NORAH
Lärmwirkungsstudie

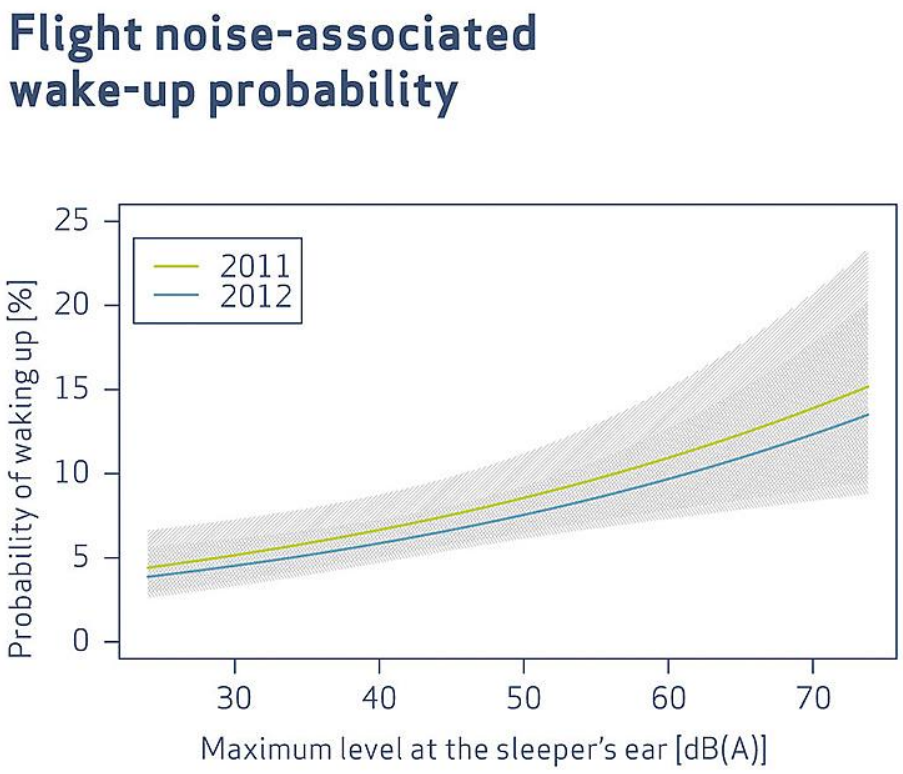
Sleep



For the Sleep Study, the scientists measured the sleep quality of persons affected by aircraft noise in the Rhine-Main area for three to four nights at a time. All in all, more than 200 persons were examined. The study participants slept in their usual home, but with several electrodes on their bodies. At the same time, a noise level meter recorded all sounds that reached the sleepers' ears at night. The first measurements took place in summer 2011, i.e. before introduction of the core resting time and opening of the north-west runway. In the summers of 2012 and 2013, further measuring phases followed, some performed on the same persons.

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The figure shows the probability of waking up during a flight at a certain maximum level. This did not differ significantly between 2011 and 2012. This is evident by the strong overlap of the hatched "trust areas" (confidence intervals). Müller / DLR

Residents wake up less often since the night flight restrictions

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The prohibition of planned starts and landings between 11 p.m. and 5 a.m. achieved an important goal: the residents at the Frankfurt airport woke up less often in 2012 than in the prior year, due to the smaller number of night flights. The probability of waking up at a night flight did not differ in the years of 2011 and 2012, however. In 2012, such participants who went to bed later and thus noticed more of the flights after 5 a.m. during their sleeping time woke up more often, though. This group of "late sleepers" did not differ from the "early sleepers" in typical indices of sleep research, however: they spent the same share of their bed time sleeping ("sleep efficiency") and were not awake between 4:30 a.m. and the end of their "bedtime" any longer than neighbours who went to bed an hour earlier.

This objectively measured reduction of the wake-up reactions is, however, not reflected in the

personal evaluations of the participants. They stated that they were tired and sleepy during the day – no matter the aircraft noise burden - with a slightly increasing tendency from 2011 to 2013. The scientists cannot derive any explanation for this effect from the data. Therefore, it must be due to factors that the study did not examine.

Do airport critics sleep less well?

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Participants of the study were asked, among other things, how they assessed aircraft traffic in general. A comparison with the sleep measurements showed that people with a negative attitude towards aircraft traffic slept less well than those participants who saw aircraft traffic positively. Among other things, they needed more time to fall asleep, spent less time in deep sleep and were lying awake for longer. This is a purely statistical interrelation. NORAH could not determine whether the negative attitude was the cause or consequence of the bad sleep. Both would be possible.

New method

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Usually, sleep examinations monitor many body functions, including brain currents. NORAH was able to show that a relatively simple measurement of pulse and body movement may be enough to reliably describe important reactions of sleepers to noise. This way, scientists spare their test subjects the application of many electrodes. The new method, called the “vegetative-motoric” method (VMM), can be applied independently by the test persons and automatically evaluated, thus permitting sleep studies with a lot more participants than before. However, the scientific inductiveness of this new method should be confirmed in further studies.

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Comparison between early and late sleepers

	2001: Sleep time: 10/10.30 PM to 6/6.30 AM	2012: Sleep time: 10/10.30 PM to 6/6.30 AM	2012: Sleep time: 11/11.30 PM to 7/7.30 AM
Total duration of sleep	7:06 hrs	7:08 hrs	7:07 hrs
Duration between going to bed and falling asleep	13.9 min	14.5 min	13.1 min
Sleep efficiency *(share of sleep in time in bed)*	90%	90%	91%
Duration of being awake after falling asleep in min	36.7 min	34,4 Min	33,8 Min
Difference bet. planned and actual sleep end in min	3,3 Min	5,4 Min	5,7 Min
Share of being awake in percent between 4:30 AM and planned end of sleep	14%	14%	12%

The group of the "early sleepers" did not differ from the "late sleepers" who go to bed between 11 and 11:30 PM in typical indices of sleep research.

Cologne/Bonn data not easily transferrable

Insights of sleep studies in the area of the Cologne/Bonn airport from 2001/2002 cannot just be transferred to the Rhine-Main area, because aircraft noise and its effects are too different in the two locations. Cologne/Bonn continually has flights at night. Therefore test persons in the

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Rhineland woke up at night more often and spent less time in deep sleep than in the Frankfurt area after the core resting time was introduced. The probability of waking up from aircraft noise at a certain maximum level only moderately differed between the two studies. Generally, however, the NORAH participants felt clearly more annoyed by aircraft noise of the previous night in 2013 than the test persons from the Cologne/Bonn study in 2001/2002.

Further information

For more information on the Sleep study, see the "NORAH Knowledge" booklets no. 5 (Methods) and no. 10 (Results). More information on the results of the NORAH study can be found in NORAH Knowledge 14.

- NORAH Knowlede no. 5 PDF, 2 MB (https://www.laermstudie.de/media/download/norah_knowledge_05.pdf)
- NORAH Knowlede no. 10 PDF, 2 MB (https://www.laermstudie.de/media/download/norah_knowledge_10.pdf)
- NORAH Knowlede no. 14 PDF, 2 MB (https://www.laermstudie.de/media/download/norah_knowledge_14.pdf)

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