Expert Views

Using Number Needed to Treat (NNT) in Health & Wellness Program Evaluation

SCOR

The Art & Science of Risk

February 2023

Introduction

Life insurance companies are eager to assist their policyholders in meaningful ways. Policies provide financial protection in the case of early death. However, many of these deaths are preventable.

These preventable deaths all have one thing in common: the presence of one or more modifiable risk factors. Recognizing these modifiable risk factors is the first step, which is then followed by taking specific actions to mitigate the concern. Some companies have recognized this and are considering health and wellness programs designed to assist their policyholders in recognizing modifiable risk factors and doing the necessary interventions to eliminate or mitigate them. Participating in a health and wellness program can lead to the policyholder enjoying a longer and healthier life in addition to forming a stronger bond with the life insurance company.

Health and wellness programs are frequently designed to be a value-added service. They are being considered as part of the natural partnership between policyholders and life insurance companies. For some companies, enhancing customer engagement and the customer experience is primary. For others improving persistency or mortality over time takes precedence. Either way, it is imperative to plan for and ask questions early in the process about what will be required for long-term sustainability. The key to this concept is structuring programs with flexibility so that results can be measured both from the beginning and over time.

Many third-party companies are dedicated to providing health and wellness programs with numerous targeted conditions and with varied approaches. With limited available resources it is important for life insurance companies to identify programs that are most meaningful and have the best opportunity to be successful. When comparing various programs, one frequently used tool is the number needed to treat (NNT) calculation.

What is the NNT?

The NNT is a measure of a treatment effect. When evaluating screening procedures, it is sometimes referred to as the number needed to screen (NNS). For this discussion we will use NNT and NNS interchangeably.

It is sometimes easy to think that actions recommended by health professionals will be successful for every individual. Unfortunately, that is not always the case. As an example, screening mammograms are recommended for discovery of abnormalities associated with early-stage cancer. Often, those early-stage cancers are more successfully treated when compared to late-stage breast cancer, and thus breast cancer deaths can be avoided.

Studies have clearly shown benefit of screening mammograms, so it is easy to think that if one obtains a mammogram as per the guidelines and recommendations, they will not die from breast cancer. That is not true. Even if a person is compliant with the guidelines and obtains mammograms as recommended, he or she can still die from breast cancer.

A mammogram is a tool that is considered very helpful, but it can't prevent all cancer deaths. In addition, many women will never develop breast cancer; therefore, they won't benefit from that screening. It isn't possible to identify those people individually so the recommendation is for all women to undergo mammography knowing that some will not benefit directly. Therefore, many women need to obtain the recommended mammograms for one death to be avoided. But how many?

The NNT tool helps answer that question. For the purposes of this discussion, we are considering the value of the NNT in context with a large population of people, not for one individual. Everyone has his or her own risks and considerations, and the NNT designed for population management is not as impactful for an individual assessment. For instance, high-risk individuals, based upon family history or other risk factors, have different screening recommendations, and the benefit of screening of a high-risk individual will be much higher than that for a person of average risk.

It isn't just mammograms. Consider cholesterol medication to treat those with high values. Does everyone that takes the medication avoid dying prematurely from heart disease? The answer unfortunately is no. And yet, when looking at a large group of individuals, studies have shown that it can be very effective.

Each health-related activity designed to eliminate a modifiable risk factor has a different NNT. As programs are being developed, the NNT tool is one factor that can be used to help select the components of the program.

This isn't the only thing to consider when building a program. Other considerations include how successful recruitment and enrollment will be, how impactful education and encouragement are in producing needed behavior changes, the cost of the intervention, the intervention-to-impact interval, ease/complexity of the intervention, ability to recognize impact, and the prevalence of the condition/potential for harm of the condition. But NNT is important and can be used by companies to better understand the intervention opportunity.

Uses of the NNT

NNT determination can be used for identifying any specific outcome. It could be the number needed to avoid a heart attack, a fall, an infection, etc. It is frequently used to identify the magnitude of the action/intervention. For this discussion we will look at mortality.

A mortality NNT of 1 would be perfect. This would imply that for every person that takes the mortality improving action, an unnecessary death would be avoided. Unfortunately, there are very few of these actions with a value of 1. The number is typically significantly higher.

In some cases, it is very difficult to ascertain this number. Sometimes clinical studies haven't been done to evaluate the NNT. With some interventions, scientific studies have shown widely discrepant NNT values for many mortality improving actions.

Going back to the mammogram example, the NNT varies by the risk (e.g., age, family history) of the population studied. If there are many individuals in the study with high risks versus other studies with average or low-risk individuals, varied results will be discovered.

Also, the NNT might vary based upon the technology used during studies. Mammograms, for instance, have improved over the years. Early studies analyzing NNT will be more likely to have worse results than more current studies.

The length of follow up can also impact the NNT value. Finally, looking at NNT can be confusing when analyzing the value of one mammogram versus annual testing over several decades.

Words of Caution Regarding the Tool

Like all tools, the NNT tool is not perfect and could be misleading or harmful if used inappropriately. For instance, the tool might be helpful for evaluating large groups of people with similar risk factors. The tool is not as helpful for one individual to use exclusively when evaluating value. This should always be done with the consultation and guidance of an individual's own health care professional.

When evaluating NNT studies, several important considerations to keep in mind include:
- Changing technology: Technology has improved significantly during the last few years/decades, and previous studies frequently involved older, less impactful technology.

- Population studied: Age, family history, environmental exposures, comorbid conditions, exercise level, other treatment, and screening exposures are just a few of the concerns.

- Alternative treatments

- Degree of benefit: Did it delay death one day, one month, or one year? Sometimes studies will report on years of life gained based upon the mortality improving action. When available, this is very helpful.

- What was the mortality improving action compared to? Placebo? Another treatment?

- The size and duration of the studies, including follow-up timeframe.

- The number needed to harm data, including false positive, false negatives, and inconclusive results from some testing procedures.

- The number of studies pooled together to arrive at a more accurate value.

Also, while there has been an increased number of studies reporting on absolute risk and/or NNT, there still are many studies published without this information. One analysis of clinical studies reported in 2021 that only about 8.7% of the current studies published included NNT results.

Therefore, NNT data is not readily available for many screening tests, treatments, and interventions.

When available, it is helpful to consider the results of evaluations by large independent health organizations or institutions in evaluating NNT. The U.S. Preventative Task Force is an example of an organization that does extensive work in this area.

Examples of NNT

Table 1 features a list of some NNT values which might be helpful as H&W program components are being considered.

As life insurance companies evaluate prospective H&W programs, it is helpful to identify what the NNT might be for individual components of the program as well as for the whole program when all components are combined. Third-party companies who specialize in providing effective H&W solutions might be helpful in trying to arrive at a NNT for their program.

Table 1- Number Needed to Treat (NNT) for selected interventions

Intervention	Condition category	Eligible in the population	~NNT to save 1 life
Low dose CT scan (LDCT) scan	Lung cancer early detection	Current or recent smokers >50 y/o. See the American Cancer Society's recommendations for a full description.	**130-323 (*6-10 years)**
Multicancer early detection test	Cancer early detection in addition to current screening	All those >50 y/o	**1,000**
Colon cancer test with FIT or colonoscopy	Colon cancer	Over age 50. Note: screening is now recommended for those 45 and older.	**40 (*lifetime)**
Mammography	Breast cancer	Those 50-69 years to prevent one breast cancer death at the age of 55-79.	**96-257 (*lifetime)**
Statins	All cause mortality	>18 with hyperlipidemia	**250 (*lifetime)**
Pneumococcal vaccine	Infectious disease	>65 y/o	**26,000 (to prevent 1 invasive infection) 2,600-14K(to prevent 1 pneumonia)**

NNT in single condition versus multi-condition management

Single condition management programs might not be as impactful as multi-condition management programs. Let's compare H&W program selection to underwriting. Underwriting doesn't look for one condition, say cancer screening compliance, to evaluate mortality risk. Instead, many conditions, including the presence of cardiovascular risk factors and/or previous cardiovascular events, diabetes, lung disease, renal disease, and others are evaluated in addition to cancer risk and screening, which allows a more complete and impactful evaluation of risk.

Similarly, a H&W program designed to impact one condition, especially if it is just one component of that condition, would not be expected to assist a large group of individuals in managing their mortality risk. Instead, when designing impactful H&W programs for large groups of individuals, a program designed to help with multiple conditions would be more effective.

If an individual person wanted to improve his or her mortality risk, he or she would most likely benefit from looking at multiple areas. An individual should consider exercising regularly, maintaining a healthy body weight, avoiding smoking, and screening themselves for cancer regularly, naming just a few.

Similarly, H&W programs designed to assist policyholders manage their risks for multiple conditions are most successful. Doing this in a cost effective and impactful way to have a sustainable model is key.

Identifying the NNT for individual components of a H&W program isn't always easy; identifying the NNT for combined components is sometimes even more complex. However, the effort to predict the NNT is helpful, and measuring the program for impact comparing actual results to predicted results is even more valuable.

Low dose CT scan use for identifying lung cancer early which is associated with improved mortality is listed in the table. For more discussion regarding this intervention, consider reading the case study example that follows.

> *The number needed to treat tool is very useful; however, it needs to be fully understood and used appropriately. It should be considered along with many other tools when considering health and wellness programs to obtain the most value.*

Preventing lung cancer deaths, one life at a time

A 65-year-old woman decides to obtain a low dose CT scan for lung cancer screening. A history of what led to this decision is helpful. While she is not a current smoker, she did smoke approximately one pack per day for 40 years. She was able to quit at age 58.

The U.S. Preventative Services Task Force (USPSTF)[1] and the CDC[2] recommend that people over age 50 or who have quit in the last 15 years and have at least a 20 pack-year smoking history obtain a low dose CT (LDCT) scan. This woman was not aware of that recommendation until she enrolled in the wellness program offered by her life insurance company.

During the enrollment process she completed a health risk assessment and was particularly interested in the question regarding lung cancer screening. As part of the question, there was an educational explanation that lung cancer is common and frequently asymptomatic until it has spread; she learns there is a screening test for lung cancer, and one large study showed that those who obtained a LDCT had a 20% lower chance of dying from lung cancer than those who got chest x-rays[3]. She was especially struck by the fact that the American Cancer Society documents that lung cancer is "by far the leading cause of cancer death."[4]

She did additional research and talked to her doctor about the test. She checked with her Medicare plan and was told the test was covered. She decided to proceed.

The LDCT test was completed, showing normal results. Not only was she relieved but she also was thankful that she took the opportunity to join the H&W program offered by the insurance company. She felt the education regarding lung cancer and the screening test were valuable.

Life insurance companies have an opportunity to partner with their policyholders and assist them in living longer and healthier lives. This case illustrates how a H&W program could assist in educating and encouraging guideline-recommended and effectiveness-proven care.
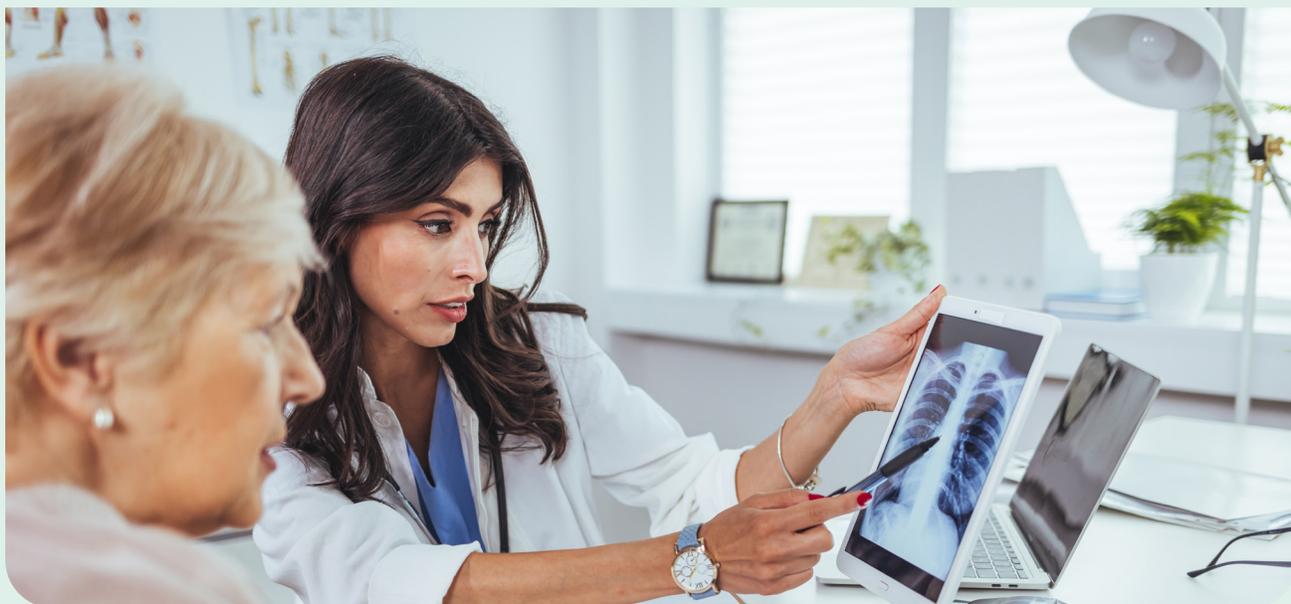
Driving increased screenings

One important aspect of this H&W program potential is the current low percentage of those who are eligible for the LDCT scan obtaining it. There has been a struggle getting this percentage significantly above 10%. Several factors potentially contribute to this low uptake in testing, including a delay in discovery to delivery that occurs with new technology and new recommendations. Both patients and their doctors sometimes are either not aware or haven't had a chance to incorporate the new recommendations into their practice.

Also, eligible patients include those who are not current smokers but have quit in the last 15 years. This situation might not be readily discovered during routine office visits. Many people just aren't familiar with the recommendations, thus the potential for an effective education and encouragement program.

Improving lung cancer survival

Note: Lung cancer is common, being the second most common cancer (not including skin cancer)[4]. Approximately 84% of lung cancers are non-small cell lung cancer (NSCLC). Of those, the five-year relative survival rate is shown below from a chart produced by the American Cancer Society[5].

The American Lung Association states that if lung cancer is caught before it spreads, the likelihood of surviving five years or more improves to 60%. They also have several "saved by the scan" stories including Frank F.[6] who had LDCT scan which did show a suspicious nodule that turned out to be cancer, which was removed surgically and Frank F. is now cancer free.

These numbers are based on people diagnosed with NSCLC between 2011 and 2017

SEER stage	5-year relative survivale rate
localized	64%
Regional	37%
Distant	8%
All SEER stages combiined	26%

Case Study References

1. https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/lung-cancer-screening
2. https://www.cdc.gov/cancer/lung/basic_info/screening.htm
3. https://www.cancer.org/latest-news/who-should-be-screened-for-lung-cancer.html
4. https://www.cancer.org/cancer/lung-cancer/about/key-statistics.html
5. https://www.cancer.org/cancer/lung-cancer/detection-diagnosis-staging/survival-rates.html
6. https://www.lung.org/lung-health-diseases/lung-disease-lookup/lung-cancer/saved-by-the-scan/stories/frank-f

References for the table

1. Oeffinger, K. et al. Breast cancer screening for women at average risk. 2015 Guideline update from the American Cancer Society. JAMA 2015. Breast Cancer Screening for Women at Average Risk: 2015 Guideline Update From the American Cancer Society | Breast Cancer | JAMA | JAMA Network

2. Duffy, S et al. Real and artificial controversies in breast cancer screening. Breast Cancer Management, Vol. 2, No.6. Oct 2013. Real and artificial controversies in breast cancer screening | Breast Cancer Management (futuremedicine.com)

3. Hubbell, E et al. Modeled Reductions in Late-stage cancer with a multi-cancer early detection test. Cancer Epidemiology, Biomarkers & Prevention. 2021;30:460-8

4. US Preventative Services Task Force. Screening for colorectal cancer: US Preventative Services Task Force Recommendation Statement. JAMA. 2021;325(19):1965-1977. Doi:10.1001/jama.2021.6238 Screening for Colorectal Cancer: US Preventive Services Task Force Recommendation Statement | Cancer Screening, Prevention, Control | JAMA | JAMA Network

5. US Preventative Services Task Force. Final recommendation statement Lung Cancer Screening. March 9, 2021. Recommendation: Lung Cancer: Screening | United States Preventive Services Taskforce (uspreventiveservicestaskforce.org)

6. Zhao, Y et al. Nelson lung cancer screening study. Cancer Imaging. 2011 Oct 3. NELSON lung cancer screening study - PMC (nih.gov)

7. Jonas, D. et al. Screening for lung cancer with low-dose computed tomography: An evidence review for the US Preventative services task force. Agency for Healthcare Research and Quality. 2021. Mar. Report No: 20-05266-EF-1. Screening for Lung Cancer With Low-Dose Computed Tomography: An Evidence Review for the U.S. Preventive Services Task Force [Internet] - PubMed (nih.gov)

8. Chou, R. et al. Statins for Prevention of Cardiovascular Disease in Adults Evidence report and systematic review for the US Preventive Services Task Force. JAMA November 15, 2016. Statins for Prevention of Cardiovascular Disease in Adults: Evidence Report and Systematic Review for the US Preventive Services Task Force | Cardiology | JAMA | JAMA Network

Additional references

1. The NNT , explained. The NNT Group, 2010-2023https://www.thennt.com/thennt-explained/

2. Number needed to treat (NNT) in clinical literature: an appraisal. Mendes, D et al. BMC Med 2017;15:112

3. Number Needed to Treat. Clincalc.com. https://clincalc.com/Stats/NNT.aspx

4. Guidelines to understand and compute the number needed to treat. Vancak, V et al. Evidence-Based Mental Health 2021;24:131-136 https://ebmh.bmj.com/content/24/4/131

5. Hendrick, RE et al. Mammography screening: a new estimate of number needed to screen to prevent one breast cancer death. AJR Am J Roentgenol. 2012 Mar. Mammography screening: a new estimate of number needed to screen to prevent one breast cancer death - PubMed (nih.gov)

6. US Preventative Services Task Force. Screening for breast cancer. Annals of Internal Medicine. February 2016. Screening for Breast Cancer: U.S. Preventive Services Task Force Recommendation Statement | Annals of Internal Medicine (acpjournals.org)

7. Elliott, M et al. Research Letter: Characteristics and reporting of number needed to treat, number needed to harm, and absolute risk reduction in controlled clinical trials, 2001-2019. JAMA Intern Med 2021;181(2): 282-284

For more information, contact the author:

Dr. Bill Rooney MD
VP, Medical Director
BROONEY@scor.com

SCOR

The Art & Science of Risk

February 2023