS in Guangdong Province. You may propose any combination of prevention, protection and/or cessation strategies. You should define and justify your choice of target population and other specific target choices (timeline) as well as your choice of interventions. On Saturday, you will present your recommendations for the provincial plan to the Governor and his cabinet and you should expect questions regarding the various tradeoffs involved in your decisions.
References


(17) "Regulated Forms of Advertising, Promotion and Sponsorship." Tobacco Control Laws:


## Appendix I: Public Health Consequences of Tobacco Use

### Health consequences related to tobacco exposure

<table>
<thead>
<tr>
<th>Heart and blood vessel diseases</th>
<th>- Atherosclerosis, coronary heart disease</th>
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<tbody>
<tr>
<td></td>
<td>- Cerebrovascular diseases</td>
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<td></td>
<td>- Abdominal aortic aneurysm</td>
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<td>- Peripheral vascular disease (may cause gangrene in the legs)</td>
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<td></td>
<td>- Erectile dysfunction or impotence (atherosclerosis and endothelial dysfunction of the internal pudendal and penile arteries)</td>
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</tbody>
</table>

| Cancers                       | - Cancers of the bladder, cervix, esophagus, kidney, larynx, lung, oral cavity and pharynx, pancreas, stomach and leukemia |
|                               | - Precancerous lesions, leucoplakia, erythroplakia of the oral cavity |

<table>
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<tr>
<th>Respiratory diseases</th>
<th>- Chronic obstructive pulmonary disease, chronic bronchitis</th>
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<tr>
<td></td>
<td>- Acute respiratory illnesses: pneumonia, bronchitis, and other respiratory infections</td>
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<tr>
<td></td>
<td>- Respiratory effects mediated in utero, reduced respiratory function in infants</td>
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<tr>
<td></td>
<td>- Respiratory effects in childhood and adolescence: decreased physical fitness, potential retardation in the rate of lung growth, and the level of maximum lung function among children and adolescents</td>
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<td>- Respiratory effects in adulthood: acceleration of age-related decline in lung function among adults</td>
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<td></td>
<td>- Other respiratory effects: increased cough, phlegm production, wheezing, respiratory infections, and dyspnea</td>
</tr>
</tbody>
</table>
| Reproductive effects | - Fetal death and stillbirth: sudden infant death syndrome (SIDS)  
|                      | - Fertility: delayed conception (primary and secondary infertility)  
|                      | - Pregnancy complications: premature rupture of membranes, abruption placentae, and placenta previa |
| Other effects        | - Cataract  
|                      | - Adverse surgical outcomes related to wound healing and respiratory complications  
|                      | - Low bone density among postmenopausal women and risk of hip fracture  
|                      | - Peptic ulcer disease and periodontitis |