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Cost-effectiveness of reverting to the limited use of "TNNIS Climb" in Queens, NY, USA

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Background

- Historically, flights departing from LaGuardia Airport (LGA) flew over the tennis stadium in Flushing Meadows and over other sparsely populated areas (e.g., East River)

- Loud noise during US Open disrupted matches

- During US Open, flights diverted over densely populated neighborhoods of Queens (Community Boards 7 and 11)

- This flight path, which uses runway 13 at LGA, has been known as ‘TNNIS Climb’

Background

- In the era of NextGen, use of runway 13 at LGA has become a common route of departure, and TNNIS Climb has become year-round

- **Objective of this study**: Using evidence from published literature, to quantify the potential health problems of the year-round use of TNNIS and cost-effectiveness of reverting to the limited use of TNNIS

European vs. US allowable noise limit

- According to the European's Environmental Noise Directive, 55 dB is the threshold noise level for day, evening, and night (Lden)

- The allowable noise threshold in US is 65 dB averaged for day and night levels (DNL)

- Difference of 10 dB in noise makes a 65 dB ten times the intensity (power) and two times the loudness of a 55 dB

- Several published studies have shown detrimental health conditions associated with noise above 55 dB DNL

TNNIS Climb and noise

- The Port Authority of New York and New Jersey measured the average noise estimate and determined noise contours for 55+, 60+, 65+, 70+, and 75+ decibels (dB) DNL

- We estimated number of Queens' inhabitants from Community Boards 7 and 11 within 60+ (n=83,807) and 65+ (n=31,329) dB DNL noise contours

- The Port Authority of New York and New Jersey has created a real-time online noise tracker, through which we verified various time point data in the existing noise corridor under the TNNIS Climb

- According to the online noise tracker, that noise levels from nearby monitors can rise from below 55 dB to above 90 dB when an aircraft overflies sound monitors on ground

Health impacts of noise

- There is a heavy body of literature on health impacts of aircraft noise including but not limited to physiatrist disorders, depression, hypertension, and sleep quality

- Aircraft noise interferes with sleep and might have broader effects on health, economic productivity, and educational outcomes among children

- We only modeled the increased risk of cardiovascular diseases (CVD) (ICD-10 Chapter I) and generalized anxiety disorder associated with aircraft noise

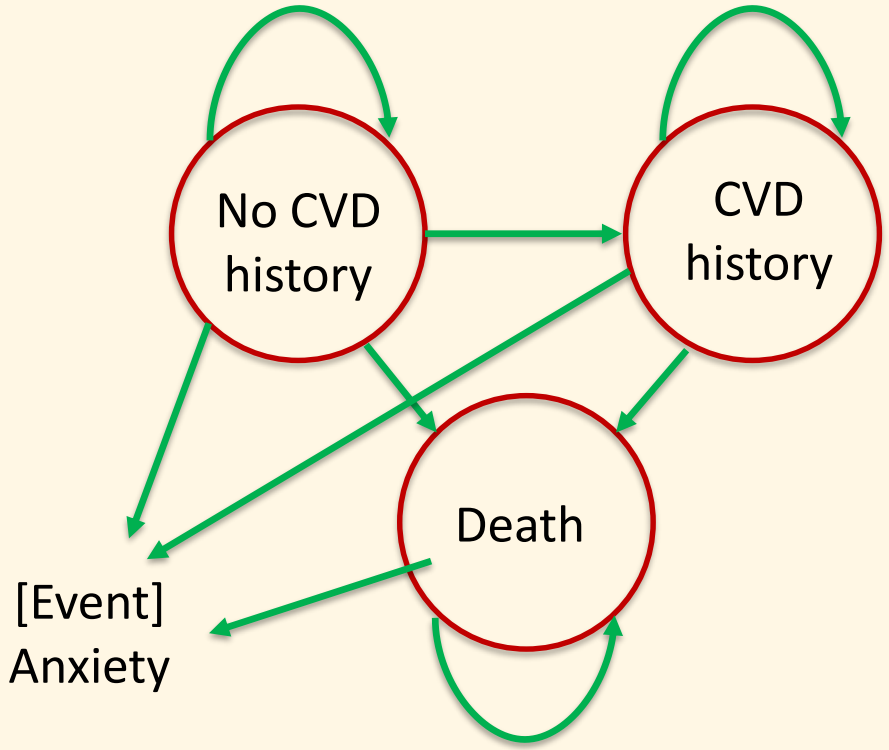
- According to Hansell et al. [Hansell, BMJ, 2013], daytime exposure to noise (>60 vs. <50) is associated with relative risk of 1.14 for CVD (ICD-10 Chapter I)

- According to Hardoy et al. [Soc. Psychiatry Psychiatr. Epidemiol, 2005], aircraft noise is associated with generalized anxiety disorder with an odds ratio of 2

Economic analysis

- Developed a Monte Carlo Markov model

- Health states
  - ❖ No prior history of cardiovascular disease (CVD)
  - ❖ Having a history of CVD
  - ❖ Anxiety (modelled as an event)
  - ❖ Death



Economic analysis

- We analyzed the Bureau of Transportation Statistics records pre and post TNNIS in 2012
- According to the Bureau of Transportation Statistics, average on-time departures at LGA dropped from 82% (in 2012) to 77% (in 2016)
- On-time arrivals declined from 77% (in 2012) to 72% (in 2016)
- According to the 2016 Air Traffic Report from the Port Authority of NY & NJ, total # of domestic and international flights at LGA and JFK has not changed from 2007

Economic analysis

- The Global Gateway Alliance claimed:
  - During a 5-day test period, TNNIS reduced average delay time at JFK from 45.7 to 25.3 min
  - During that test period, TNNIS reduced # of delayed flights from 204 to 12
- Modeled costs associated with delays through two components
  - (1) Operating costs: fuel, labor, and other costs
  - Operating $costs_i = DELAY_i \times SPEED \times CASM \times SEAT \times FLIGHT_i$
  - (2) Productivity losses among passengers per flight
  - Productivity $losses_i = DELAY_i \times WAGE \times SEAT \times FLIGHT_i$

Analysis

- Modelled direct (e.g., medications, hospitalizations) and indirect costs (i.e., productivity losses) associated with CVD and generalized anxiety
- Modelled quality-adjusted life years (QALYs) based on health-state utility values associated with CVD and anxiety
- Ran model for lifetime
- Future values discounted at 3%
- Performed a probabilistic Monte Carlo simulation with 10,000 random draws
- Performed 1-way sensitivity analyses

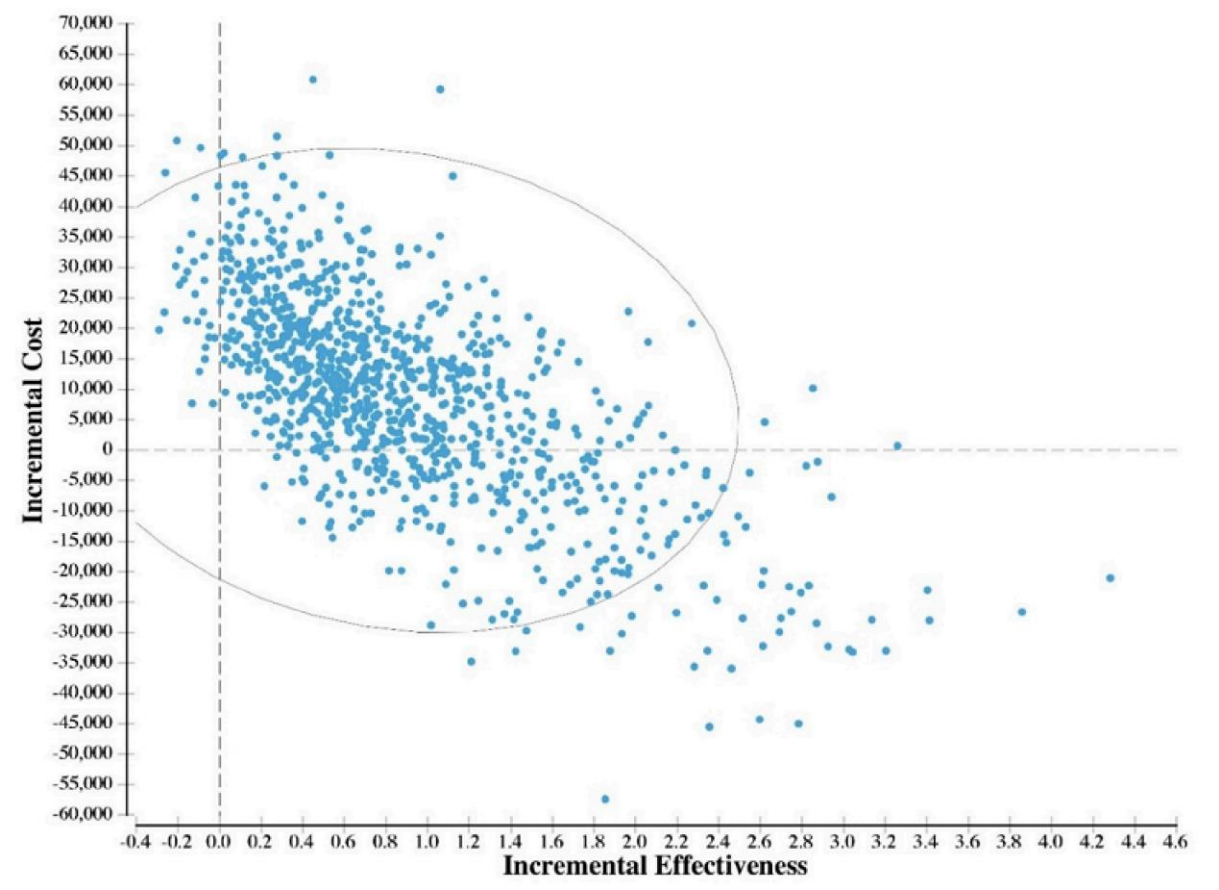
Results

- Expected lifetime costs and QALYs for an average person exposed to noise at LGA

Scenario	Costs	Incremental costs	QALYs	Incremental QALYs	ICER ($/QALY)
Limited use of TNNIS	$656,173	$11,288	18.72	1.13	10,006
Year-round use of TNNIS	$644,885	Reference	17.6	Reference	Reference

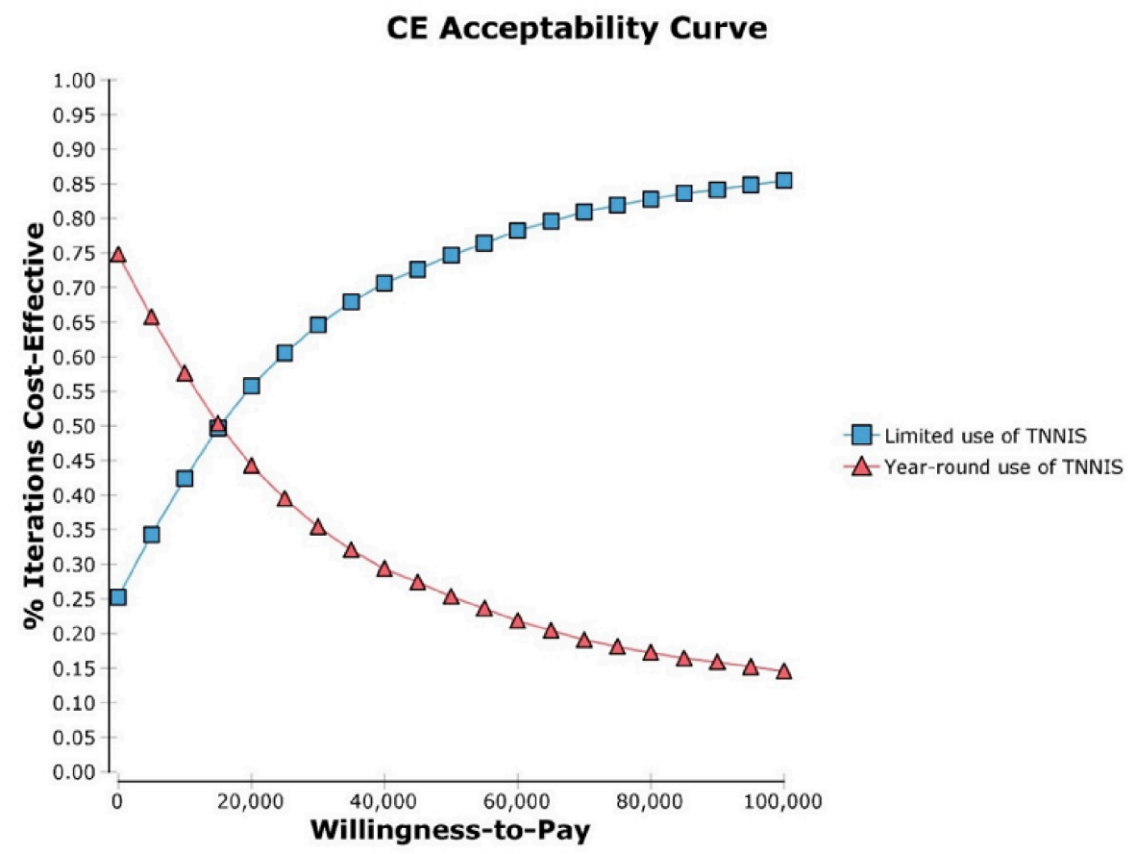
Results

- Probabilistic analyses in a cost-effectiveness plane
  - 25% limited TNNIS was cost-saving
  - 60% limited TNNIS was cost-effective (below $100,000/QALY)



Results

- Cost-effectiveness acceptability curve
  - At WTP of $0/QALY: 25% chance for limited TNNIS
  - At WTP of $50,000/QALY: 75% chance for limited TNNIS
  - At WTP of $100,000/QALY: 85% chance for limited TNNIS



Conclusions

- We only modeled CVD and anxiety as health consequences of noise
- Based on a subset of health and economic endpoints modelled here, it is likely that limited use of TNNIS will be cost-effective
- Our findings are contingent upon reliability of previous findings by Hansel et al. and Hardoy et al.
- We did not have data to model other cost savings from future lost tax revenue, social service consumption, and crime costs associated with lower educational attainment
- We focused on increased use of TNNIS caused by NextGen in NYC and did not speak about the broader trade-offs produced by NextGen in other locations

Conclusions

- Our findings by no means should be taken as a blanket assessment of changes to flight patterns that might reduce airline fuel consumption, increase productivity, and reduce global warming

- Our findings show the strong need for careful study of public health impacts of such changes before they are implemented

- NextGen has potential for improving our lives. However, from a public health perspective, it could also produce an increase in disability, at least in New York City

- We hope that models such as ours can be used to better understand the trade-offs that new technologies bring