

Population health's unanimity on lung cancer screening: far ahead of medical advice

Bruce Pyenson¹, Claudia I. Henschke², David F. Yankelevitz²

¹Milliman LLC, NY, NY 10119, USA; ²Icahn School of Medicine at Mount Sinai, NY, USA

Correspondence to: Bruce Pyenson, FSA, MAAA. Principal & Consulting Actuary, Milliman Inc., 1 Pennsylvania Plaza, NY, NY 10119, USA.

Email: Bruce.pyenson@milliman.com.

Provenance: This is a Guest Editorial commissioned by Section Editor Jianrong Zhang, MD (Department of Thoracic Surgery, First Affiliated Hospital of Guangzhou Medical University, Guangzhou Institute of Respiratory Disease, Guangzhou, China).

Comment on: Ten Haaf K, Tammemägi MC, Bondy SJ, *et al.* Performance and Cost-Effectiveness of Computed Tomography Lung Cancer Screening Scenarios in a Population-Based Setting: A Microsimulation Modeling Analysis in Ontario, Canada. *PLoS Med* 2017;14:e1002225.

Submitted Apr 22, 2017. Accepted for publication May 04, 2017.

doi: 10.21037/atm.2017.05.26

View this article at: <http://dx.doi.org/dx.doi.org/10.21037/atm.2017.05.26>

A recent publication found that lung cancer screening of high risk smokers and ex-smokers is cost-effective in Ontario, Canada. The carefully designed modeling by Ten Haaf *et al.* (1) agrees with many recent studies—lung cancer screening saves lives at a reasonable cost. Other studies that were based on either the National Lung Screening Trial (NLST) (2) or the International Early Lung Cancer Action Program (I-ELCAP) (3) results have come to this same conclusion. Of note, ten Haaf presents a scenario (scenario 11) where screening reduces deaths from lung cancer by over 80%, which is consistent with I-ELCAP findings. Several other features of ten Haaf's work are notable, including his recognition that “false positives” found by lung cancer screening are very rarely harmful, and that improvements in protocols since NLST will likely further improve cost effectiveness.

Lung cancer is the biggest cancer killer, consuming 160,000 US lives each year, so the potential number of lives to be saved are staggering.

The consensus of favorable cost-benefit across recent studies is remarkable, because the studies have varied in many ways, including the national system modeled and the populations modeled (2-5), the bases of costs and mortality, the projection period, whether inflation or discounting were considered and other methodological issues. Lung cancer screening is truly robust. Earlier studies that assumed ineffective screening (6) of course concluded that LC screening would be non-cost-effectiveness. The sharp

divide between NLST-type assumptions and anti-NLST assumptions was somehow missed by a recent literature review (7).

Competent cost-effectiveness analysis in its various guises (cost-benefit, average cost-effectiveness, increment cost effectiveness, etc.) requires real-world modeling of a population's health. Although it is common to model “perfect” compliance, costs must be real and documentable, and impacts are modeled for a population that is followed for long enough—through death for LC screening. In other words, the analysis simulates the lives of at-risk individuals—morality, cost and outcomes year-by-year—with or without screening. Modeling a population's health dynamics year-by-year avoids errors from misinterpreting short-term results. For lung cancer screening, year-by-year modeling of the shift to diagnosing earlier cancer stages produced relatively uniform results across studies.

Modeling and extrapolating results is fundamental to progress and population health. In the mid-1800s, actuaries developing mortality tables invented a Kaplan Meier-like methodology to construct full mortality tables, since the emerging life insurance business did not have the luxury of waiting for a full cohort of births to be observed until everyone died. In healthcare, actuarial and microeconomic models are designed to be credible to decision-makers in business and payers. These models typically inform decision makers among payers, business and government. Such decision makers often have in-depth knowledge of costs,

outcomes and processes. Proper modeling is essential for the real-world health system decisions that affect millions of lives. For lung cancer screening, modeling and the long-term follow-up from I-ELCAP show that screening can reduce lung cancer mortality in high-risk patients by about 80%.

Contrast this rigor to the primitive approach used in one prominent patient decision aid for lung cancer screening (8). The NLST reached its goal when it found a 20% mortality reduction in lung cancer screening after 3 annual screens (baseline and 2 annual repeat round with an average of 6.5 years of follow-up). The typical patient decision aid for lung cancer screening fails to extrapolate this result to the full series of screenings and instead tells the patient that 80% of people who would have died of lung cancer would die anyway with screening. This methodology would make the pro-tobacco proud: in the first three years of smoking, the absolute risk of lung cancer for smokers is low—and not much different for non-smokers.

We appreciate ten Haaf's elegant presentation of the efficient frontier of scenarios of lung cancer screening, but we hope that debate over the best approach is not an excuse to further delay widespread screening. The best screening is the screening that gets done, when failure to screen means over 100,000 avoidable deaths per year.

Population health is broadly acknowledged as the replacement for today's cottage industry of healthcare and embodied in the Triple Aim (9), integrated care, and health improvement. It's time for patient decision aids for lung cancer screening to use this science.

Acknowledgements

None.

Footnote

Conflicts of Interest: Dr. DF Yankelevitz is a named inventor on a number of patents and patent applications relating to the evaluation of diseases of the chest including measurement of nodules. Some of these, which are owned by Cornell Research Foundation (CRF) are non-exclusively licensed to General Electric. As an inventor of these patents, Dr. Yankelevitz is entitled to a share of any compensation which CRF may receive from its commercialization of these patents. He is also an equity owner in Accumetra, a privately held technology company committed to improving the science and practice of image-based decision making.

He is a member of scientific advisory board for Grail Inc., a company developing biomarkers for detection of cancer. B Pyenson is a Principal and Consulting Actuary at Milliman, Inc., a large consulting firm with clients from across the healthcare and insurance industries and employers. The other authors have no conflicts of interest to declare.

References

1. Ten Haaf K, Tammemägi MC, Bondy SJ, et al. Performance and Cost-Effectiveness of Computed Tomography Lung Cancer Screening Scenarios in a Population-Based Setting: A Microsimulation Modeling Analysis in Ontario, Canada. *PLoS Med* 2017;14:e1002225.
2. Black WC, Gareen IF, Soneji SS, et al. Cost-effectiveness of CT screening in the National Lung Screening Trial. *N Engl J Med* 2014;371:1793-802.
3. Pyenson BS, Henschke CI, Yankelevitz DF, et al. Offering lung cancer screening to high-risk medicare beneficiaries saves lives and is cost-effective: an actuarial analysis. *Am Health Drug Benefits* 2014;7:272-82.
4. Villanti AC, Jiang Y, Abrams DB, et al. A cost-utility analysis of lung cancer screening and the additional benefits of incorporating smoking cessation interventions. *PLoS One* 2013;8:e71379.
5. Shmueli A, Fraifeld S, Peretz T, et al. Cost-effectiveness of baseline low-dose computed tomography screening for lung cancer: the Israeli experience. *Value Health* 2013;16:922-31.
6. McMahon PM, Kong CY, Bouzan C, et al. Cost-effectiveness of computed tomography screening for lung cancer in the United States. *J Thorac Oncol* 2011;6:1841-8.
7. Puggina A, Broumas A, Ricciardi W, et al. Cost-effectiveness of screening for lung cancer with low-dose computed tomography: a systematic literature review. *Eur J Public Health* 2016;26:168-75.
8. A Decisionmaking Tool for You and Your Health Care Professional. Available online: <https://effectivehealthcare.ahrq.gov/ehc/assets/File/lung-cancer-screening-patient-encounter-160323.pdf>
9. Berwick DM, Nolan TW, Whittington J. The triple aim: care, health, and cost. *Health Aff (Millwood)* 2008;27:759-69.

Cite this article as: Pyenson B, Henschke CI, Yankelevitz DF. Population health's unanimity on lung cancer screening: far ahead of medical advice. *Ann Transl Med* 2017;5(17):355. doi: 10.21037/atm.2017.05.26