HHS Public Access

Author manuscript

JAMA Oncol. Author manuscript; available in PMC 2022 September 06.

Published in final edited form as:

JAMA Oncol. 2015 September ; 1(6): 829–830. doi:10.1001/jamaoncol.2015.0933.

Why Do Airline Pilots and Flight Crews Have an Increased Incidence of Melanoma?

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Because of the unique occupational risk factors of commercial pilots, cabin crew, and flight attendants, numerous studies have investigated their risks for various diseases. In general, mortality from cancer, as well as cardiovascular, respiratory, and cerebrovascular diseases, is significantly lower in pilots and cabin crew compared with the general population.[1] However, despite their overall improved health outcomes, pilots and flight crew have been reported to have an increased incidence and/or mortality from melanoma.[2,3]

The report published in *JAMA Dermatology* in January by Sanlorenzo et al[3] assessed the risk of melanoma among airline pilots and cabin crew in a meta-analysis that included 19 previously published studies. The studies reflect data from 1943 to 2008 and include more than 266 000 pilots and cabin crew. These 19 studies were selected because they reported a standardized incidence ratio (SIR) or a standardized mortality ratio (SMR) or had relevant data to allow for calculation of these established measures of disease incidence and death. Pilots and cabin crew were found to have approximately twice the incidence of melanoma when compared with the general population (SIR, 2.21[95%CI, 1.76–2.77]), and mortality from melanoma among pilots was significantly increased (SMR, 1.83[95% CI, 1.27–2.63]). Because of the observational and retrospective nature of the 19 studies, it was not possible to control for certain potentially confounding factors such as aggregate flight time, Fitzpatrick skin type, and lifestyle.[3]

Pilots and cabin crew are regularly exposed to higher levels of cosmic radiation during flight,[4,5] and it is important to consider whether this additional radiation exposure is associated with their increased risk of melanoma. Cosmic (ionizing) radiation is composed of high-energy particles (neutrons and gamma rays) that are capable of penetrating the plane's exterior.[4] Lower levels of cosmic radiation reach the earth's surface and lead to annual background radiation exposure of approximately 2 mSv per person (to convert to rem, multiply by 0.1).[1] Passengers and crewmembers are exposed to higher levels of radiation depending on cruising altitude, latitude, and solar activity.[4] Pilots and flight crew receive an additional annual dose of 2 to 9 mSv,[5] which is significantly below the

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Conflict of Interest Disclosures: None reported.

current exposure limit of 20 mSv per year according to the International Commission on Radiological Protection.[3] For comparison, a single chest x-ray provides roughly 0.02 mSv and a computed tomographic scan of the chest, abdomen, and pelvis provides approximately 8 mSv. The lifetime risk of dying of cancer among US adults is approximately 220 in 1000 and would be expected to increase modestly to approximately 223 in 1000 after a 20-year career as an airline crewmember (assuming 80 mSv of aggregate radiation exposure).[4] In addition to the fact that this modest dose of cosmic radiation should have little effect on cancer risk more generally, there is also no known relationship between even relatively high doses of ionizing (cosmic-type) radiation and melanoma.[5] Thus, it seems unlikely that cosmic radiation exposure is relevant in the observed increase in melanoma in this population.

Beyond cosmic radiation exposure, there are many established risk factors for melanoma that could be relevant in flight crews, including skin type, number of common and atypical nevi, family history of melanoma, history of severe sunburn, use of tanning beds, and socioeconomic status.[6,7] Many of these factors increase the risk of developing melanoma by more than 2-fold. Notably, the relative risk of developing melanoma among people with 101 to 120 common nevi is 6.89 (95%CI, 4.63–10.25)and with 5 atypical nevi is 10.49 (95% CI, 5.05–21.76).[6] Although these risk factors significantly influence the development of melanoma, they were not accounted for in the 19 studies of flight crews. Therefore, the impact of these risk factors on the incidence of melanoma observed among aircrew remains undetermined because they could not be controlled for in the meta-analysis.

Higher socioeconomic status, a demographic characteristic shared by pilots and cabin crew, is associated with increased incidence of melanoma but decreased mortality from melanoma.[7] The Federal Aviation Administration has stringent health standards and requires employees to routinely undergo medical evaluation. Regular physical examination increases the detection of early-stage melanoma and thus increases the reported incidence. Flight crew and air traffic control officers undergo similar health screenings and have similar socioeconomic status, and both have an increased risk of developing melanoma even though air traffic control officers are not occupationally exposed to high-altitude flight.[2] On the basis of this observation, it is possible that the increased incidence of melanoma among pilots and cabin crew could be more associated with socioeconomic status, required health screenings, or other melanoma risk factors rather than their greater number of flight hours.

Episodic UV exposure is also associated with an increased risk of developing melanoma, whereas frequent low to moderate UV exposure is more associated with risk for nonmelanoma skin cancers. As discussed by Sanlorenzo et al,[3] a pilot's exposure to UV-B (280–320 nm) radiation through the windshield is minimal because it is blocked by glass, but more than half of UV-A (320–380 nm) radiation penetrates glass.[3] The additional UV-A exposure for pilots offers a possible explanation for their increased incidence of melanoma but does not account for the increased risk for the cabin crew. A study with more than 3000 aircrew members found that pilots and cabin attendants reported more intermittent UV exposure (via sunny vacations) than the general population but concluded that the increased incidence of melanoma described in many studies could not be solely explained by behavioral differences.[5]

Whereas many groups noted an increased melanoma risk among pilots and cabin crew, Sanlorenzo et al[3] conducted the largest and most robust meta-analysis of this association. Multiple hypotheses have been proposed, but the etiology of the increased incidence of melanoma among aircrews remains largely unexplained. Although this increased risk is now well established in the literature and reinforced by this study, it will be difficult for airlines or aircrews to take specific preventive action until the cause is more clearly defined. It is likely that known risk factors, not available from the original studies, substantially underlie this association. Physicians should counsel patients to minimize skin cancer risk by avoiding established unsafe behaviors such as sun exposure that leads to burns and excessive aggregate UV exposure.

Funding/Support:

This work was supported by National Institutes of Health K24-CA139052 (to Dr Nghiem).

Role of the Funder/Sponsor:

The National Institutes of Health had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

REFERENCES

1. Hammer GP, Auvinen A, De Stavola BL, et al. Mortality from cancer and other causes in commercial airline crews: a joint analysis of cohorts from 10 countries. Occup Environ Med. 2014;71(5): 313–322. [PubMed: 24389960]
2. dos Santos Silva I, De Stavola B, Pizzi C, Evans AD, Evans SA. Cancer incidence in professional flight crew and air traffic control officers: disentangling the effect of occupational versus lifestyle exposures. Int J Cancer. 2013;132(2):374–384. [PubMed: 22532267]
3. Sanlorenzo M, Wehner MR, Linos E, et al. The risk of melanoma in airline pilots and cabin crew: a meta-analysis. JAMA Dermatol. 2015;151(1): 51–58. [PubMed: 25188246]
4. Friedberg W, Faulkner DN, Snyder L, Darden EB Jr, O'Brien K. Galactic cosmic radiation exposure and associated health risks for air carrier crewmembers. Aviat Space Environ Med. 1989;60 (11):1104–1108. [PubMed: 2818404]
5. Rafnsson V, Hrafnkelsson J, Tulinius H, Sigurgeirsson B, Olafsson JH. Risk factors for cutaneous malignant melanoma among aircrews and a random sample of the population. Occup Environ Med. 2003;60(11):815–820. [PubMed: 14573711]
6. Gandini S, Sera F, Cattaruzza MS, et al. Meta-analysis of risk factors for cutaneous melanoma: I. common and atypical naevi. Eur J Cancer. 2005;41(1):28–44. [PubMed: 15617989]
7. Jiang AJ, Rambhatla PV, Eide MJ. Socioeconomic and lifestyle factors and melanoma: a systematic review. Br J Dermatol. 2015;172(4):885–915. [PubMed: 25354495]