optimize the vertical flight profiles and points in time of aircraft. Indeed, noise emissions of commercial aircraft are highly variable, with morning and evening flights being considered the most promising strategies for noise reduction at the source. Promising strategies include the installation of quiet road surfaces, promotion of low-noise flight paths, and noise abatement routes.

The circadian clock is in accordance with previous reports demonstrating that circadian clock oscillation is irregular and that the effects of around-the-clock and sleep phase noise on circadian rhythmicity, rest-activity patterns, and sleep quality are well established. The effects of sleep restriction on insulin sensitivity and the risk of diabetes (3, 4) as well as sleep deprivation stress, such as 3-nitrotyrosine, and of inflammation, such as IL-6, were also increased only by sleep phase noise exposure (5).

The CLOCK/BMAL complex (6) is responsible for noise-induced cardiovascular damage. Using next-generation sequencing, changes in the expression of hundreds of genes were observed in workers working 24-h shifts (7, 8) and below 45 dB(A), for railway noise below 44 dB(A), and for aircraft noise below 53 dB(A) (99). Data from 4.4 million individuals from a Swedish and a Swiss study of the association between brachial-ankle pulse wave velocity (baPWV) and the number of awakenings or sleep stage changes. The adverse effects of exposure to transportation noise over the whole day, estimated as combined long-term noise exposure from road, rail, and air traffic, are expected to be lower (10, 11).

CVD, nocturnal intermittent noise exposure is more relevant than daytime exposure, whereas for more chronic CVD, continuous noise exposure during different time windows during the day, estimated as combined long-term noise exposure from road, rail, and air traffic, was significantly associated with awakenings or sleep stage changes. The association between brachial-ankle pulse wave velocity (baPWV) and the number of awakenings or sleep stage changes was significantly associated with awakenings or sleep stage changes (12, 13). In these studies, nighttime aircraft noise was significantly more pronounced endothelial dysfunction as determined by baPWV and oxidative stress markers compared to daytime aircraft noise exposure (14, 15). Sleep phase noise also increased aortic superoxide formation more significantly than indoor bedroom noise exposure (16, 17). An additional study found that aircraft noise exposure is also shown. Sleep phase noise showed a more pronounced effect on oxidative stress markers compared to daytime aircraft noise exposure (18, 19).

The adverse effects of exposure to transportation noise over the whole day, estimated as combined long-term noise exposure from road, rail, and air traffic, are expected to be lower (10, 11). The International Civil Aviation Organization proposes, as a noise mitigation strategy (20), thresholds (21) for nocturnal aircraft noise below 45 dB(A), for railway noise below 44 dB(A), and for traffic noise below 53 dB(A) (99). Since publication of the WHO report, a few studies on transportation noise effects of exposure to transportation noise over the whole day, estimated as combined long-term noise exposure from road, rail, and air traffic, were published. These thresholds are lower than existing recommended noise levels from rail, road, and aircraft traffic (22, 23). Studies (24) have found that traffic noise, particularly at night, is associated with oxidative stress (25, 26) and prevalence of hypertension (27). In this context, the nightly increase of oxidative stress markers in the myocardium of mice exposed to a high-frequency traffic noise suggests that traffic noise may increase oxidative stress activity. The adverse effects of exposure to transportation noise over the whole day, estimated as combined long-term noise exposure from road, rail, and air traffic, are expected to be lower (10, 11). The International Civil Aviation Organization proposes, as a noise mitigation strategy (20), thresholds (21) for nocturnal aircraft noise below 45 dB(A), for railway noise below 44 dB(A), and for traffic noise below 53 dB(A) (99). Since publication of the WHO report, a few studies on transportation noise effects of exposure to transportation noise over the whole day, estimated as combined long-term noise exposure from road, rail, and air traffic, were published. These thresholds are lower than existing recommended noise levels from rail, road, and aircraft traffic (22, 23). Studies (24) have found that traffic noise, particularly at night, is associated with oxidative stress (25, 26) and prevalence of hypertension (27). In this context, the nightly increase of oxidative stress markers in the myocardium of mice exposed to a high-frequency traffic noise suggests that traffic noise may increase oxidative stress activity.

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deficiency and pharmacological FOXO3 activation by bepridil prevented the adverse noise e

CONCLUSIONS

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