COMMENTARY

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Number Needed To... $ave?

Abstract

The 'Number Needed to Treat' (NNT) is a useful measure for estimating the number of patients that would need to receive a therapeutic intervention to avoid one of the adverse events that the treatment is designed to prevent. We explored the possibility of an adaption of NNT to estimate the 'Number Needed to $ave' (NN$) as a new, conceptual systems metric to estimate potential cost-savings to the health system from implementation of a treatment, or in this case, a program. We used the outcomes of the INSPIRED COPD Outreach Program™ to calculate that 26 patients would need to complete the program to avoid healthcare expenditures of $100,000, based on hospital bed days avoided. The NN$ does not translate into 'cost savings' *per se*, but redirection of resource expenditures for other purposes. We propose that the NN$ metric, if further developed, could help to inform system-level resource allocation decisions in a manner similar to the way that the NNT metric helps to inform individual-level treatment decisions.

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Clinicians, educators and researchers are familiar with the concept of the "Number Needed to Treat" (NNT), a useful measure for assessing the potential benefit from a given clinical intervention such as a drug or other therapy [1]. As the name implies, NNT estimates the number of patients who need to be treated with an intervention in order to avoid one of the adverse events that the treatment is designed to prevent, over a specific duration of time. Lower NNT values, all else being equal, indicate greater potential benefit from an intervention to the population under consideration. Cost, however, is not directly incorporated into the NNT metric. The "Number Needed to Harm" is another epidemiological measure that has been developed to estimate the number of patients that would need to be treated before a side-effect or consequence of a treatment or program can be expected, over a specific duration of time [2].

We were interested in adapting this concept to one of understanding how many people need treatment to achieve a particular economic outcome; namely adapting the NNT to estimate the "Number Needed to $ave" (NN$). The NN$ is defined as the number of patients who need to be treated with an intervention to realize a specific unit of cost-savings.

We applied this conceptual adaptation of the NNT to the INSPIRED COPD Outreach Program™ at the Queen Elizabeth II Health Sciences Centre (QEII HSC) in Halifax, Nova Scotia, Canada as an example. The INSPIRED COPD Outreach Program™ targets hospitalized patients with moderate to severe chronic obstructive pulmonary disease (COPD); an incurable, progressive lung disease that globally affects as many women as men and that has been attributed to increased tobacco use among women in high-income countries [3]. Treatment can slow the progression of the disease, but at a high cost, which is related to reliance on hospital-based care. In Canada, Mittmann et al. have estimated these costs to be $750,000,000 annually [4]. These costs will rise with the forecasted increase in the prevalence of the disease. In Ontario a 2013 study reported that the 12% of the adult population with a physician-diagnosis of COPD accounted for 24% of hospital admissions [5].

The INSPIRED COPD Outreach Program™ provides patients with access to supports and services designed to increase their confidence in their ability to manage their illness more effectively in their home and community. We summarize below, and have reported in detail elsewhere [6], our outcomes in terms of reduced facility usage among patients engaged in the INSPIRED program. Here, we wanted to estimate the number of patients who need to be enrolled and complete the INSPIRED COPD Outreach Program™ to contain or 'save'

the system $100,000 through reduced emergency department (ED) visits and hospitalizations. In our most recent analysis of our enrollment cohort of 257 patients [5] we reported outcomes from 131 patients who had completed the full program and had survived for a minimum of six months (see Figure 1 for flow diagram). Compared with six months pre-INSPIRED for these 131 patients who completed the full program between January 2011 and June 2014 (3.5 years) there were

- 60% fewer ED visits (from 282 to 113);
- 63% fewer hospital admissions (154 to 57); and
- 62% fewer days in hospital (1573 to 596).

Limitations

We accept that there are important limitations to our proposal for the NN$ concept. First, NN$ is calculated from data obtained before and after the intervention, without a comparison group; therefore, the estimated 'savings' could be the result of a variety of factors such as a temporal change or a co-intervention. Second, NN$ is influenced by many factors, making it challenging to interpret. Recall that NNT and NNH are estimated by taking the reciprocal of the absolute risk reduction over a certain period of time and influenced by either the magnitude of risk reduction or the baseline risk. Contrarily, the NN$ can be influenced by several factors: the number of patients who complete the program; the proposed amount of budget to be 'saved'; the estimated cost-savings associated with the program (contained costs); and, the cost to deliver the program. We acknowledge that NN$ requires further development as a concept before it is applied in any systematic fashion in practice; nevertheless, we argue it is a useful metric to develop to inform resource allocation decisions.

INSPIRED 'saved' the system approximately $1,000,000 related to hospitalized patients (977 fewer bed days) based on inpatient care at $1000 per bed day [3] and a modest adjustment for inflation between 2008 to current [7] INSPIRED program costs include full-time equivalent (FTE) staff salaries averaged over the relevant time period plus operating costs x 0.5, if we accept that approximately 50% of our team time and resources were allocated to the 131 (out of 257 total) patients. The annual program cost to deliver INSPIRED is summarized in Table 1, followed by the proposed NN$ formula and the INSPIRED NN$.

TABLE 1. Breakdown of approximate annual program cost for the INSPIRED COPD Outreach Program™ at the Queen Elizabeth II Health Sciences Centre in Halifax, Nova Scotia, Canada

RESOURCE	COSTS PER YEAR	COSTS PER YEAR 'allocated' to 131/257 patients
Spiritual care practitioner (1FTE)		
Respiratory therapist educator (s) (1FTE)	$200,000	$100,000
Coordinator/Evaluator (1FTE)		
Medical Director/Respirologist (0.2 FTE)	$60,000	$30,000
Program overhead (travel, supplies etc)	$20,000	$10,000
TOTAL per year	$280,000	$140,000
TOTAL for 131 patients enrolled in INSPIRED for 3.5 years		$490,000

Calculating the NN$ for the INSPIRED COPD Outreach Program™

NN$ = N (number of patients who completed the program) x {no. of proposed dollars to be saved/[(contained costs – cost to deliver the program) x no. of years in the program]}

The contained costs or 'savings' over 3.5 years for 131 patients using 977 fewer bed days is approximately $1,000,000.

'Contained costs' – program costs = $1,000,000-$490,000 = $510,000

Thus, the INSPIRED NN$ = 131 x $100,000/$510,000 = 25.6

In other words, 26 patients would need to complete the INSPIRED program to save the healthcare system $100,000, or to allow the healthcare resources to be used for other purposes. This NN$ of 26 is likely an overestimate as we have factored in neither the costs related to the reduction in ED visits nor the savings related to avoided or reduced bed utilization for decedents within our program (~20% of our patients die annually).(5) Cost 'savings' related to fewer ED visits will, at best, be an estimate since reported figures from across the country are so variable(8-13) and, in general, do not take into consideration all associated physician fees. Since patients in our program are usually seniors, and many spend more than 24 hours in the ED before returning home, were we to use an estimate of $500 per visit (which is, arguably, still conservative) this would bring the INSPIRED NN$ to 22. Obtaining more precise estimates on per capita costs for various healthcare services would help to refine this type of calculation and improve our understanding of the potential system benefits.

Even as an approximation or concept-in-development, the NN$ for INSPIRED lends further rationale to the system-level benefits that are possible when developing programs that 'free up' reliance on hospital-based costs in favour of home and community-based supports and services. While NN$ cannot make claims to save 'real' healthcare dollars (after all, freed up beds become occupied by other patients and costs of care in home and community are not inconsequential), avoiding hospital admissions for patients, whose care can be adequately managed in the community, allows for increased access of care for others, all else being equal. Moreover, a cost aversion of $100,000 is the equivalent to salary costs of ~1.5 FTE respiratory therapists, who could be instrumental in the spread of an outreach program such as INSPIRED. Like NNT, our NN$ concept is intuitive. Targeted savings could be scaled up or down according to what we need to achieve. Could NN$ be further developed to help understand potential efficiency gains for new treatments and clinical programs in the way that the NNT metric helps to understand the effort:yield of impact of treatment and program decisions? We believe so.
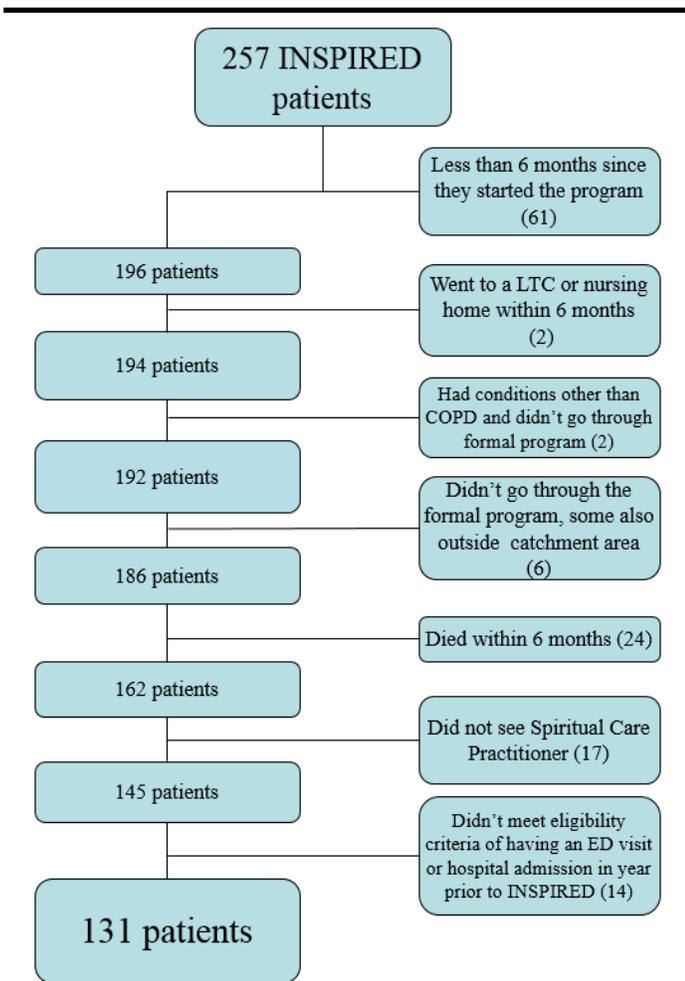
FIGURE 1. Flowchart of eligible patients for undertaking analysis of the INSPIRED COPD Outreach Program™ [6].

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