

## · 航空机组人员职业照射与健康管理的健康管理 ·

## 航空机组人员宇宙辐射照射健康危害研究进展

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**【摘要】** 来自初级宇宙射线的高能粒子与地球大气相互作用形成次级宇宙射线, 共同组成宇宙辐射。航空机组人员因长期在高空环境作业, 成为受到宇宙辐射照射水平较高的职业人群之一, 健康状况不可忽视。本文对宇宙辐射照射的遗传毒性与细胞损伤、航空机组人员受照剂量水平以及癌症和非癌症健康效应的相关研究进行综述, 旨在为该职业人群的健康风险评估与辐射防护策略提供新思路 and 科学依据。多数研究显示航空机组人员乳腺癌、皮肤癌风险显著高于一般人群, 其他癌症结局研究结果不一致。不同研究结果存在的差异主要源于样本量、混杂因素控制及“健康工人效应”的影响。

**【关键词】** 航空机组人员; 宇宙辐射; 健康危害

**Research progress on health hazards to aircrew by cosmic radiation exposure**Li Mingyu<sup>1</sup>, Li Mengxue<sup>1</sup>, Zhang Lin<sup>2</sup>, Fan Shengnan<sup>1</sup>, Deng Jun<sup>1</sup>, Sun Quanfu<sup>1</sup>

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**【Abstract】** High-energy particles from primary cosmic rays interact with the earth's atmosphere to form secondary cosmic rays, collectively composing cosmic radiation. Due to long-term working at high altitude, the aircrew have become one of the most highly exposed occupational groups, with in-negligible health status. This study presents a narrative review of the research findings relevant to the genotoxicity and cellular damage induced by cosmic radiation exposure, the radiation doses received by aircrew, and the cancerous and non-cancerous health effects. The aim of the present study is to provide new inputs and scientific basis for health risk assessment and radiation protection strategies for aircrew as one of exposed occupational groups. Most studies available have shown that the risks of breast cancer and skin cancer to aircrew are significantly higher than in the general population, of which the research findings on other cancer effects are still inconformity each other. The discrepancies between different research result are mainly attributed to such factors as sample size, control of confounding factors, and impact on healthy workers.

**【Key words】** Aircrew; Cosmic radiation; Health hazards

航空机组人员在工作中面临着多种健康危害因素, 如宇宙辐射、昼夜节律紊乱、噪声等<sup>[1]</sup>。其中, 宇宙辐射是一种来自太空的电离辐射, 由银河宇宙射线和太阳宇宙射

线组成; 其包括高能粒子与地球大气相互作用, 产生的中子、质子、光子、带电和不带电的介子等各种次级粒子, 称为次级宇宙射线<sup>[2]</sup>。宇宙辐射剂量水平受海拔高度、地

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