What Is a Good or Bad Number Needed to Treat (NNT)? A 2022 Updated Literature Review

Poster #HTA100

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Background

- Number needed to treat (NNT) captures treatment effectiveness by indicating the number of patients necessary to receive active treatment to prevent one additional bad outcome vs a control.
- A perfect NNT would be one, which would indicate a beneficial outcome is observed for every patient treated; a larger NNT would mean fewer benefits from intervention.
- The main concern of NNT is finding an acceptable balance between the benefits of the intervention and the severity of the bad outcome. No threshold is currently available for what may be considered an acceptable NNT in oncology.
- This is an update of a previously published review by Azimpour et al. 2019.[1]

Objective

- The goal of this review was to examine the ranges and averages of reported NNT in selected oncology studies and study factors that may affect it.

Methods

- A targeted literature review was conducted in PubMed to identify oncology studies reporting NNT. Relevant records published between June 6, 2019 and June 29, 2022 were extracted and assessed.
- Details on inclusion and exclusion criteria are presented in Table 1.
- Descriptive statistics were performed to identify factors influencing NNT values and help determine the positioning of new NNT values relative to recent published literature.

Table 1. PICOS used in the selection process

PICOS	Inclusion	Exclusion
Population	Patients diagnosed with any types of cancer	• Patients without cancer • Patients diagnosed with any types of cancer, but mixed with other diseases except cancer
Intervention and comparators	Not applicable	Not applicable
Outcomes measured	• NNT reported for OS • NNT reported for PFS • NNT reported for reduction in risk of cancer mortality	• NNT reported for other outcomes except OS and PFS (e.g., event-free survival, disease-free survival, and complete clinical response)
Study design	• Prospective observational studies • Retrospective studies • Interventional studies • Database analyses • Registries • Systemic reviews and meta-analyses • Pooled analyses	• Case reports • Notes/comments/letters • Non-human • Case series • Editorial • Review • Published before June 5, 2019

Abbreviations: NNT, number needed to treat; OS, overall survival; PFS, progression-free survival; PICOS, population, intervention, comparators, outcomes, and study design

Results

- Twelve studies[2-13] of the 83 studies identified met the inclusion criteria. Details on the included and excluded studies are presented in Figure 1.
- Among the included studies, two were in renal-cell carcinoma and 10 were in distinct cancer types, with seven cancer types that were not included in the prior review. The field and the malignancy type of the included studies are shown in Figure 2.

Figure 1. Literature flow diagram

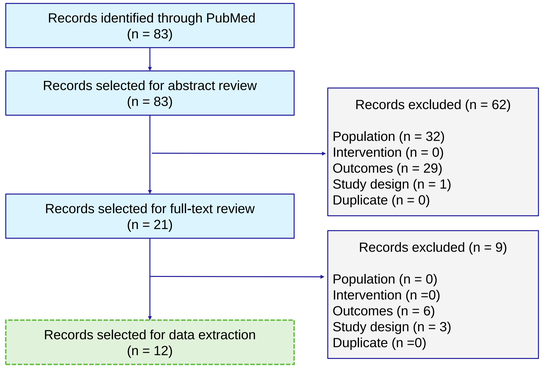
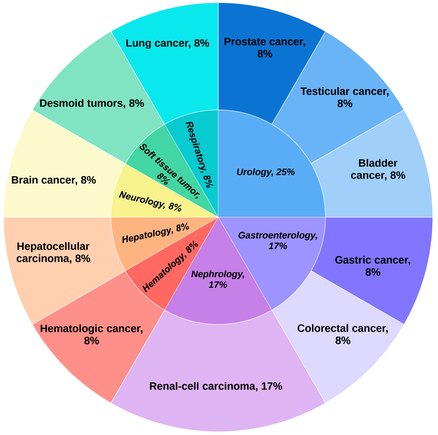
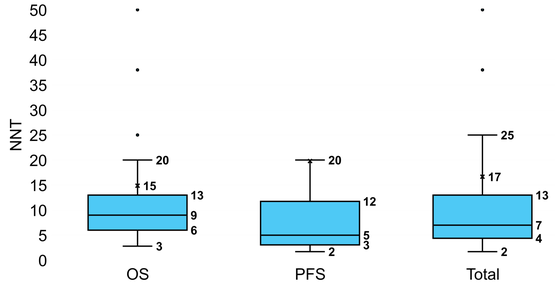


Figure 2. Identified studies by field and malignancy type



- NNTs in oncology typically ranged from two to 25 in all outcomes of interest (relevant to this review), all cancer types, and all follow-up times, with a few notable outliers at 100 or 135 (not shown) (Figure 3).
- The median NNT for overall survival (OS) and progression-free survival (PFS) were nine and five, respectively. The ranges of NNT for OS and PFS overlapped, as shown in Figure 3. As a result, it was unclear if there was a discernible difference between NNT values for OS and PFS, in contrast with the results from Azimpour et al 2019[1] who observed a more noticeable difference between the NNTs for OS and PFS.

Figure 3. NNT by outcome in oncology



x: mean value
Note: Only studies with treatment as an intervention were considered.
Abbreviations: NNT number needed to treat; OS overall survival; PFS progression-free survival

- When comparing NNT by cancer type and only considering studies with treatment as an intervention, the median NNT ranged from two (desmoid tumors) to 135 (gastric cancer).
- One study[5] reported NNT values for a preventative surgery (i.e., orchiopexy) and not for a treatment, and therefore was analyzed separately. The reported NNT ranged from 1,366 to 5,315 and was of a larger magnitude than for studies with treatment as an intervention.

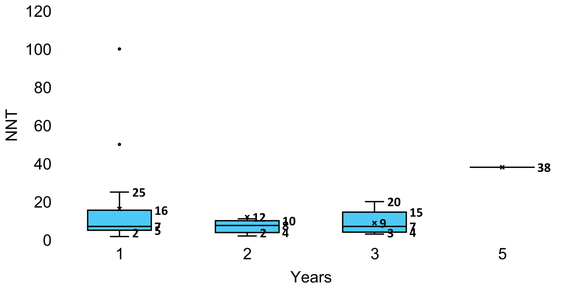
Table 2. Median NNT and # of NNTs reported by cancer type

Type of cancer	# of NNTs reported	Median NNT
Bladder	2	6
Brain	2	7.5
Colorectal	1	38
Desmoid tumors	2	2
Gastric	1	135
Hematologic	1	5
Lung	8	3.2
Prostate	2	12.5
Renal-cell carcinoma	32	10
Testicular*	4	3007.5*

*Reported the NNT for a cancer preventative surgery; all other studies reported the NNT for treatment.[5]

- Conflicting trends were observed in NNTs stratified by risk. In bladder cancer, patients who were considered low risk and high risk had low and high NNT values (low risk: 3, high risk: 9), respectively.[8] In prostate cancer however, the reverse result was observed (low risk: 20, high risk: 5).[6]
- NNTs generally trended upwards with increasing follow-up time (Figure 4).

Figure 4. NNT in oncology by follow-up time



x: mean value
Note: Only studies with treatment as an intervention were considered.
Abbreviations: NNT, number needed to treat

Discussion and Conclusions

- This update includes fields and cancer types that were not captured in the previous review[1] but confirms its findings: factors such clinical endpoint, treatment type, cancer type, patient characteristics (i.e., risk type) and follow-up period may influence NNTs in oncology.
- NNTs appeared to be slightly higher for OS than for PFS.
- The magnitude of NNTs was significantly higher in studies with preventative surgery as an intervention compared with treatment.
- The relationship between NNTs and patient characteristics may be heterogeneous across different cancer types.
- In general, NNTs increased with longer follow-up time.
- NNT values should not be considered naïvely without taking into consideration the context of the evaluation. Future research is required to explore links between these factors and NNT values.

References

1. Azimpour et al, Value Health, 2019; 2. Casadei-Gardini et al, Target Oncol, 2021; 3. Engel Ayer Botrel et al, J Med Econ, 2021; 4. Ford et al, Gut, 2020; 5. Higgins et al, World J Urol, 2020; 6. Hoyle et al, Eur Urol, 2019; 7. Johns et al, J Oncol Pharm Pract, 2023; 8. Pak et al, Sci Rep, 2019; 9. Paladini et al, J Med Econ, 2021; 10. Reif de Paula et al, Colorectal Dis, 2022; 11. Revilla-Pacheco et al, Medicine (Baltimore) 2021; 12. Santoni et al, Pharmacoecon Outcomes Res, 2022;13. Zeidan et al, Leuk Lymphoma, 2022.

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