2019–2020年中国40岁及以上人群职业粉尘或有害气体暴露与防护情况分析

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【摘要】目的 分析中国≥40岁人群粉尘或有害气体的暴露和防护情况，为开展职业粉尘或有害气体暴露防控工作提供基础数据。方法 数据来源于2014-2015年和2019-2020年中国居民慢性阻塞性肺疾病监测。两次监测均采用多阶段分层整群抽样方法。在全国31个省(自治区、直辖市)中125个监测点抽取调查对象，并采用面对面询问调查的方式收集职业粉尘或有害气体暴露及其防护状况等相关信息。采用复杂抽样加权方法估计职业粉尘或有害气体暴露率及防护率，并比较两次监测的结果。结果 2014-2015年和2019-2020年分别有71061人和71023人纳入分析。2019-2020年我国≥40岁人群职业粉尘或有害气体的暴露率为33.8%(95%CI: 29.9%~37.7%)，男性高于女性，乡村高于城镇。随着文化程度的升高，职业粉尘或有害气体的暴露率呈下降趋势。2019-2020年我国≥40岁人群职业粉尘或有害气体防护率为47.9%(95%CI: 43.2%~52.6%)。与2014~2015年相比，2019~2020年我国≥40岁人群职业粉尘或有害气体暴露率在不同性别、地区和职业人群中均有所下降，总体下降了10.7个百分点。职业粉尘或有害气体防护率均有所上升，总体上升了21.9个百分点。西部地区职业暴露率下降幅度高于东、中部地区，职业防护率上升幅度高于东、中部地区。结论 2019~2020年我国职业粉尘或有害气体暴露率有所下降，职业粉尘或有害气体防护率有所上升，但仍约有三分之一的人群存在职业粉尘或有害气体暴露，且其中采取防护的比例尚不足一半，应更加关注文化程度较低的职业人群、农民工群体等重点人群的职业防护。

【关键词】 粉尘；有害气体；职业暴露；防护；横断面研究

Analysis on occupational dust or harmful gas exposure and protection in people aged 40 and above in China, 2019-2020

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【Abstract】Objective To understand the current status of occupational exposure to dust or harmful gases and occupational protection in people aged ≥40 years in China, and provide data support for the prevention and control of occupational dust or harmful gas exposure. Methods The data were obtained from the surveillance for chronic obstructive pulmonary disease (COPD) in adults aged ≥40 years selected by multi-stage stratified cluster sampling from 125 surveillance points in 31 provinces (autonomous regions and municipalities) during 2014-2015 and 2019-2020, and relevant information about occupational dust or harmful gas exposure and protection measures were collected through face-to-face interviews. Occupational dust or harmful gas exposure rate and protection rate decreased significantly in China in 2019-2020 compared to 2014-2015. Conclusions In 2019-2020, the occupational dust or harmful gas exposure rate in China decreased significantly, and the protection rate increased, but still about one third of the population were exposed to occupational dust or harmful gases, with the protective ratio less than half. It is necessary to pay more attention to the occupational protection of those with low educational levels, migrant workers, and other key groups.
occupational protection rate were estimated by using weighting complex sampling methods, and then the results were compared. **Results** From 2014 to 2015 and from 2019 to 2020, a total of 71 061 and 71 023 individuals aged ≥40 years were surveyed, respectively. The rate of occupational exposure to dust or hazardous gas was 33.8% (95%CI: 29.9%-37.7%) during 2019-2020. The occupational exposure rate was higher in men than in women and in rural residents than in urban residents. With the increase of education level, the rate of occupational exposure to dust or harmful gas showed a downward trend. The protection rate against occupational dust or hazardous gas exposure was 47.9% (95%CI: 43.2%-52.6%) during 2019-2020. Compared with 2014-2015, the rate of occupational exposure to dust or hazardous gas decreased by 10.7 percentage points in different gender, area and occupational groups and the occupational protection rate increased by 21.9 percentage points during 2019-2020. The decrease in occupational exposure rate was higher in western China than in eastern and central China, and the increase in occupational protection rate was higher in western China than in eastern and central China. **Conclusions** The rate of occupational exposure to dust or harmful gas decreased and the rate of occupational protection against dust or harmful gas exposure increased in China during 2019-2020. However, about one-third of the population still suffer from the occupational exposure, and less than half of them take protection measures. It is necessary to pay more attention to the key populations, such as workers with lower cultural level and rural migrant workers, in occupational health practice.

【Key words】Dust; Harmful gas; Occupational exposure; Protection; Cross-sectional study

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据的清理和分析。本研究基于复杂抽样设计应用复杂加权方法估计不同特征人群职业粉尘或有害气体暴露及其防护率[10],应用泰勒级数法差法估计抽样误差及率的95%CI,用第七次全国人口普查数据对2014-2015年和2019-2020年两次监测数据
分析结果进行调整。采用基于复杂抽样设计的Rao-Scott χ^2 检验比较两次监测和不同人群间粉尘或有害气体的暴露情况。采用基于复杂抽样 logistic 回归系数的假设检验进行趋势性检验。双侧检验,检验水准 α=0.05。

结果

1. 人口学特征: 2019-2020年共纳入71 023名≥40岁的调查对象,男女性各占50.0%(95%CI:48.7%~51.3%)。城镇人口占60.0%(95%CI:52.6%~67.3%),略高于乡村[40.0%(95%CI:32.7%~47.4%)]。文化程度为小学及以下的人数最多,占45.4%(95%CI:39.0%~51.7%)。不同职业人群中从事农林牧渔业的人数最多,占31.9%(95%CI:26.2%~37.6%)。见表1。

2. 粉尘或有害气体暴露情况: 经过复杂加权计算后, 2019-2020年我国≥40岁人群职业粉尘或有害气体的暴露率为33.8%(95%CI:29.9%~37.7%),其中男性为39.2%(95%CI:35.6%~42.9%),女性为28.3%(95%CI:24.0%~32.6%(P<0.001); 乡村人群职业粉尘或有害气体的暴露率为40.3%(95%CI:36.0%~44.6%),高于城镇的29.4%(95%CI:25.1%~33.7%)(P<0.001); 不同年龄段中, 50~54 岁年龄段相对较高,暴露率为36.3%(95%CI:31.7%~40.9%), 40~44 岁年龄段最低, 为28.7%(95%CI:23.8%~33.6%); 不同地区人群中, 西部地区职业暴露水平

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### 表1 研究对职业分布及城乡分布情况
为 40.4% (95% CI: 32.7%~48.1%)，东、中、西部地区分别 为 32.3% (95% CI: 36.1%~38.4%) 和 30.2% (95% CI: 24.7%~35.8%)。随着文化程度的升高，职业粉尘或有害气体的暴露率呈下降趋势 (P<0.001)；不同职业人群中，从事生产运输设备操作职业的人群职业暴露率最高，为 49.2% (95% CI: 43.9%~54.5%)。见表 2。

3. 职业粉尘或有害气体暴露人群采取职业防护情况。经过复杂化权计算后，2019–2020 年我国≥40 岁人群职业粉尘或有害气体防护率为 47.9% (95% CI: 43.2%~52.6%)，其中经常防护的比例为 60.7% (95% CI: 57.8%~63.6%)，有时防护的比例为 19.3% (95% CI: 17.4%~21.2%)，偶尔防护的比例为 20.0% (95% CI: 17.6%~22.4%)。随着年龄的增加，采取职业防护的人群比例逐渐下降 (P<0.001)。城镇为 50.8% (95% CI: 45.7%~55.9%)，略高于乡村的

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<td>东、中部</td>
<td>32.3% (95% CI: 36.1%~38.4%)</td>
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<td>西部</td>
<td>30.2% (95% CI: 24.7%~35.8%)</td>
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<tbody>
<tr>
<td>东、中部</td>
<td>60.7% (95% CI: 57.8%~63.6%)</td>
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<td>西部</td>
<td>49.2% (95% CI: 43.9%~54.5%)</td>
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<td>东、中部</td>
<td>39.2% (35.6%~42.9%)</td>
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<tr>
<td>西部</td>
<td>32.3% (31.1%~39.4%)</td>
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<tr>
<td>东、中部</td>
<td>23.7% (19.2~28.1)</td>
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<td>西部</td>
<td>23.6% (20.2~30.5)</td>
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<td>东、中部</td>
<td>50.8% (45.7%~55.9%)</td>
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<td>50.8% (45.7%~55.9%)</td>
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44.7% (95% CI: 39.5~50.1%) (P<0.01)。不同地区人群中，东部地区职业防护率为 52.1% (95% CI: 46.7~57.4%)，其次为西部地区 [47.9% (95% CI: 37.0~58.9%) ]。不同职业人群中，从事生产运输设备操作的职业人群防护率最高 [59.3% (95% CI: 52.8~65.9%) ]，其次为行政干部/办事人员/专业技术人员 [54.0% (95% CI: 44.4~63.6%) ]。见表3。

4. 不同特征人群职业粉尘或有害气体暴露率与防护率变化情况，经第七次全国人口普查数据标准化后，2014~2015 年我国职业粉尘或有害气体的暴露率为 44.5% (95% CI: 39.9~49.0%)，职业粉尘或有害气体防护率为 26.0% (95% CI: 23.7~28.3%)。与 2014~2015 年相比，2019~2020 年我国职业粉尘或有害气体暴露率降低了 10.7 个百分点，在不同地区，性别和职业人群中均有所下降，差异有统计学意义 (均 P<0.05)。其中西部地区职业暴露率下降了 16.6 个百分点，下降幅度高于东部、中部地区；从事农林牧渔业和生产运输设备操作的人群职业暴露率下降幅度高于其他职业。与 5 年前相比，2019~2020 年我国职业粉尘或有害气体防护率上升了 21.9 个百分点，在不同地区，性别和职业人群中均有所上升，差异有统计学意义 (均 P<0.05)，其中西部地区职业防护率上升幅度最高 (25.7 个百分点)，超过了东部地区 (22.6 个百分点) 和中部地区 (15.9 个百分点)；乡村人群职业防护率的上升幅度 (23.0 个百分点) 略高于城镇 (21.1 个百分点)。见图1，2。

### 表3 2019~2020年中国40岁及以上不同特征职业粉尘或有害气体暴露人群采取职业防护情况

<table>
<thead>
<tr>
<th>变量</th>
<th>采取防护措施</th>
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<th>偶尔防护</th>
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<td></td>
<td>防护率 (%)</td>
<td>防护率 (%)</td>
<td>防护率 (%)</td>
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<tr>
<td></td>
<td>(95% CI)</td>
<td>(95% CI)</td>
<td>(95% CI)</td>
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<tr>
<td>性别</td>
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<td>1 544</td>
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<td>59.3 (56.4~62.1)</td>
<td>19.3 (17.1~21.5)</td>
</tr>
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<td>3 451</td>
<td>1 101</td>
</tr>
<tr>
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<td>62.8 (59.1~66.4)</td>
<td>19.3 (17.0~21.6)</td>
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<td>年龄组(岁)</td>
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<td>250</td>
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<tr>
<td></td>
<td>62.1 (57.5~66.8)</td>
<td>62.3 (57.9~66.7)</td>
<td>16.4 (13.9~18.9)</td>
</tr>
<tr>
<td>45~</td>
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<td>1 380</td>
<td>456</td>
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<td>61.6 (57.7~65.5)</td>
<td>18.9 (16.4~21.4)</td>
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<td>1 606</td>
<td>554</td>
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<td>61.1 (57.2~64.9)</td>
<td>19.1 (16.2~21.9)</td>
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<tr>
<td>55~</td>
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<td>1 322</td>
<td>464</td>
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<td>60.6 (56.1~65.0)</td>
<td>20.4 (17.2~23.5)</td>
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<td>1 161</td>
<td>415</td>
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<td>61.3 (57.6~65.0)</td>
<td>20.8 (17.8~23.8)</td>
</tr>
<tr>
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<td>58.2 (52.8~63.4)</td>
<td>20.5 (16.2~24.8)</td>
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<td>972</td>
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<td>62.3 (58.5~66.0)</td>
<td>17.9 (15.3~20.4)</td>
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<td>4 455</td>
<td>1 673</td>
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<td>1 080</td>
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<tr>
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<td>62.2 (58.8~65.7)</td>
<td>20.0 (16.6~23.5)</td>
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<td>中部</td>
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<td>61.1 (56.9~65.3)</td>
<td>18.7 (15.7~21.8)</td>
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<tr>
<td>西部</td>
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<td>58.2 (51.0~65.3)</td>
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<td>小学及以下</td>
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<td>3 721</td>
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<td>60.0 (55.2~64.9)</td>
<td>19.7 (16.5~22.8)</td>
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<tr>
<td>初中</td>
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<td>2 909</td>
<td>966</td>
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<td></td>
<td>55.9 (52.5~59.3)</td>
<td>61.3 (58.4~64.3)</td>
<td>19.1 (17.0~21.2)</td>
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<td>高中/中专/技校</td>
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<td>911</td>
<td>268</td>
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<tr>
<td></td>
<td>57.0 (52.7~61.2)</td>
<td>63.6 (59.0~68.3)</td>
<td>17.4 (14.5~20.3)</td>
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<tr>
<td>大专及以上</td>
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<td>993</td>
<td>249</td>
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<td>43.1 (37.0~49.2)</td>
<td>49.0 (24.6~71.4)</td>
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<td>57.1 (53.4~60.9)</td>
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<td>22.3 (17.4~27.2)</td>
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<td>服务业</td>
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<td>78</td>
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<td></td>
<td>53.9 (48.1~59.7)</td>
<td>68.2 (61.7~74.7)</td>
<td>11.4 (7.2~15.6)</td>
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<td>行政干部/办事人员/专业技术人员</td>
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<td>275</td>
<td>85</td>
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<td>58.7 (50.3~67.1)</td>
<td>16.4 (11.5~21.3)</td>
</tr>
<tr>
<td>家务/家政服务</td>
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<td>18.5 (16.0~20.9)</td>
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<td>其他劳动者</td>
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<td>1 208</td>
<td>424</td>
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<td>47.2 (38.6~55.8)</td>
<td>65.3 (59.9~68.7)</td>
<td>17.1 (11.8~22.4)</td>
</tr>
</tbody>
</table>

合计 12 685 7 654 2 645 2 386 20.0 (17.6~22.4)

注：该特征人群不同组别间采取防护措施率趋势性检验差异有统计学意义；该特征人群不同组别间采取防护措施率差异有统计学意义。
职业粉尘和有害气体暴露是COPD等慢性呼吸系统疾病的主要危险因素。2014-2015年中国居民COPD监测数据显示，≥40岁人群中职业粉尘或有害气体暴露调查对象COPD的患病率为15.4%，明显高于非暴露组(12.1%)。2017年中国职业有还因素暴露导致的死亡人数为32.38万，其中由颗粒物和气体烟雾导致的死亡占57.8%。本研究数据仕显示，尽管五年期间我国≥40岁人群中职业粉尘或有害气体暴露率有所下降，但仍有约三分之一的人口存在职业暴露，这与2020年全国职业病危害现状统计调查结果一致，该项调查结果显示，被调查企业的从业人员中接触职业病危害因素的劳动者占39.36%；且被调查的约28万家企业中，存在≥1种职业病危害因素的企业占93.46%，其中存在粉尘危害的企业占74.18%。2023年COPD全球倡议提出按照病因对COPD进行分型以精准防控，强调加强职业暴露防护是COPD等慢性呼吸系统疾病防控的重要内容。
我国西部地区≥40岁人群职业粉尘或有害气体暴露率五年期间下降幅度高于东、中部地区，且职业防护率提高幅度也超过了东、中部地区，这可能与“十三五”期间我国职业病防治规划有关。《国家职业病防治规划(2016-2020年)》指出，要在矿山、有色金属、冶金、建材等行业领域开展专项整治，而能源和矿产资源等产业主要集中在我国西部地区[14]。但本研究数据显示，西地区职业暴露率仍然相对较高，需继续加强对西部地区职业暴露的治理，同时也要关注中部地区的职业防护情况，提高中部地区的职业防护水平。

文化程度越低的职业人群粉尘或有害气体暴露水平越高，两次监测数据显示，乡村地区职业暴露率均明显高于城镇，虽然乡村职业暴露率有所降低，但仍有约三分之一的人群存在职业粉尘或有害气体暴露，且该人群中采取防护的比例尚不足一半。应更加关注文化程度较低的职业人群，农民工人群，中西部地区职业人群以及从事生产运输设备操作等重点人群的职业防护，加强职业健康的监测能力，加强职业防护等知识的宣传普及，加速传统技术改进和优化，保证职业人群的健康权益，实现《健康中国行动（2019-2030年）》以及《国家职业病防治规划（2021-2025年）》的相关目标。

2022年我国一项关于建筑工人职业暴露的调查显示，87.84％的工人没有职业保护或只有一种保护措施，且在收集调查对象职业粉尘或有害气体暴露及接触时间等信息时仍存在一定回忆偏倚。


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参考文献


