Thinking and Talking about Prognosis in Advanced Cancer

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Abstract

Estimating and explaining prognosis (i.e., a quantitative estimate of life expectancy) is important for people with advanced cancer. The aim of the work described in this thesis was to improve the way oncologists think and talk about prognosis in advanced cancer. This was done by evaluating the usefulness (prognostic significance and accuracy) of oncologists' estimates of expected survival time, studying recommendations about the timing of discussions of prognosis, and evaluating a method for formulating and explaining prognosis.

To evaluate the usefulness of oncologists' estimates of expected survival time, data was collected from eight clinical trials including 2109 participants with advanced cancers of various types. Oncologists were asked at baseline to estimate the expected survival time of each individual participating patient (defined as the 'median survival of a group of similar patients'). Each participating patient was then followed to determine their observed survival time. Oncologists' estimates were well-calibrated (i.e., unbiased), imprecise (less often than not within one third of the observed survival time), and independently associated with observed survival times (in multivariable prognostic models). Simple multiples (1/4, 1/2, 2, and 3) of each estimate provided well-calibrated ranges to describe worst-case, typical, and best-case scenarios for survival for that individual. The benefits of formatting prognostic information as three scenarios for survival were discussed.

A systematic review was conducted to summarise research addressing timepoints when discussions about prognosis between doctors and their patients with advanced cancer occur or should occur. Several key timepoints were identified: at first consultation after diagnosis; upon disease progression; when there were no further anti-cancer treatments; and, when referring to palliative care services. Preferences for the timing and content of discussions about prognosis were highly individualised, and such discussions needed to be tailored and

perhaps occur several times during the course of a person's illness. It is important for doctors to identify appropriate timepoints to elicit each patient's preferences for the type and amount of information desired, and to offer discussions about prognosis.

To evaluate the clinical application of these findings, a web-based tool was developed to help oncologists estimate and explain worst-case, typical, and best-case scenarios for survival time for individuals with advanced cancer. The attitudes of 146 patients, 102 of their family members, and 140 healthcare professionals to this information about life expectancy, were evaluated in a single-arm clinical trial. Over 84% of patients, of family members, and of healthcare professionals found it useful to receive information about prognosis formulated as three scenarios for survival time. This trial provided strong evidence to support thinking and talking about prognosis in this way, and introduced a simple, freely accessible, web-based tool that oncologists could use routinely in their clinical practice (https://ctc.usyd.edu.au/3scenarios/).

In conclusion, the work in this thesis provides new information about the: usefulness of oncologists' estimates of expected survival time; recommended timing of discussions about prognosis; and methods for communicating information about prognosis. Improving the way oncologists think and talk about prognosis should help people affected by advanced cancer, because a better understanding of life expectancy should lead to better informed plans and decision making.

Statement of originality

This is to certify that to the best of my knowledge, the intellectual content of this thesis is the product of my own work and that all the assistance received in preparing this thesis and sources have been acknowledged. This thesis has not been submitted for any degree or other purposes.

Sharon Nahm ______________ 20/11/2024

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As supervisor for the candidature upon which this thesis is based, I can confirm that the authorship attribution statements above are correct.

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"And we know that in all things God works for the good of those who love him, who have been called according to his purpose." Romans 8:28.

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Rationale for the thesis

I am a medical oncologist based in Sydney, Australia, and have found that one of the most challenging aspects of my job is discussing prognosis with people affected by advanced cancer. The majority of patients with advanced cancer participating in studies about their information preferences report wanting to know about their prognosis, but many do not receive this information.[1] Many people with advanced cancer mistakenly believe that their cancers are curable and misunderstand the palliative intent of their treatment.[2,3] This can lead to overly-aggressive care towards the end of life that may not align with patients' goals, and may reduce their opportunities to plan financial and other affairs, and maximise time with significant others.[4,5,6] I have seen first-hand the negative impacts that this can have on patients and their loved ones.

There are many barriers to discussing prognosis, and there is limited training for oncologists on how to estimate and communicate prognosis. The lack of disclosure about prognosis reflects oncologists' difficulties with formulating and communicating information about life expectancy.[7] The motivation for my research was to help oncologists think and talk about prognosis, and ultimately help their patients make more informed decisions about treatment and end of life care.

1.2 Aims and objectives

The general aim of the work in this thesis was to help oncologists think and talk about prognosis with people affected by advanced cancer.

The specific objectives were to evaluate:

1. The prognostic significance and accuracy (usefulness) of oncologists' estimates of expected survival time (i.e., the "what");
2. The timing of discussions about prognosis in advanced cancer (i.e., the "when");
3. Methods that can be used to formulate and communicate prognosis with people affected by advanced cancer (i.e., the "how").

1.3 Selection of studies and outline of chapters

This is a hybrid thesis, combining traditional chapters (introduction, background, discussion) with a series of published manuscripts.

Chapter 2 provides a background for the research work presented in subsequent chapters. It covers both the importance of understanding prognosis in advanced cancer and the relevant background literature about estimating and communicating prognosis that preceded my research.

Chapter 3 provides an overview of additional methodological considerations pertinent to the subsequent 'Results' sections in the published journal articles.

Chapters 4, 5, and 6 collectively address objective 1, adding original data to the body of evidence evaluating the usefulness (i.e., accuracy, prognostic significance, and clinical application) of oncologists' estimates of expected survival time.

Chapter 4 is a published manuscript that helps oncologists understand the accuracy of their estimates of expected survival time. This pooled analysis of seven prospective studies challenges the commonly held belief that oncologists overestimate survival time by determining the calibration of estimates of expected survival time, and of scenarios based on these estimates.

Chapter 5 is a published manuscript that expands on this work, by evaluating the accuracy and prognostic significance of oncologists' estimates in a specific cohort of people with recurrent ovarian cancer.

Chapter 6 is a published commentary aimed at a clinical audience, highlighting the challenges associated with estimating life expectancy to determine eligibility for Voluntary Assisted Dying (VAD) in Australia. It aims to help clinicians understand what it means to identify people expected to live six months or less.

Chapter 7 addresses objective 2 by describing the timepoints when discussions about prognosis should occur. It is a published systematic review of research regarding the recommended timepoints according to published guidelines, doctors, and patients.

Chapter 8 addresses objective 3 and describes a clinical trial evaluating a web-based tool for estimating and explaining 3 scenarios for expected survival time to people affected by advanced cancer (patients, family members, and other healthcare professionals). The majority of study participants found this format of information on survival time helpful.

Chapter 9 summarises the main findings of the thesis as a whole, and outlines the strengths and limitations of the work undertaken. It discusses the clinical implications of these findings, and proposes directions for future research.

2 BACKGROUND

2.1 Introduction

Despite many advances in the treatment of cancer, a person's life expectancy is still often significantly shortened when they are diagnosed with advanced cancer. In Australia, the 5-year survival rate of cancers in the advanced stage (stage IV) remains low: for example 32% (breast), 13% (bowel), and 3% (lung).[8-10] For people with advanced cancer, the intent of treatment is usually not to achieve cure, but rather to improve or maintain quality of life and prolong life.

Definition of 'prognosis'

The term 'prognosis' can be used to describe several things, such as the general outlook of a person's life after diagnosis, the likelihood of cure, or the anticipated symptoms and clinical sequelae as the cancer progresses. Patients with advanced cancer provided a variety of responses when asked how they understood the term 'prognosis', ranging from temporal survival, to impact on current quality of life and meaningful events or decisions.[11] Some patients equated prognosis with life expectancy, discussing it in terms of how much "time [they have] left."[5] This is consistent with how several quantitative research studies have defined prognostic understanding.[12] For the purposes of this thesis, 'prognosis' is defined as "a quantitative estimate of life expectancy".[13]

2.2 The importance of understanding prognosis in advanced cancer

Importance for people with cancer

For the most part, people with cancer want information about their prognosis. In fact, Russell and Ward found that patients rated prognostic information as the most important element of communication with their doctor, even more important than information about their diagnosis or treatment.[1] Understanding the palliative nature of their treatment is important, because it may influence how patients weigh up the potential risks and benefits of certain therapies. It is particularly important for patients with a short prognosis for whom treatments may extend life by a few weeks or months, but may substantially worsen quality of life at the end of life. Understanding their prognosis allows patients to make informed decisions about their treatment, make plans for the future, and prioritise their remaining time with family and loved ones.[14] Patients who were well informed about their prognosis made different decisions to patients who were less informed; they were more likely to choose less aggressive treatments and engage in advanced care planning.[14] Communication about prognosis can also improve end-of-life care, for example by facilitating early engagement with palliative care and enabling people to die in their preferred setting.[15]

Importance for family members and carers

When family members and carers have an accurate understanding about prognosis, they are better positioned to participate in conversations about goals of care, advocate for patients' best interests, anticipate the expected outcome of terminal illness, and make informed decisions.[16] Some may even need to act as surrogate decision makers, particularly when patients lose the ability to make their own medical decisions as their illness progresses. Having honest information about a person’s prognosis helps prepare carers for managing end-of-life care at home and improves their quality of life during bereavement.[17]

Carers also want prognostic information to moderate their own emotions and better plan for the ‘next phase’ (e.g., for treatment, for decline, for the end-of-life). Such contingency planning was associated with ideas of being a good caregiver, ‘doing everything you can’, and making good decisions about care.[18]

Importance for doctors

Discussing prognosis with people affected by advanced cancer is an essential element of informed consent, and “the avoidance of [discussing] prognosis represents the shirking by physicians of not only a clinical responsibility, but also a moral responsibility.”[19] The ethical principle of autonomy requires patients to have access to all information about their illness trajectory.[20] Provision of prognostic information can also strengthen the doctor-patient relationship and promote trust by giving patients confidence that their doctor has, and will, tell them the truth.[21]

Understanding a patient’s life expectancy also guides oncologists’ management recommendations, as they weigh the potential pros and cons of treatment options. Accurate estimation of prognosis can help inform whether anticancer treatment is likely to beneficial.[22] It is also useful when considering the role of adjunctive therapies or procedures such as pacemaker insertion, dialysis, or surgical procedures.

Oncologists are also required to estimate life expectancy to determine clinical trial eligibility (e.g., life expectancy greater than three months); to complete life insurance policy payout forms; and, in some countries, to determine a person’s eligibility to access Voluntary Assisted Dying.

2.3 How prognosis is estimated

Prognosis and its estimation are both inherently uncertain. Oncologists usually draw information from a variety of sources to formulate a quantitative estimate of a patient’s life expectancy. Sources include overall survival times from published clinical trials, prognostic tools, nomograms, real-world data from institutional databases, and previous clinical experience with similar patients. The ‘median survival time’ from a clinical trial is a common starting point when estimating survival. The median survival is the most common, quantitative, summary measure of survival time,[23] meaning the length of time that 50% of a group would live longer than and 50% would live shorter than.

Clinical trial and ‘real-world’ data

Median overall survival times reported in pivotal clinical trials are often used as a basis for estimating survival. However, participants of clinical trials are often younger, have better performance status, and have fewer comorbidities than many ‘real-world’ patients, and their survival times are often longer as a consequence.[24,25] Therefore, the median overall survival time from clinical trials may need to be adjusted according to individual patient factors in order to formulate a more realistic estimate of expected survival time in an individual who is not typical of those in the trial. Henselmans et al reported that oncologists introduced prognostic factors such as tumour biology, physical functioning, and response to past treatment when determining if a patient was likely to be better or worse off than the group “average.”[7]

Prognostic tools

The European Association of Palliative Care (EAPC) published recommendations on the use of prognostic markers for patients with advanced cancer. These recommendations were informed by eight studies examining different validated prognostic tools: the Terminal Cancer Prognostic Score, the Palliative Performance Scale, the Palliative Prognostic Index, and the Palliative Prognostic Score.[22] Most of these tools used assessment of physical functional status as a core component. These tools have been validated in many studies, and consistently found to be associated with subsequent survival time, but they vary in their complexity, subjectivity, and clinical utility. They have also only been validated in people with short survival times, measured in weeks to months, and may not be applicable to people with advanced cancer who have been recently diagnosed. Another prognostic tool is the website www.cancersurvivalrates.com, which provides cancer-specific survival rates based on epidemiological data from the US Surveillance, Epidemiology, and End Results (SEER) program.[26]

2.4 Information needs of patients and caregivers

People with cancer

The majority of people with cancer in studies of information preferences wanted to know about their prognosis, even if the news might be distressing.[1,27] In Fallowfield et al's survey study of 1046 patients with cancer being treated palliatively, 85% reported wanting "as much information as possible [about their illness], good and bad."[28] Despite this, many will not ask about prognosis and prefer "their specialist just to tell", leaving it up to the doctor to initiate this discussion.[27]

Information phrased in positive terms (e.g., the chance of living 5 years, longest survival without treatment) tended to be slightly more desired than information phrased less positively (e.g., shortest survival without treatment).[27] Maintaining hope was one of the most commonly preferred elements of discussions about prognosis.[29-31] Patients wanted prognostic information to be disclosed in a straightforward, honest manner, to promote trust and effective decision making, as well to protect themselves from false expectations.[30]

It is also important to remember that patient needs and preferences for information may change over time based on the progress of their illness, treatment response, decline in performance status, and development of complications or other comorbidities.[32] A survey of 126 patients with metastatic cancer reported that 59% wanted to be told how long they had to live when first diagnosed, but 17% wanted their doctor to first check with them whether they wanted to discuss expected survival time, and 21% wanted to be told their life expectancy only if they directly asked.[27] As such, discussions about prognosis probably need to be offered several times along the course of a patient's illness and may need to be done with a staged approach, depending on the situation and the patient's preferences. Communication between oncologists and their patients is complex and should be carefully contextualised.

Caregivers

For family members and caregivers studied, almost all wanted some information about prognosis, despite knowing it could be highly distressing.[33] The preferred type and amount of information may differ between people living with cancer and their caregivers, further adding to the challenges. In fact, an Australian qualitative study found that most caregivers of people living with cancer wanted more information about prognosis than the person they were caring for, in order to gain greater certainty, to care effectively, help manage their own emotions, and to be better able to plan for the future.[18] Caregivers expressed the need to know what to expect, to help them 'hope for the best, and plan for the worst'. Importantly however, there was still a wide range of information preferences, ranging from those who never wanted to talk about prognosis, to those who wished to have more regular conversations about the patient's outlook.[18]

Impact of cultural contexts

It is important to recognise cultural differences in attitudes towards truth-telling and prognostic disclosure. In many cultures, the family is the strongest support system and expected to provide a high level of psychological support, including ‘bearing the burden’ of discussing prognosis. Mystakidou et al found in some European (Spain, Italy, Greece), Middle-Eastern (Saudi Arabia, Egypt) and Asian countries (China, Singapore, Japan), attitudes towards information disclosure are different from the Northern European or Anglo-Saxon model.[34] In studies examining the attitudes regarding prognostic disclosure from different cultural groups, although the majority of non-informed patients suspected the nature of their disease, many did not want to receive additional information, or preferred their families handle such matters. Others believed serious prognoses should not be routinely disclosed to the patient, and only in special circumstances.[35,36] Blackhall et al’s study of attitudes of different ethnic groups towards disclosure of prognosis in the terminally ill found that Korean Americans (35%) and Mexican Americans (48%) were less likely than African Americans (63%) and European Americans (69%) to believe that a patient should be told of a terminal prognosis, holding more of a family-centred model of medical decision making rather than a patient autonomy model.[37]

2.5 Discussing prognosis with people affected by advanced cancer

Do oncologists discuss prognosis?

A 2007 systematic review found that although most doctors in those studies believed patients should be told their prognosis, in practice many avoided such discussions.[38] An Australian study of audio-recorded initial consultations between 118 patients with incurable cancer and their 9 oncologists found that approximately half (58%) of the patients were told something about their life expectancy.[39] Epstein et al’s study of 178 patients with advanced cancers whom their oncologists expected to die within six months found only 23% of the patients reported recent discussions of prognosis, 38% reported only past discussions, and 38%

reported never having a discussion about prognosis.[3] Studies from Spain, Japan, Hong Kong, and Greece (referred to as 'non-Anglo Saxon' countries) reported some doctors at least partially agreeing with the idea of not telling patients they were dying.[38]

When do discussions occur?

A survey of oncologists from Australia and New Zealand reported several triggers for starting a conversation about prognosis: at initial consultation; following disease progression; when no further systemic anticancer therapy was planned; when the estimated prognosis was less than 6 – 12 months; when a patient directly asked; and when a patient was hospitalised.[40] In addition to these timepoints, the 2007 'Australian Clinical Practice Guidelines for communicating prognosis with adults in the advanced stages of a life-limiting illness' recommends discussing prognosis when a treatment decision needs to be made, if there are expectations that are inconsistent with clinical judgement, and when referring a patient to palliative care services.[41] Despite this, many oncologists reported disclosing prognostic information only when their patient directly asked.[42,43]

How do oncologists discuss prognosis?

There are many different ways that oncologists explain prognosis to their patients. Some oncologists provide a point estimate (i.e., a median, or a survival rate at a particular timepoint), often quantified by a range.[23,40] A survey of 238 oncologists and general practitioners from Norway found that 43% would communicate prognosis to a hypothetical patient using the median survival time or percentiles (e.g., "half will still be alive after 4 years"), and 15% would use probabilities (e.g., "80% chance [of being alive at a certain time point]").[23] Some provided a range of general time frames without numbers, for example "weeks to months", or "months to years".[40] Henselmans et al's observational study of consultations between oncologists and patients with advanced cancer found there was almost always explicit mention of indeterminacy or emphasis on the wide range (e.g., “could be 4 months, could be 3 years”).[7]

Some oncologists preferred to provide qualitative estimates such as whether it was likely or unlikely the patient would experience a future personal event such as a birthday, or discuss lucky outliers (“some may in fact survive for very long”).[7,23,40] Some used graphical illustrations, for example survival curves, to communicate variation in survival times, but this remained a relatively small minority (11%).[23]

Our team has proposed a method of presenting prognostic information as worst-case, typical, and best-case scenarios for survival using simple multiples of the estimated median survival.[44-47] Providing a range of prognostic estimates in the form of three scenarios for survival achieves a good balance between being realistic and conveying hope, allowing patients to plan for the worst, but maintain hope for the best. Further details about this method of formulating prognostic information are discussed in Chapter 3.

Interventions or tools that assist discussions about prognosis

A systematic review of interventions aiming to improve communication of prognosis to adult patients found three broad types of intervention: educational; patient-mediated; and palliative care led.[48]

Educational interventions for doctors included lectures, videos, and coaching sessions with role-playing. Patient-mediated interventions included question prompt lists, patient coaching, or communication support programs. In Clayton et al’s randomised trial, a question prompt list given to patients prior to their initial consultation with an oncologist increased the frequency of questions about prognosis.[49] The VOICE trial (Values and Options in Cancer

Care) evaluated individualised communication training and question prompt lists for oncologists and patients. This improved patient-centred communication, but not the prognostic awareness of patients.[50] Palliative care led interventions included consultations for the patient with a multidisciplinary team comprising of a palliative care physician and nurse, social worker, chaplain, and other disciplines as needed.

All three types of interventions have been shown to improve communication behaviours, improve trust in doctors, help patients ask questions about prognosis, and improve satisfaction of care.[48] However, these interventions attempted to improve communication broadly, and there is limited evidence of their specific effects on communicating prognosis. It is also unclear whether increasing the frequency, length, or quality of prognostic discussions improves prognostic awareness.

2.6 Prognostic awareness

Prognostic awareness refers to a patient's level of understanding of their prognosis and likely illness trajectory. In advanced cancer, this means awareness of the terminal nature of the disease and associated life expectancy. This can be assessed in a number of ways, for example by asking patients to quantify the chance that their cancer will be cured, to estimate their life expectancy, or to express the seriousness of their illness.[51]

The mean prevalence of accurate prognostic awareness in a large international meta-analysis including 11,326 participants with advanced cancer was 49% (range 5 to 86%).[12] A recent integrated literature review found that 11 of the 14 papers reported the majority (i.e., more than 50%) of participants with advanced cancer had inaccurate prognostic awareness. Hypothesised explanations for this discordance included not being informed of their prognosis, not accurately interpreting the information, and not accurately retaining the information.[14] In a longitudinal cohort study of people with advanced cancer, Loucka et al found that prognostic awareness did not change significantly over a six month period.[51] It is possible that some patients choose to keep inaccurate views about their prognosis as part of their coping methods or personality traits.[20,51]

Can prognostic awareness be harmful?

A systematic review of studies investigating the association between prognostic disclosure and psychological outcomes found depressive symptoms were less prevalent among respondents perceiving a worse prognosis after a full (versus no or brief) discussion about life expectancy.[2] Findings regarding the impact of prognostic disclosure on anxiety were mixed, with some studies finding no differences[52-54] whilst others found greater levels of anxiety and distress.[55] Despite many doctors' concerns of the impact of prognostic disclosure to the doctor-patient therapeutic relationship, studies either showed a positive association with communication and therapeutic alliance, or no significant change.[2] Literature examining potential associations between prognostic disclosure and psychological outcomes is limited and of varying quality, and most point to either no or positive associations.[2]

2.7 Barriers to discussing prognosis

The barriers to communication about prognosis can be grouped into three main categories: doctor-related, patient-related, and system-related.[56]

Many oncologists have reported that they lack the skills and confidence to initiate discussions regarding prognosis and some fear that they will be held accountable for an inaccurate estimate.[20,57-59] Some doctors reported worrying that discussing prognosis may upset their patients and cause them to lose hope.[58] Others feared that patients will view them less favourably, or might feel that they have ‘given up on them.’[20,60,61] Oncologists may also avoid these discussions due to their own desires to remain hopeful and maintain wishful thinking.[62]

Qualitative studies of patient-related barriers reported a preference for optimism and maintaining hope, using avoidance as a coping mechanism, and feeling emotionally unprepared, as possible reasons for patients not wanting to discuss prognosis.[63] Although personal autonomy and full disclosure are major ethical principles underpinning Western medicine, collectivist cultures such as those found in Asia, Latin America, and the Middle East view family members as a part of a collective ‘unit’.[64] Some family members may request doctors withhold information and avoid discussing prognosis with patients.[20] Some patients may prefer that doctors discuss their treatment and prognosis with other members of their family, rather than with them personally.

System-related barriers include lack of training and lack of time during clinic consultations.[20,58] The way in which clinical care is organised, prioritised, and delivered at an institutional level influences opportunities to initiate these discussions.[63] Doctors may feel that in the limited allocated appointment time, discussing prognosis is not as high of a priority as discussing different treatment options, side effects, and other logistical details.

2.8 Areas requiring further research

Oncologists need to better understand the accuracy and significance of their estimates of expected survival time. Studies evaluating the accuracy of doctor’s estimates of life expectancy have generally been in hospice settings including patients with life expectancies of only a few weeks.[65,66] There is little prospective data on the accuracy of oncologists’ estimates of survival times for people with advanced cancer typically seen in oncology outpatient clinics, who generally have survival times of months to years.

Many oncologists report the optimal timing of discussions about prognosis to be challenging, as this may vary not only between patients, but also within a given individual over time. Research is needed to identify and understand recommended timepoints to discuss prognosis, and when these discussions are occurring in studies involving communication of prognosis.

A number of studies have demonstrated the efficacy of interventions in prompting more frequent discussions of prognosis.[20] One example is the Serious Illness Care Program (SICP), an intervention that includes training, coaching, and prompting oncologists; information for patients and their families/caregivers; and tools for identifying suitable patients and prompting conversations with them.[4] However, building such complex interventions into health care practice systems is complicated and requires significant resources.[67] There is a need for simple and pragmatic interventions to ensure more widespread uptake in routine clinical practice.

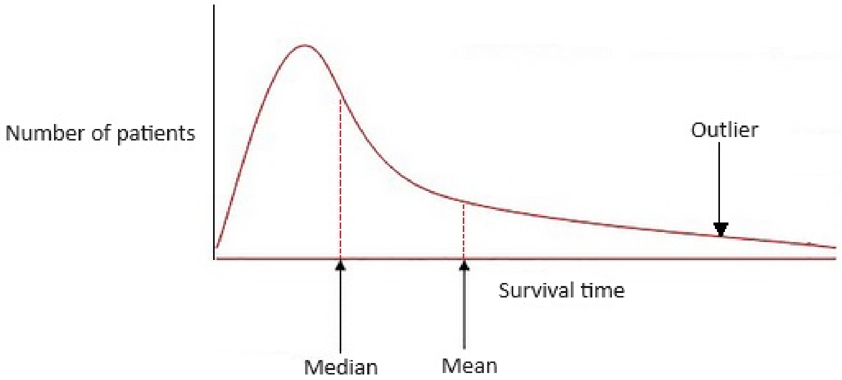
3 METHODOLOGICAL CONSIDERATIONS

3.1 Thinking about survival data

Survival data can be thought about in two major ways: as binary data (whether someone is alive or dead at a given timepoint), or as continuous data (the duration of time they lived). The latter is referred to as ‘time to event’ data and is commonly used as a primary outcome measure in cancer clinical trials.

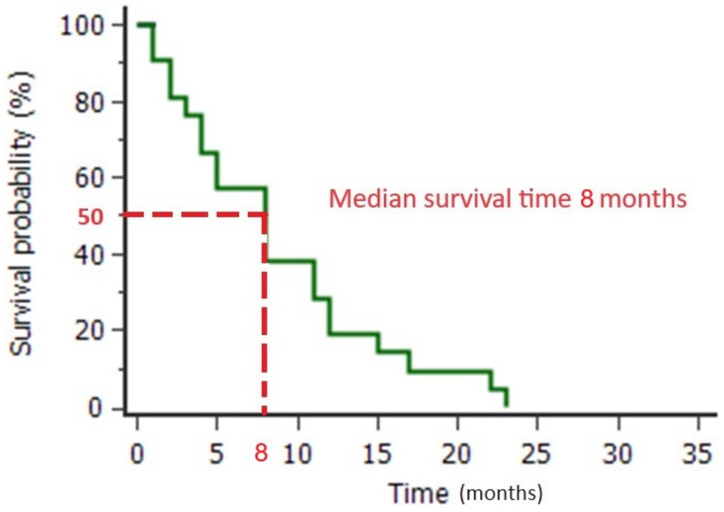
Survival times for people with advanced cancer are not normally distributed. They are commonly skewed to the right (towards longer survival times) as the minimum survival time can be no shorter than zero, but there may be a small number of outliers that live markedly longer than expected (Figure 1). Because of this, the median survival time (which measures the central location of the distribution of data) is used more often by doctors and in clinical trials rather than the average or mean, as it is less impacted by outliers.

Figure 1. An example of a typical survival curve with positive (right-sided) skew.



The most common method of displaying survival data in oncology is the Kaplan-Meier survival plot. This summarises the proportion of participants surviving a given length of time or longer. Figure 2 shows an example of a Kaplan-Meier survival plot; the x-axis indicates time and the y-axis indicates the proportion of the sample alive, that has not yet experienced death, also known as the survival probability. At time zero on the x-axis, the survival probability is 100%. The plot remains horizontal over the time period in which no deaths have occurred, followed by a vertical “drop” (step) when one or more deaths occur. The size of the drop reflects the proportion of participants followed at least that long who died at that time point. These plots are often referred to as survival ‘curves’ despite being made up of a series of linear steps.

Figure 2. Example of a Kaplan-Meier survival plot**.**



Kaplan-Meier survival plots can be used to determine the proportion of participants who remain alive at a given point in time. For example, 50% on the y-axis represents a survival probability of 50%, also known as the median. If all participants were followed until death, with none censored, then the median is the time when 50% of the group were still alive and 50% had died. In Figure 2, the median survival time is approximately 8 months.

Many survival plots in clinical trials including participants with advanced cancers follow an approximately exponential distribution.[44,47,68] This means events (or deaths) occur independently and randomly in a constant proportion of those surviving at any given time.

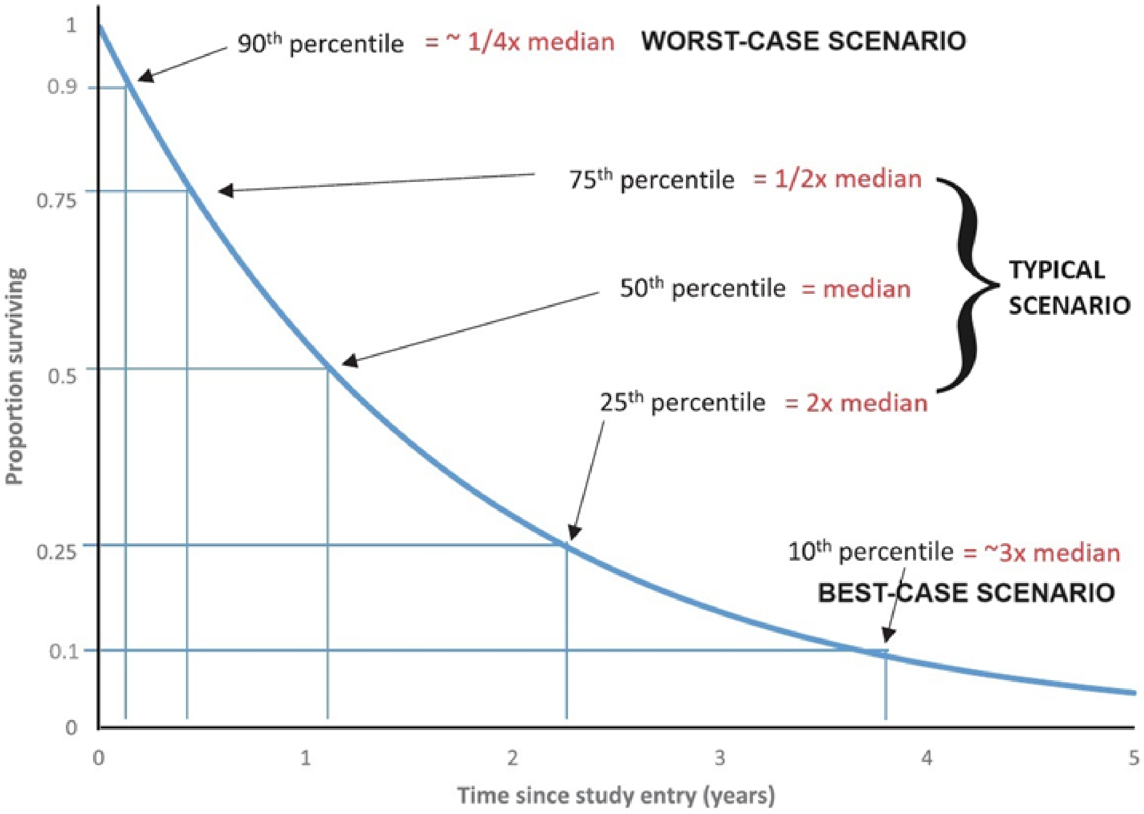
The median survival is the time taken for the group to be halved (half alive, half dead), and in an exponential distribution, this time is constant along the whole curve and analogous to the half-life of radioactive decay.[47] Therefore, in an exponential survival distribution, the proportion of participants remaining alive after two half-lives is 25%, after three half-lives is 12.5%, and after four half-lives is 6.25%.

Based on this principle, and examination of survival curves from systematic reviews of trials using chemotherapy in advanced cancer, we hypothesised that certain multiples of the median of a survival curve (i.e., the “half-life”) could be used to approximate given percentiles of the curve in an approximately exponential distribution (Figure 3).

For example:

- The 90th percentile is approximated by 1/4 x median
- The 75th percentile is approximated by 1/2 x median
- The 25th percentile is approximated by 2 x median
- The 10th percentile is approximated by 3 x median.

Figure 3. Percentiles on a survival curve and the multiples of the median that can be used to estimate them.



Stockler and colleagues proposed that these percentiles provided a useful basis for ranges that define three scenarios for survival time.[47] This is illustrated in Figure 3 and described below:

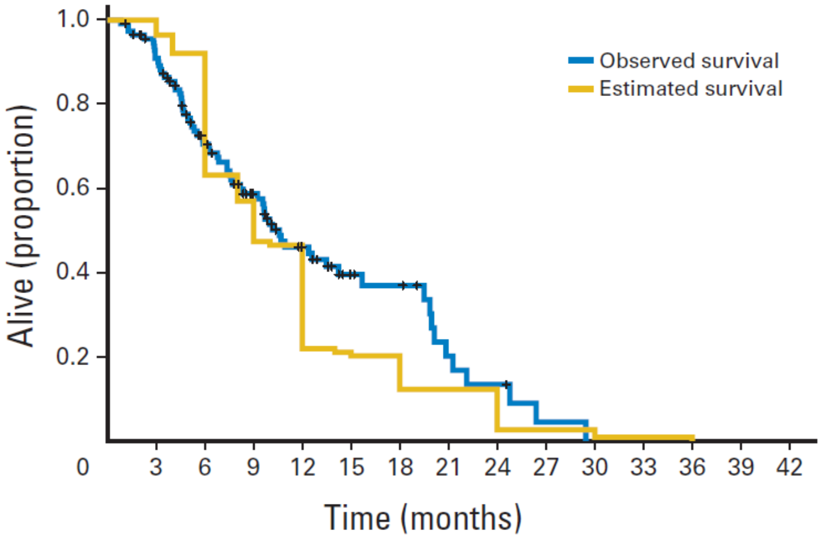
- the 90th percentile (the time when 90% of a group were alive and 10% had died) represents the upper bound of a 'worst-case scenario', including the shortest 10% of survival times,
- the 75th percentile (when 75% were alive) and 25th percentile (when 25% of people were alive) represent the lower and upper bounds of a 'typical scenario' (middle 50% of survival times), and
- the 10th percentile (when 10% were alive and 90% had died) represents the lower bound of a 'best-case scenario', including the longest 10% of survival times.

3.2 Estimating prognosis

When a doctor is asked to estimate an individual patient's expected survival time, it can be helpful to estimate the median survival for a group of similar patients. Providing this single number estimate to a patient is not recommended because it implies unwarranted precision and can be misinterpreted. Many people without statistical knowledge interpret a "median survival of 6 months," as implying that most individuals live for approximately 6 months, not understanding that this is the length of time that 50% are expected to live longer than and 50% are expected to live shorter than. Others interpret a median survival time as a hard maximum or limit ("I was told I had 6 months to live"). Single point estimates do not capture the inherent uncertainty of prognostication or life expectancy, and give no indication of the possibility of long term survival that can provide realistic hope, or of short survival that is an equally realistic possibility.

Kiely et al assessed the accuracy of oncologists' estimates of expected survival time (EST), defined as "the median survival of a group of similar patients", in people with advanced cancer. The survival plot for estimates of EST approximated the plot of observed survival times, except that the estimated times were aggregated at particular multiples, e.g. 3, 6, 9, 12, and 18 months (Figure 4).[44]

Figure 4. Kaplan-Meier curves of observed survival and estimated survival times.



Simple multiples (1/4, 1/2, 2, and 3) of the oncologists' estimates of EST provided reasonable approximations of the proposed percentiles for worst-case, typical, and best-case scenarios for survival.[44]

- 6% lived ≤1/4 x EST (close to the a priori hypothesis of 10%)
- 63% lived between 1/2 to 2 x EST (close to the a priori hypothesis of 50%)
- 14% lived ≥ 3 x EST (close to the a priori hypothesis of 10%)

Based on this observation, and others, we have proposed that the same simple multiples (1/4, 1/2, 2, and 3) used to estimate three scenarios from the median of an overall survival curve are a reasonable basis for estimating these scenarios from an oncologist's estimate of median survival for a group of similar patients. This proposal has been further evaluated and validated in studies of people with advanced gastric, breast, and non-small cell lung cancer.[68-70] Providing ranges for three possible scenarios for survival time conveys more meaningful information to patients than a single point estimate, and accurately conveys the inherent uncertainty of survival estimates.

3.3 Measuring accuracy of doctors' estimates

'Accuracy' is a broad term that can have many definitions, but generally refers to the proximity of an estimate or measurement to its true value. Higginson et al asked doctors to estimate the minimum and maximum expected survival time for patients and defined an estimate as accurate if the observed survival time was within the minimum to maximum range.[71] Fairchild et al defined accuracy as an estimate within 30 days of the observed survival.[72] For the purposes of this thesis, we have defined accuracy in terms of 'calibration' and 'precision'.

Calibration refers to the measurement of variation from a known standard.[73] It can be used to describe the degree of systematic error or bias. The greater the degree of systematic error, the poorer the calibration. In this thesis, oncologists' estimates of expected survival time are judged to be well-calibrated if the proportion of estimates that are greater than the observed survival time is approximately equal to the proportion shorter than the observed survival time (i.e., oncologists neither systematically over-estimate nor under-estimate observed survival time).

Precision refers to the quality of being exact.[74] In this thesis, it refers to the proximity of estimates to actual observed outcomes. An estimate of survival for an individual patient is defined as precise if it falls within a pre-specified range of the observed survival for that patient. In chapters 4 and 8, oncologists' estimates of expected survival time are considered accurate if they are within 0.67 to 1.33 times the observed survival time. This definition was chosen for comparability with previous studies.[44,47,68] The range 0.75 – 1.33 was used in chapter 5 because it is symmetrical on a logarithmic scale which is more appropriate for a ratio of two values (estimated : observed). Both ranges for accuracy are proportional to the observed survival time (relative), so when expressed on an absolute linear scale (time), they will be narrower when the observed survival is short and wider when the observed survival is long, reflecting the increasing uncertainty associated with longer survival times and estimates.

3.4 Measuring associations between potential prognostic factors and outcomes

In chapters 4 and 5, associations between predictor variables (e.g., patient characteristics) and outcomes (e.g., observed survival times) were assessed by Cox proportional hazards regression models. When necessary, continuous variables were divided into logical categories based on commonly accepted cut-points (neutrophil/lymphocyte ratio <5 and ≥ 5), or using statistical methods, for example selecting a cut-point that minimised the P-value of a log-rank test comparing two groups defined by the cut-point.[75] In general, variables with a P-value <0.05 in univariable analysis were included as candidates for inclusion in multivariable analysis. Using backward selection, non-significant variables were removed one at a time until all remaining variables were significant at P <0.05.

In chapter 8, associations between participants' baseline characteristics and responses to survey questions were assessed with simple linear regression and Pearson's correlation coefficients.

3.5 Study-specific questionnaires

The questionnaires used in the study in Chapter 5 for quality of life analysis were chosen by the investigators of the main Gynaecologic Cancer Intergroup (GCIG) Symptom Benefit Study.[76] These validated questionnaires were the European Organisation for Research and

Treatment of Cancer Quality of Life Questionnaire Core and ovarian cancer modules (QLQ-C30 and QLQ-OV28).[77,78]

The study-specific questionnaires used in the study in Chapter 8 were developed by the investigators. They included a series of study-specific statements and 5-point Likert scales to elicit attitudes to each statement (strongly agree, agree, unsure, disagree and strongly disagree). Levels of anxiety, hope, and optimism were measured using validated questionnaires: the Short State Trait Anxiety Inventory (STAI);[79] Herth Hope Index;[80] and the Life Orientation Test Revised LOTR)[81]. Printed patient questionnaires were provided to consenting participants after an iTool consultation (a consultation where a web-based tool was used to estimate and communicate prognosis) and were returned within 14 days via post (using stamped, self-addressed envelopes provided) or in person into a sealed collection box at their next scheduled clinic visit. A member of the research team contacted the participant in the two weeks following their iTool consultation to remind them to complete the questionnaire, assist with any problems encountered completing it, and provide the option of completing the questions over the phone. Family members who were also present during an iTool consultation were asked to complete a printed questionnaire, and these were also returned within 14 days either in person or by post. Other health professionals were sent the study information, the health professionals' questionnaire, and the 1 page printed summary of the information about life expectancy along with the oncologists standard consultation letter. Health professional questionnaires were returned by post, email or fax within four weeks. Family members and health professionals were not sent reminders to return questionnaires. The oncologist questionnaires were completed electronically at the end of each consultation in which the iTool was used.

4 ACCURACY OF ONCOLOGISTS' ESTIMATES OF EXPECTED SURVIVAL TIME IN ADVANCED CANCER

Overview

Many oncologists lack confidence in estimating an individual patient's life expectancy, and uncertainty regarding the accuracy of their estimates is a key barrier to initiating discussions of prognosis.[82] It is a commonly held dogma that "oncologists are overly optimistic with their patients and tend to over-estimate survival,"[83] making it difficult for patients to prepare for the future and make informed decisions about treatments.

It is therefore important to understand the accuracy (i.e., calibration and precision) of oncologists' estimates of expected survival time. This published manuscript evaluated the usefulness of oncologists' estimates of survival for patients with advanced cancer in a pooled analysis of 7 prospective studies. It also determined the calibration of worst-case, typical, and best-case scenarios based on simple multiples of the oncologists' estimates of expected survival time.

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Contribution of authors

SHN was involved in conceptualisation, formal analysis, investigation, methodology, and writing of the manuscript.

AJM was involved in conceptualisation, data curation, formal analysis, investigation, and methodology.

JMC, PG, EBM, NP, KS, MES, AT, and AV were involved in data curation and revision of the manuscript.

MRS and BEK were involved in conceptualisation, data curation, investigation, methodology and revision of the manuscript.

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Article

Accuracy of oncologists' estimates of expected survival time in advanced cancer

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Abstract

Background: To evaluate the claim that oncologists overestimate expected survival time (EST) in advanced cancer.

Methods: We pooled 7 prospective studies in which observed survival time (OST) was compared with EST (median survival in a group of similar patients estimated at baseline by the treating oncologist). We hypothesized that EST would be well calibrated (approximately 50% of EST longer than OST) and imprecise (<30% of EST within 0.67 to 1.33 of OST), and that multiples of EST would provide well-calibrated scenarios for survival time: worst-case (approximately 10% of OST <1/4 of EST), typical (approximately 50% of OST within half to double EST), and best-case (approximately 10% of OST >3 times EST). Associations between baseline characteristics and calibration of EST were assessed.

Results: Characteristics of 1,211 patients: median age 66 years, male 61%, primary site lung (40%) and upper gastrointestinal (16%). The median OST was 8 months, and EST was 9 months. Oncologists' estimates of EST were well calibrated (50% longer than OST) and imprecise (28% within 0.67 to 1.33 of OST). Scenarios for survival time based on simple multiples of EST were well calibrated: 8% of patients had an OST less than 1/4 their EST (worst-case), 56% had an OST within half to double their EST (typical), and 11% had an OST greater than 3 times their EST (best-case). Calibration was independent of age, sex, and cancer type.

Conclusions: Oncologists were no more likely to overestimate survival time than to underestimate it. Simple multiples of EST provide well-calibrated estimates of worst-case, typical, and best-case scenarios for survival.

It is a commonly held belief that doctors overestimate survival times for people with advanced cancer, but this is largely based on research in palliative care settings including people with very short survival times (measured in days to weeks) (1-3). However, several studies including people with longer survival times (measured in months to years) reported that oncologists' estimates were well calibrated, that is, they were just as likely to overestimate survival as they were to underestimate it (4-6). To provide stronger evidence about the calibration of oncologists' estimates of survival times, larger numbers of people with a range of advanced cancer types and wider ranges of survival times are needed, where the oncologists estimated patients' expected survival times at baseline and these patients were subsequently followed up to determine their observed survival times.

The accuracy of oncologists' estimates of survival time has been reported to range from 10% to 40%, depending on the type of estimate and the definition used for accuracy (7-9). For example, Higginson et al. asked health care professionals to estimate the minimum and maximum expected survival time (EST) for individual patients and defined an estimate as accurate if the observed survival time (OST) was within the minimum to maximum range (8). Fairchild et al. defined accuracy as an estimate within 30 days of the observed survival (7), and a number of other studies have used the definition of an estimate within 33% of the observed survival (9-13).

Studies in advanced cancer have reported that most patients wanted information about their EST, including specific scenarios, such as a longest survival with treatment, an average survival, and a shortest survival without treatment (14-16). In previous

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work, we showed that certain percentiles of an overall survival (OS) curve can be used to define ranges representing best-case, worst-case, and typical scenarios for survival time (4,17). For example in Figure 1, the 90th percentile, when 90% were still alive and 10% had died, could be considered the upper limit of a range for a worst-case scenario (shortest 10% of survival times), and the 10th percentile, when 10% were still alive and 90% had died, could be considered the lower limit of a range for a best-case scenario (longest 10% of survival times). The interval between the 75th and 25th percentiles (middle 50% of survival times) could be considered a range for a typical scenario. In previous work, we have also shown that simple multiples (0.25, 0.5, 2, and 3) of an OS curve's median can be used to estimate these percentiles (4,17-20). These same simple multiples can be applied to an oncologist's estimate of an individual patient's EST, defined as the median survival in a group of similar patients, to provide individualized scenarios for survival time. In a recent study in which oncologists explained prognosis to patients with advanced cancer expressed as worst-case, typical, and best-case scenarios, we found that 91% of patients and 91% of family members found it helpful to receive prognostic information in this format (17). This prognostic information will be most useful to patients if it is accurate, and of limited use if oncologists consistently overestimate survival.

The aim of this study was to evaluate the usefulness of oncologist estimates of survival by exploring the widely reported claim that oncologists consistently overestimate survival time in advanced cancer. We did this by determining the calibration of EST, and of scenarios based on these estimates, in 7 prospective studies including EST and OST.

Methods

We pooled data from 7 studies that included patients with advanced cancer attending oncology clinics mostly in Australia (4,13,17,21-24). These studies were selected because in each the patient's oncologist estimated that patient's EST at baseline (defined as the estimated median survival time in a group of similar patients), and patients were subsequently followed to determine their OST. The EST did not necessarily have to be communicated to the patient. We compared each patient's EST with their OST. Each patient's oncologist recorded the patient's age, sex, Eastern Cooperative Oncology Group (ECOG) performance status, and cancer type. Study procedures followed were in accordance with the ethical standards of the Helsinki Declaration, and informed consent and approval by the health research ethics committee at all participating sites were previously obtained.

Accuracy is a widely understood but variably defined term. For the purpose of this study, we conceptualized accuracy in terms of calibration and precision. Our primary objective was to determine the calibration of oncologists' estimates of EST, defined as the proportion of patients with an EST longer than their OST (proportion where oncologists overestimated survival). We expected oncologists' EST to be well calibrated (ie, approximately equal proportions [50%] of estimates being longer than the OST and shorter than the OST). We also evaluated the proportion of patients with a "precise EST," which was defined as an EST within 0.67 to 1.33 times the OST for comparability with previous studies (4). We used prior research to hypothesize that less than 30% of estimates would meet this definition (5,6,25). We explored whether the calibration and precision of oncologists' estimates of EST varied according to the length of EST or baseline characteristics of patients (age, sex, cancer type, length of EST, and receipt of a trial intervention or standard of care). We hypothesized that there would not be important associations between these variables.

Additionally, we evaluated the calibration of scenarios for survival time on the basis of simple multiples of the EST. Using our previous findings (17,18), we hypothesized the following:

- Approximately 10% of patients would live shorter than one-quarter of their oncologist's estimate (ie, OST/EST <0.25), corresponding to a worst-case scenario.
- Approximately 50% of patients would have a survival time within half to double their oncologist's estimate ($0.5 \le$ OST/EST ≤ 2), corresponding to a typical scenario.
- Approximately 10% of patients would live longer than three times their oncologist's estimate (OST/EST >3), corresponding to a best-case scenario.

Statistical analysis

Associations between oncologists' estimates of EST and baseline patient characteristics were assessed with univariable Cox regression. For each patient, we calculated the ratio of the OST to their oncologist's EST and used the Kaplan–Meier distribution of

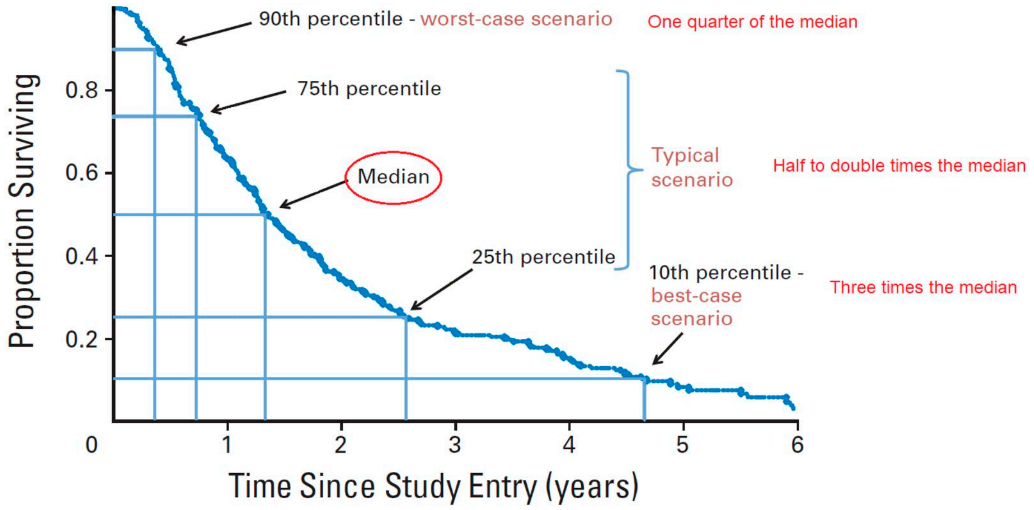

Figure 1. Survival curve percentiles and their corresponding scenarios. This curve comes from an unrelated study of patients with advanced breast cancer (18).

Table 1. Study characteristics[a]

Design	Cancer types	Minimum life expectancy eligibility criteria (months)	Other relevant eligibility criteria	Treatments/Interventions given during the study period	Number of patients	Median age (years)	ECOG performance status ≤1 (%)	Country	Ref
Cohort study	Mixed advanced cancers	Nil	Newly referred for noncurative intent treatment	Usual care (Chemotherapy 57%, Radiation 22%, Hormone 45%, Observation 10%, Surgery 1%)	102	64	Not available	Australia	(4)
Placebo-controlled phase 2 trial	Metastatic/locally recurrent gastric cancer	≥3	Refractory to ≤2 lines of chemotherapy	Regorafenib vs placebo	152	63	100	Australia, Canada, New Zealand, South Korea	(13)
Multi-site, phase 2 trial	Mixed advanced cancers	Nil	Patients wanting quantitative information about their prognosis	Web-based tool estimating and explaining life expectancy	215	67	80	Australia	(17)
Randomized control trial	Stage III/IV Non-small-cell lung cancer	≥3	Starting first line chemotherapy	Chemotherapy +/- Nitroglycerin	363	64	93	Australia, New Zealand	(21)
Randomized control trial	Mixed advanced cancers	3–12	Progression on ≥1 line of systemic therapy for advanced cancer	Usual care +/- advanced care planning intervention	163	66	Not available	Australia	(22)
Cohort study	Mixed advanced cancers	Nil	Age ≥65 years and starting first or subsequent line chemotherapy	Single or combination chemotherapy	102	74	82	Australia	(23)
Randomized control trial	Mixed advanced cancers	>3	Baseline score ≥4/10 on scales for depression, anxiety, fatigue, or low energy from the Pt DATA form	Sertraline vs placebo	114	60–69	85	Australia	(24)

[a] ECOG = Eastern Cooperative Oncology Group performance status; Pt DATA form = Patient Disease And Treatment Assessment Form.

the ratio (OST/EST) to account for censored observations (patients still alive at their last follow-up). A 2-sided *P* value of less than .05 was considered statistically significant. Statistical analyses were done using R version 4.0.4.

Results

In total, there were 1,211 patients from 7 studies published between 2006 and 2022 (Table 1). The characteristics of the patients are summarized in Table 2. The median age was 66 years, and the majority (61%) were male. The median EST was 9 months (interquartile range = 6–12, absolute range = 2–96). The median OST was 8 months (interquartile range = 4–15, absolute range = 0.03–62).

Table 2. Patient characteristics (N = 1,211)

Characteristic	No. (%)
Median age, years (range)	66 (16-92)
Sex, male	739 (61)
ECOG performance status[a]	
0	254 (27)
1	576 (61)
2	111 (12)
3	5 (0.5)
Cancer type	
Lung	485 (40)
Upper gastrointestinal	189 (16)
Colorectal	110 (9)
Breast	67 (6)
Other	360 (30)
Treatment group	
Experimental	404 (33)
Control	469 (39)
Routine clinical practice	338 (28)
Estimated survival time	
<4 months	79 (7)
4–8 months	334 (28)
>8–12 months	280 (23)
>12–16 months	327 (27)
>16–20 months	76 (6)
>20 months	115 (9)
Observed survival time	
<4 months	302 (25)
4–8 months	283 (23)
>8–12 months	178 (15)
>12–16 months	167 (14)
>16–20 months	117 (10)
>20 months	164 (14)

[a] Not available for 265 patients. ECOG = Eastern Cooperative Oncology Group.

As hypothesized, oncologists' estimates of EST were perfectly calibrated: 50% of patients had an EST longer than their OST (95% CI = 47% to 53%), and 28% of patients had a "precise EST" (95% CI = 25% to 31%). The calibration of oncologists' estimates of EST did not vary greatly according to length of EST (Figure 2), except for those with EST of more than 20 months, in whom 60% of EST were longer than the OST. The precision of oncologists' estimates of EST also did not vary greatly according to length of EST (Figure 3). There were no significant associations between the calibration of oncologists' estimates and the baseline characteristics of patients in univariable analyses (Table 3).

The proportion of patients with OSTs falling within prespecified ranges for the 3 scenarios corresponded closely with our a priori hypotheses: 8% (95% CI = 7 to 10) of patients (hypothesis = 10%) lived shorter than one-quarter of their oncologist's estimate (OST/EST <0.25) corresponding to a worst-case scenario; 56% (95% CI = 53 to 59) of patients (hypothesis = 50%) lived within half to double their oncologist's estimate ($0.5 \le \text{OST/EST} \le 2$) corresponding to a typical scenario; and 11% (95% CI = 8 to 13) of patients (hypothesis = 10%) lived longer than 3 times their oncologist's estimate (OST/EST >3) corresponding to a best-case scenario.

Discussion

This study brings together prospectively collected, individualized predictions of EST in more than 1,000 patients with advanced cancers who were rigorously followed, allowing formal comparisons with OST. We present the largest pooled analyses comparing oncologists' estimates of EST with OST of patients with advanced cancer attending oncology outpatient clinics. Oncologists' estimates of EST were remarkably well calibrated, with exactly 50% of estimates being longer (or shorter) than the observed survival times, that is, oncologists were equally likely to overestimate survival time as they were to underestimate it. We also found that simple multiples of the oncologists' estimates of

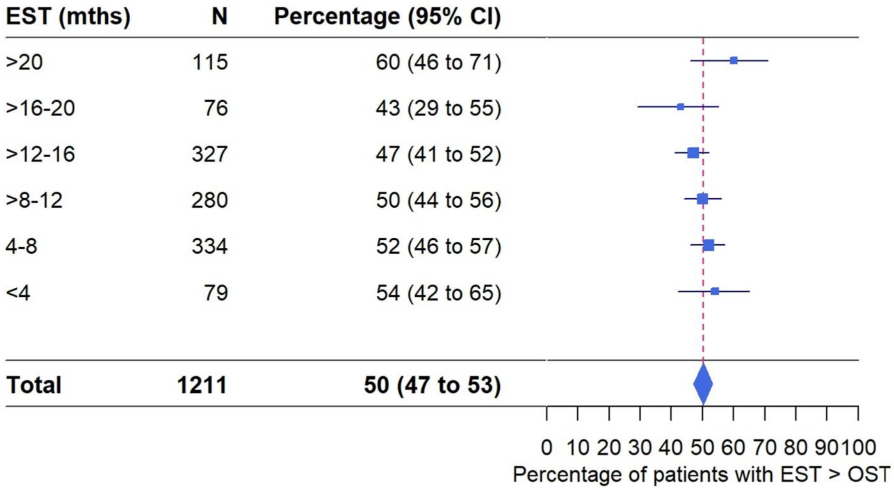

Figure 2. Percentage of patients with expected survival time longer than observed survival time (calibration) according to length of expected survival time. EST = estimated survival time; mths = months; N = number of patients; OST = observed survival time. Box represents the percentage and whiskers represent the 95% confidence intervals.

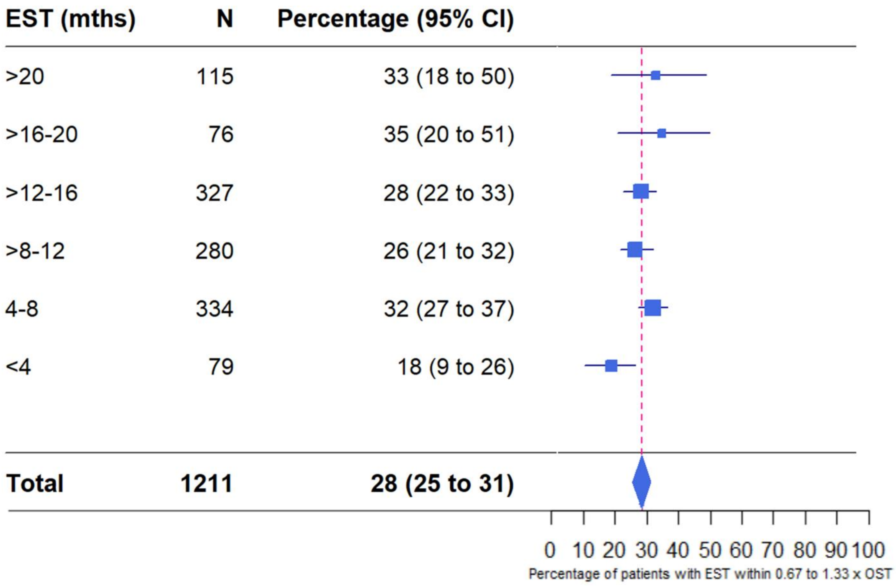

Figure 3. Percentage of patients with expected survival time within 0.67 to 1.33 times the observed survival time (precision) according to length of expected survival time. EST = estimated survival time; mths = months; N = number of patients; OST = observed survival time. Box represents the percentage and whiskers represent the 95% confidence intervals.

Table 3. Calibration of oncologists' estimates according to patient baseline characteristics in univariable analyses

Variable	**Hazard ratio (95% CI)**	**P-value**
Age, years	1.00 (0.99 to 1.01)	.45
Sex (ref: female)	1.02 (0.89 to 1.17)	.78
Cancer type (ref: breast)		
Colorectal	0.77 (0.52 to 1.13)	.20
Lung	0.83 (0.60 to 1.16)	
Pancreas	1.13 (0.73 to 1.74)	
Prostate	0.73 (0.45 to 1.18)	
Upper GI	0.91 (0.64 to 1.29)	
Other	0.77 (0.54 to 1.08)	
EST category (ref: <4 months)		
4–8 months	1.10 (0.85 to 1.45)	.14
>8–12 months	1.24 (0.94 to 1.64)	
>12–16 months	1.15 (0.87 to 1.52)	
>16–20 months	0.93 (0.62 to 1.40)	
>20 months	1.52 (1.05 to 2.20)	
Treatment arm (ref: intervention)[a]	0.99 (0.85 to 1.15)	.59

[a] Excludes patients in single-arm trials (N = 338).

EST provided well-calibrated predictions of worst-case, typical, and best-case scenarios for survival, a format preferred by patients seeking prognostic information (17).

Our findings are contrary to those reported by Glare et al. in a systematic review of physicians' estimates of survival time in 1,563 patients deemed "terminal" or referred for hospice admission. Doctors' clinical predictions of survival in Glare's review were generally overoptimistic, that is, ESTs were longer than OSTs (3); however, the median OST was 29 days. Many other studies supporting the dogma that oncologists' estimates are "almost always optimistic" (26) are similarly based on studies of patients with very short survival times of usually less than 1 month (1,27,28). Our data did not show evidence of systematic overestimation or underestimation, even in those with an expected survival time of less than 4 months. However, our study included no patients with an expected survival time of less than 2 months.

As hypothesized, oncologists' estimates were imprecise, with less than 30% of EST within 33% of the OST, similar to other studies (10-12,25). Given the inherent variability of survival time, it is unrealistic to expect point estimates of survival time to be any more precise (29). However, simple multiples of the oncologists' estimates provided remarkably well-calibrated ranges corresponding to worst-case (approximately 10% of patients), typical (50% of patients), and best-case (approximately 10% of patients) scenarios for survival.

The oncologists in this study did not consistently overestimate survival time. The clinical implication of this is that oncologist estimates of expected survival time are useful for patients with advanced cancer. Patients require accurate prognostic information to make important decisions and plans for the future. Overly optimistic survival estimates may generate false hope and unrealistic expectations leaving patients unprepared for death.

In previous work, we surveyed more than 700 patients and found that the majority preferred to receive prognostic information formatted as worst-case, typical, and best-case scenarios for survival time rather than point estimates of the median survival time (17,30). These findings support our recommendation that oncologists formulate and explain 3 scenarios for survival when thinking and talking about prognosis in advanced cancer, which can be done using our freely available web-based tool at https://ctc.usyd.edu.au/3scenarios/.

The calibration of oncologists' estimates was independent of the length of the EST and of the baseline characteristics of each patient. Discrepancies between estimated and observed survival time were greatest for extremes of EST (ie, the longest and shortest categories of EST), as expected.

The main strengths of this study are its large sample size and inclusion of a broad range of patients with variable survival times. The heterogeneity of cancer types included shows that oncologists' estimates are well calibrated across a range of tumor types. Our study also assessed oncologists' estimates of EST for patients with longer OSTs (median = 8 months) than previous studies and is therefore more representative of the prevalent overall population of people with advanced cancer, who may live for many months or even years.

The participating oncologists were mostly Australian, and all were investigators in trials or prospective studies in advanced cancer, so they may have had greater interest and expertise in estimating prognosis, limiting the general applicability of the results to all oncologists. Similarly, the patients were participants in trials or prospective studies. Four of the 7 studies had a minimum life expectancy of 3 months as an eligibility criterion, so conclusions about the accuracy of expected survival times shorter than this may be limited. We were unable to attribute individual predictions to particular oncologists, and so are unable to assess or comment on the calibration of individual oncologists. We did not have information about what participating patients wanted to know about their prognosis, nor about what they were told or what they understood about their prognosis. These questions warrant further research.

The patients in the 7 included studies were treated largely with chemotherapy or targeted therapies, and future research is needed to determine how prognosis should be formulated and explained for people with advanced cancer treated with immune checkpoint inhibitors, many of whom may have longer survival times. It is not known whether providing feedback on the accuracy of survival estimates to individual oncologists influences the accuracy of future predictions. More research is also needed to encourage and prompt oncologists to offer discussions about prognosis with their patients because we know many patients do not receive the information they desire, or receive this information too late (31).

Oncologists' estimates of EST for people with advanced cancer were well calibrated but imprecise. Despite long-held dogma, oncologists were no more likely to overestimate survival than to underestimate it. Oncologist estimates of EST also provided well-calibrated estimates of worst-case, typical, and best-case scenarios for survival time, a format of information preferred by patients. When people with advanced cancer request quantitative information about their prognosis, we recommend that oncologists estimate the EST (defined as the median survival time in a group of similar patients) and explain 3 scenarios for survival based on simple multiples of the EST using our freely available web-based tool (https://ctc.usyd.edu.au/3scenarios/). More research is needed to help oncologists and patients initiate earlier conversations about prognosis.

Data availability

The data underlying this article cannot be shared due to the privacy of individuals who participated in the study. Individual deidentified data can be made available from the repository to accredited researchers who submit a proposal that is approved by the NHMRC Clinical Trials Centre.

Author contributions

Sharon Nahm (Conceptualization; Formal analysis; Investigation; Methodology; Writing—original draft; Writing—review & editing), Andrew J. Martin (Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Resources; Supervision; Writing—review & editing), Josephine M. Clayton (Data curation; Writing—review & editing), Peter Grimison (Data curation; Writing—review & editing), Erin B. Moth (Data curation; Writing—review & editing), Nick Pavlaki (Data curation; Writing—review & editing), Katrin Sjoquist (Data curation; Writing—review & editing), Megan E.S. Smith-Uffen (Data curation; Writing—review & editing), Annette Tognela (Data curation; Writing—review & editing), Anuradha Vasista (Data curation; Writing—review & editing), Martin R. Stockler (Conceptualization; Data curation; Investigation; Methodology; Supervision; Writing—review & editing), Belinda E. Kiely (Conceptualization; Data curation; Investigation; Methodology; Supervision; Writing—review & editing).

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Conflicts of interest

MS, who is a *JNCI Cancer Spectrum* Deputy Editor and co-author on this paper, was not involved in the editorial review or decision to publish this contribution. The authors have no relevant financial or nonfinancial interests to disclose.

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References

1. Forster LE, Lynn J. Predicting life span for applicants to inpatient hospice. *Arch Intern Med*. 1988;148(12):2540-2543.
2. Christakis NA, Lamont EB. Extent and determinants of error in doctors' prognoses in terminally ill patients: prospective cohort study. *BMJ*. 2000;320(7233):469-472.
3. Glare P, Virik K, Jones M, et al. A systematic review of physicians' survival predictions in terminally ill cancer patients. *BMJ*. 2003;327(7408):195-198.
4. Stockler MR, Tattersall MH, Boyer MJ, et al. Disarming the guarded prognosis: predicting survival in newly referred patients with incurable cancer. *Br J Cancer*. 2006;94(2):208-212.
5. Kiely BE, Martin AJ, Tattersall MH, et al. The median informs the message: accuracy of individualized scenarios for survival time based on oncologists' estimates. *J Clin Oncol*. 2013;31(28):3565-3571.
6. Smith-Uffen MES, Johnson SB, Martin AJ, et al. Estimating survival in advanced cancer: a comparison of estimates made by oncologists and patients. *Support Care Cancer*. 2020;28(7):3399-3407.
7. Fairchild A, Debenham B, Danielson B, et al. Comparative multidisciplinary prediction of survival in patients with advanced cancer. *Support Care Cancer*. 2014;22(3):611-617.
8. Higginson IJ, Costantini M. Accuracy of prognosis estimates by four palliative care teams: a prospective cohort study. *BMC Palliat Care*. 2002;1(1):1.
9. Perez-Cruz PE, Dos Santos R, Silva TB, et al. Longitudinal temporal and probabilistic prediction of survival in a cohort of patients with advanced cancer. *J Pain Symptom Manage*. 2014;48(5):875-882.
10. Hui D, Kilgore K, Nguyen L, et al. The accuracy of probabilistic versus temporal clinician prediction of survival for patients

with advanced cancer: a preliminary report. *Oncologist*. 2011;16(11):1642-1648.

11. Lam PT. Accuracy of clinical prediction of survival in a palliative care unit. *Progress in Palliative Care*. 2008;16(3):113-117.
12. Faris M. Clinical estimation of survival and impact of other prognostic factors on terminally ill cancer patients in Oman. *Support Care Cancer*. 2003;11(1):30-34.
13. Pavlakis N, Sjoquist KM, Martin AJ, et al. Regorafenib for the treatment of advanced gastric cancer (INTEGRATE): a multinational placebo-controlled phase II trial. *J Clin Oncol*. 2016;34(23):2728-2735.
14. Kaplowitz SA, Campo S, Chiu WT. Cancer patients' desires for communication of prognosis information. *Health Commun*. 2002;14(2):221-241.
15. Greisinger AJ, Lorimor RJ, Aday LA, et al. Terminally ill cancer patients: their most important concerns. *Cancer Pract*. 1997;5(3):147-154.
16. Hagerty RG, Butow PN, Ellis PA, et al. Cancer patient preferences for communication of prognosis in the metastatic setting. *J Clin Oncol*. 2004;22(9):1721-1730.
17. Nahm SH, Stockler MR, Martin AJ, et al. Using three scenarios to explain life expectancy in advanced cancer: attitudes of patients, family members, and other healthcare professionals. *Support Care Cancer*. 2022;30(9):7763-7772.
18. Kiely BE, Soon YY, Tattersall MH, et al. How long have I got? Estimating typical, best-case, and worst-case scenarios for patients starting first-line chemotherapy for metastatic breast cancer: a systematic review of recent randomized trials. *J Clin Oncol*. 2011;29(4):456-463.
19. West TA, Kiely BE, Stockler MR. Estimating scenarios for survival time in men starting systemic therapies for castration-resistant prostate cancer: a systematic review of randomised trials. *Eur J Cancer*. 2014;50(11):1916-1924.
20. Kiely BE, Alam M, Blinman P, et al. Estimating typical, best-case and worst-case life expectancy scenarios for patients starting chemotherapy for advanced non-small-cell lung cancer: a systematic review of contemporary randomized trials. *Lung Cancer*. 2012;77(3):537-544.
21. Davidson A, Veillard AS, Tognela A, et al.; Australasian Lung Cancer Trials Group. A phase III randomized trial of adding topical nitroglycerin to first-line chemotherapy for advanced nonsmall-cell lung cancer: the Australasian lung cancer trials group NITRO trial. *Ann Oncol*. 2015;26(11):2280-2286.
22. Johnson SB, Butow PN, Bell ML, et al. A randomised controlled trial of an advance care planning intervention for patients with incurable cancer. *Br J Cancer*. 2018;119(10):1182-1190.
23. Moth EB, Blinman P, Stefanic N, et al. Estimating survival time in older adults receiving chemotherapy for advanced cancer. *J Geriatr Oncol*. 2020;11(4):617-625.
24. Stockler MR, O'Connell R, Nowak AK, et al.; Zoloft's Effects on Symptoms and Survival Time Trial Group. Effect of sertraline on symptoms and survival in patients with advanced cancer, but without major depression: a placebo-controlled double-blind randomised trial. *Lancet Oncol*. 2007;8(7):603-612.
25. Vasista A, Stockler M, Martin A, et al. Accuracy and prognostic significance of oncologists' estimates and scenarios for survival time in advanced gastric cancer. *Oncologist*. 2019;24(11):e1102-e1107.
26. Lee SR, Smith A. Survival estimates in advanced terminal cancer. In: Morrison RS, ed. *UpToDate*. Wolters Kluwer. Accessed February 20, 2022.
27. Oxenham D, Cornbleet MA. Accuracy of prediction of survival by different professional groups in a hospice. *Palliat Med*. 1998;12(2):117-118.
28. Maltoni M, Pirovano M, Scarpi E, et al. Prediction of survival of patients terminally ill with cancer. results of an Italian prospective multicentric study. *Cancer*. 1995;75(10):2613-2622.
29. Henderson R, Jones M, Stare J. Accuracy of point predictions in survival analysis. *Stat Med*. 2001;20(20):3083-3096.
30. Kiely BE, McCaughan G, Christodoulou S, et al. Using scenarios to explain life expectancy in advanced cancer: attitudes of people with a cancer experience. *Support Care Cancer*. 2013;21(2):369-376.
31. Hagerty RG, Butow PN, Ellis PM, et al. Communicating prognosis in cancer care: a systematic review of the literature. *Ann Oncol*. 2005;16(7):1005-1053.

5 PROGNOSTIC SIGNIFICANCE AND ACCURACY OF ONCOLOGISTS’ ESTIMATES OF SURVIVAL TIME IN RECURRENT OVARIAN CANCER

Overview

This published manuscript evaluated the accuracy of oncologists’ estimates of survival time in a specific cohort of people with recurrent ovarian cancer. It also evaluated the prognostic significance of oncologists’ estimates, i.e., the extent to which they were independently associated with actual survival times, after accounting for established prognostic variables.

Publication details

Nahm SH, Kiely BE, O'Connell RL, Lee YC, Davis A, Avall-Lundqvist E, Berek JS, Berton D, Donnellan P, Hilpert F, Joly F, Lanceley A, Ledermann JA, Okamoto A, Oza A, Pignata S, Sehouli J, King MT, Friedlander M, Stockler MR, Roncolato FT; GCIG Symptom Benefit Group. Prognostic significance and accuracy of oncologists' estimates of survival time in recurrent ovarian cancer. *International Journal of Gynecological Cancer* 2025. https://doi.org/10.1016/j.ijgc.2024.100030.

Contribution of authors

SHN was involved in conceptualisation, formal analysis, writing, and revision of the manuscript.

BEK and MRS were involved in conceptualisation, methodology, and revision of the manuscript.

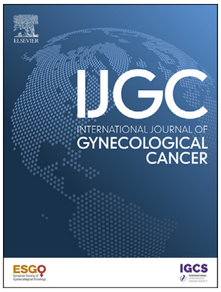
ROC was involved in the methodology, software, validation, formal analysis, data curation, and revision of the manuscript.

YCL, AD, EAL, JSB, DB, PD, FH, FJ, AL, JAL, AO, AO, SP, JS, MTK and MF were involved in conceptualisation, investigation, methodology, and revision of the manuscript.

FTR was involved in conceptualisation, methodology, formal analysis, investigation, and revision of the manuscript.

ORIGINAL RESEARCH

Prognostic significance and accuracy of oncologists' estimates of survival time in recurrent ovarian cancer



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ABSTRACT

Objective: We evaluated the accuracy of oncologists' estimates of expected survival time in recurrent ovarian cancer.

Methods: Oncologists estimated expected survival time at baseline for each patient, who were then followed up for survival time. We hypothesized that oncologists' estimates of expected survival time would be independently significant predictors of survival, unbiased (approximately equal proportions [50%] living longer versus shorter than their expected survival time), or imprecise ($<$30% within 0.75-1.33 times their observed survival time). We also hypothesized that simple multiples (0.25, 0.5, 2, and 3) of each expected survival time would define ranges that accurately described 3 scenarios for survival time: worst-case (10% of participants with the shortest survival), typical (middle 50%), and best-case (10% with the longest survival) scenarios.

Results: There were 898 participants; the median (interquartile range) for expected survival time was 12 months (range; 8-14) and the median for observed survival time was 13 months (range; 12-14). Oncologists' estimates of expected survival time were independently significant predictors of observed survival time (HR 0.96 per month, 95% CI 0.94-0.98, $p < .0001$). As hypothesized, 55% lived longer than their expected survival time, 45% shorter than their expected survival time, and 23% of estimates of expected survival time were within 0.75 to 1.33 times their observed survival time. Simple multiples of the expected survival time provided ranges that accurately described 3 scenarios for survival time: 7% of patients died within 0.25 times their expected survival time (worst-case), 53% lived between 0.5 and 2 times their expected survival time (typical), and 13% lived longer than 3 times their expected survival time (best case).

Conclusion: Oncologists' estimates of expected survival time were independently significant predictors of survival time. Simple multiples of the expected survival time provided accurate ranges for scenarios for survival that are useful for explaining prognosis.

WHAT IS ALREADY KNOWN ON THIS TOPIC

Estimating and communicating prognosis with individuals patients with recurrent ovarian cancer is important;, however, there is a paucity of data on this topic.

WHAT THIS STUDY ADDS

We evaluated the accuracy of oncologists' estimates of expected survival time in recurrent ovarian cancer. Oncologists' estimates of expected survival time were independently significant predictors of observed survival time. Simple multiples of expected survival time provided accurate ranges describing worst-case, typical, and best-case scenarios for survival time.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE, OR POLICY

Oncologists' estimates of expected survival time are useful for predicting, formulating, and explaining prognosis in recurrent ovarian cancer.

Keywords:
Quality of Life

INTRODUCTION

Most patients with ovarian cancer have advanced disease at diagnosis. Despite initial responses to platinum-based chemotherapy, most patients relapse and eventually develop "platinum-resistant" disease with limited responses to subsequent treatment and shortened life expectancy. Patients with advanced cancer require an understanding of their life expectancy to guide treatment decisions and plan their future. Those with a good understanding of their prognosis are less likely to choose aggressive and futile treatments toward end of life and more likely to engage in advanced care planning[1-3] Estimating and communicating prognosis in recurrent ovarian cancer is important but little researched.

Clinical variables such as good performance status, prolonged chemotherapy-free interval, and absence of ascites are independent predictors of improved survival in recurrent ovarian cancer.[4] Studies in a variety of advanced cancers have shown that oncologists' personalized estimates of expected survival time are also independently associated with actual survival time, even after accounting for established prognostic variables.[5-7] The extent to which this applies to patients with recurrent ovarian cancer is unclear.

We have previously proposed a method of estimating and communicating life expectancy using the percentiles of an overall survival curve to define ranges representing worst-case, typical, and best-case scenarios for survival time.[8,9] For example in Figure 1, the 90th percentile, the time when 90% are alive and 10% have died, can be considered the upper limit of a range for a worst-case scenario (shortest 10% of survival times), and the 10th percentile, the time when 10% are alive and 90% have died, can be considered the lower limit of a range for a best-case scenario (longest 10% of survival times). The interval between the 75th and 25th percentiles (middle 50% of survival times) can be considered the range for a typical scenario. We have shown that simple multiples (0.25, 0.5, 2, and 3) of an overall survival curve's median can be used to estimate these percentiles and formulate worst-case, typical, and best-case scenarios for survival time.[8-12]

These same simple multiples can also be applied to an oncologist's estimate of an individual patient's expected survival time (defined as the median survival in a group of similar patients). A pooled analysis of more than 1000 patients with a range of advanced cancers showed that simple multiples (0.25, 0.5, 2, and 3) of the oncologists' estimate of expected survival time provided ranges corresponding to these worst-case, typical, and best-case scenarios for survival.[13] This study aimed to evaluate the prognostic significance and accuracy of oncologists' estimates of expected survival time in patients with recurrent ovarian cancer.

METHODS

In accordance with the journal's guidelines, we will provide our data for independent analysis by a team selected by the Editorial Team for the purposes of additional data analysis or for the reproducibility of this study in other centers if such is requested.

Participants were enrolled in the previously reported Gynaecologic Cancer InterGroup (GCIG) Symptom Benefit Study, a prospective observational cohort study conducted between February 2011 and January 2015 in 11 countries in Australia, Canada, France, Germany, Ireland, Italy, Japan, New Zealand, Sweden, the United Kingdom, and the United States (clinical trial registration number ACTRN12607000603415).[14,15] As per the inclusion criteria of the original study, participants were adults with recurrent or progressive epithelial ovarian, peritoneal, or fallopian tube cancer; had an Eastern Cooperative Oncology Group (ECOG) performance status of 0 to 3; who were commencing a third or subsequent line of chemotherapy; or had platinum-resistant disease about to start any line of chemotherapy and an estimated life expectancy of greater than 3 months.

Participating oncologists were qualified in treating gynecologic cancers and working at collaborating GCIG centers. The treating oncologist estimated the expected survival time of each participant at baseline, and participants were then followed up to determine their observed survival time. Baseline data included clinical variables (ECOG performance status, chemotherapy-free interval, CA125 level) and self-ratings of quality of life (QOL) using the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire Core and ovarian cancer module (QLM-OV28).[16,17] These validated questionnaires were used for QOL analysis. Participants completed questionnaires at enrollment of the study within 2 weeks of their first cycle of chemotherapy. Cut-off points for dichotomizing variables from the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire Core were as recommended by Diouf and colleagues,18 except for social function where the cutoff was data-derived based on minimizing the log-rank *p*-value.[19] Higher scores indicate better QOL for functional domains, and worse QOL for symptoms. Cut-off points for abdominal symptoms from the QLQ-OV28 were based on previous publications from the GCIG Symptom Benefit Study.[20]

The study was in accordance with the National Health and Medical Research Council Statement on Ethical Conduct in Research Involving Humans and the Declaration of Helsinki. It was approved by the Cancer Institute NSW Clinical Research Ethics Committee (2007C/10/027) and at all participating sites. Written informed consent was obtained from all participants. In accordance with the journal's guidelines, we will provide our data for independent analysis by a selected team by the editorial team for the purposes of additional data analysis or for the reproducibility of this study in other centers if such is requested.

Our specific objectives were to determine the prognostic significance of oncologists' estimates of expected survival time when considered on their own in the univariable analyses, the prognostic significance of oncologists estimates of expected survival time above and beyond other established prognostic factors (eg, clinical characteristics and patient-reported outcomes at baseline) in multivariable analyses, and the accuracy of oncologists' estimates of expected survival time.

Accuracy is a term that is used widely and has many definitions. For this study, we assessed accuracy by evaluating the presence of bias (the extent to which oncologists consistently over-estimated or under-estimated survival time); precision (the proportion of expected survival time that were within 0.75 to 1.33 times the observed survival time); and whether simple multiples (0.25, 0.5, 2, and 3) of the oncologists' estimates of expected survival time provided ranges corresponding to worst-case, typical, and best-case scenarios for survival.

Statistical Analysis

Cox proportional hazards regression models were used to assess associations of expected survival time, clinical variables, and QOL, with observed survival time. Variables with a $p < .05$ in univariable analysis (objective 1) were candidates for inclusion in multivariable analysis (objective 2). Using backward selection, non-significant variables were removed 1 at a time until all remaining variables were significant at $p < .05$. We hypothesized that oncologists' estimates of expected survival time would be independently associated with observed survival time, above and beyond other clinical and QOL variables. We also predicted that clinical variables such as platinum sensitivity, ECOG performance status, and aspects of QOL such as physical function and global health status and QOL would be independently associated with observed survival time.

To assess the accuracy of oncologists' estimates of expected survival time, we calculated the ratio of each participant's observed

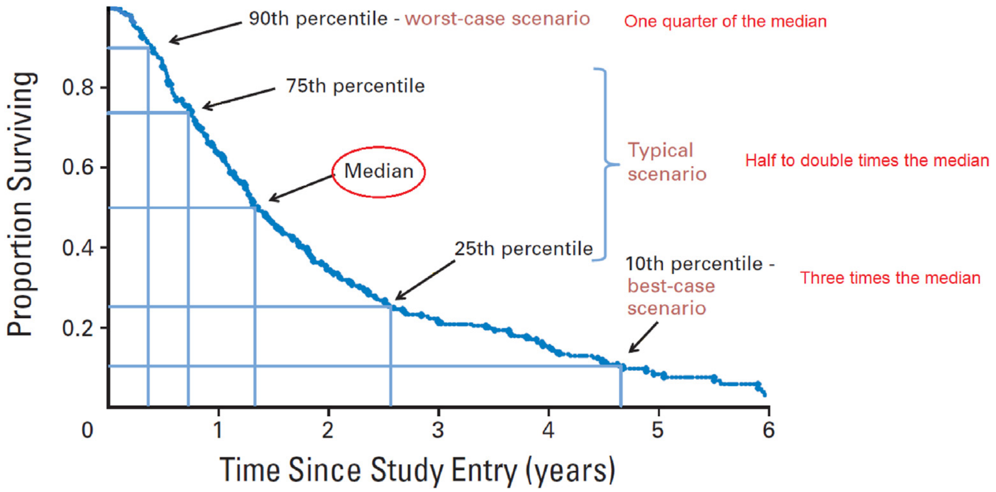

Figure 1 Multiples of the median on an overall survival curve correspond with 3 scenarios for survival.

survival time to their expected survival time and described the distribution of these ratios of observed survival time/expected survival time with Kaplan-Meier curves to account for censored values of observed survival time. Based on previous research, we hypothesized that oncologists' estimates of expected survival time would be unbiased, that is, approximately 50% of participants would have an observed survival time greater than their expected survival time (observed survival time/expected survival time >1) and 50% of participants would have an observed survival time less than their expected survival time (observed survival time/expected survival time <1).[5-7] We also hypothesized that less than 30% of estimates of expected survival time would be precise (within 0.75-1.33 times the observed survival time) for comparability with previous studies.[12,21]

We also tested hypotheses based on our previous findings[9,10] that 10% of participants would live shorter than one-quarter of their oncologist's estimate of expected survival time, (ie, observed survival time/expected survival time <0.25), corresponding to a worst-case scenario; 50% of participants would live from half to double their oncologist's estimate of expected survival time (ie, 0.5 ≤ observed survival time/expected survival time ≤ 2), corresponding to a typical scenario; and 10% of participants would live longer than 3 times their oncologist's estimate of expected survival time (ie, observed survival time/expected survival time >3), corresponding to a best-case scenario.

RESULTS

Oncologists estimated an expected survival time at baseline in 898 participants recruited during the study period. Baseline characteristics are summarized in Table 1. The median expected survival time was 12 months (interquartile range; 8-14). The median observed survival time was 13 months (interquartile range; 12-14). The frequency distribution of oncologists' estimates of expected survival time is shown in Figure S.

The variables associated with observed survival time in univariable analyses, and in multivariable analysis are shown in Table 2. Oncologists' estimates of expected survival time were independently associated with observed survival time (HR 0.96 per month, 95% CI 0.94-0.98, $p < .001$) in a multivariable model including all clinical variables that were independently significant. Patient-reported role functioning, social functioning, global health status/QOL, and abdominal symptoms were all significantly associated with observed survival time in the univariable analyses but not in the multivariable analysis. Physical functioning and all the clinical variables remained significant in the multivariable analysis.

Oncologists' estimates were unbiased: approximately equal proportions of participants had an observed survival time greater than their expected survival time (55%, 95% CI 52-59) versus an observed survival time less than their expected survival time (45%, 95% CI 41-48) (Fig. 2). As hypothesized, oncologists' estimates were also imprecise, with only 23% (95% CI 20-26) of estimates of expected survival time within 0.75 to 1.33 times the observed survival time.

Simple multiples (0.25, 0.5, 2, and 3) of an oncologists' estimate of expected survival time provided ranges for worst-case, typical, and best-case scenarios for survival that corresponded with our hypothesized percentages. Figure 3 shows the Kaplan-Meier

Table 1 Participant Baseline Characteristics

Characteristics	***n* (%)**[a]
Age (y)	
< 40	16 (2)
≥40 to 49	87 (10)
≥50 to 59	246 (27)
≥60 to 69	296 (33)
≥70	253 (28)
Country	
United Kingdom	166 (18)
France	151 (17)
Australia	128 (14)
Germany	97 (11)
Japan	93 (10)
Italy	81 (9)
Ireland	68 (8)
Canada	56 (6)
Sweden	32 (4)
New Zealand	14 (2)
United States	12 (1)
Pathology	
Serous	665 (74)
Clear cell	42 (5)
Endometrioid	41 (5)
Mixed	33 (4)
Other	112 (13)
Missing	5 (1)
ECOG performance status	
0	312 (35)
1	487 (54)
≥2	99 (11)
Platinum sensitivity	
Resistant	545 (61)
Sensitive	353 (39)
Chemotherapy-free interval (months)	
< 6	591 (66)
6-12	187 (21)
>12	87 (10)
Missing	33 (4)
Number of lines of previous chemotherapy	
1	174 (20)
2	339 (38)
3	201 (22)
4	102 (11)
≥5	82 (9)
BMI	
<18.5	42 (5)
≥18.5	852 (95)
Missing	5 (1)

Table 1 (*continued*)

Characteristics	***n* (%)**[a]
CA125 (unit/mL)	
≤1000	623 (69)
>1000	191 (21)
Missing	84 (9)
Neutrophil/lymphocyte ratio	
<5	667 (74)
≥5	198 (22)
Missing	33 (4)
Platelet count (× 10^9/L)	
≤600	865 (96)
>600	21 (2)
Missing	12 (1)
Presence of ascites	
Yes	205 (23)
No	693 (77)
Physical functioning[a]	
<58.33	270 (31)
≥58.33	589 (66)
Missing	39 (4)
Role functioninga	
<66.67	546 (61)
≥66.67	309 (34)
Missing	43 (5)
Social functioning[a]	
<67	499 (56)
≥67	347 (39)
Missing	52 (6)
Global health status/quality of life[a]	
<50	239 (27)
≥50	604 (67)
Missing	55 (6)
Abdominal symptoms[b]	
<13	172 (19)
13-44	439 (49)
>44	239 (27)
Missing	48 (5)

Abbreviations: BMI, body mass index; ECOG, Eastern Cooperative Oncology Group.

[a] Cut-off points for dichotomizing the Quality of Life Questionnaire-Core 30 (QLQ-C30) are as recommended by Diouf and colleagues[18] or determined using the log-rank method, which selected the cut-off point that minimized the significance level of a log-rank test with comparison of 2 groups defined by the cut-off point.[19] Higher scores indicated better quality of life.

[b] Cut-off points for categorizing abdominal symptoms from the QLQ-OV28 are consistent with previous publications from the GCIC Symptom Benefit Study,[20] with higher scores indicating worse symptoms.

distribution of the ratios of observed survival time to estimated survival time for each patient (observed survival time/expected survival time). The proportion of participants who lived shorter than one-quarter of their expected survival time (observed survival time/expected survival time ≤0.25) was 7% (95% CI 5-9), close to a worst-case scenario representing the shortest 10% of survival times. The proportion of participants who lived between half to double their expected survival time (0.5 ≤ observed survival time/expected survival time ≤ 2) was 53% (95% CI 50-57), close to a typical scenario representing the middle 50% of survival times. The proportion of participants who lived longer than 3 times their expected survival time (observed survival time/expected survival time ≥3) was 13% (95% CI 10-16), close to a best-case scenario representing the longest 10% of survival times.

DISCUSSION

Summary of Main Results

Oncologists' estimates of expected survival time for patients with recurrent ovarian cancer were independently associated with their subsequent observed survival time, providing additional prognostic information above and beyond established prognostic factors. Self-reported aspects of QOL at baseline were also associated with observed survival time but only physical functioning was independently prognostic in multivariable analyses including other prognostic factors. Oncologists' estimates of expected survival time remained an independently significant predictor of observed survival time in a multivariable model including self-rated physical functioning and other established clinical prognostic factors.

Research in the Context of Published Literature

These findings are consistent with our previous studies in other settings. Oncologists' estimates of expected survival time have been shown to be independently predictive of observed survival time in heterogenous populations with a range of advanced cancers in adults aged ≥65 years with cancer and in specific types of cancer, such as advanced gastric cancer.[5-7,9] This study adds to the growing body of evidence that oncologists' estimates of expected survival time for an individual patient are meaningful and add important prognostic information above and beyond that provided by other established prognostic factors.

Our findings contradict the common belief that oncologists estimates are biased and over-estimate survival time.[22,23] We found that oncologists' estimates of expected survival time were unbiased, that is, they were almost as likely to under-estimate survival time as to over-estimate it. This supports our previously reported finding in an independent pooled analysis of over 1000 patients with a range of advanced cancers, in which oncologists' estimates of expected survival time were also unbiased.[13] These estimates were made at various timepoints (including before treatment, starting first-line systemic therapy, and stopping treatment), with a broad range of observed survival times. Our findings from this study show that the accuracy of oncologists' estimates of expected survival time remain consistent in patients with very short survival times.

As expected from previous studies,[12,21] oncologists' estimates of expected survival time were imprecise, with less than 30% of point estimates of expected survival time within 0.75 to 1.33 times the observed survival time. It is unrealistic to expect point estimates to be any more precise given the inherent variability of survival time.[24]

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Table 2 Associations of Baseline Characteristics with Observed Survival Time

Characteristic	**Univariable analysis**		**Multivariable analysis**	
	HR (95% CI)	***p*-Value**	**HR (95% CI)**	***p*-Value**
Clinical variables				
Oncologists' estimate of expected survival time in months	0.91 (0.90-0.93)	<.001	0.96 (0.94-0.98)	< .001
ECOG performance status				
0	Ref		Ref	
1	1.59 (1.33-1.90)	<.001	1.37 (1.11-1.69)	.004
≥2	2.93 (2.25-3.81)	<.001	1.25 (0.89-1.76)	.20
Platinum sensitivity				
Sensitive	Ref		Ref	
Resistant	1.64 (1.38-1.94)	<.001	1.40 (1.14-1.72)	.001
Chemotherapy-free interval in months	0.94 (0.93-0.96)	<.001	0.97 (0.95-0.99)	< .001
BMI	0.98 (0.96-0.99)	<.001	0.98 (0.97-0.99)	.008
Ca-125 (natural logarithm of unit/mL)	1.24 (1.18-1.31)	<.001	1.17 (1.10-1.25)	< .001
Neutrophil/lymphocyte ratio				
<5	Ref		Ref	
≥5	1.01 (1.01-1.02)	<.001	1.61 (1.30-1.99)	< .001
Platelet count (× 10^9/L)	1.25 (1.18-1.33)	<.001	1.11 (1.02-1.18)	.01
Presence of ascites	2.32 (1.95-2.78)	<.001	1.45 (1.16-1.81)	.001
Patient-reported quality of life (QOL) Scores				
Physical functioning[a]				
<58.33	Ref		Ref	
≥58.33	0.58 (0.49-0.69)	<.001	0.66 (0.54-0.82)	< .001
Role functioning[a]				
<66.67	Ref		NA	
≥66.67	0.61 (0.51-0.72)	<.001		
Social functioning[a]				
<67	Ref		NA	
≥67	0.70 (0.59-0.83)	<.001		
Global health status/QOL[a]				
<50	Ref		Ref	
≥50	0.53 (0.44-0.63)	<.001	0.84 (0.68-1.10)	0.13
Abdominal symptoms[b]				
<13	Ref	<.001	0.81 (0.59-1.12)	0.20
13-44	1.68 (1.33-2.13)		1.09 (0.87-1.36)	0.50
>44	2.41 (1.88-3.10)		Ref	

Abbreviations: BMI, body mass index; ECOG, Eastern Cooperative Oncology Group; NA, not applicable as by using backward selection, non-significant variables were removed 1 at a time until all remaining variables were significant at $p < .05$; QOL, quality of life; Ref, reference.

Oncologists' estimates of expected survival time, chemotherapy-free interval, BMI, and laboratory variables fitted as continuous variables. HRs are expressed per natural log increase in CA125 and per 100 increase in platelets. QOL variables fitted as categorized variables.

[a] Cut-off points for dichotomizing the Quality of Life Questionnaire-Core 30 (QLQ-C30) are as recommended by Diouf and colleagues[18] or determined using the log-rank method, which selected the cut-off point that minimized the significance level of a log-rank test with comparison of 2 groups defined by the cut-off point.[19] Higher scores indicated better quality of life.

[b] Cut-off points for categorizing abdominal symptoms from the QLQ-OV28 are consistent with previous publications from the GCIC Symptom Benefit Study,[20] with higher scores indicating worse symptoms.

This study adds to the body of evidence that simple multiples (0.25, 0.5, 2, and 3) of an oncologists' estimate of expected survival time provide ranges of survival times that correspond to hypothesized percentages for worst-case, typical, and best-case scenarios.[5-7,9,13] Knowing how to estimate scenarios for survival time is important because patients report a preference for receiving prognostic information in this format.[8] A study of over 500 people with cancer experience showed that 88% preferred to receive prognostic information formatted as 3 scenarios for survival (worst-case, typical, and best-case) rather than a single estimate of the

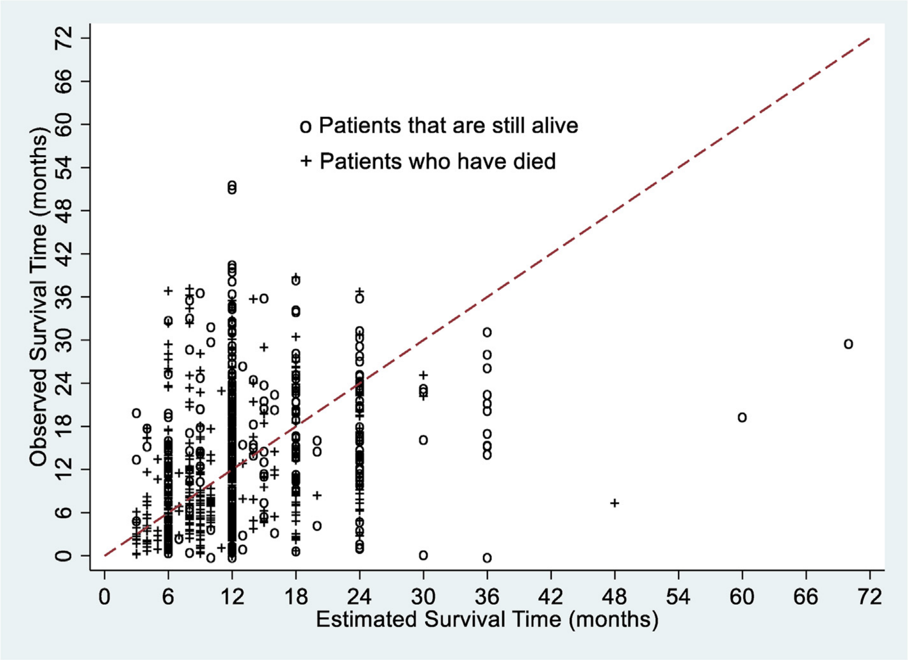
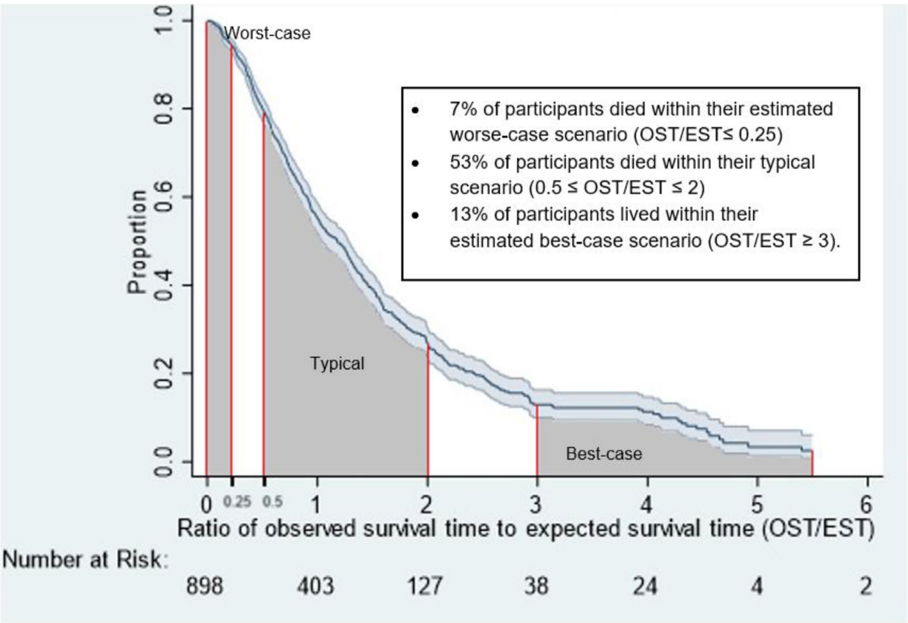


Figure 2 Observed versus estimated survival time for all participants. Points on the 45° line signify patients who lived exactly as long as predicted, points above the line signify patients who lived longer than predicted (observed survival time $>$ estimated survival time), and points below the line signify patients who lived for less time than predicted (observed survival time $<$ estimated survival time).



- 7% of participants died within their estimated worse-case scenario (OST/EST≤ 0.25)
- 53% of participants died within their typical scenario (0.5 ≤ OST/EST ≤ 2)
- 13% of participants lived within their estimated best-case scenario (OST/EST ≥ 3).

Figure 3 Kaplan-Meier distribution of observed-to-estimated survival time ratios.

median survival time.[25] In previous work, we found that most patients (91%), family members (91%), and oncologists (96%) reported that it was helpful to receive information about prognosis formatted as these 3 scenarios for survival time. The majority of patients (64%) reported that it improved their understanding, and 88% reported that it helped them make plans.[9] This method of formulating and communicating prognostic information is superior to a single-point estimate because it accounts for the inherent unpredictability of estimating prognosis and allows patients to maintain hope for the possible best-case scenario while preparing for the possible worst-case.

Strengths and Weaknesses

Strengths of the present study include its prospective design, with oncologists providing estimates of each patient's expected survival time at baseline and rigorous follow-up of observed survival time. We included over 800 participants in 11 countries. Previous studies have assessed the prognostic significance of oncologists' estimates of expected survival time in multivariable models with clinical factors,[13] but this study also included self-ratings of QOL to assess the incremental prognostic significance of oncologists' estimates above and beyond other important prognostic factors.

The main limitation of this study is that the oncologists participating in the GCIG Symptom Benefit Study may have had greater understanding of ovarian cancer and/or expertise estimating prognosis, perhaps limiting the generalizability of the results to oncologists in general. Participants in the Ovarian Symptom Benefit Study were to have an estimated life expectancy of at least 3 months, so the results may not be applicable to those with expected survival times of less than 3 months.

Implications for Practice and Future Research

This study has important clinical implications. Our finding that oncologists' estimates of expected survival time provided prognostic information above and beyond that of established prognostic factors supports the value of using this information to formulate and explain prognosis to patients and help with planning and decision-making. Although oncologists' estimates of expected survival time are useful, providing patients with single-point estimates of their expected survival time will not adequately convey the uncertainty and variability within these estimates. We instead recommend that oncologists use their estimate of expected survival time to formulate and explain life expectancy as 3 scenarios for survival time (worse-case, typical, and best-case scenarios). Providing ranges of survival times is more accurate and conveys more hope than a single-point estimate and allows patients to better understand the uncertainty of survival estimates. Our freely available web-based tool at https://ctc.usyd.edu.au/3scenarios/ has been designed to help oncologists do this.

It is not known whether the accuracy of oncologists' estimates of expected survival time change over the course of a patient's illness or vary according to different countries based on cultural and health policy factors and are areas for future studies. More research is also needed to evaluate the prognostic significance and accuracy of oncologists' estimates of expected survival time in people being treated with novel therapies that may be associated with longer survival than chemotherapy, for example, immunotherapy and molecularly targeted therapies. Our findings need to be validated in cohorts receiving these treatments. It is also not known whether the accuracy of oncologists' estimates vary according to oncologist factors (eg, age, sex, and years of experience). Surveyed patients have reported their preference to receive prognostic information formatted as 3 scenarios for survival, but more research is needed to evaluate how much patients understand and the extent to which this information improves prognostic awareness.[13,26,27]

CONCLUSION

Oncologists' estimates of expected survival time were unbiased, imprecise, and provided independently significant prognostic information above and beyond established prognostic factors. Worst-case, typical, and best-case scenarios for survival based on simple multiples of these estimates of expected survival time provided a useful approach for predicting, formulating, and explaining prognosis in recurrent ovarian cancer.

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Author Contributions Conceptualization: SHM, BEK, YCL, AD, EA-L, JSB, DB, PD, FH, FJ, AL, JAL, AO, AO, SP, JS, MTK, MF, MRS, FTR. Investigation: YCL, AD, EA-L, JSB, DB, PD, FH, FJ, AL, JAL, AO,AO, SP, JS, MTK, FTR. Formal analysis: SHM, RLO, FTR. Writing – original draft and review: SHM. Visualization: SHM, Funding acquisition: SHM, MF, MRS, FTR. Methodology: BEK, RLO, MF, MRS, FTR. Supervision: BEK, MF, MRS. Software: RLO. Validation: RLO. Data curation: RLO. Resources: RLO, YCL, AD, EA-L, JSB, DB, PD, FH, FJ, AL, JAL, AO, SP, JS, MTK. Writing – review and editing: BEK, RLO, YCL, AD, EA-L, JSB, DB, PD, FH, FJ, AL, JAL, AO, AO, SP, JS, MTK, MF, MRS, FTR. Project administration: MF, MRS, FTR.

Declaration of Competing Interests YCL acknowledges an institutional research grant from BeiGene, paid honoraria for educational events from AstraZeneca, and serves on the Advisory Board of GSK. FJ receives research funding from AstraZeneca and GSK (coordinating PI, no financial interest); paid honoraria as invited speaker from Amgen, GSK, Bayer, ESAI, MSD; support for congress travel from GSK, MSD, ESAI, IPSEN; and serves in the advisory board for GSK, AstraZeneca, Clovis, Seagen, Janssen, ESAI, Bayer, Viatris, MSD, Ipsen and Astellas. J.A.L. receives research grants from AstraZeneca and MSD; paid honoraria for lectures from Clovis, AstraZeneca, Neopharm, GSK and MSD; and serves on the advisory board/independent data monitoring committee for AstraZeneca, GSK, Artios Pharma, Clovis, ImmunoGen, Mersana, BMS, Nuvation, Ellipses Pharma, BVL Therapeutics, Eisai, Immagene, Mersana, SutroBio. AO received a research grant from AstraZeneca; serves on advisory council for BMS; participates on a data safety monitoring/advisory board for Morphosys, AstraZeneca and BMS; CEO of Ozmosis Research, uncompensated steering committee member for AstraZeneca, GSK and principal investigator for AstraZeneca and GSK. J.S. in the president of North-Eastern German Society of Gynecological Oncology (NOGGO), and Pan-Arabian Research Society for Gynecological Oncology. M.F. receives consulting fees from AstraZeneca, Novartis, GSK, Incyclix; paid honoraria from AstraZeneca, GSK and MSD; participates in data safety monitoring/advisory board for AGITG IDSMB and ENDO-3; and institutional research grants from AstraZeneca, BeiGene and Novartis. The remaining authors declare no conflict of interest.

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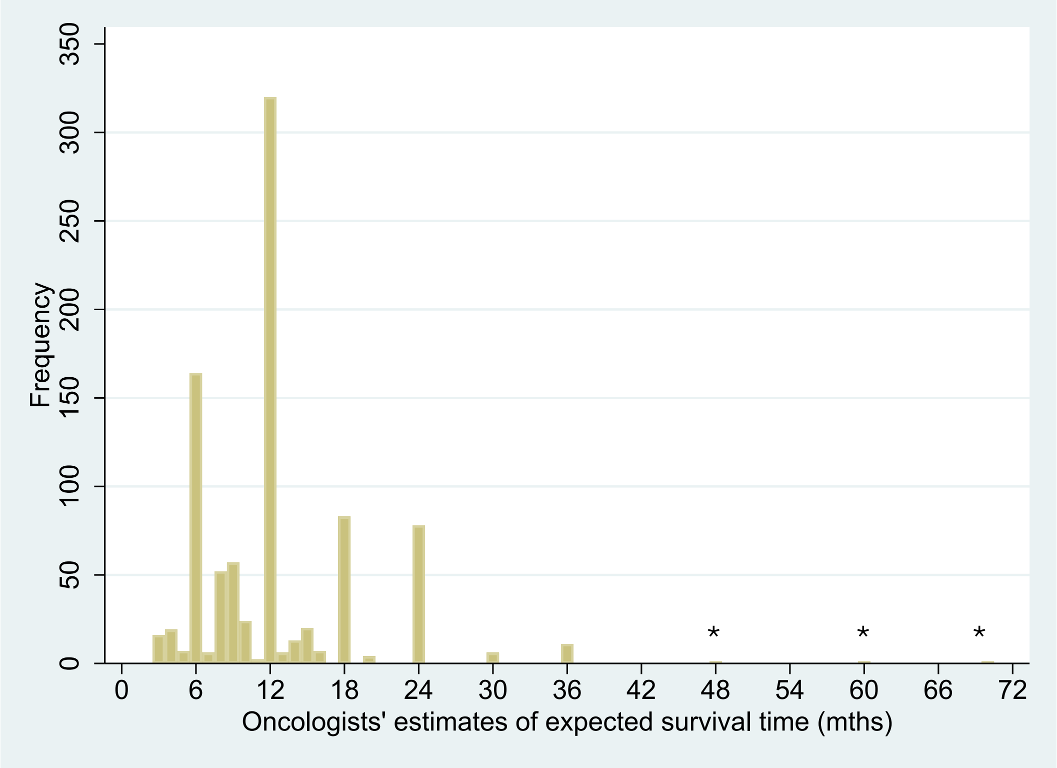
REFERENCES

1. Mone S, Kerr H. Prognostic awareness in advanced cancer: an integrative literature review. *BMJ Support Palliat Care*. 2021;11(1):53–58. https://doi.org/10.1136/bmjspcare-2020-002287.
2. Weeks JC, Cook EF, O'Day SJ, et al. Relationship between cancer patients' predictions of prognosis and their treatment preferences. *JAMA*. 1998;279(21):1709–1714. https://doi.org/10.1001/jama.279.21.1709.
3. Hauser CA, Stockler MR, Tattersall MH. Prognostic factors in patients with recently diagnosed incurable cancer: a systematic review. *Support Care Cancer*. 2006;14(10):999–1011. https://doi.org/10.1007/s00520-006-0079-9.
4. Roncolato FT, O'Connell RL, Joly F, et al. Predictors of progression free survival, overall survival and early cessation of chemotherapy in women with potentially platinum sensitive (PPS) recurrent ovarian cancer (ROC) starting third or subsequent line(>/=3) chemotherapy - the GCIG symptom benefit study (SBS). *Gynecol Oncol*. 2020;156(1):45–53. https://doi.org/10.1016/j.ygyno.2019.10.001.
5. Kiely BE, Martin AJ, Tattersall MH, et al. The median informs the message: accuracy of individualized scenarios for survival time based on oncologists' estimates. *J Clin Oncol*. 2013;31(28):3565–3571. https://doi.org/10.1200/JCO.2012.44.7821.
6. Vasista A, Stockler M, Martin A, et al. Accuracy and prognostic significance of oncologists' estimates and scenarios for survival time in advanced gastric cancer. *Oncologist*. 2019;24(11):e1102–e1107. https://doi.org/10.1634/theoncologist.2018-0613.
7. Moth EB, Blinman P, Stefanic N, et al. Estimating survival time in older adults receiving chemotherapy for advanced cancer. *J Geriatr Oncol*. 2020;11(4):617–625. https://doi.org/10.1016/j.jgo.2019.08.013.
8. Stockler MR, Tattersall MH, Boyer MJ, et al. Disarming the guarded prognosis: predicting survival in newly referred patients with incurable cancer. *Br J Cancer*. 2006;94(2):208–212. https://doi.org/10.1038/sj.bjc.6602908.
9. Nahm SH, Stockler MR, Martin AJ, et al. Using three scenarios to explain life expectancy in advanced cancer: attitudes of patients, family members, and other healthcare professionals. *Support Care Cancer*. 2022;30(9):7763–7772. https://doi.org/10.1007/s00520-022-07167-3.
10. Kiely BE, Soon YY, Tattersall MH, Stockler MR. How long have I got? Estimating typical, best-case, and worst-case scenarios for patients starting first-line chemotherapy for metastatic breast cancer: a systematic review of recent

randomized trials. *J Clin Oncol*. 2011;29(4):456—463. https://doi.org/10.1200/JCO.2010.30.2174.

11. West TA, Kiely BE, Stockler MR. Estimating scenarios for survival time in men starting systemic therapies for castration-resistant prostate cancer: a systematic review of randomised trials. *Eur J Cancer*. 2014;50(11):1916—1924. https://doi.org/10.1016/j.ejca.2014.04.004.
12. Kiely BE, Alam M, Blinman P, et al. Estimating typical, best-case and worst-case life expectancy scenarios for patients starting chemotherapy for advanced non-small-cell lung cancer: a systematic review of contemporary randomized trials. *Lung Cancer*. 2012;77(3):537—544. https://doi.org/10.1016/j.lungcan.2012.04.017.
13. Nahm SH, Martin AJ, Clayton JM, et al. Accuracy of oncologists' estimates of expected survival time in advanced cancer. *JNCI Cancer Spectr*. 2023;7(6):pkad094. https://doi.org/10.1093/jncics/pkad094.
14. Friedlander ML, Stockler M, O'Connell R, et al. Symptom burden and outcomes of patients with platinum resistant/refractory recurrent ovarian cancer: a reality check: results of stage 1 of the gynecologic cancer intergroup symptom benefit study. *Int J Gynecol Cancer*. 2014;24(5):857—864. https://doi.org/10.1097/IGC.0000000000000147.
15. Lee YC, King MT, O'Connell RL, et al. Symptom burden and quality of life with chemotherapy for recurrent ovarian cancer: the Gynecologic Cancer InterGroup-Symptom Benefit Study. *Int J Gynecol Cancer*. 2022;32(6):761—768. https://doi.org/10.1136/ijgc-2021-003142.
16. Greimel E, Bottomley A, Cull A, et al. An international field study of the reliability and validity of a disease-specific questionnaire module (the QLQ-OV28) in assessing the quality of life of patients with ovarian cancer. *Eur J Cancer*. 2003;39(10):1402—1408. https://doi.org/10.1016/s0959-8049(03)00307-1.
17. Aaronson NK, Ahmedzai S, Bergman B, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst*. 1993;85(5):365—376. https://doi.org/10.1093/jnci/85.5.365.
18. Diouf M, Bonnetain F, Barbare JC, et al. Optimal cut points for quality of life questionnaire-core 30 (QLQ-C30) scales: utility for clinical trials and updates of prognostic systems in advanced hepatocellular carcinoma. *Oncologist*. 2015;20(1):62—71. https://doi.org/10.1634/theoncologist.2014-0175.
19. Faraggi D, Simon R. A simulation study of cross-validation for selecting an optimal cutpoint in univariate survival analysis. *Stat Med*. 1996;15(20):2203—2213. https://doi.org/10.1002/(SICI)1097-0258(19961030)15:20<2203::AID-SIM357>3.0.CO;2-G.
20. Roncolato FT, Joly F, O'Connell R, et al. Reducing uncertainty: predictors of stopping chemotherapy early and shortened survival time in platinum resistant/refractory ovarian cancer-the GCIG symptom benefit study. *Oncologist*. 2017;22(9):1117—1124. https://doi.org/10.1634/theoncologist.2017-0047.
21. Kiely BE, Martin A, Grimison P, et al. How long have I Got? Attitudes of patients to receiving survival information formatted as three scenarios. *Ann Oncol*. 2014;25:iv484. https://doi.org/10.1093/annonc/mdu352.9.
22. Forster LE, Lynn J. Predicting life span for applicants to inpatient hospice. *Arch Intern Med*. 1988;148(12):2540—2543. https://doi.org/10.1001/archinte.1988.00380120010003.
23. Oxenham D, Cornbleet MA. Accuracy of prediction of survival by different professional groups in a hospice. *Palliat Med*. 1998;12(2):117—118. https://doi.org/10.1191/026921698672034203.
24. Henderson R, Jones M, Stare J. Accuracy of point predictions in survival analysis. *Stat Med*. 2001;20(20):3083—3096. https://doi.org/10.1002/sim.913.
25. Kiely BE, McCaughan G, Christodoulou S, et al. Using scenarios to explain life expectancy in advanced cancer: attitudes of people with a cancer experience. *Support Care Cancer*. 2013;21(2):369—376. https://doi.org/10.1007/s00520-012-1526-4.
26. Butow PN, Clayton JM, Epstein RM. Prognostic awareness in adult oncology and palliative care. *J Clin Oncol*. 2020;38(9):877—884. https://doi.org/10.1200/JCO.18.02112.
27. Kühne F, Hermann M, Preisler M, et al. Prognostic awareness in advanced disease: a review update and concept analysis. *Front Psychol*. 2021;12:629050. https://doi.org/10.3389/fpsyg.2021.629050.

Supplementary Figure 1. Frequency distribution of oncologists' estimates of expected survival time



*One estimate at these timepoints

6 VOLUNTARY ASSISTED DYING: ESTIMATING LIFE EXPECTANCY TO DETERMINE ELIGIBILITY

Overview

Chapters 4 and 5 demonstrated that oncologists' estimates of expected survival time were well-calibrated (i.e., unbiased) and useful as a basis for estimating scenarios, but imprecise. This has important clinical applications. For example oncologists are frequently required to estimate prognosis to determine eligibility for many things including: clinical trials; life insurance policy payouts; and in Australia and some other countries, voluntary assisted dying (VAD).

This published commentary firstly highlights the challenges associated with estimating life expectancy to determine eligibility for VAD according to current Australian legislation. It then suggests a framework for conceptualising what it means to identify people "expected to die within 6 months", based on the premise that multiples of the median survival time in a group of similar people can be used to formulate worst-case, typical, and best-case scenarios for survival.

We also include our response to a letter to the editor about this manuscript.

Publication details

Nahm SH, Stockler M, Kiely BE. Voluntary Assisted Dying: How will doctors estimate life expectancy to determine eligibility? *Medical Journal of Australia* 2022. https://doi.org/10.5694/mja2.51648

And in response to: Ryan CJ, White BP, Stewart CL. Voluntary assisted dying: estimating life expectancy to determine eligibility. Medical Journal of Australia 2023. https://doi.org/10.5694/mja2.51789,

Nahm SH, Stockler MR, Kiely BE. Voluntary assisted dying: estimating life expectancy to determine eligibility. Medical Journal of Australia 2023. https://doi.org/10.5694/mja2.51790

Contribution of authors

SHN contributed to the concept development, data analysis, writing, and revision of the manuscripts.

.

BEK and MRS contributed to the concept development, and revision the manuscripts.

Voluntary assisted dying: estimating life expectancy to determine eligibility

Understanding what it means to identify people with less than 6 months to live

Victoria operationalised Australia's first voluntary assisted dying (VAD) Act in June 2019, shortly followed by Western Australia. Since then, Tasmania, South Australia, Queensland and more recently New South Wales have passed similar Acts, with VAD to commence in all states in the next 18 months. The VAD Acts were designed to provide a safe legal framework for people with a terminal illness who wish to choose the manner and timing of their death. For a person to be eligible to access VAD, they must be diagnosed with a medical condition that is causing suffering that cannot be relieved in a manner that the person considers tolerable. In addition, eligibility requires doctors to document that the applicant's life expectancy meets a particular criterion. There are differences among states in the exact wording of this requirement.

In Victoria and South Australia, a person may be eligible for VAD if they have a condition that is "expected to cause death within weeks or months, not exceeding 6 months"[1,2] and in Tasmania if the condition is "expected to cause death within 6 months".[3] The legislation in Western Australia, and New South Wales, states that the condition "will, on the balance of probabilities, cause death within a period of 6 months".[4,5] In each of these states, a longer period (12 months) is allowed for people with a neurodegenerative disease. In Queensland, the legislation states that the condition is "expected to cause death within 12 months",[6] without distinguishing the type of condition. The wording of these eligibility criteria warrants careful examination and consideration.

For example, "on the balance of probabilities" is a legal concept, typically applied to the burden of proof in civil claims, generally taken to mean "more probable than not", and therefore perhaps corresponding to a percentage probability of 51% or more. Does this mean that a person may be eligible for VAD if their probability of dying within 6 months is judged to be 51% or higher? The phrase "expected to die within 6 months" implies a higher degree of belief, but does this correspond to a probability of 70%, 80%, 90%, or some other percentage? The phrase "not exceeding 6 months" seems to imply an expectation that all people meeting this criterion would die within 6 months, corresponding to a probability of 100%. Despite these differences, we believe the intent behind the current legislation is that most people judged to be eligible for VAD would be expected to die within 6 months (or 12 months in Queensland).

Estimates of life expectancy are inherently uncertain and imprecise. To illustrate this, we pooled data from six studies of participants with a range of advanced cancers, in which we could compare their medical oncologist's estimate of expected survival time (median survival time in a group of similar patients) versus the actual survival time that was subsequently observed.[7-12] We have previously reported that these estimates of expected survival time were imprecise, with less than 30% of participants having estimates within 0.67–1.33 times their observed survival time, but well calibrated (unbiased), with about equal proportions of participants living longer or shorter than their expected survival time.[7,8,13-15] Of the 1057 participants, 182 had an expected survival time of less than 6 months, and of these, 127 (70%) died within 6 months. In other words, most patients in these studies with an expected survival time of less than 6 months died within 6 months.

These data have several limitations when applied to the issue of eligibility for VAD. Medical oncologists in these trials were asked to record "the expected survival time in a group of similar people", not whether they "expected death to occur within 6 months". Furthermore, participants in cancer clinical trials would be expected to have longer survival times than people seeking assistance with dying. Finally, our data are confined to people with advanced cancer, and we have no data about prognostication in people with other terminal illnesses. Despite these limitations, our findings support the claim that Australian medical oncologists participating in these studies were reasonably good at predicting a survival time with a probability of 50%, even if they were unable to accurately predict each individual's survival time.

The VAD legislation requires doctors to predict an unspecified probability of a patient dying within a certain period. This is different to the question more commonly asked by patients, which is "how long have I got?". Doctors are not trained to formulate estimates of expected survival time, or to explain them to patients. We predict that many doctors will find it difficult to answer whether they expect individual patients to die within 6 months.

Our research on prognostication in advanced cancer has shown that ranges of survival time corresponding to information sought by patients, namely a worst-case scenario, a typical scenario, and a best-case scenario, can be determined using simple multiples of an oncologist's estimate of the expected survival time (ie, median survival time in a group of similar patients). For example, when medical oncologists were asked to estimate the expected survival times for an individual patient in our studies, about 5–10% of individuals died within one-quarter of their expected survival time (worst-case scenario), the middle 50% lived from half to double their expected survival time (typical scenario), and 5–10% lived longer than three times their expected survival time (best-case scenario).[7,8,13-16]

The wording of laws about VAD does not clarify how certain a doctor should be that an individual

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requesting VAD would die within the specified time. If we take "expected to die within 6 months" to mean an expectation that about 90% of such people would die within 6 months, then this corresponds to a best-case scenario of 6 months. People eligible for VAD would therefore be those with an expected survival time of 2 months (one-third of 6 months) or less. Among a group of individuals with expected survival times of 2 months, we would expect 5–10% to die within 2 weeks (one-quarter of 2 months), 50% to live 1–4 months (half to double 2 months), and 5–10% to live beyond 6 months (three times 2 months). Similarly, individuals with an expected survival time "not exceeding 12 months" (as per the Queensland legislation) would be those with an expected survival time of 4 months or less, among a group of whom we would expect 5–10% to die within 1 month, 50% to live for 2–8 months, and 5–10% to live beyond 12 months. We wonder whether the intention behind the current legislative wording is that people eligible for VAD are those who are unlikely to survive beyond 6 months, meaning a best-case scenario of 6 months and an expected survival time of 2 months.

We are not advocating that the eligibility criteria be broadened or narrowed, rather, our aim is to highlight our uncertainty about which patients are eligible for VAD under current legislation. Assessing a person's eligibility for VAD is difficult because prognostication is difficult, prognosis is inherently uncertain, and the eligibility criteria are not clearly specified. Legislation should be improved by including clearer definitions and explanations of phrases such as "expected to cause death within 6 months" using probabilistic terminology that corresponds with how prognoses are best formulated and communicated.

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1 Parliament of Victoria. Voluntary *Assisted Dying Act 2017* [Act No. 61/2017] 2019 (Authorised Version No. 003: [134]). https://content.legislation.vic.gov.au/sites/default/files/2021-06/17-61aa005%20authorised.pdf (viewed June 2022).

2 Government of South Australia. *Voluntary Assisted Dying Act 2021* [67]. https://www.legislation.sa.gov.au/lz?path=%2FC%2FA%2FVOLUNTARY%20ASSISTED%20DYING%20ACT%202021 (viewed June 2022).

3 Tasmanian Government. End-of-Life Choices (Voluntary Assisted Dying) Act 2021. https://www.legislation.tas.gov.au/view/html/asmade/act-2021-001 (viewed June 2022).

4 Government of Western Australia. *Voluntary Assisted Dying Act* 2019. https://www.legislation.wa.gov.au/legislation/statutes.nsf/law_a147242.html (viewed June 2022).

5 Parliament of New South Wales. Voluntary Assisted Dying Bill 2021. https://www.parliament.nsw.gov.au/bills/Pages/bill-details.aspx?pk=3891 (viewed June 2022).

6 Queensland Government. Voluntary Assisted Dying Act 2021. https://www.legislation.qld.gov.au/view/html/asmade/act-2021-017 (viewed June 2022).

7 Stockler MR, Tattersall MH, Boyer MJ, et al. Disarming the guarded prognosis: predicting survival in newly referred patients with incurable cancer. *Br J Cancer* 2006; 94: 208-212.

8 Kiely BE, Martin AJ, Tattersall MH, et al. The median informs the message: accuracy of individualized scenarios for survival time based on oncologists' estimates. *J Clin Oncol* 2013; 31: 3565-3571.

9 Johnson SB, Butow PN, Bell ML, et al. A randomised controlled trial of an advance care planning intervention for patients with incurable cancer. *Br J Cancer* 2018; 119: 1182-1190.

10 Davidson A, Veillard AS, Tognela A, et al. A phase III randomized trial of adding topical nitroglycerin to first-line chemotherapy for advanced nonsmall-cell lung cancer: the Australasian lung cancer trials group NITRO trial. *Ann Oncol* 2015; 26: 2280-2286.

11 Pavlakis N, Sjoquist KM, Martin AJ, et al. Regorafenib for the Treatment of Advanced Gastric Cancer (INTEGRATE): a multinational placebo-controlled phase II trial. *J Clin Oncol* 2016; 34: 2728-2735.

12 Nahm SH, Blinman P, Butler S, et al. Factors associated with fear of cancer recurrence in breast and colorectal cancer survivors: A cross-sectional study of cancer survivors. *Asia Pac J Clin Oncol* 2021; 17: 222-229.

13 Vasista A, Stockler M, Martin A, et al. Accuracy and prognostic significance of oncologists' estimates and scenarios for survival time in advanced gastric cancer. *Oncologist* 2019; 24: e1102-e1107.

14 Smith-Uffen MES, Johnson SB, Martin AJ, et al. Estimating survival in advanced cancer: a comparison of estimates made by oncologists and patients. *Support Care Cancer* 2020; 28: 3399-3407.

15 Tognela A, Espinoza D, Davidson A, et al. Oncologists' estimates of expected survival time and scenarios for survival: accuracy in the ALTG NITRO trial of 1st line chemotherapy for advanced non–small-cell lung cancer. *J Clin Oncol* 2016; 34 (Suppl): 9074.

16 Kiely BE, Soon YY, Tattersall MH, Stockler MR. How long have I got? Estimating typical, best-case, and worst-case scenarios for patients starting first-line chemotherapy for metastatic breast cancer: a systematic review of recent randomized trials. *J Clin Oncol* 2011; 29: 456-463. ■

Voluntary assisted dying: estimating life expectancy to determine eligibility

To the Editor: When statutes govern clinical activity, doctors need to know exactly what those legislative provisions mean. Nahm and colleagues[1] address this in their article on eligibility for Australia's voluntary assisted dying (VAD) laws.[1] However, in our opinion, the authors misinterpreted the relevant provisions, risking reduced access for eligible patients.

Generally, a statutory provision should be given its "ordinary and natural meaning";[2] in other words, a plain English interpretation. As the authors note, each of the VAD Acts uses a particular form of words to set eligibility around a terminally ill person's life expectancy. In Victoria, for example, a coordinating medical practitioner must conclude their patient has been "diagnosed with a disease, illness or medical condition that … is expected to cause death within weeks or months, not exceeding 6 months".[3]

Nothing in that wording refers to a probabilistic estimation of the percentage chance that the patient will die within 6 months nor any estimation of the best-case scenario, as Nahm and colleagues suggest. If the Victorian Parliament had wanted this type of estimation, wording reflecting it could have been inserted into the *Voluntary Assisted Dying Act 2017* (Vic). Instead, what is needed is that doctors have an expectation, based on the patient's clinical condition, that the illness will result in death within weeks or months, with the proviso that the number of months that the expectation of death will occur within is 6 or fewer.

That clinical judgement is the beginning and end of this criterion. Although that judgement might be informed by knowledge about survival times and even by knowledge about doctors' accuracy judging survival times, doctors need only certify that they expect that the patient's illness will cause death within 6 months. Nahm and colleagues are wrong to conclude that this wording might mean that people eligible for VAD would be "those with an expected survival time of 2 months". That is not what the legislation says, and it is a mistake to introduce elements that are not there. Such an interpretation could, in practice, convert the 6 months test to 2 months for some patients, with the risk of narrowing access to VAD for patients the Parliament intended to be eligible.

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1 Nahm SH, Stockler MR, Kiely BE. Voluntary assisted dying: estimating life expectancy to determine eligibility. *Med J Aust* 2022; 217: 178-179. https://www.mja.com.au/journal/2022/217/4/voluntary-assisted-dying-estimating-life-expectancy-determine-eligibility
2 *Amalgamated Society of Engineers v Adelaide Steamship Co Ltd* [1920] CLR 129.
3 *Voluntary Assisted Dying Act 2017* (Vic). ■

Voluntary assisted dying: estimating life expectancy to determine eligibility

In reply: We thank Ryan and colleagues[1] for reiterating the challenges interpreting the life expectancy criteria in Australian laws regarding voluntary assisted dying (VAD).

Ryan and colleagues recommend a plain English interpretation, using the wording from the Victorian legislation as an example: “expected to cause death within weeks or months, not exceeding 6 months”. We agree and posit that these words mean death within 6 months is expected, and that survival beyond 6 months is not expected. Ryan and colleagues also state that “clinical judgement is the beginning and end of this criterion”. We agree with this too, but this clinical judgement about death occurring within a given period is inherently probabilistic.

Our aim was therefore to help doctors identify those patients unlikely to live beyond 6 months using our experience researching prognostication in advanced cancer.[2] We are not advocating that the criterion regarding life expectancy should be narrowed from 6 months to 2 months. We are advocating that Australia’s VAD laws should be harmonised and improved by including clearer definitions and explanations of phrases such as “expected to cause death within 6 months” to clarify how certain a doctor should be that a person requesting VAD would otherwise die within the specified time. This formulation would correspond better with how prognoses should be estimated and communicated.

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1 Ryan CJ, White BP, Stewart CL. Voluntary assisted dying: estimating life expectancy to determine eligibility [letter]. *Med J Aust* 2023; 218: 000-000.
2 Nahm SH, Stockler MR, Kiely BE. Voluntary assisted dying: estimating life expectancy to determine eligibility. *Med J Aust* 2022; 217: 178-179. https://www.mja.com.au/journal/2022/217/4/voluntary-assisted-dying-estimating-life-expectancy-determine-eligibility#:~:text=In%20Victoria%20and%20South%20Australia,cause%20death%20within%206%20months%E2%80%9D ■

7 TIMING OF PROGNOSTIC DISCUSSIONS IN PEOPLE WITH ADVANCED CANCER: A SYSTEMATIC REVIEW

Overview

The previous chapters improved our understanding of the accuracy, prognostic significance, and practical applications of oncologists' estimates of expected survival time. This published manuscript reviews the literature regarding the optimal timing of discussions about prognosis between doctors and people with advanced cancer. It summarises studies reporting when doctors and patients reported thinking they should discuss prognosis, as well as guidelines and expert recommendations about appropriate timepoints to discuss life expectancy.

Publication details

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Contribution of authors

SHN contributed to the conceptualisation, literature search, data analysis, writing, and revision of the manuscript.

SS contributed to the data analysis and revision of the manuscript.

BEK and MRS contributed to the conceptualisation and revision of the manuscript.

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REVIEW

Timing of prognostic discussions in people with advanced cancer: a systematic review

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Abstract

Purpose Many people with cancer (patients) want to know their prognosis (a quantitative estimate of their life expectancy) but this is often not discussed or poorly communicated. The optimal timing of prognostic discussions with people with advanced cancer is highly personalised and complex. We aimed to find, organise, and summarise research regarding the timing of discussions of prognosis with people with advanced cancer.

Methods We conducted a systematic review of publications from databases, clinical practice guidelines, and grey literature from inception to 2023. We also searched the reference lists of systematic reviews, editorials, and clinical trial registries. Eligibility criteria included publications regarding adults with advanced cancer that reported a timepoint when a discussion of prognosis occurred or should occur.

Results We included 63 of 798 identified references; most of which were cross-sectional cohort studies with a range of 4–9105 participants. Doctors and patients agreed on several timepoints including at diagnosis of advanced cancer, when the patient asked, upon disease progression, when there were no further anti-cancer treatments, and when recommending palliative care. Most of these timepoints aligned with published guidelines and expert recommendations. Other recommended timepoints depended on the doctor's clinical judgement, such as when the patient 'needed to know' or when the patient 'seemed ready'.

Conclusions Prognostic discussions with people with advanced cancer need to be individualised, and there are several key timepoints when doctors should attempt to initiate these conversations. These recommended timepoints can inform clinical trial design and communication training for doctors to help improve prognostic understanding.

Keywords Discussing prognosis · Timing · Doctor-patient communication · Life expectancy

Background

Many people with cancer (patients) want to know their prognosis (a quantitative estimate of their life expectancy) but this is often not discussed or poorly communicated leading to misunderstanding [1]. One reason for this is uncertainty regarding the best time to initiate discussions about prognosis. Many oncologists report receiving little or no formal training on how to conduct or initiate discussions about prognosis, and this remains a difficult task for even experienced physicians [2]. Additionally, preferences regarding the timing and nature of prognostic discussions may vary not only between individuals, but also for a given individual over time [3]. There may also be discrepancies between patients and their caregivers [4], and therefore, communication needs are personal and context-dependent.

Research is needed to determine suitable timepoints (specific events along the course of a patient's disease) when oncologists should offer to discuss prognosis, and to identify timepoints at which prognostic discussions are actually occurring. Several studies have reported doctor and/or patient preferences regarding when to initiate discussions about prognosis [5–9]. We aimed to

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find, organise, and summarise research regarding the timing of discussions about prognosis with people with advanced cancer.

The specific objectives were to summarise the following:

- Guideline and expert recommendations about timepoints for doctors to discuss prognosis with people with advanced cancer;
- Studies reporting when doctors thought they should discuss prognosis with people with advanced cancer;
- Studies reporting when people with advanced cancer (patients) thought they wanted to discuss prognosis;
- Studies reporting timepoints when discussions of prognosis occurred.

Methods

Eligibility criteria

We included publications that:

1. Focused on prognosis communication in adults with advanced cancer
2. Reported a timepoint when a discussion of prognosis (i.e. a quantitative estimate of their life expectancy) occurred or should occur
3. Were written in or translated to English
4. Had full text available.

Information sources and search strategy

We searched Scopus, Ovid Medline, Ovid Embase, CINAHL, PsycINFO, and The Cochrane Central Register of Controlled Trials (CENTRAL) databases using medical subject headings (MeSH) terms and free text terms. The detailed search strategy can be found in Online Resource 1. We also searched the reference lists of relevant published systematic reviews, clinical practice guidelines, editorials, and clinical trial registries. All searches were conducted from inception of the databases to June 6, 2023.

Selection and data collection

All included studies were imported into Covidence, a primary screening and data extraction tool, and duplicates removed automatically before title and abstract screening. Two reviewers (S. N., S. S.) independently screened titles and abstracts of all references using the eligibility criteria. Full texts of all eligible references were either automatically imported from databases or manually imported from grey literature searches and independently screened again. All disagreements were resolved by consensus after re-examination with the eligibility criteria and further discussion. The author, year, region, title, method, number of participants, and timepoint were collected for each publication. Studies were grouped according to the four specific objectives listed above and re-tabulated according to timepoints.

Reliability of evidence

Given the heterogenous nature of the studies, we reported study methods and levels of evidence were independently determined by the reviewers using the Oxford Centre for Evidence-based medicine: Levels of Evidence 2 Table [10].

Results

A total of 63 references were included from 798 identified references (Fig. 1). The Cohen's kappa coefficient for full text review was 0.77 (substantial agreement). Guideline and expert recommendations about timepoints for doctors to discuss prognosis in people with advanced cancer are summarised in Table 1. There were 12 publications, all from Western countries in North America, Europe, or Australia/New Zealand, and based on expert opinion or consensus. The most common recommended timepoint was 'at first diagnosis of advanced cancer' (7 publications) [11–17]. Significant 'transition points' were recommended such as at remission/stable disease/disease progression, changing treatment approach, stopping anti-cancer therapies, and developing end-of-life consensus [11, 13, 15–17]. Other timepoints were individualised, such as at patient's request, when there were expectations that were inconsistent with clinical judgement, and when the doctor 'would not be surprised' if the patient were to die within 6 to 12 months [11, 13, 18].

Studies reporting when doctors thought they should discuss prognosis with people with advanced cancer are summarised in Table 2. There were 11 studies, the majority of which were qualitative (5) or surveys (6). The most common timepoints were when the patient raised the topic or directly asked about their prognosis; when the patient was symptomatic, in pain, having bad complications, or there was a change in their clinical picture; and when patients had a very short life expectancy/estimated prognosis less than 12 months [5–8, 23–26]. Other recommended timepoints required clinical judgement, such as when the patient 'needed to know' or when the patient 'seemed ready' [5, 7].

Studies reporting when people with advanced cancer thought they wanted to discuss prognosis are summarised in Table 3. There were 11 studies, mostly from focus groups and individual interviews from Australia, Brazil, and North America. The most common timepoints reported were shortly after diagnosis and when 'things changed for the worse/their oncologist felt their prognosis had changed' [8, 9, 30–34].

Studies reporting timepoints when discussions of prognosis actually occurred are summarised in Table 4. There were 35

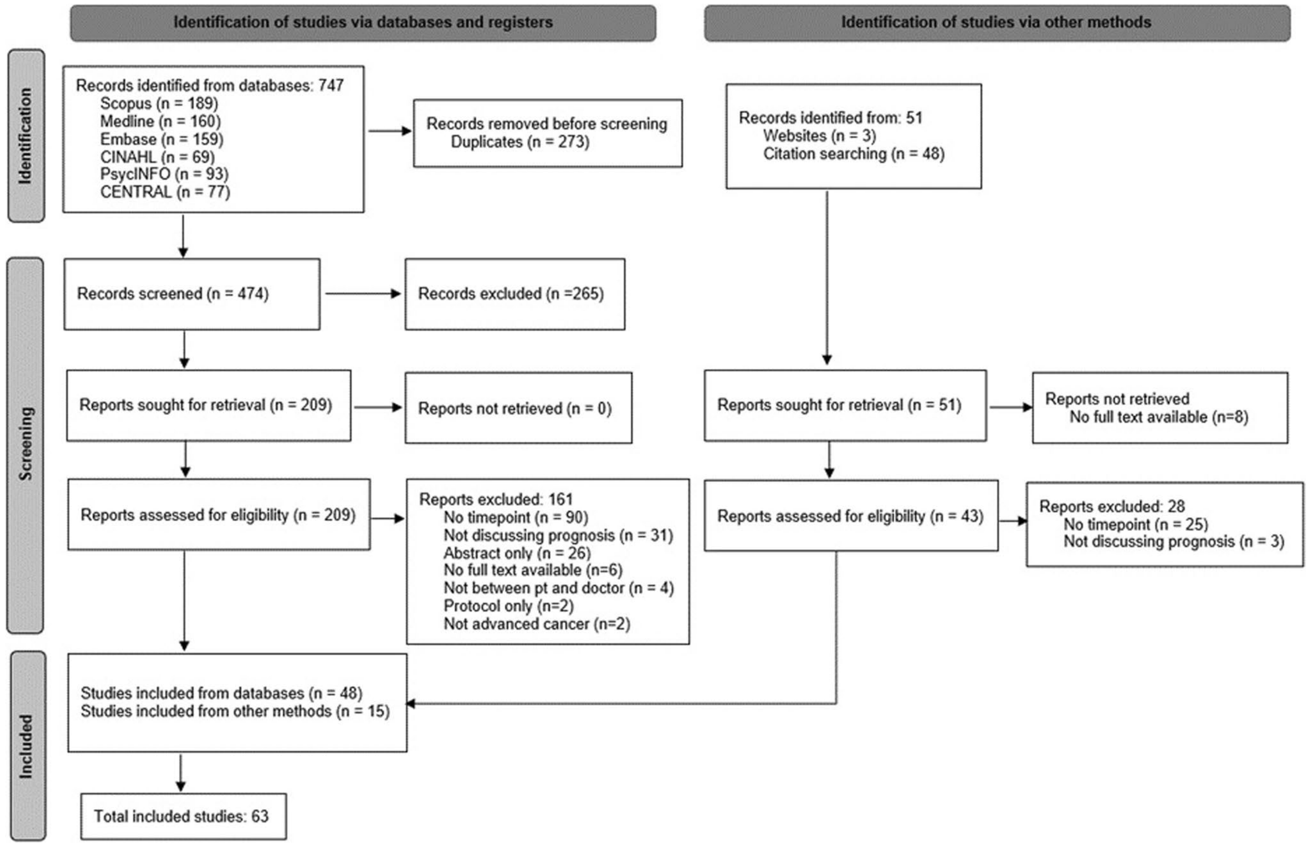

Fig. 1 PRISMA flow diagram

studies using a variety of methods including randomised controlled trials, questionnaires, and qualitative studies. The most commonly studied timepoint was at the first consultation after diagnosis of advanced cancer (12 studies) [30, 38–48] and other timepoints were similar to those in Tables 1, 2, and 3. Table 5 summarises recommended timepoints to discuss

Table 1 Guideline and expert recommendations about timepoints for doctors to discuss prognosis with people with advanced cancer

Timepoint	Quality of evidence rating[a]	Region	Year	Ref
At first consultation following diagnosis of advanced cancer	5	Australia/New Zealand, Germany, USA	2003 - 2019	[11–17]
Prior to commencing treatment	5	Canada	2011	[19]
When outcomes of varying treatment options were discussed	5	Australia, Germany	2003 - 2019	[12, 16]
When patients requested prognostic information	5	UK	2017 - 2020	[11, 18]
When current therapies were not working	5	Australia/New Zealand, USA	2007 - 2017	[13, 17, 20]
Significant decline in physical or mental function	5	Australia/New Zealand	2007 - 2016	[13, 14]
When the patient was hospitalised and required a need to reassess prognosis, patient understanding, treatment options and goals of care	5	USA	2017	[21]
At each transition (e.g. remission/stable disease/disease progression, changing treatment approach, stopping anti-cancer therapies, developing end of life consensus)	5	Australia/New Zealand, Germany, USA	2007 - 2019	[11, 13, 15–17]
If there were expectations that were inconsistent with clinical judgement	5	Australia/New Zealand	2007	[13]
When there were no further cancer-directed therapies	5	UK, USA	2002 - 2020	[18, 22]
When referring to palliative care services	5	Australia/New Zealand	2007	[13]
If the doctor ‘would not be surprised’ if the patient died within 6 – 12 months	5	Australia/New Zealand	2007	[13]

[a] Modified from the Oxford Centre for Evidence-based Medicine [10]; 5 – expert opinion/consensus

Table 2 Studies reporting when doctors thought they should discuss prognosis with people with advanced cancer

Timepoint	Method	Quality of evidence rating[a]	Region	Year	Ref
When there were no more non-palliative treatments	Survey of medical oncologists	4	Japan, USA	2014 - 2015	[6, 24]
At first consultation following diagnosis of advanced cancer	Survey of medical oncologists Semi-structured interviews	4	Australia, Japan, USA	2015 - 2020	[6, 23, 27]
Early in the oncologist-patient relationship (within the first three visits)	Semi-structured interviews	4	USA	2018	[8]
When treatment decisions needed to be made	Semi-structured interviews	4	Japan, USA	2003 - 2019	[5, 27]
When patient raised the topic/directly asked	Focus groups and individual interviews Survey of medical oncologists/physicians caring for cancer patients	4	Australia, Japan, USA	2003 - 2015	[5–7, 24, 25]
Upon disease progression	Online survey Semi-structured interviews	4	USA	2003 - 2021	[5, 8, 26]
When patient expectations didn't align with expected prognosis	Focus groups and individual interviews	4	Australia, USA	2003 - 2005	[5, 28]
When 'the patient needed to know'	Focus groups and individual interviews	4	Australia	2005	[7]
When the patient was symptomatic, in pain, having bad complications, change in clinical picture	Semi-structured interviews Survey of medical oncologists/physicians	4	Japan, USA	2003 - 2018	[5, 6, 8, 24, 25]
When 'the patient seemed ready'	Focus groups and individual interviews	4	Australia, USA	2003 - 2005	[5, 7]
When there were no further anti-cancer treatments, or limitations in remaining treatment options	Semi-structured interviews	4	USA	2018	[8]
When patients were declining in hospital	Semi-structured interviews Survey of medical oncologists/physicians caring for cancer patients	4	Japan, USA	2003 - 2015	[5, 6, 24]
When discussing resuscitation status	Online survey	4	USA	2015	[29]
When recommending palliative care	Semi-structured interviews	4	USA	2003	[5]
When patients had a very short life expectancy/estimated prognosis less than 12 months	Survey of medical oncologists/physicians caring for cancer patients	4	Australia, USA	2010 - 2021	[23–26]

[a] Modified from the Oxford Centre for Evidence-based Medicine [10]; 4 - case series or cross sectional study

prognosis by source of recommendation. The complete data extraction tables for all references can be found in Online Resource 2 (Tables 1, 2, 3, and 4).

Discussion

This systematic review summarises research regarding the timing of discussions about prognosis with people with advanced cancer. There were many timepoints that doctors and patients agreed were suitable to offer discussions about prognosis (Table 5). These included at first consultation after diagnosis of advanced cancer, when the patient asked, upon disease progression, when there were no further anti-cancer treatments, and when recommending palliative care. Most of the timepoints were also endorsed by the guideline and expert recommendations, as well as additional timepoints such as 'prior to commencing treatment' and 'when the patient was hospitalised and required a need to reassess prognosis'. Other common timepoints required the doctor to use their judgment, such as when the patient 'needed to know' or when the patient 'seemed ready'. Such judgments might vary according to the doctor's attitudes and nature of the therapeutic relationship.

Despite 'first consultation after diagnosis of advanced cancer' being one of the most reported timepoints doctors thought they should discuss prognosis, and the most common timepoint used for prognostic discussions in studies, only one study mentioned this timepoint as preferred by patients [35]. This might reflect practicality for clinicians (such as

Table 3 Studies reporting when people with advanced cancer thought they wanted to discuss prognosis

Timepoint	Method	Quality of evidence rating[a]	Region	Year	Ref
At first consultation following diagnosis of advanced cancer	Survey	4	Australia	2004	[35]
Shortly after diagnosis	Systematic review Semi-structured interviews	4	Australia, Canada, USA	2004 - 2021	[8, 30, 31, 33]
When treatment decisions needed to be made	Structured interviews Semi-structured interviews	4	USA	2007 - 2018	[36]
When patient raised the topic/directly asks	Focus groups and individual interviews Patient interviews	4	Australia	2005 - 2012	[7, 9]
When 'the patient needed to know'	Focus groups and individual interviews	4	Australia	2005	[7]
At disease progression	Cross-sectional cohort study Qualitative study	4	Brazil, USA	2022	[34, 37]
At 'decision points' (e.g., test results, starting or failing treatment, high symptom burden)	Semi-structured interviews	4	USA	2018	[8]
When 'things changed for the worse'/their oncologist felt their prognosis had changed	Sequential explanatory mixed-method pilot study Patient interviews Cross-sectional cohort study	4	Australia, Brazil, USA	2012 - 2022	[9, 30, 32, 34]
When 'the patient seemed ready'	Focus groups and individual interviews Patient interviews	4	Australia	2005 - 2012	[7, 9]
When there were limited or no further anti-cancer treatments	Semi-structured interviews	4	USA	2018	[8]
When referred to palliative care services	Focus groups and individual interviews	4	Australia	2005	[6]

[a] Modified from the Oxford Centre for Evidence-based Medicine [10]; 4 - case series or cross sectional study

choosing a timepoint for an intervention in a clinical trial), but may not reflect patients' preferences. It is also important to recognise that although most people with advanced cancer want some information about their life expectancy, a minority of people do not [31, 35]. Many of the publications stressed the importance of personalising the timing of discussions according to the patient's wishes and readiness to receive such information, and some recommended a staged approach across several consultations [5, 18, 19].

Strengths of this systematic review are that it summarised the preferences for the timing of discussions of prognosis from both doctors and patients. These preferences were then compared with the recommendations from guidelines and experts as well as studies where prognostic discussions actually occurred.

Study limitations

We included studies published in English from mostly Western settings, so we may not know if the recommended timepoints are similar in culturally diverse populations. Some studies suggest people from culturally and linguistically diverse backgrounds may prefer non-disclosure, whilst others have found consistency in patient preferences, regardless of ethnicity [9, 35, 70]. Few studies included details about what was actually discussed, patients' awareness of their prognosis, or the impact of the discussions on patient decision making.

Clinical implications

Conversations about prognosis are often deferred until the last months of life [23, 25], robbing patients and families of the opportunity to make plans and discuss their wishes whilst they are well. This review summarises recommendations and observations about key timepoints when doctors should offer to discuss prognosis in people with advanced cancer. Doctors should consider and initiate conversations about prognosis from the time of diagnosis of advanced cancer and continue to offer these conversations until death. Educating doctors about the recommended timepoints for prognostic discussions is likely to help increase the frequency of prognostic discussions and hopefully improve patients' understanding of their life expectancy. Previous studies of patients with advanced cancer have reported that those who had a good

Table 4 Studies reporting timepoints when discussions of prognosis occurred

Timepoint	Method	Quality of evidence rating[a]	Region	Year	Ref
At first consultation following diagnosis of advanced cancer	Randomized controlled trial Qualitative study Prospective observational cohort study Semi-structured interviews and questionnaires	1, 4	Australia, Austria, Netherlands, USA,	1994 - 2021	[30, 38–48]
When treatment decisions needed to be made	Prospective observational study Sequential explanatory mixed-method pilot study	4	Netherlands, USA	2004 - 2020	[32, 49, 50]
First visit after imaging to assess response to first-line treatment	Randomized controlled trial	1	USA	2020 - 2021	[51, 52]
Evaluative consultations that concerned disease response/post-imaging visit	Prospective observational study Qualitative substudy/secondary analysis of a randomized controlled trial Qualitative study	4	Austria, Netherlands, USA	2017 - 2019	[46, 49, 53]
When second opinion was sought	Qualitative study	4	Netherlands	2021	[54]
When the patient indicated they wanted quantitative information (either spontaneously or when offered) about their life expectancy	Phase 2 trial	4	Australia	2021	[55]
When the patient asked questions related to their prognosis	Prospective observational study	4	Singapore	2020	[56]
Upon disease progression	Prospective observational study Cross-sectional cohort study Qualitative study	4	Brazil, Netherlands USA	2017 - 2022	[34, 49, 57, 58]
When symptoms became severe	Qualitative analysis	4	USA	2021	[30]
When there were no further anti-cancer treatments, or limitations in remaining treatment options	Qualitative analysis Interviews using standardized questionnaires	4	Japan, USA	2015 - 2021	[30, 59, 60]
At clinical deterioration	Cross-sectional cohort study	4	Brazil	2022	[34]
At first consultation or within the first three consultations with palliative care team	Multicentre randomized controlled trial Randomized controlled trial	1	Australia, France, USA	2007 - 2021	[61–63]
Initial consultation between palliative care clinicians and hospitalized patients	Prospective observational study	4	USA	2019	[64]
When the doctor 'would not be surprised if the patient were to die within 12 months'	Randomized clinical trial Qualitative analysis Cluster randomized controlled trial Qualitative study	1, 4	Australia, USA	2014 - 2019	[60, 65–67]
When the patient had clinical indicators of increased risk of death within 6 months	Randomized control trial	1	USA	2022	[68]
Final hospitalization to receive end-of-life care	Before-after study	4	Japan	2015	[69]

[a] Modified from the Oxford Centre for Evidence-based Medicine [10]; 1 –randomized clinical trial, 4 - case series or cross sectional study

Table 5 Recommended timepoints to discuss prognosis by source of recommendation

Timepoint	Guidelines/expert consensus	Studies of doctors	Studies of people with advanced cancer
When there were no more non-palliative treatments		√	
At first consultation following diagnosis of advanced cancer	√	√	√
Early in the oncologist-patient relationship (within the first three visits)		√	√
Prior to commencing treatment	√		
When treatment decisions needed to be made/outcomes of varying treatment options were discussed	√	√	√
When patient raised the topic/directly asked	√	√	√
At each transition (e.g. follow-up visits resulting in remission, stable disease or disease progression, stopping anti-cancer therapies, developing end-of-life consensus)	√		√
Upon disease progression	√	√	√
When patient expectations did not align with expected prognosis or when 'the patient needed to know'	√	√	√
When 'the patient seemed ready'		√	√
When the patient was hospitalised and required a need to reassess prognosis, patient understanding, treatment options, and goals of care	√		
When the patient was symptomatic, in pain, having bad complications, significant decline in physical or mental function	√	√	√
When there were no further anti-cancer treatments or limitations in remaining treatment options	√	√	√
When discussing resuscitation status		√	
When recommending palliative care	√	√	√
When patients had a very short life expectancy/estimated prognosis less than 12 months	√	√	

understanding of their prognosis were more likely to accept input from palliative care earlier, were less likely to choose futile treatments towards the end of life, and had better quality of life at the end of life [71, 72]. Surviving caregivers also reported better quality of life during the bereavement period if patients had better quality of life near death [73]. These recommended timepoints could also be used to help design clinical trials of interventions to prompt doctors to discuss prognosis with their patients and improve prognostic communication. Existing communication skills workshops could train doctors to recognise the recommended timepoints and equip them with the skills needed to start conversations about prognosis at different timepoints.

Future directions

There were only 11 studies reporting patient preferences for the timing of prognostic discussions, and all were from Australia, Brazil, or North America. More research is required to better understand patient preferences from culturally and geographically diverse populations, as well as the attitudes and practices of their doctors. The preferences of patient caregivers and other healthcare providers (e.g. nurse practitioners) are also important. Further research is needed to improve the frequency of prognostic discussions at the recommended timepoints and to assess patients' understanding of prognosis.

Conclusions

There are several key timepoints when doctors should consider discussing prognosis in people with advanced cancer. Because preferences for the timing of these conversations vary between individual patients, these timepoints should serve as 'triggers' for doctors to offer discussions about prognosis.

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Declarations

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References

1. Russell BJ, Ward AM (2011) Deciding what information is necessary: do patients with advanced cancer want to know all the details? Cancer Manag Res 3:191–199
2. Horlait M, Chambaere K, Pardon K et al (2016) What are the barriers faced by medical oncologists in initiating discussion of palliative care? A qualitative study in Flanders, Belgium. Support Care Cancer 24:3873–3881
3. Hui D, Paiva CE, Del Fabbro EG et al (2019) Prognostication in advanced cancer: update and directions for future research. Support Care Cancer 27:1973–1984
4. van der Velden NCA, Smets EMA, Hagedoorn M et al (2023) Patient-caregiver dyads' prognostic information preferences and perceptions in advanced cancer. J Pain Symptom Manage 65(442-455):e442
5. Gordon EJ, Daugherty CK (2003) 'Hitting you over the head': oncologists' disclosure of prognosis to advanced cancer patients. Bioethics 17:142–168
6. Mori M, Shimizu C, Ogawa A et al (2015) A national survey to systematically identify factors associated with oncologists' attitudes toward end-of-life discussions: what determines timing of end-of-life discussions? Oncologist 20:1304–1311
7. Clayton JM, Butow PN, Tattersall MH (2005) When and how to initiate discussion about prognosis and end-of-life issues with terminally ill patients. J Pain Symptom Manage 30:132–144
8. Schulman-Green D, Smith CB, Lin JJ et al (2018) Oncologists' and patients' perceptions of initial, intermediate, and final goals of care conversations. J Pain Symptom Manag 55:890–896
9. Mitchison D, Butow P, Sze M et al (2012) Prognostic communication preferences of migrant patients and their relatives. Psycho-Oncology 21:496–504
10. OCEBM Levels of Evidence Working Group: Howick J, Chalmers I, Glasziou P, Greenhalgh T, Heneghan C, Liberati A, Moschetti I, Phillips B, Thornton H, Goddard O, Hodgkinson M (2011) The Oxford levels of evidence 2. https://www.cebm.ox.ac.uk/resources/levels-of-evidence/ocebm-levels-of-evidence. Accessed 2 Feb 2022
11. Guidelines A (2017) Patient-clinician communication: ASCO consensus guideline
12. Turner J, Zapart S, Pedersen K et al (2005) Clinical practice guidelines for the psychosocial care of adults with cancer. Psychooncology 14:159–173
13. Clayton JM, Hancock K, Butow P et al (2007) Clinical practice guidelines for communicating prognosis and end-of-life issues with adults in the advanced stages of a life-limiting illness, and their caregivers
14. Scott IA (2016) What does the future hold? The need to engage in discussions around prognosis. Intern Med J 46:873–875
15. Smith TJ, Longo DL (2012) Talking with patients about dying. New Engl J Med 367:1651–1652
16. Villalobos M, Siegle A, Hagelskamp L et al (2019) Communication along milestones in lung cancer patients with advanced disease. Oncol Res Treat 42:41–46
17. Weir AB, Brint JM (2011) Hope is a verb: a course correction in delivering bad news. Am J Hosp Palliat Med 28:525–527
18. Chu C, Anderson R, White N, Stone P (2020) prognosticating for adult patients with advanced incurable cancer: a needed oncologist skill. Curr Treat Options Oncol 21:5
19. Rodin G MJ, Zimmerman C, Mayer C, Howell D, Katz M, Sussman J, McNair S, Brouwers M (2011) Provider-patient communication: A report of evidence-based recommendations to guide practice in cancer
20. Childers JW, Back AL, Tulsky JA, Arnold RM (2017) REMAP: A framework for goals of care conversations. Journal of Oncology Practice/American Society of Clinical Oncology 13:e844–e850
21. Ragland J, Thakore K, Anderson WG (2017) Addressing prognosis in serious illness. Hosp Med Clin 6:359–373
22. Rich BA (2002) Prognostication in clinical medicne: prophecy or professional responsibility? J Legal Med 23:297–358
23. Vasista A, Stockler MR, Martin A et al (2020) Communicating prognostic information: what do oncologists think patients with incurable cancer should be told? Intern Med J 50:1492–1499
24. Liu PH, Landrum MB, Weeks JC et al (2014) Physicians' propensity to discuss prognosis is associated with patients' awareness of prognosis for metastatic cancers. J Palliat Med 17:673–682
25. Keating NL, Landrum MB, Rogers SO Jr et al (2010) Physician factors associated with discussions about end-of-life care. Cancer 116:998–1006
26. Epstein AS, Kakarala SE, Reyna VF et al (2021) Development of the Oncolo-GIST ("Giving information strategically & transparently") Intervention manual for oncologist skills training in advanced cancer prognostic information communication. J Pain Symptom Manage 62:10–19.e14
27. Ozeki-Hayashi R, Fujita M, Tsuchiya A et al (2019) Beliefs held by breast surgeons that impact the treatment decision process for advanced breast cancer patients: a qualitative study. Breast Cancer Targets and Therap 11:221–229
28. Clayton JM, Butow PN, Arnold RM, Tattersall MH (2005) Fostering coping and nurturing hope when discussing the future with terminally ill cancer patients and their caregivers. Cancer 103:1965–1975
29. Einstein DJ, Einstein KL, Mathew P (2015) Dying for advice: code status discussions between resident physicians and patients with advanced cancer--a national survey. J Palliat Med 18:535–541
30. Dillon EC, Meehan A, Nasrallah C et al (2021) Evolving goals of care discussions as described in interviews with individuals with advanced cancer and oncology and palliative care teams. Am J Hosp Palliat Med 38:785–793
31. Parker SM, Clayton JM, Hancock K et al (2007) A systematic review of prognostic/end-of-life communication with adults in the advanced stages of a life-limiting illness: patient/caregiver preferences for the content, style, and timing of information. J Pain Symptom Manage 34:81–93
32. Lippe M, Farya P, Jennifer M et al (2020) Communicating oncologic prognosis with empathy: a pilot study of a novel communication guide. Am J Hosp Palliat Med 37:1029–1036
33. Kirk P, Kirk I, Kristjanson LJ (2004) What do patients receiving palliative care for cancer and their families want to be told? A Canadian and Australian qualitative study. BMJ 328:1343
34. Paiva CE, Teixeira AC, Minto Lourenco B et al (2022) Anticancer treatment goals and prognostic misperceptions among advanced cancer outpatients. Int J Environ Res Public Health 19(10):6272
35. Hagerty RG, Butow PN, Ellis PA et al (2004) Cancer patient preferences for communication of prognosis in the metastatic setting. J Clin Oncol 22:1721–1730
36. Elkin EB, Kim SH, Casper ES et al (2007) Desire for information and involvement in treatment decisions: elderly cancer patients'

preferences and their physicians' perceptions. J Clin Oncol 25:5275–5280

37. Petrillo LA, Shimer SE, Zhou AZ et al (2022) Prognostic communication about lung cancer in the precision oncology era: A multiple-perspective qualitative study. Cancer 128:3120–3128
38. Bruera E, Sweeney C, Willey J et al (2003) Breast cancer patient perception of the helpfulness of a prompt sheet versus a general information sheet during outpatient consultation: a randomized, controlled trial. J Pain Symptom Manage 25:412–419
39. Butow P, Devine R, Boyer M et al (2004) Cancer consultation preparation package: changing patients but not physicians is not enough. J Clin Oncol 22:4401–4409
40. Butow PN, Dunn SM, Tattersall MH, Jones QJ (1994) Patient participation in the cancer consultation: evaluation of a question prompt sheet. Ann Oncol 5:199–204
41. Chou WS, Hamel LM, Thai CL et al (2017) Discussing prognosis and treatment goals with patients with advanced cancer: A qualitative analysis of oncologists' language. Health Expect 20:1073–1080
42. Danesh M, Belkora J, Volz S, Rugo HS (2014) Informational needs of patients with metastatic breast cancer: What questions do they ask, and are physicians answering them? J Cancer Educ 29:175–180
43. Gattellari M, Voigt KJ, Butow PN, Tattersall MH (2002) When the treatment goal is not cure: are cancer patients equipped to make informed decisions? J Clin Oncol 20:503–513
44. Rodriguez KL, Gambino FJ, Butow PN et al (2008) 'It's going to shorten your life': framing of oncologist-patient communication about prognosis. Psycho-Oncology 17:219–225
45. Rumpold T, Lütgendorf-Caucig C, Jagsch R et al (2015) Information preferences regarding cure rates and prognosis of Austrian patients with advanced lung cancer. Strahlentherapie und Onkologie 191:549–556
46. van Vliet LM, Francke AL, Meijers MC et al (2019) The use of expectancy and empathy when communicating with patients with advanced breast cancer; an observational study of clinician-patient consultations. Frontiers in Psychiatry Frontiers Research Foundation 10:464
47. Yeh JC, Cheng MJ, Chung CH, Smith TJ (2014) Using a question prompt list as a communication aid in advanced cancer care. Journal of Oncology Practice/American Society of Clinical Oncology 10:e137–e141
48. Owusuaa C, van Beelen I, van der Heide A, van der Rijt CCD (2021) Physicians' views on the usefulness and feasibility of identifying and disclosing patients' last phase of life: a focus group study. BMJ Support Palliat Care 22:22
49. Henselmans I, Smets EMA, Han PKJ et al (2017) How long do I have? Observational study on communication about life expectancy with advanced cancer patients. Patient Educ Couns 100:1820–1827
50. Koedoot CG, Oort FJ, de Haan RJ et al (2004) The content and amount of information given by medical oncologists when telling patients with advanced cancer what their treatment options are. palliative chemotherapy and watchful-waiting. Eur J Cancer 40:225–235
51. Annadurai V, Smith CB, Bickell N et al (2021) Impact of a novel goals-of-care communication skills coaching intervention for practicing oncologists. J Palliat Med 24:838–845
52. Bickell NA, Back AL, Adelson K et al (2020) Effects of a communication intervention randomized controlled trial to enable goals-of-care discussions. JCO Oncol Pract 16:e1015–e1028
53. Singh S, Cortez D, Maynard D et al (2017) Characterizing the nature of scan results discussions: insights into why patients misunderstand their prognosis. Journal of Oncology Practe/American Society of Clinical Oncology 13:e231–e239
54. van der Velden NCA, van der Kleij MBA, Lehmann V et al (2021) Communication about prognosis during patient-initiated second opinion consultations in advanced cancer care: an observational qualitative analysis. Int J Environ Res Public Health [Electronic Resource] 18:26
55. Nahm SH, Stockler MR, Martin AJ et al (2022) Using three scenarios to explain life expectancy in advanced cancer: attitudes of patients, family members, and other healthcare professionals. Support Care Cancer 30:7763–7772
56. Malhotra C, Kanesvaran R, Barr Kumarakulasinghe N et al (2020) Oncologist-patient-caregiver decision-making discussions in the context of advanced cancer in an Asian setting. Health Expect 23:220–228
57. Thomas TH, Jackson VA, Carlson H et al (2019) Communication differences between oncologists and palliative care clinicians: a qualitative analysis of early, integrated palliative care in patients with advanced cancer. J Palliat Med 22:41–49
58. Owusuaa C, van Lent LGG, van 't Spijker A et al (2022) Discussing prognosis and the end of life with patients with advanced cancer or COPD: A qualitative study. PLoS One 17:e0274201
59. Umezawa S, Fujimori M, Matsushima E et al (2015) Preferences of advanced cancer patients for communication on anticancer treatment cessation and the transition to palliative care. Cancer 121:4240–4249
60. Epstein RM, Duberstein PR, Fenton JJ et al (2017) Effect of a patient-centered communication intervention on oncologist-patient communication, quality of life, and health care utilization in advanced cancer: The voice randomized clinical trial. JAMA Oncol 3:92–100
61. Bouleuc C, Savignoni A, Chevrier M et al (2021) A question prompt list for advanced cancer patients promoting advance care planning: A french randomized trial. J Pain Symptom Manag 61:331–341.e338
62. Clayton JM, Butow PN, Tattersall MH et al (2007) Randomized controlled trial of a prompt list to help advanced cancer patients and their caregivers to ask questions about prognosis and end-of-life care. J Clin Oncol 25:715–723
63. Gramling R, Ingersoll LT, Anderson W et al (2019) End-of-life preferences, length-of-life conversations, and hospice enrollment in palliative care: A direct observation cohort study among people with advanced cancer. J Palliat Med 22:152–156
64. Ingersoll LT, Alexander SC, Priest J et al (2019) Racial/ethnic differences in prognosis communication during initial inpatient palliative care consultations among people with advanced cancer. Patient Educ Couns 102:1098–1103
65. Mazer BL, Cameron RA, DeLuca JM et al (2014) "Speaking-for" and "speaking-as": Pseudo-surrogacy in physician-patient-companion medical encounters about advanced cancer. Patient Educ Couns 96:36–42
66. Bernacki R, Hutchings M, Vick J et al (2015) Development of the Serious Illness Care Program: a randomised controlled trial of a palliative care communication intervention. BMJ Open 5:e009032
67. Walczak A, Henselmans I, Tattersall MH et al (2015) A qualitative analysis of responses to a question prompt list and prognosis and end-of-life care discussion prompts delivered in a communication support program. Psycho-Oncology 24:287–293
68. Greer JA, Moy B, El-Jawahri A et al (2022) Randomized trial of a palliative care intervention to improve end-of-life care discussions in patients with metastatic breast cancer. J Natl Compr Canc Netw 20:136–143
69. Nakajima N, Kusumoto K, Onishi H, Ishida M (2015) Does the approach of disclosing more detailed information of cancer for the terminally ill patients improve the quality of communication involving patients, families, and medical professionals? Am J Hosp Palliat Med 32:776–782

70. Hagerty RG, Butow PN, Ellis PM et al (2005) Communicating prognosis in cancer care: a systematic review of the literature. Ann Oncol 16:1005–1053
71. Eidinger RN, Schapira DV (1984) Cancer patients' insight into their treatment, prognosis, and unconventional therapies. Cancer 53:2736–2740
72. Weeks JC, Cook EF, O'Day SJ et al (1998) Relationship between cancer patients' predictions of prognosis and their treatment preferences. JAMA 279:1709–1714
73. Wright AA, Zhang B, Ray A et al (2008) Associations between end-of-life discussions, patient mental health, medical care near death, and caregiver bereavement adjustment. JAMA 300:1665–1673

Online Resource 1. Search strategy for Medline

1. neoplasm metastasis.mp. or exp Neoplasm Metastasis/
2. (advanced adj1 cancer*).tw.
3. (metastatic adj1 cancer*).tw.
4. (incurable adj1 cancer*).tw.
5. 1 or 2 or 3 or 4
6. Physician-Patient Relations/ or doctor patient communication.mp.
7. prognosis/ or medical futility/
8. life expectancy/
9. prognos*.tw.
10. life expectanc*.tw.
11. 7 or 8 or 9 or 10
12. 5 and 6 and 11

NB. Similar search terms adapted for all other database

Online Resource 2. Complete data extraction of all references included in the review.

Table 1) Guideline and expert recommendations about timepoints for doctors to discuss prognosis with people with advanced cancer.

Authors	Year	Region (Group)	Title	Design/Method	Timepoint	Type of Evidence	Comments
American Society of Clinical Oncology[1]	2017	USA	Patient-Clinician Communication: American Society of Clinical Oncology Consensus Guideline	Multidisciplinary expert panel considering evidence, clinical experience and formal consensus process	1. Initial diagnosis, relapse or progression 2. Change in treatment approach 3. Change in goals of care 4. At patient/family request	Expert opinion or consensus statement	
Childers et al[2]	2017	USA (University of Pittsburgh, PA; University of Washington, WA: Dana-Farber Cancer Institute, MA)	REMAP: A Framework for Goals of Care Conversations	Recommendations/ Communication framework	When current therapies are not working	Expert opinion or consensus statement	
Chu et al[3]	2020	UK (Marie Curie Palliative Care Research Department, University College London)	Prognosticating for Adults Patients with Advanced Incurable Cancer: a Needed Oncologist Skill	Evaluation of literature	1. When patients request prognostic information. 2. When patients reach the end of cancer-directed therapies.	Expert opinion or consensus statement	Patients frequently requested prognostic information by using statements (e.g. “I don’t know when it’s coming”) rather than asking direct questions. These statements allowed doctors to proceed to checking patients’ current understanding and their perspectives, and to re-confirm their readiness to hear a prognosis, before delivering it.
Clayton et al[4]	2007	Australia/New Zealand (Australian and New Zealand Expert	Clinical practice guidelines for communicating prognosis and end-of-life issues with adults in the advanced stages of a	Systematic review and refining of guidelines with expert advisory panel	1. Once it is clear that the patient has a life-limiting advanced progressive illness. 2. If the doctor would not be surprised if the patient died within 6–12 months.	Expert opinion or consensus statement	

Authors	Year	Region (Group)	Title	Design/Method	Timepoint	Type of Evidence	Comments
		Advisory Group)	life-limiting illness, and their caregivers		3. When there is a change in condition, or a perception (by patients, caregivers or clinical staff) of change. 4. When a treatment decision needs to be made. 5. If there are requests or expectations that are inconsistent with clinical judgement. 6. If disease-specific treatment is not working or there are complications from this treatment that limit its effectiveness. 7. At the time of referring the patient to specialist palliative care services.		
National Breast Cancer Centre and National Cancer Control Initiative[5]	2003	Australia	Clinical practice guidelines for the psychosocial care of adults with cancer	Multidisciplinary Steering Group with representatives from various cancer areas	1. At the first visit prior to initiation of systemic therapy. 2. When outcomes of varying treatment options are being discussed.	Expert opinion or consensus statement	Recommended providing information in a staged manner to those who wish to receive it.
Ragland et al[6]	2017	USA	Addressing Prognosis in Serious Illness	Recommendations/Expert advice	Sentinel hospitalization	Expert opinion or consensus statement	Sentinel hospitalization defined as: a hospitalization in the patient's disease course that heralds a need to reassess prognosis, patient understanding, treatment options and intensities, and goals of care.

Authors	**Year**	**Region (Group)**	**Title**	**Design/Method**	**Timepoint**	**Type of Evidence**	**Comments**
Rich[7]	2002	USA	Prognostication in Clinical Medicine: Prophecy or Professional Responsibility?	Opinion/Review	When there are limitations in remaining treatment options	Expert opinion or consensus statement	
Rodin et al[8]	2011	Canada (Cancer Care Ontario)	Provider-Patient Communication	Evidence-based education series	Prior to commencing treatment as part of treatment decision	Expert opinion or consensus statement	Also recommended to ask first if the person wants to be given information about prognosis.
Scott[9]	2016	Australia	What does the future hold? The need to engage in discussions around prognosis	Editorial/Opinion	1. At diagnosis of end-stage disease. 2. Significant decline in physical or mental function.	Expert opinion or consensus statement	
Smith et al[10]	2012	USA	Talking with patients about dying	Letter to Editor/Opinion	At first visit, and then at each transition	Expert opinion or consensus statement	
Villalobos et al[11]	2019	Germany	Communication along milestones in lung cancer patients with advanced disease	Review article	1. First encounter with disclosure of diagnosis, prognosis, and treatment options. 2. Follow up encounters resulting in remission or stable disease. 3. Disease progression. 4. Stopping disease modifying treatment and developing end-of-life consensus.	Expert opinion or consensus statement	

Authors	**Year**	**Region (Group)**	**Title**	**Design/Method**	**Timepoint**	**Type of Evidence**	**Comments**
Weir et al[12]	2011	USA	Hope is a verb: a course correction in delivering bad news	Commentary	1. Initial visit 2. Disease progression	Expert opinion or consensus statement	

Table 2) Studies reporting when doctors thought they should discuss prognosis with people with advanced cancer.

Authors	Year	Region (Group)	Title	Design/Method	Number of participants	Timepoint	Comments
Clayton et al[13]	2005	Australia (The University of Sydney)	Fostering Coping and Nurturing Hope When Discussing the Future with Terminally Ill Cancer Patients and Their Caregivers	Focus groups and individual interviews with patients with advanced cancer, caregivers and palliative care health professionals	22	When plans don't align with expected prognosis (e.g. planning a trip for a distant time in the future when their condition obviously was deteriorating).	
Clayton et al[14]	2005	Australia (The University of Sydney)	When and How to Initiate Discussion about Prognosis and End-of-Life Issues with Terminally Ill Patients	Focus groups and individual interviews with palliative care patients, carers and health professionals	22	1. Wait for patient/carer to raise the topic. 2. When the patient/family needs to know. 3. When the patient/family seems ready.	
Einstein et al[15]	2015	USA	Dying for Advice: Code status discussions between resident physicians and patients with advanced cancer - a national survey	Online case-based survey	375	When discussing code (resuscitation status)	47% were likely to discuss prognosis at this timepoint
Epstein et al[16]	2021	USA (Memorial Sloan Kettering Cancer Center, NY)	Development of the Oncolo-GIST ("Giving Information Strategically & Transparently") Intervention Manual for Oncologist Skills Training in Advanced Cancer Prognostic Information Communication	Online questionnaires	9	1. In the setting of worsened scan results 2. Patients who have, typically, less than a year of survival	

Gordon, Daugherty[17]	2003	USA	‘Hitting you over the head’: Oncologists' disclosure of prognosis to advanced cancer patients	Semi-structured interviews	14	1. When patients directly ask for the information and physicians determine they can emotionally 'handle' the information. 2. Worsening clinical situations: therapy is failing; patient is symptomatic, in pain, sick, having bad complications 3. When treatment decisions must be made 4. When recommending palliative care 5. When patients have a very short life expectancy and are declining in the hospital 6. When they feel compelled to give patients a 'reality check' when they make 'unrealistic' therapy requests or expectations	Oncologists reported that they determine when and how much information to provide patients according to the nature of patients’ responses to initial attempts to discuss prognosis.
Liu et al[18]	2014	USA	Physicians' propensity to discuss prognosis is associated with patients' awareness of prognosis for metastatic cancers	Prospective cohort study with patient and physician surveys	486	1.When the estimated prognosis is between 4 -6 months 2. When the patient first has symptoms 3. When there are no more non-palliative treatments 4. If the patient is hospitalized 5. If the patient or family bring it up	
Mori et al[19]	2015	Japan	A national survey to systematically identify factors associated with oncologists' attitudes towards end-of-life discussions: what determines timing of end-of-life discussions?	Nationwide survey of medical oncologists	479	1. At diagnosis of metastatic cancer 2. If the patient/family bring it up 3. When there are no more non-palliative treatments 3. When the patient first develops symptoms 4. If the patient is hospitalized	

Keating et al[20]	2010	USA	Physicians factors associated with discussions about end-of-life care	National survey of physicians caring for cancer patients	4074	1. When the estimated survival is between 4-6 months 2. When patient first develops symptoms 3. When there are no more non-palliative treatments 4. If the patient/family bring it up	65% of physicians would discuss prognosis "now" (i.e. expected survival 4-6 months), while 15% would have this discussion only if the patient/family brings it up. Younger age, male sex, having more terminally-ill patients and non-Asian ethnicity were more likely to discuss prognosis "now".
Ozeki-Hayashi et al[21]	2019	Japan	Beliefs held by breast surgeons that impact the treatment decision process for advanced breast cancer patients: A qualitative study	Semi-structured interviews	21	At diagnosis of recurrence/metastatic diagnosis, and at subsequent timepoints when treatment decisions were being made	Survey of surgeons who provide chemotherapy in Japan.
Schulman-Green et al[22]	2018	USA	Oncologists' and Patients' Perceptions of Initial, Intermediate, and Final Goals of Care Conversations	Semi-structured interviews	21	1. Early in the oncologist-patient relationship, some stated within the first three visits 2. Cancer progression/change in clinical picture 3. End of trajectory when no options left	

Vasista et al[23]	2020	Australia	Communicating prognostic information: what do oncologists think patients with incurable cancer should be told?	Survey	206	1. When estimated survival is less than 6 months 2. At first consultation	Nearly all respondents reported always or usually discussing expected survival time if a patient directly requested information about prognosis (98%), or if the doctor estimated survival time was less than 6 months (91%), but only half reported always or usually discussing expected survival time at the initial consultation.

Table 3) Studies reporting when people with advanced cancer thought they wanted to discuss prognosis.

Authors	Year	Region (Group)	Title	Design/Method	Number of participants	Timepoint	Comments
Clayton et al[14]	2005	Australia (The University of Sydney)	When and How to Initiate Discussion about Prognosis and End-of-Life Issues with Terminally Ill Patients	Focus groups and individual interviews with palliative care patients, carers and health professionals	19	1. Wait for patient/carer to raise the topic. 2. When referred to palliative care services. 3. When the patient/family needs to know. 4. When the patient/family seems ready.	
Dillon et al[24]	2021	USA	Evolving Goals of Care Discussions as Described in Interviews with Individuals With Advanced Cancer and Oncology and Palliative Care Teams	Interviews	25	Shortly after diagnosis, and when "things changed for the worse".	While most patients wanted general information about prognosis shortly after diagnosis, after that, many did not desire more detailed conversations until things changed for the worse. Most patients expressed a preference for as much information as possible about their diagnosis and prognosis, but receptivity varied by personal preference, and stage of disease/treatment.
Elkin et al[25]	2007	USA (Memorial Sloan-Kettering Cancer Center, NY)	Desire for Information and Involvement in Treatment Decisions: Elderly Cancer Patients' Preferences and Their Physicians' Perception	Structured interviews	73	At the time of their initial treatment discussion	44% (n = 32) patients reported they wanted to discuss prognosis at this timepoint. Preference for prognostic information was associated with being male, but not with age, education level or comorbidities.

Hagerty et al[26]	2004	Australia (The University of Sydney)	Cancer Patient Preferences for Communication of Prognosis in the Metastatic setting	Survey	126	When first diagnosed	59% wanted to be told how long they had to live when first diagnosed, and 53% wanted the specialist to "just tell them" this. 17% wanted the specialist to check first if they wanted to discuss expected survival, and 21% only wanted the information if they asked.
Kirk et al[27]	2004	Australia, Canada	What do patients receiving palliative care for cancer and their families want to be told?	Semi-structured interviews	37	As soon as or shortly after diagnosis	Most wanted to know shortly after diagnosis but some stated the information had been given too soon or when they hadn't asked for it. Participants sometimes verbalised ambiguity: they wanted to be told but they did not want to know.
Lippe et al[28]	2020	USA	Communicating Oncologic Prognosis with Empathy: A Pilot Study of a Novel Communication Guide	Sequential explanatory mixed-method pilot study	42	When their oncologist feels their prognosis has changed	
Mitchison et al[29]	2012	Australia	Prognostic communication preferences of migrant patients and their relatives	Interviews	73	1. If the patient directly asked for it 2. When the situation has become 'worse' and the patient was closer to death 3. When the doctor judges the patient is capable of 'handling' the information	Suggestions were made by patients and relatives that doctors should either obtain permission or make a capacity judgment before providing information.

Paiva et al[30]	2022	Brazil	Anticancer treatment goals and prognostic misperceptions among advanced cancer outpatients	Cross-sectional cohort study	90	At disease progression and/or clinical deterioration	Seventy-eight (88%) patients wanted their oncologist to inform them about their prognosis; only 35% (n = 31) received such information at their present appointment.
Parker et al[31]	2007	Australia	A systematic review of prognostic/end-of-life communication with adults in the advanced stages of a life-limiting illness: patient/caregiver preferences for the content, style, and timing of information	Systematic review	4 - 9105	Early in/shortly after diagnosis	Only 5 of 99 studies included in review addressed timing of prognosis. 4/5 of these studies were conducted in English-speaking/Northern European countries.
Petrillo et al[32]	2022	USA	Prognostic communication about lung cancer in the precision oncology era: A multiple-perspective qualitative study	Qualitative study	39	Disease progression	
Schulman-Green et al[22]	2018	USA	Oncologists’ and Patients’ Perceptions of Initial, Intermediate, and Final Goals of Care Conversations	Semi-structured interviews	39	1. Early in the oncologist-patient relationship 2. At "decision points" 3. End of trajectory when no options left	Intermediate decision points = test results, starting or failing treatment, when patients had high symptom burden, or with functional changes. Patients preferred delaying final conversations until it was unavoidable or ‘‘when they had enough’’.

Table 4) Studies reporting timepoints when discussions of prognosis occurred.

Authors	Year	Region (Group)	Title	Design/Method	Number of participants	Timepoint	Comments
Annadurai et al[33]	2021	USA	Impact of a Novel Goals-of-Care Communication Skills Coaching Intervention for Practicing Oncologists	Randomized controlled trial	22 oncologists	First visit after imaging to assess response to first-line treatment	All oncologists received a 1hr didactic training session by a trained VitalTalk facilitator which emphasised the importance of starting prognostic discussions at this timepoint.
Bernacki et al[34]	2015	USA	Effect of the Serious Illness Care Program in Outpatient Oncology	Cluster randomized clinical trial	278 patients 91 oncologists	When the physician "would not be surprised" if the patient were to die within 12 months	
Bickell et al[35]	2020	USA	Effects of a Communication Intervention Randomized Controlled Trial to Enable Goals-of-Care Discussions	Randomized controlled trial	Not available	Post-imaging visit to assess response to first-line cancer treatment	During study preparation, consensus from oncologists identified this timepoint as an opportune time to start Goal of Care discussions if none had occurred.
Bouleuc et al[36]	2021	France	A Question Prompt List for Advanced Cancer Patients Promoting Advance Care Planning	Multicentre, randomized controlled trial	142 patients	Second consultation with the palliative care team	Patients were invited to enrol at the time of their first consultation with the palliative care team and those allocated to the Question Prompt List arm received a booklet. Discussions occurred at the next consultation.
Bruera et al[37]	2003	USA (M.D. Anderson Cancer Center)	Breast Cancer Patient Perception of the Helpfulness of a Prompt Sheet Versus a General Information Sheet During Outpatient Consultation:	Randomized controlled trial	60 patients	First consultation with breast medical oncologist	

			A Randomized, Controlled Trial				
Butow et al[38]	2004	Australia (The University of Sydney)	Cancer Consultation Preparation Package: Changing Patients but Not Physicians Is Not Enough	Randomized controlled trial	164 patients	Initial consultation with medical or radiation oncologist	
Butow et al[39]	1994	Australia (The University of Sydney)	Patient participation in the cancer consultation: Evaluation of a question prompt sheet	Randomized controlled trial	142 patients	First consultation with a medical oncologist	
Chou et al[40]	2017	USA	Discussing prognosis and treatment goals with patients with advanced cancer	Qualitative analysis	26 patients 9 oncologists	First appointment to see a medical oncologist to discuss medical treatment (chemotherapy)	Described oncologists' language during discussions of prognosis in clinical interactions with African American patients diagnosed with cancer.
Clayton et al[41]	2007	Australia	Randomized Controlled Trial of a Prompt List to Help Advanced Cancer Patients and Their Caregivers to Ask Questions About Prognosis and End-of-Life Care	Randomized Controlled Trial	174 patients	Within three consultations from initial contact with a palliative care physician	A Question Prompt List and physician endorsement of its use assists terminally ill cancer patients and their caregivers to promote discussion about prognosis without creating patient anxiety or impairing satisfaction.
Danesh et al[42]	2014	USA	Informational Needs of Patients with Metastatic Breast Cancer: What Questions Do They Ask, and Are Physicians Answering Them?	Descriptive study	59 patients	At first consultation with breast medical oncologist	64% requested information about prognosis in their question lists provided to the oncologist. Physicians addressed questions about prognosis in 40% when asked in a very direct manner, and 29% when asked indirectly.

Dillon et al[24]	2021	USA	Evolving Goals of Care Discussions as Described in Interviews with Individuals With Advanced Cancer and Oncology and Palliative Care Teams	Qualitative analysis	25 patients 25 oncology/palliative care doctors	Upon diagnosis or metastasis, and when treatments stopped working or pain and symptoms became severe	While most patients wanted general information about prognosis shortly after diagnosis, after that, many did not desire more detailed conversations until things changed for the worse. Most patients expressed a preference for as much information as possible about their diagnosis and prognosis, but receptivity varied by personal preference, and stage of disease/treatment.
Epstein et al[43]	2016	USA (Memorial Solan Kettering Cancer Center, NY)	Discussions of Life Expectancy and Changes in Illness Understanding in Patients with Advanced Cancer	Interviews using standardised questionnaires Data drawn from Coping with Cancer II study - multi-institutional study across nine US cancer centres.	178 patients	At a visit with oncology provider to discuss scan results and evaluate disease progression in patients whose cancer was refractory to prior chemotherapy and expected to die within 6 months	18 (10%) discussed prognosis at this timepoint; 68 (38%) had only past discussions; 24 (13%) had both recent and past discussions; and 68 (38%) never had discussions of prognosis/life expectancy with the oncologist.
Epstein et al[44]	2017	USA	Effect of a Patient-Centred Communication Intervention on Oncologist-Patient Communication, Quality of Life, and Health Care Utilization in Advanced Cancer. The VOICE Randomized Clinical Trial	Randomized clinical trial	265 patients 38 oncologists	When the physician "would not be surprised" if the patient were to die within 12 months	A combined communication training intervention targeting physicians and patients with clinically meaningful increases in discussions of prognosis.
Gattellari[45]	2002	Australia	When the Treatment Goal is not Cure: Are Cancer Patients Equipped to Make Informed Decisions?	Prospective observational cohort study	118 patients 9 oncologists	First consultation with an oncologist	58% were given information about life expectancy.

Gramling et al[46]	2019	USA	End-of-Life Preferences, Length-of-Life Conversations, and Hospice Enrolment in Palliative Care: A direct observational cohort study among people with advanced cancer	Prospective observational cohort study	231 patients	Initial consultations with palliative care team	44% of initial conversations included at least one statement regarding expectations for the patient's length of life.
Greer et al[47]	2022	USA	Randomized trial of a palliative care intervention to improve end-of-life discussions in patients with metastatic breast cancer	Randomized control trial	120 patients	When the patient had clinical indicators of increased risk of death within 6 months	
Henselmans et al[48]	2017	Netherlands and USA	How long do I have? Observational study on communication about life expectancy with advanced cancer patients	Prospective observational study	41 patients 13 oncologists	1. Initial treatment planning consultations 2. Evaluative consultations that concerned disease progression and disease response.	Communication about life expectancy was identified in 19 of 62 (32%) consultations.
Ingersoll et al[49]	2019	USA	Racial/ethnic differences in prognosis communication during initial inpatient palliative care consultations among people with advanced cancer	Prospective observational study	231 patients 54 palliative care doctors	Initial consultation between palliative care clinicians and hospitalised people with advanced cancer	76% contained prognosis communication. Prognosis communication was less than half as likely to occur with Black or Latino patients compared to others.
Koedoot et al[50]	2004	Netherlands	The content and amount of information given my medical oncologists when telling patients with advanced cancer what their treatment options are: palliative chemotherapy and watchful waiting	Prospective observational study	95 patients	First consultation with the medical oncologist during which a decision about whether or not to start palliative chemotherapy was discussed	39% of medical oncologists explained prognosis.

Lippe et al[28]	2020	USA	Communicating Oncologic Prognosis with Empathy: A Pilot Study of a Novel Communication Guide	Sequential explanatory mixed-method pilot study	42 patients	An appointment with the oncology team at a time when a treatment decision needed to be made	
Malhotra et al[51]	2020	Singapore	Oncologist-patient-caregiver decision-making discussions in the context of advanced cancer in an Asian setting	Prospective observational study	100 patients 30 oncologists	When the patient asked questions related to their prognosis	
Mazer et al[52]	2014	USA	"Speaking-for" and "Speaking-as": Pseudo-surrogacy in physician patient-companion medical encounters about advanced cancer	Qualitative analysis of transcribed outpatient visits	49 patients 17 oncologists	When the oncologist "would not be surprised" if the patient died within 12 months	
Nahm et al[53]	2021	Australia	Using three scenarios to explain life expectancy in advanced cancer: attitudes of patients, family members, and other healthcare professionals	Single-arm phase 2 trial	222 patients 33 oncologists	When the patient indicated they wanted quantitative information (either spontaneously or when their oncologist offered to discuss prognosis)	
Nakajima et al[54]	2015	Japan	Does the Approach of Disclosing More Detailed Information of Cancer for the Terminally Ill Patients Improve the Quality of Communication Involving Patients, Families, and Medical Professionals?	Before-after study	91 patients	Final hospitalization to receive end-of-life care.	
Owusuaa et al[55]	2022	Netherlands	Discussing prognosis and the end of life with patients with advanced cancer or COPD: A qualitative study	Qualitative study	7 patients	1. When it became evident that their disease was incurable 2. When (curatively aimed) treatment had to be stopped due to disease progression	
Paiva et al[30]	2022	Brazil	Anticancer treatment goals and prognostic misperceptions among	Cross-sectional cohort study	90 patients 28 oncologists	1. At disease progression 2. Clinical deterioration	Seventy-eight (88%) patients wanted their oncologist to inform them

			advanced cancer outpatients				about their prognosis; only 35% (n = 31) received such information at their present appointment.
Rodriguez et al[56]	2008	Australia	‘It’s going to shorten your life’: framing of oncologist– patient communication about prognosis	Qualitative study	29 patients	First outpatient consultation with oncologist	
Rumpold et al[57]	2015	Austria	Information preferences regarding cure rates and prognosis of Austrian patients with advanced lung cancer	Semi-structured interviews and questionnaires	50 patients	First consultation with radiation oncologist	
Singh et al[58]	2017	USA	Characterizing the nature of scan results discussions: Insights into why patients misunderstand their prognosis	Qualitative substudy/secondary analysis of a randomised controlled trial (RCT)	11 oncologists	Post-imaging visit	Audio recordings of 64/128 encounters from main RCT involved scan results. Only 4 encounters involved prognosis talk, of which 3 were initiated by patients/caregivers.
Thomas et al[59]	2019	USA	Communication differences between oncologists and palliative care clinicians: A qualitative analysis of early, integrated palliative care in patients with advanced cancer.	Qualitative study	19 patients	Post-progression visit	Audio recorded two outpatient clinic visits with medical oncology and two outpatient clinic visits with palliative care immediately after patients’ first and second cancer progressions.
Umezawa et al[60]	2015	Japan	Preferences of advanced cancer patients for communication on anticancer treatment cessation and the transition to palliative care	Questionnaire	106 patients	When anticancer treatment had stopped working or was being ceased	
van der Velden et al[61]	2021	Netherlands	Communication about prognosis during patient-initiated second opinion	Qualitative study	60 patients 21 oncologists	When second opinion was sought	

			consultations in advanced cancer care: An observational qualitative analysis				
van Vliet et al[62]	2019	Netherlands	The use of expectancy and empathy when communicating with patients with advanced breast cancer; An observational study of clinician-patient consultations	Qualitative study	45 patients 12 oncologists	1. First consultation with medical oncologist 2. Follow up after significant results	
Walczak et al[63]	2015	Australia	A qualitative analysis of responses to a question prompt list (QPL) and prognosis and end-of-life care discussion prompts delivered in a communication support program	Qualitative study	31 patients	Prognosis estimated to be <12 months	When presented with QPL questions and prompts to discuss life expectancy, almost half of the patients explicitly indicated they did not wish to discuss this during consultations or receive estimates (n = 14 clearly no interest, 6 clear interest, 11 unclear about interest).
Yeh et al[64]	2014	USA	Using a question prompt list as a communication aid in advanced cancer care	Questionnaire	30 patients	Initial consultation with oncologist	

References

1. Guidelines A: Patient-Clinician Communication: ASCO Consensus Guideline. 2017
2. Childers JW, Back AL, Tulsky JA, et al: REMAP: A Framework for Goals of Care Conversations. Journal of oncology practice/American Society of Clinical Oncology 13:e844-e850, 2017
3. Chu C, Anderson R, White N, et al: Prognosticating for Adult Patients With Advanced Incurable Cancer: a Needed Oncologist Skill. Curr Treat Options Oncol 21:5, 2020

4. Clayton JM, Hancock K, Butow P, et al: Clinical practice guidelines for communicating prognosis and end-of-life issues with adults in the advanced stages of a life-limiting illness, and their caregivers. 2007

5. Initiative NBCCaNCC: Clinical practice guidelines for the psychosocial care of adults with cancer. 2003

6. Ragland J, Thakore K, Anderson WG: Addressing Prognosis in Serious Illness. Hospital Medicine Clinics 6:359-373, 2017

7. Rich BA: Prognostication in Clinical Medicne: Prophecy or Professional Responsibility? Journal of Legal Medicine 23:297-358, 2002

8. Rodin G MJ, Zimmerman C, Mayer C, Howell D, Katz M, Sussman J, McNair S, Brouwers M.: Provider-Patient Communication: A Report of Evidence-based Recommendations to Guide Practice in Cancer. 2011

9. Scott IA: What does the future hold? The need to engage in discussions around prognosis. Intern Med J 46:873-5, 2016

10. Smith TJ, Longo DL: Talking with patients about dying. New England Journal of Medicine 367:1651-1652, 2012

11. Villalobos M, Siegle A, Hagelskamp L, et al: Communication along milestones in lung cancer patients with advanced disease. Oncology Research and Treatment 42:41-46, 2019

12. Weir AB, Brint JM: Hope is a verb: a course correction in delivering bad news. American Journal of Hospice & Palliative Medicine 28:525-7, 2011

13. Clayton JM, Butow PN, Arnold RM, et al: Fostering coping and nurturing hope when discussing the future with terminally ill cancer patients and their caregivers. Cancer 103:1965-1975, 2005

14. Clayton JM, Butow PN, Tattersall MH: When and how to initiate discussion about prognosis and end-of-life issues with terminally ill patients. J Pain Symptom Manage 30:132-44, 2005

15. Einstein DJ, Einstein KL, Mathew P: Dying for Advice: Code Status Discussions between Resident Physicians and Patients with Advanced Cancer--A National Survey. Journal of Palliative Medicine 18:535-41, 2015

16. Epstein AS, Kakarala SE, Reyna VF, et al: Development of the Oncolo-GIST ("Giving Information Strategically & Transparently") Intervention Manual for Oncologist Skills Training in Advanced Cancer Prognostic Information Communication. Journal of Pain & Symptom Management 62:10-19.e4, 2021

17. Gordon EJ, Daugherty CK: 'Hitting you over the head': oncologists' disclosure of prognosis to advanced cancer patients. Bioethics 17:142-68, 2003

18. Liu MPH, Landrum MB, Weeks JC, et al: Physicians' propensity to discuss prognosis on patients' prognosis awareness for metastatic lung or colorectal cancer. Journal of General Internal Medicine 1):S147-S148, 2013

19. Mori M, Shimizu C, Ogawa A, et al: A National Survey to Systematically Identify Factors Associated With Oncologists' Attitudes Toward End-of-Life Discussions: What Determines Timing of End-of-Life Discussions? Oncologist 20:1304-11, 2015

20. Keating NL, Landrum MB, Rogers SO, Jr., et al: Physician factors associated with discussions about end-of-life care. Cancer 116:998-1006, 2010

21. Ozeki-Hayashi R, Fujita M, Tsuchiya A, et al: Beliefs held by breast surgeons that impact the treatment decision process for advanced breast cancer patients: a qualitative study. Breast Cancer Targets and Therap 11:221-229, 2019

22. Schulman-Green D, Smith CB, Lin JJ, et al: Oncologists' and Patients' Perceptions of Initial, Intermediate, and Final Goals of Care Conversations. Journal of Pain & Symptom Management 55:890-896, 2018

23. Vasista A, Stockler MR, Martin A, et al: Communicating prognostic information: what do oncologists think patients with incurable cancer should be told? Intern Med J 50:1492-1499, 2020

24. Dillon EC, Meehan A, Nasrallah C, et al: Evolving Goals of Care Discussions as Described in Interviews With Individuals With Advanced Cancer and Oncology and Palliative Care Teams. American Journal of Hospice & Palliative Medicine 38:785-793, 2021

25. Elkin EB, Kim SH, Casper ES, et al: Desire for information and involvement in treatment decisions: elderly cancer patients' preferences and their physicians' perceptions. Journal of Clinical Oncology 25:5275-5280, 2007

26. Hagerty RG, Butow PN, Ellis PA, et al: Cancer patient preferences for communication of prognosis in the metastatic setting. J Clin Oncol 22:1721-30, 2004

27. Kirk P, Kirk I, Kristjanson LJ: What do patients receiving palliative care for cancer and their families want to be told? A Canadian and Australian qualitative study. BMJ 328:1343, 2004

28. Lippe M, Farya P, Jennifer M, et al: Communicating Oncologic Prognosis With Empathy: A Pilot Study of a Novel Communication Guide. American Journal of Hospice & Palliative Medicine 37:1029-1036, 2020

29. Mitchison D, Butow P, Sze M, et al: Prognostic communication preferences of migrant patients and their relatives. Psycho-Oncology 21:496-504, 2012

30. Paiva CE, Teixeira AC, Minto Lourenco B, et al: Anticancer Treatment Goals and Prognostic Misperceptions among Advanced Cancer Outpatients. Int J Environ Res Public Health 19, 2022

31. Parker SM, Clayton JM, Hancock K, et al: A systematic review of prognostic/end-of-life communication with adults in the advanced stages of a life-limiting illness: patient/caregiver preferences for the content, style, and timing of information. J Pain Symptom Manage 34:81-93, 2007

32. Petrillo LA, Shimer SE, Zhou AZ, et al: Prognostic communication about lung cancer in the precision oncology era: A multiple-perspective qualitative study. Cancer 128:3120-3128, 2022

33. Annadurai V, Smith CB, Bickell N, et al: Impact of a Novel Goals-of-Care Communication Skills Coaching Intervention for Practicing Oncologists. Journal of Palliative Medicine 24:838-845, 2021

34. Bernacki R, Paladino J, Neville BA, et al: Effect of the Serious Illness Care Program in Outpatient Oncology: A Cluster Randomized Clinical Trial. JAMA Intern Med 179:751-759, 2019

35. Bickell NA, Back AL, Adelson K, et al: Effects of a Communication Intervention Randomized Controlled Trial to Enable Goals-of-Care Discussions. JCO Oncology Practice 16:e1015-e1028, 2020

36. Bouleuc C, Savignoni A, Chevrier M, et al: A Question Prompt List for Advanced Cancer Patients Promoting Advance Care Planning: A French Randomized Trial. Journal of Pain & Symptom Management 61:331-341.e8, 2021

37. Bruera E, Sweeney C, Willey J, et al: Breast cancer patient perception of the helpfulness of a prompt sheet versus a general information sheet during outpatient consultation: a randomized, controlled trial. J Pain Symptom Manage 25:412-9, 2003

38. Butow P, Devine R, Boyer M, et al: Cancer consultation preparation package: changing patients but not physicians is not enough. J Clin Oncol 22:4401-9, 2004

39. Butow PN, Dunn SM, Tattersall MH, et al: Patient participation in the cancer consultation: evaluation of a question prompt sheet. Ann Oncol 5:199-204, 1994

40. Chou WS, Hamel LM, Thai CL, et al: Discussing prognosis and treatment goals with patients with advanced cancer: A qualitative analysis of oncologists' language. Health Expectations 20:1073-1080, 2017

41. Clayton JM, Butow PN, Tattersall MH, et al: Randomized controlled trial of a prompt list to help advanced cancer patients and their caregivers to ask questions about prognosis and end-of-life care. Journal of Clinical Oncology 25:715-23, 2007

42. Danesh M, Belkora J, Volz S, et al: Informational needs of patients with metastatic breast cancer: What questions do they ask, and are physicians answering them? Journal of Cancer Education 29:175-180, 2014

43. Epstein AS, Prigerson HG, O'Reilly EM, et al: Discussions of Life Expectancy and Changes in Illness Understanding in Patients With Advanced Cancer. J Clin Oncol 34:2398-403, 2016

44. Epstein RM, Duberstein PR, Fenton JJ, et al: Effect of a Patient-Centered Communication Intervention on Oncologist-Patient Communication, Quality of Life, and Health Care Utilization in Advanced Cancer: The VOICE Randomized Clinical Trial. JAMA Oncology 3:92-100, 2017

45. Gattellari M, Voigt KJ, Butow PN, et al: When the treatment goal is not cure: are cancer patients equipped to make informed decisions? J Clin Oncol 20:503-13, 2002

46. Gramling R, Ingersoll LT, Anderson W, et al: End-of-life preferences, length-of-life conversations, and hospice enrollment in palliative care: A direct observation cohort study among people with advanced cancer. Journal of Palliative Medicine 22:152-156, 2019

47. Greer JA, Moy B, El-Jawahri A, et al: Randomized Trial of a Palliative Care Intervention to Improve End-of-Life Care Discussions in Patients With Metastatic Breast Cancer. J Natl Compr Canc Netw 20:136-143, 2022

48. Henselmans I, Smets EMA, Han PKJ, et al: How long do I have? Observational study on communication about life expectancy with advanced cancer patients. Patient Educ Couns 100:1820-1827, 2017

49. Ingersoll LT, Alexander SC, Priest J, et al: Racial/ethnic differences in prognosis communication during initial inpatient palliative care consultations among people with advanced cancer. Patient Education & Counseling 102:1098-1103, 2019

50. Koedoot CG, Oort FJ, de Haan RJ, et al: The content and amount of information given by medical oncologists when telling patients with advanced cancer what their treatment options are. palliative chemotherapy and watchful-waiting. European Journal of Cancer 40:225-35, 2004

51. Malhotra C, Kanesvaran R, Barr Kumarakulasinghe N, et al: Oncologist-patient-caregiver decision-making discussions in the context of advanced cancer in an Asian setting. Health Expectations 23:220-228, 2020

52. Mazer BL, Cameron RA, DeLuca JM, et al: "Speaking-for" and "speaking-as": pseudo-surrogacy in physician-patient-companion medical encounters about advanced cancer. Patient Education & Counseling 96:36-42, 2014

53. Nahm SH, Stockler M, Martin AJ, et al: Using three scenarios to explain life expectancy in advanced cancer: attitudes of patients, family members, and other healthcare professionals. Unpublished work, 2021

54. Nakajima N, Kusumoto K, Onishi H, et al: Does the approach of disclosing more detailed information of cancer for the terminally ill patients improve the quality of communication involving patients, families, and medical professionals? American Journal of Hospice & Palliative Medicine 32:776-782, 2015

55. Owusuaa C, van Lent LGG, van 't Spijker A, et al: Discussing prognosis and the end of life with patients with advanced cancer or COPD: A qualitative study. PLoS One 17:e0274201, 2022

56. Rodriguez KL, Gambino FJ, Butow PN, et al: 'It's going to shorten your life': framing of oncologist-patient communication about prognosis. Psycho-Oncology 17:219-25, 2008

57. Rumpold T, Lutgendorf-Caucig C, Jagsch R, et al: Information preferences regarding cure rates and prognosis of Austrian patients with advanced lung cancer. Strahlentherapie und Onkologie 191(7):549-556, 2015

58. Singh S, Cortez D, Maynard D, et al: Characterizing the Nature of Scan Results Discussions: Insights Into Why Patients Misunderstand Their Prognosis. Journal of oncology practice/American Society of Clinical Oncology 13:e231-e239, 2017

59. Thomas TH, Jackson VA, Carlson H, et al: Communication Differences between Oncologists and Palliative Care Clinicians: A Qualitative Analysis of Early, Integrated Palliative Care in Patients with Advanced Cancer. Journal of Palliative Medicine 22:41-49, 2019

60. Umezawa S, Fujimori M, Matsushima E, et al: Preferences of advanced cancer patients for communication on anticancer treatment cessation and the transition to palliative care. Cancer 121:4240-9, 2015

61. van der Velden NCA, van der Kleij MBA, Lehmann V, et al: Communication about Prognosis during Patient-Initiated Second Opinion Consultations in Advanced Cancer Care: An Observational Qualitative Analysis. International Journal of Environmental Research & Public Health [Electronic Resource] 18:26, 2021

62. van Vliet LM, Francke AL, Meijers MC, et al: The Use of Expectancy and Empathy When Communicating With Patients With Advanced Breast Cancer; an Observational Study of Clinician-Patient Consultations. Frontiers in psychiatry Frontiers Research Foundation 10:464, 2019

63. Walczak A, Henselmans I, Tattersall MH, et al: A qualitative analysis of responses to a question prompt list and prognosis and end-of-life care discussion prompts delivered in a communication support program. Psycho-Oncology 24:287-93, 2015

64. Yeh JC, Cheng MJ, Chung CH, et al: Using a question prompt list as a communication aid in advanced cancer care. Journal of oncology practice/American Society of Clinical Oncology 10:e137-41, 2014

8 USING THREE SCENARIOS TO EXPLAIN LIFE EXPECTANCY IN ADVANCED CANCER: ATTITUDES OF PATIENTS, FAMILY MEMBERS, AND OTHER HEALTHCARE PROFESSIONALS

Overview

Thinking and talking about prognosis using worse-case, typical, and best-case scenarios for survival is more meaningful for people with advanced cancer than providing a single-point estimate of expected survival time. It is important to consider how this method of communicating prognosis could be implemented into routine clinical practice. A simple web-based tool was developed to calculate ranges for the three scenarios for survival based on the oncologist's estimate of expected survival time. This published manuscript evaluates the satisfaction of patients with advanced cancer, and their oncologists, to using three scenarios for survival time to explain prognosis, and evaluates the accuracy of the oncologists' estimates.

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Contribution of authors

SHN contributed to the formal analysis, validation, writing and revision of the manuscript. MRS contributed to the conceptualisation, data curation, methodology, and revision of the manuscript.

AJM contributed to formal analysis, validation, and revision of the manuscript.

PG, PF, RZ, GH, contributed to data curation and revision of the manuscript.

MT contributed to the conceptualisation and data curation of the manuscript.

BEK contributed to the conceptualisation, data curation, formal analysis, methodology, and revision of the manuscript.

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ORIGINAL ARTICLE

Using three scenarios to explain life expectancy in advanced cancer: attitudes of patients, family members, and other healthcare professionals

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Abstract

Aim To evaluate a web-based tool for estimating and explaining three scenarios for expected survival time to people with advanced cancer (patients), their family members (FMs), and other healthcare professionals (HCPs).

Methods Thirty-three oncologists estimated the "median survival of a group of similar patients" for patients seeking quantitative prognostic information. The web-based tool generated worst-case, most likely, and best-case scenarios for survival based on the oncologist's estimate. Oncologists presented the scenarios to each patient and provided a printed summary to patients, FMs, and HCPs. Attitudes to the information were assessed by questionnaires. Observed survival for each patient was compared with the oncologist's estimated survival and the three scenarios.

Results Prognosis was discussed with 222 patients: median age 67 years; 61% male; most common primary sites pancreas 15%, non-small-cell lung 15%, and colorectal 12%. The median (range) for observed survival times was 9 months (0.5–43) and for oncologist's estimated survival times was 12 months (2–96). Ninety-one percent of patients, 91% of FMs, and 84% of HCPs agreed that it was helpful having life expectancy explained as three scenarios. The majority (77%) of patients judged the information presented about their life expectancy to be the same or better than they had expected before the consultation. The survival estimates met a priori criteria for calibration, precision, and accuracy.

Conclusions Patients, FMs, and HCPs found it helpful to receive personalized prognostic information formatted as three scenarios for survival. It was feasible, acceptable, and safe to use a web-based resource to do this.

Keywords Prognosis · Prognostic discussions · Life expectancy · Doctor-patient communication · Scenarios for survival · Advanced cancer

Introduction

Conversations about prognosis are important for people affected by incurable cancer and help patients and their families make decisions about treatment, plans for the future, and choices about end-of-life care. Patients who have a good understanding of their life expectancy are less likely to choose futile treatments and aggressive medical interventions toward the end of life; are more likely to accept palliative care services earlier; have better quality of life at the end of life; and have surviving carers with better quality of life during the bereavement period [1–3].

Despite this, many oncologists provide patients with minimal information about life expectancy or avoid such discussions altogether [4–6]. Reported reasons for this include fear of upsetting patients, fear of providing inaccurate information, and insufficient training in

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This is in tribute to Prof Martin H.N. Tattersall 1941-2020 for his pioneering role in medical oncology and research to enhance patient-doctor communication and shared decision-making.

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prognostication [7, 8]. As a consequence, many patients do not fully understand their situation and goals of treatment. Conversations about prognosis are often deferred until the last months of life, robbing patients and families the opportunity to plan and discuss their wishes while they are well. When conversations about prognosis do occur, they are rarely documented in the patient's medical record or letters to other healthcare professionals [9, 10]. This makes it difficult for all healthcare professionals involved in the patient's care to know what has been discussed and may result in patients receiving inconsistent information.

Most patients want some information about their expected survival time, and many want information about specific scenarios, for example, the longest survival with treatment, average survival, and shortest survival without treatment [11–13]. We previously surveyed 505 people with a cancer experience about their preferred format for presenting information on expected survival time to a hypothetical patient with advanced cancer and found that 88% preferred three scenarios for survival (worst-case, most likely, and best-case), and only 5% preferred a single estimate of the median survival time [14].

In previous work, we showed that certain percentiles of an overall survival (OS) curve provide a useful basis for estimating three scenarios for survival [15]. For example, the 90th percentile, the time when 90% of people are still alive and 10% have died, can approximate the worst-case scenario (shortest 10% of survival times) and the 10th percentile, the time when 10% of people are still alive and 90% have died, can approximate the best-case scenario (longest 10% of survival times). We have also shown that simple multiples (0.25, 0.5, 2, and 3) of an OS curve's median can be used to estimate its percentiles [15–23]. To illustrate, the 90th percentile (representing the upper bound of the worst-case scenario) is approximately one-quarter of the median OS; the 75th percentile (lower bound of the most likely scenario) is approximately half the median OS; the 25th percentile (upper bound of the most likely scenario) is approximately double the median OS; and the 10 percentile (lower bound of the best-case scenario) is approximately three times the median OS. For example, if the median OS is 12 months then the worst-case scenario is less than 3 months (0.25 x 12), the most likely scenario is 6 to 24 months (0.5 to 2 x 12), and the best-case scenario is 36 months or longer (3 x 12).

Using these simple rules of thumb, we developed a web-based tool (iTool) to help oncologists estimate and explain individualized scenarios for survival to patients with incurable cancer seeking quantitative information about their prognosis. With consumer input, we developed a one-page summary to help explain this information to patients, family members or carers (FMs), and other healthcare professionals (HCPs).

The aim of this study was to evaluate the iTool for estimating and explaining personalized information about life expectancy in people with advanced cancer, their medical oncologists, FMs, and other HCPs.

Patients and methods

We conducted a multi-site, single-arm, phase 2 trial. The target population was adults with incurable cancer attending the clinic of a participating medical oncologist and indicating that they wanted quantitative information about their prognosis (either spontaneously or when their oncologist offered to discuss prognosis). FMs were eligible if present during the consultation when life expectancy was discussed. HCPs involved in a participating patient's care and receiving letters from the oncologist as standard of care (e.g., general practitioner, referring surgeon, radiation oncologist) were also invited to participate.

Participating oncologists were provided with access to the iTool for the duration of the study (available at https://ctc.usyd.edu.au/3scenarios/). When a patient wanted information on their expected survival time, we asked the oncologist to estimate the patient's life expectancy defined as "the median survival of a group of similar patients" based on studies of patients in the same situation, prognostic tools, or their personal clinical experience. The iTool calculated ranges for the three scenarios using simple multiples of the oncologist's estimate based on our previous work [16]. This information was printed for the patient and FMs to take home (Supplementary Text 1), and copies were placed in the patient's medical record and sent to HCPs with the oncologist's standard letter.

Following the consultation, the oncologist entered the patient demographics and cancer details and completed a questionnaire about the perceived usefulness of the iTool for that patient, including if it was helpful, easy to use, stressful, or lengthened the consultation (Supplementary Text 2). After providing written, informed consent, patients completed a questionnaire about the prognostic information they received (Supplementary Text 3). FMs and HCPs completed similar questionnaires regarding the information they received (Supplementary Text 4 and 5). The study was approved by the health research ethics committee at all participating sites.

The primary measure of effect was the proportion of patients who agreed or strongly agreed that "having my life expectancy explained this way was helpful." Other measures of effect included the proportions of patients who agreed or strongly agreed that "Having my life expectancy explained this way": made sense, gave hope, or made them feel worried or anxious. Patients were asked if the information about their life expectancy was better, worse, or about the same as they had thought before the consultation. Patients were also asked if they agreed it was helpful to be told each of the scenarios (best-case, worst-case, and most likely).

Patients also completed three other questionnaires:

1. The Short State Trait Anxiety Inventory (STAI), a six-item short form of the state scale of the Spielberger STAI [24]
2. The Herth Hope Index, a 12-item adapted version of the Herth Hope Scale with three subscales measuring temporality and future, positive readiness and expectancy, and interconnectedness [25]
3. The Life Orientation Test Revised (LOTR), a 10-item scale measuring levels of optimism [26]

A higher score indicated greater levels of either anxiety, hope, or optimism with each scale, respectively.

At the end of the study, participating oncologists completed a second questionnaire to determine their attitudes to using the iTool when discussing prognosis with their patients (Supplementary Text 6). Oncologists were sent emails asking them to update the survival status of each patient at time points corresponding to simple multiples of their estimated median survival time: 0.25, 0.5, 1.0, 2.0, 3.3, and 5.

For comparability with previous studies, we defined a point estimate of life expectancy (estimated median survival time of a group of similar patients) as precise if it was within 0.67 to 1.33 times the observed survival time [15] and hypothesized that approximately 20% to 30% of estimates would meet this definition. For each patient, we calculated the ratio of the observed survival time (OST) to their oncologist's estimated survival time (EST) and used the Kaplan–Meier distribution of the ratio (OST/EST) to account for censored observations (patients still alive at their last follow-up). We expected oncologists' EST to be well-calibrated (i.e., approximately equal proportions (50%) being longer than the observed survival time ($\mathrm{OST}/\mathrm{EST} < 1$) and shorter than the observed survival time ($\mathrm{OST}/\mathrm{EST} > 1$)).

Based on the broad concept of accuracy used in our previous work, we also hypothesized that approximately:

Five to ten percent of patients would die within one-quarter of their oncologists' estimate ($\mathrm{OST}/\mathrm{EST} \leq 0.25$).

Fifty percent of patients would have a survival time within half to double their oncologists' estimate ($0.5 \leq \mathrm{OST}/\mathrm{EST} \leq 2$).

Ten percent of patients would live beyond three times their oncologist's estimate ($\mathrm{OST}/\mathrm{EST} \geq 3$) [20].

A sample of size of at least 70 patients was calculated to provide > 95% power to distinguish the observed proportion of patients finding the iTool helpful from hypothetical true proportions of 80% or more versus 60% or less with an allowance of 20% for incomplete data. Associations between baseline characteristics and responses to questions about the prognostic information were assessed with logistic regression. Statistical analyses were done using R version 4.0.4.

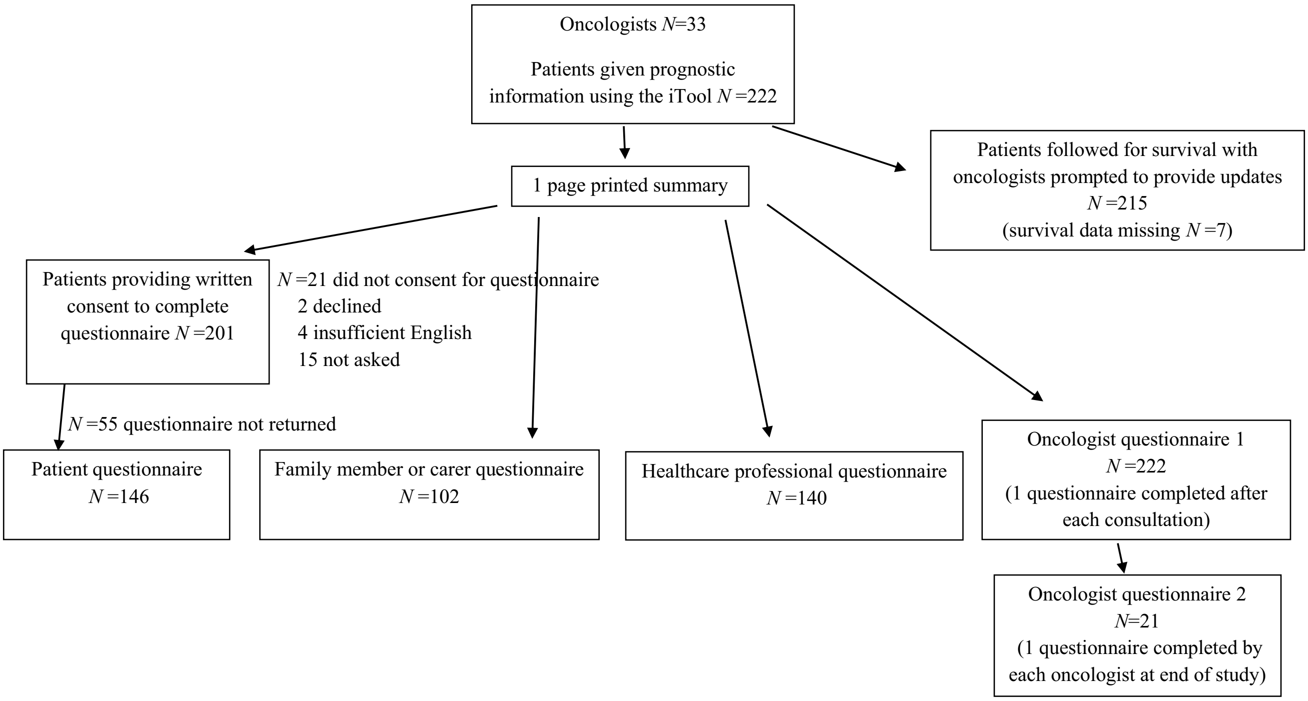


Fig. 1 Consort diagram

Results

Between August 2012 and May 2016, 33 oncologists used the iTool to explain life expectancy to 222 patients (Fig. 1), of whom 201 consented to participate in the evaluation part of the study and 146 returned completed questionnaires (response rate 73%). Completed questionnaires were returned by 102 FMs and 140 HCPs. All 33 participating oncologists completed a questionnaire following each patient consultation (oncologist questionnaire 1), and 21 of the 33 oncologists completed a questionnaire at the end of the study (oncologist questionnaire 2).

The baseline characteristics of participating patients are summarized in Table 1. The median age was 67 years, and the majority (61%) were male. For most patients, the iTool was used more than 8 weeks after their diagnosis of incurable cancer, and at a third or subsequent consultation. The median estimated survival time was 12 months (range 2 to 96 months).

Table 1 Patient baseline characteristics ($N=222$)

Characteristic	N (%)[a]
Median age, years (range)	67 (27–90)
Sex, male	137 (61)
Education *(available for 146 patients who completed the patient questionnaire)*	
Year 10 or less	
High school/post high school qualification	58 (40)
Unknown	81(55)
	7 (5)
Spoken English level	
Fluent/Native	211 (95)
Adequate	7 (3)
Poor	4 (2)
ECOG performance status	
0	46 (21)
1	130 (59)
2	43 (19)
3	3 (1)
Cancer type	
Pancreatic	34 (15)
Non-small cell lung cancer	34 (15)
Colorectal	26 (12)
Prostate	25 (11)
Breast	19 (9)
Kidney	17 (8)
Other	67 (30)
Time from diagnosis of incurable cancer	
≤ 8 weeks	99 (45)
> 8 weeks	123 (55)
Consultation number	
Initial	65 (29)
Second	26 (12)
Third or subsequent	131 (59)
Estimated survival time	
< 3 months	3 (1)
3–< 9 months	81 (36)
9–15 months	72 (32)
> 15 months	66 (30)

[a] Unless otherwise specified

The vast majority (91%) of patients agreed or strongly agreed that the survival information presented by the iTool was helpful (Table 2). More patients preferred to hear each of the three scenarios (worst-case 81%, most likely 86%, and best-case 92%) than to be told the estimated median survival (78%). Seventy-seven percent of patients responded that the information about their prognosis explained as three scenarios for survival was about the same as, or better than, they expected before discussing it with their oncologist.

The attitudes of oncologists, HCPs, and FMs to having the information estimated and explained this way are summarized in Table 3. The median number of times each oncologist used the iTool was four (range 1 to 50). In 96% of consultations, oncologists agreed or strongly agreed that explaining life expectancy as three scenarios was helpful. There were very few consultations where oncologists agreed or strongly agreed that using the iTool significantly lengthened the consultation (9%). The majority of HCPs agreed or strongly agreed that having the information presented this way would be helpful for themselves (84%) and their patients (73%) and was more informative than the prognostic information they usually received (88%).

Associations between patients' baseline characteristics and agreeing or strongly agreeing that presenting the life expectancy information as three scenarios was helpful are summarized in Table 4. Higher scores for hope were associated with a higher likelihood of agreeing that the information was helpful (OR 5.7, 95% CI 1.2 to 27, $p=0.03$).

The median observed survival time was 9 months (range 0.5 to 43). Oncologists' estimates were well-calibrated, with 54% (95% CI 46 to 61) of patients living longer than their EST and 46% (95% CI 39 to 54) living shorter than their EST. As hypothesized, 27% (95% CI 20 to 34) of oncologists' point estimates of life expectancy met our arbitrary criterion for precision (within 0.67–1.33 times the OST). The proportions of patients with OSTs falling within prespecified ranges for the three scenarios corresponded closely with our a priori hypotheses: 7% (95% CI 3 to 10) of patients died within their estimated worst-case scenario; 51% (95% CI 43 to 59) lived within their estimated most likely scenario; and 13% (95% CI 8 to 23) lived within their estimated best-case scenario. Figure 2 shows the distribution of the OST/EST ratio for each patient.

At the end of the study, 81% (17/21) of responding oncologists agreed or strongly agreed that the iTool made discussing prognosis easier; 52% (11/21) agreed or strongly agreed that it made them more prepared to discuss prognosis; and

Table 2 Attitudes of patients to receiving personalized scenarios for survival using the web-based tool ($N = 146$)

Proportion who agree[a] with each statement	N (%)	95% CI
Having my life expectancy explained this way:		
Is helpful	126/138 (91)	85–95
Makes sense	136/142 (96)	91–98
Helps them make plans	126/144 (88)	81–92
Gives them hope	78/140 (56)	47–64
Reassures them	89/139 (64)	56–72
Improves their understanding	122/138 (88)	82–93
Makes them feel worried or anxious	41/138 (30)	23–38
Upsets them	58/140 (41)	34–50
Would be useful for their family members	107/142 (75)	68–82
Would be useful for their family doctor	127/141 (90)	84–94
Being told the following scenario was helpful:		
Best-case	131/142 (92)	87–96
Most likely	122/142 (86)	79–91
Worst-case	115/142 (81)	74–87
Being told the time half a group of people would live longer or shorter than was helpful	110/141 (78)	70–84
Preference for scenario to be told about first:		
Best-case	28/143 (20)	14–27
Most likely	49/143 (34)	27–43
Worst-case	14/143 (10)	6–16
Order is not important to me	52/143 (36)	29–45
How life expectancy information compared to expectations		
Better than expected	44/142 (31)	24–39
About the same as expected	66/142 (46)	38–55
Worse than expected	32/142 (23)	16–30
It was helpful for me to receive a printed summary of this information	127/140 (91)	85–94

[a] Includes agree and strongly agree responses

86% (18/21) agreed or strongly agreed that they would like to continue using the iTool beyond the study.

Discussion

The majority of responding patients, FMs, and HCPs found it helpful to receive personalized scenarios for survival generated by the iTool. While 40% of patients found the life expectancy information upsetting, the majority of patients and FMs still found it helpful to be told each of the three scenarios, including the worst-case scenario. Most responding patients (77%) reported that the life expectancy information they received was the same or better than they had expected before the consultation. A higher score for hope was associated with higher likelihood of responding that the survival information was helpful. As hypothesized, oncologists' point estimates of life expectancy for individual patients were well-calibrated but imprecise. However, scenarios for survival time calculated by the iTool using simple multiples of the oncologists' estimates corresponded closely with our a priori estimates: approximately 10% of patients died within one quarter of their EST, approximately 50% lived within half to double their EST, and approximately 10% lived longer than three times their EST [16].

These favorable attitudes to using the iTool were consistent with our previous findings that people with cancer prefer to receive prognostic information formatted as three scenarios (worst-case, most-likely, best-case) rather than a point estimate of the median survival time [14]. Our previous work involved a hypothetical patient so it was reassuring to find similar results when real patients were presented with a personalized estimate of their own prognosis in this format. Participating oncologists reported that the iTool was easy to use and made them better prepared to discuss prognosis.

Our data indicate that the iTool could help overcome commonly cited barriers to discussions about prognosis including: lack of tools, lack of time, not knowing what to say, and fear of upsetting patients and family members [8,

Table 3 Attitudes of family members and carers, healthcare professionals, and oncologists to the information provided by the web-based tool

	N (%)	95% CI
Family members and carers (*N* = 102)		
Proportion who agree[a] that the survival information presented by the iTool		
Is helpful	92/101 (91)	84–95
Is reassuring	51/100 (51)	41–61
Makes sense	97/101 (96)	90–98
Helps them make plans	71/99 (72)	62–80
Gives them hope	56/101 (55)	46–65
Improves their understanding	85/100 (85)	77–91
Is too complicated	9/99 (9)	5–16
Is upsetting	47/98 (48)	38–58
Healthcare professionals (*N* = 140)		
Proportion who agree[a] that the survival information presented by the iTool		
Is helpful for themselves	115/137 (84)	77–89
Is helpful for patients	98/134 (73)	65–80
Is reassuring for patients	37/131 (28)	21–37
Is distressing for patients	51/135 (38)	30–46
Makes sense	122/135 (90)	84–94
Will help them make management and treatment decisions	98/138 (71)	63–78
Improves their understanding of the patients' prognosis	103/136 (76)	68–82
Is more informative than prognostic information usually received	117/133 (88)	81–93
Oncologists (*N* = 222 consultations)[b]		
Proportion of consultations where the oncologist agreed[a] that explaining life expectancy as 3 scenarios		
Is helpful	214/222 (96)	93–98
Is difficult	17/222 (8)	5–12
Is stressful	26/222 (12)	8–17
Is intrusive	42/222 (19)	14–25
Significantly lengthened the consultation	19/222 (9)	6–13
Was facilitated by using the iTool	207/222 (93)	89–96
Proportion of consultations where the oncologist agreed[a] that having life expectancy explained this way *for the patient*		
Is helpful	196/222 (88)	83–92
Is reassuring	113/222 (51)	44–57
Is upsetting	36/222 (16)	12–22
Is too complicated	6/222 (3)	1–6
Improved their understanding	193/222 (87)	82–91

[a] Includes agree and strongly agree responses

[b] Number of consultations, 33 oncologists completed a questionnaire after each patient consultation

20, 21]. Oncologists reported that using the iTool prolonged less than 10% of consultations, an important finding given fear of prolonging consultations is a reported barrier to discussing prognosis [8, 27].

Most patients found it helpful to receive a printed summary of information about their prognosis. Similarly, more than 70% of HCPs agreed that the printed three scenarios for survival information they received was more informative than the prognostic information they usually receive from oncologists, and that this information would help them make management and treatment decisions with their patients. We previously reported that quantitative information about prognosis was rarely included in letters from medical oncologists to HCPs [9]. Providing the one-page printed summary to HCPs could help ensure members of the multidisciplinary care team are aware of the estimated prognosis, and of what the patient has been told. This should improve the consistency of information and perhaps even improve patient care.

Fear of upsetting the patient is a commonly reported barrier to discussing prognosis [8]. Interestingly, oncologists

Table 4 Characteristics associated with patients agreeing that the information presented by the web-based tool was helpful (*N* = 146)

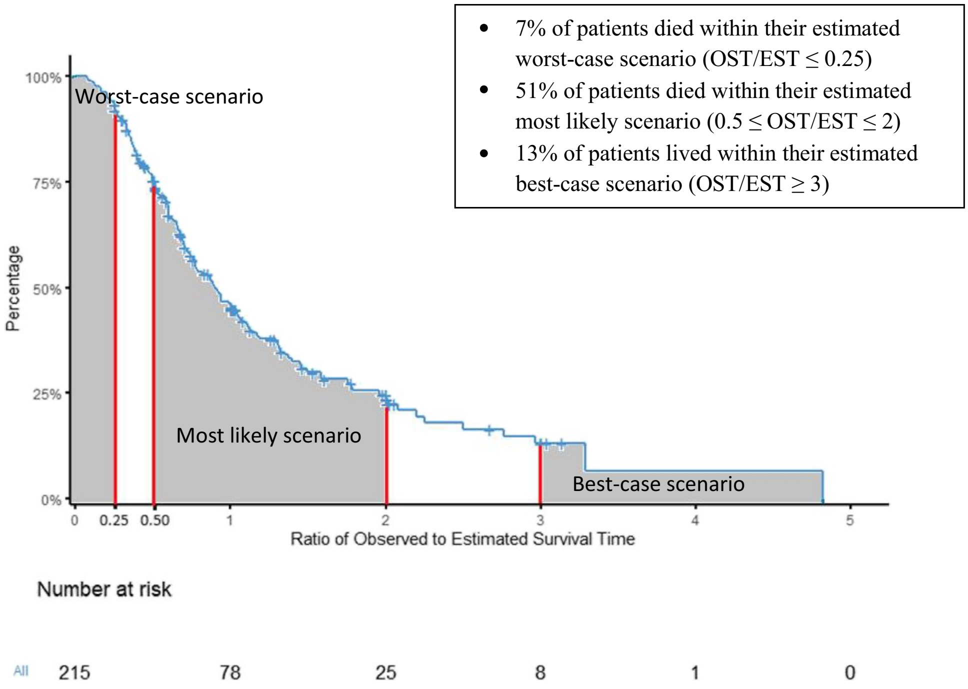
Variables	Agree or strongly agree	Disagree, strongly disagree, or unsure	Odds ratio (95% CI)	*P* value
Age, years				
< 50	14/16 (88)	2/16 (13)	ref	0.60
50–70	63/70 (90)	7/70 (10)	1.3 (0.24–6.9)	
> 70	49/52 (94)	3/52 (6)	2.3 (0.35–15)	
Sex				
Female	44/46 (96)	2/46 (4)	ref	0.22
Male	82/92 (89)	10/92 (11)	0.37 (0.08–1.8)	
Cancer type				
Prostate	18/19 (95)	1/19 (5)	2.3 (0.23–22)	0.78
Kidney	12/13 (92)	1/13 (8)	1.5 (0.15–15)	
Non-small cell lung cancer	19/21 (91)	2/21 (10)	1.2 (0.20–7.1)	
Pancreatic	16/18 (89)	2/18 (11)	1.0 (0.17–6.1)	
Colorectal	16/18 (89)	2/18 (11)	1.0 (0.17–6.1)	
Breast	13/13 (100)	0/13 (0)	NA	
Other	32/36 (89)	4/36 (11)	ref	
Education level				
Year 10 or less	49/55 (89)	6/55 (11)	ref	0.38
High school or above	71/76 (93)	5/76 (7)	1.7 (0.50–6.0)	
Short State Trait Anxiety Inventory[a]				
Below median (13)	60/65 (92)	5/65 (8)	ref	
Above median	64/70 (91)	6/70 (9)	0.89 (0.25–3.1)	0.85
Herth Hope Index[a]				
Below median (38)	58/68 (85)	10/68 (15)	ref	**0.03**
Above median	66/68 (97)	2/68 (3)	5.7 (1.2–27)	
Life Orientation Test Revised[a]				
Below median (16)	46/51 (90)	5/51 (10)	ref	0.77
Above median	77/84 (91)	7/84 (8)	1.2 (0.36–4.0)	
Estimated median survival				
< 9 months	44/48 (92)	4/48 (8)	ref	0.64
9–15 months	37/42 (88)	5/42 (12)	0.67 (0.17–2.7)	
> 15 months	45/48 (94)	3/48 (6)	1.4 (0.29–6.5)	
Time since diagnosis of incurable cancer				
≤ 8 weeks	47/50 (94)	3/50 (6)	ref	0.40
> 8 weeks	79/88 (90)	9/88 (10)	0.56 (0.14–2.2)	

[a] Higher score indicated greater levels of either anxiety, hope or optimism

in this study agreed that patients would find the prognostic information upsetting in only 16% of consultations. This may be because they perceived the format of presenting three scenarios was less upsetting or perhaps that the patients they selected for the study were those less likely to be upset by the information. We found 40% of patients agreed that the prognostic information they received was upsetting, yet despite this, over 90% agreed that the information was helpful. We previously reported that providing patients with ranges for three scenarios was judged to offer more hope than providing a single point estimate of survival [14]. It is possible that providing ranges for three scenarios helps patients understand the uncertainty of survival estimates and allows them to hope for a realistic best-case scenario. Most patients found that the information presented about their life expectancy was either about the same as, or better than, they expected, even when given their worst-case scenario. Previous studies reporting that patients with advanced cancer are more likely to over-estimate their survival compared to their oncologists have generally compared a point estimate made by the patient with a point estimate made by the oncologist [2, 21, 28]. Another possible explanation is that the majority of patients in our study (59%) received their survival time scenarios at a third or subsequent consultation, and there may have been other, earlier discussions about prognosis.

This study and approach to discussing prognosis has several key strengths. We developed an easily accessible, web-based tool designed to help oncologists explain "worst-case, most likely, and best-case scenarios for survival time" to people affected by cancer. We studied the attitudes of patients receiving personalized information about their own

Fig. 2 Kaplan–Meier distribution of observed-to-estimated survival time ratios ($N = 215$)



- 7% of patients died within their estimated worst-case scenario (OST/EST ≤ 0.25)
- 51% of patients died within their estimated most likely scenario (0.5 ≤ OST/EST ≤ 2)
- 13% of patients lived within their estimated best-case scenario (OST/EST ≥ 3)

life expectancy and also the attitudes of oncologists, FMs, and HCPs. We included patients with a wide range of ages, cancer types, and estimated life expectancies. This supports the applicability of the iTool in people with advanced cancer seeking quantitative information about their prognosis from receptive oncologists. Our data support the accuracy of scenarios for survival time based on simple multiples of their oncologist's estimate of life expectancy.

The main limitations of this study are the biases inherent to a single-arm design. Participating oncologists may have had greater interest and expertise in discussing prognosis and may have selected patients they judged likely to welcome information presented this way. Our response rate for patient questionnaires was 73%; the 55 consenting patients who did not return a questionnaire may have had less favorable views. We did not assess patients' understanding of the information presented about their prognosis. Our study involved only 33 oncologists. The generalizability of these findings requires further study, especially in the current era of increasing use of immunotherapy.

Future directions

Changing the behavior and practice of doctors is difficult. Australia has mandatory workshops on communicating prognosis for advanced trainees in medical oncology. Incorporating the iTool into this training offers an opportunity to increase its use. The www.cancersurvivalrates.com website is another useful resource for oncologists and people affected by cancer who seek quantitative information about prognosis. This website provides information based on recent data collected by the US SEER program and now provides information presented as three scenarios when the estimated median survival time is less than 3 years. These resources can help start and facilitate conversations about prognosis between patients and their doctors. Further research is needed to evaluate patients' understanding of presented information about prognosis.

Conclusion

We have provided strong evidence supporting the recommendation that oncologists use three scenarios for survival time when thinking and talking about prognosis in advanced cancer. It was feasible, acceptable, helpful, and safe to use a web-based resource to do this.

Our web-based tool can be accessed via the link https://ctc.usyd.edu.au/3scenarios/

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00520-022-07167-3.

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Author contributions SN contributed to the formal analysis; validation; verification of data; writing, original draft; and writing—review and editing. MS contributed to the conceptualization of the study, data curation, investigation, methodology, supervision, and writing—review and editing. AM contributed to formal analysis, software, and writing—review and editing. PG contributed to data curation, investigation, and writing—review and editing. PF contributed to data curation, investigation, and writing—review and editing. RZ contributed to data curation, investigation, and writing—review and editing. GH contributed to data curation, investigation, and writing—review and editing. MT contributed to the conceptualization of the study, data curation, investigation, and supervision. BK contributed to the conceptualization of the study; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; resources; supervision; validation; verification of data; writing, original draft; and writing—review and editing.

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Data availability The authors have full control of all primary data and agree to allow the journal to review their data if requested.

Code availability Not applicable.

Declarations

Ethics approval This study was performed in line with the principles of the Declaration of Helsinki and approved by the health research ethics committee at all participating sites.

Consent to participate Informed consent was obtained from all individual participants included in the study.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

References

1. Eidinger RN, Schapira DV (1984) Cancer patients' insight into their treatment, prognosis, and unconventional therapies. Cancer 53(12):2736–2740
2. Weeks JC, Cook EF, O'Day SJ et al (1998) Relationship between cancer patients' predictions of prognosis and their treatment preferences. JAMA 279(21):1709–1714. https://doi.org/10.1001/jama.279.21.1709
3. Wright AA, Zhang B, Ray A et al (2008) Associations between end-of-life discussions, patient mental health, medical care near death, and caregiver bereavement adjustment. JAMA 300(14):1665–1673. https://doi.org/10.1001/jama.300.14.1665
4. Gordon EJ, Daugherty CK (2003) 'Hitting you over the head': oncologists' disclosure of prognosis to advanced cancer patients. Bioethics 17(2):142–168
5. Helft PR (2005) Necessary collusion: prognostic communication with advanced cancer patients. J Clin Oncol 23(13):3146–3150. https://doi.org/10.1200/JCO.2005.07.003
6. Baile WF, Lenzi R, Parker PA, Buckman R, Cohen L (2002) Oncologists' attitudes toward and practices in giving bad news: an exploratory study. J Clin Oncol 20(8):2189–2196. https://doi.org/10.1200/JCO.2002.08.004
7. Hancock K, Clayton JM, Parker SM et al (2007) Truth-telling in discussing prognosis in advanced life-limiting illnesses: a systematic review. Palliat Med 21(6):507–517. https://doi.org/10.1177/0269216307080823
8. Vasista A, Stockler MR, Martin A, Lawrence NJ, Kiely BE (2020) Communicating prognostic information: what do oncologists think patients with incurable cancer should be told? Intern Med J 50(12):1492–1499. https://doi.org/10.1111/imj.14739
9. McConnell D, Butow PN, Tattersall MH (1999) Improving the letters we write: an exploration of doctor-doctor communication in cancer care. Br J Cancer 80(3–4):427–437. https://doi.org/10.1038/sj.bjc.6690374
10. Moth EB, Parry J, Stockler MR et al (2015) Doctor-to-doctor communication of prognosis in metastatic cancer: a review of letters from medical oncologists to referring doctors. Intern Med J 45(9):909–915. https://doi.org/10.1111/imj.12776
11. Kaplowitz SA, Campo S, Chiu WT (2002) Cancer patients' desires for communication of prognosis information. Health Commun 14(2):221–241. https://doi.org/10.1207/S15327027HC1402_4
12. Hagerty RG, Butow PN, Ellis PA et al (2004) Cancer patient preferences for communication of prognosis in the metastatic setting. J Clin Oncol 22(9):1721–1730. https://doi.org/10.1200/JCO.2004.04.095
13. Greisinger AJ, Lorimor RJ, Aday LA, Winn RJ, Baile WF (1997) Terminally ill cancer patients. Their most important concerns. Cancer Pract 5(3):147–154
14. Kiely BE, McCaughan G, Christodoulou S et al (2013) Using scenarios to explain life expectancy in advanced cancer: attitudes of people with a cancer experience. Support Care Cancer 21(2):369–376. https://doi.org/10.1007/s00520-012-1526-4
15. Stockler MR, Tattersall MH, Boyer MJ, Clarke SJ, Beale PJ, Simes RJ (2006) Disarming the guarded prognosis: predicting survival in newly referred patients with incurable cancer. Br J Cancer 94(2):208–212. https://doi.org/10.1038/sj.bjc.6602908
16. Kiely BE, Soon YY, Tattersall MH, Stockler MR (2011) How long have I got? Estimating typical, best-case, and worst-case scenarios for patients starting first-line chemotherapy for metastatic breast cancer: a systematic review of recent randomized trials. J Clin Oncol 29(4):456–463. https://doi.org/10.1200/JCO.2010.30.2174
17. Kiely BE, Martin AJ, Tattersall MH et al (2013) The median informs the message: accuracy of individualized scenarios for survival time based on oncologists' estimates. J Clin Oncol 31(28):3565–3571. https://doi.org/10.1200/JCO.2012.44.7821
18. West TA, Kiely BE, Stockler MR (2014) Estimating scenarios for survival time in men starting systemic therapies for castration-resistant prostate cancer: a systematic review of randomised trials. Eur J Cancer 50(11):1916–1924. https://doi.org/10.1016/j.ejca.2014.04.004
19. Vasista A, Stockler M, Martin A et al (2019) Accuracy and prognostic significance of oncologists' estimates and scenarios for survival time in advanced gastric cancer. Oncologist 24(11):e1102–e1107. https://doi.org/10.1634/theoncologist.2018-0613

20. Smith-Uffen MES, Johnson SB, Martin AJ et al (2020) Estimating survival in advanced cancer: a comparison of estimates made by oncologists and patients. Support Care Cancer 28(7):3399–3407. https://doi.org/10.1007/s00520-019-05158-5
21. Kiely BE, Alam M, Blinman P, Tattersall MH, Stockler MR (2012) Estimating typical, best-case and worst-case life expectancy scenarios for patients starting chemotherapy for advanced non-small-cell lung cancer: a systematic review of contemporary randomized trials. Lung Cancer 77(3):537–544. https://doi.org/10.1016/j.lungcan.2012.04.017
22. Vasista A, Stockler MR, West T, Wilcken N, Kiely BE (2017) More than just the median: Calculating survival times for patients with HER2 positive, metastatic breast cancer using data from recent randomised trials. Breast 31:99–104. https://doi.org/10.1016/j.breast.2016.10.007
23. Moth EB, Blinman P, Stefanic N et al (2020) Estimating survival time in older adults receiving chemotherapy for advanced cancer. J Geriatr Oncol 11:617–625
24. Marteau TM, Bekker H (1992) The development of a six-item short-form of the state scale of the Spielberger State-Trait Anxiety Inventory (STAI). Br J Clin Psychol 31(3):301–306. https://doi.org/10.1111/j.2044-8260.1992.tb00997.x
25. Herth K (1992) Abbreviated instrument to measure hope: development and psychometric evaluation. J Adv Nurs 17(10):1251–1259. https://doi.org/10.1111/j.1365-2648.1992.tb01843.x
26. Scheier MF, Carver CS, Bridges MW (1994) Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the Life Orientation Test. J Pers Soc Psychol 67(6):1063–1078. https://doi.org/10.1037//0022-3514.67.6.1063
27. Granek L, Krzyzanowska MK, Tozer R, Mazzotta P (2013) Oncologists' strategies and barriers to effective communication about the end of life. J Oncol Pract 9(4):e129–e135. https://doi.org/10.1200/JOP.2012.000800
28. Fenton JJ, Duberstein PR, Kravitz RL et al (2018) Impact of prognostic discussions on the patient-physician relationship: prospective cohort study. J Clin Oncol 36(3):225–230. https://doi.org/10.1200/JCO.2017.75.6288

Supplementary Text 1 – Example of printed summary of survival information

Imagine 100 people…

It is impossible to see into the future but we can get an idea of how the future might look by thinking about how a group of similar people would do.

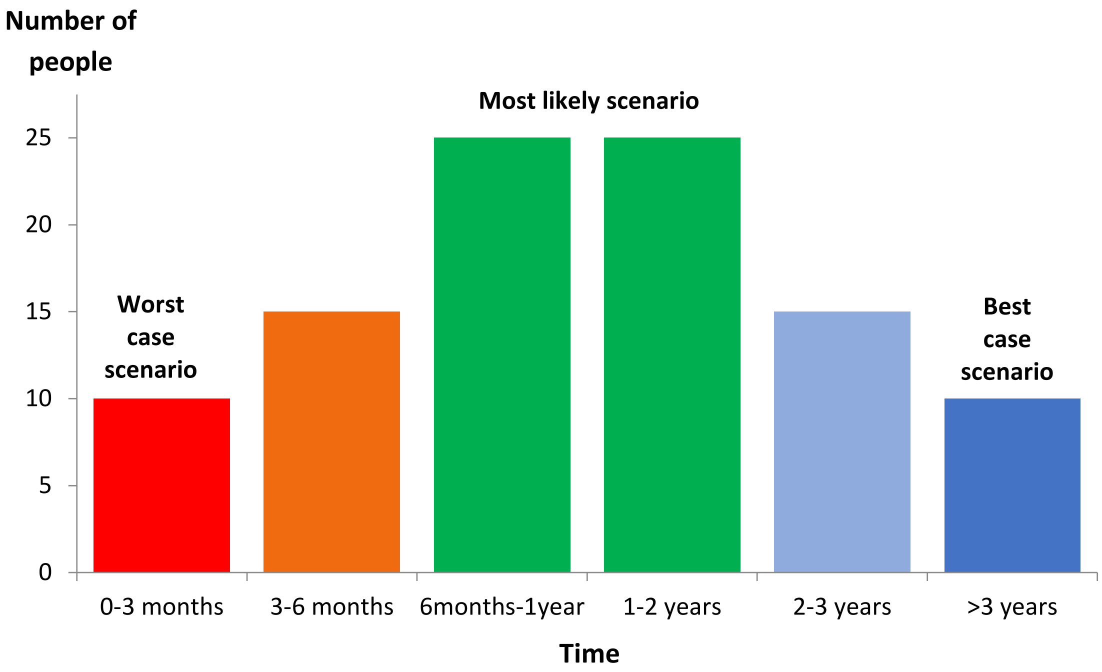
Many people in this situation have said it's helpful to think about the best case scenario, the worst case scenario, and the most likely scenario, which is somewhere in between.

If we imagine 100 people in exactly the same situation, then we'd expect:

- the 5 to 10 who did best would live longer than 3 years
- the 5 to 10 who did worst would die within 3 months
- the middle 50 would live 6 months to 2 years.

This also means that
- half the people would live longer than 12 months and
- half the people would live less than 12 months.

Cancer is very unpredictable. Sometimes that unpredictability acts in your favour.



Supplementary Text 2- Oncologist questionnaire after consultation

The following questions are designed to determine your experience using the iTool to estimate and explain survival time with *this patient*.

Please circle one number for each line to show how you feel about that statement						
Statement		**Strongly Disagree**	**Disagree**	**Unsure**	**Agree**	**Strongly Agree**
1.	**It was difficult to estimate the “median” survival to enter into the iTool for this patient**	1	2	3	4	5
2.	**For me, explaining life expectancy as 3 scenarios:**					
a	was helpful	1	2	3	4	5
b	was difficult	1	2	3	4	5
c	was stressful	1	2	3	4	5
d	significantly lengthened the consultation	1	2	3	4	5
e	was facilitated by using the iTool	1	2	3	4	5
3.	**Using the iTool during the consultation was intrusive**	1	2	3	4	5
4.	**For the patient, having life expectancy explained this way was:**					
a	helpful	1	2	3	4	5
b	reassuring	1	2	3	4	5
c	upsetting	1	2	3	4	5
d	too complicated	1	2	3	4	5
e	improved their understanding	1	2	3	4	5

5.	**The information was helpful for the other family member(s) or carer(s) in the room (leave blank if no other people)**	1	2	3	4	5

Supplementary Text 3- Patient questionnaire

1. Age in years: __ __

2. Sex: ☐ M ☐ F

3. Highest education level achieved: (please select one of the options below)

   ☐ Year 10 or less

   ☐ Completed high school

   ☐ College diploma, university degree or other post high school qualification

4. Year your cancer was first diagnosed: __ __ __ __

5. What part of the body did your cancer start in (please tick only one of the boxes):

   ☐ Breast

   ☐ Lung

   ☐ Bowel (colon or rectum)

   ☐ Prostate

   ☐ Ovary, uterus (womb) or cervix

   ☐ Bladder

   ☐ Kidney

   ☐ Oesophagus

   ☐ Stomach

   ☐ Pancreas

   ☐ Mouth, tongue or throat

   ☐ Skin (melanoma)

   ☐ Other

☐ Unsure

Please circle one number for each line to show how you feel about that statement						
6.	**Having my life expectancy explained this way:**	**Strongly Disagree**	**Disagree**	**Unsure**	**Agree**	**Strongly Agree**
a	made sense (the information was clear and easy to understand)	1	2	3	4	5
b	will help me make plans for the future	1	2	3	4	5
c	gives me hope	1	2	3	4	5
d	was reassuring	1	2	3	4	5
e	was upsetting	1	2	3	4	5
f	improved my understanding	1	2	3	4	5
g	made me feel worried or anxious	1	2	3	4	5
h	was helpful	1	2	3	4	5
7.	**Being told the *best case scenario* was helpful**	1	2	3	4	5
8.	**Being told the *worst case scenario* was helpful**	1	2	3	4	5
9.	**Being told the *most likely scenario* was helpful**	1	2	3	4	5
10.	**Being told the time *half a group of people would live longer or shorter than* was helpful**	1	2	3	4	5
11.	**I found this way of presenting information about life expectancy helpful**	1	2	3	4	5

12.	**It was helpful for me to receive a printed summary of this information**	1	2	3	4	5
13.	**It would be helpful for my family members to receive this information**	1	2	3	4	5
14.	**It would be helpful for my family doctor (GP) to receive this information**	1	2	3	4	5

15. Overall, how did the information your doctor explained about your life expectancy compare with what you thought before this discussion (please tick only one box)?

☐ Better than expected

☐ Worse than expected

☐ About the same as expected

16. Given the choice, which scenario would you prefer to be told about first (please tick only one box)?

☐ Best case

☐ Worst case

☐ Most likely range

☐ The order is not important to me

17. Do you plan to show (or have you already shown) the print out about your life expectancy to your family, friends or carers (please tick only one box)?

☐ Yes

☐ No

Please read each statement and then **circle the most appropriate number to the right** of the statement to indicate how you feel **right now**, at this moment. There is no right or wrong answer. Do not spend too much time on any of the statements but give the answer which seems to describe your present feelings best.

	Statement	Not at all	Somewhat	Moderately	Very much
18.	I feel calm	1	2	3	4
19.	I am tense	1	2	3	4
20.	I feel upset	1	2	3	4
21.	I am relaxed	1	2	3	4
22.	I feel content	1	2	3	4
23.	I am worried	1	2	3	4

Please read each statement below and then **circle the most appropriate number to the right** of the statement to indicate how much you agree with that statement. Try not to let your response to one statement influence your responses to other statements. There are no "correct" or "incorrect" answers. Answer according to your own feelings, rather than how you think "most people" would answer.

	Statement	Strongly Disagree	Disagree	Agree	Strongly Agree
24.	I have a positive outlook toward life	1	2	3	4
25.	I have short and/or long range goals	1	2	3	4
26.	I feel all alone	1	2	3	4
27.	I can see possibilities in the midst of difficulties	1	2	3	4
28.	I have a faith that gives me comfort	1	2	3	4
29.	I feel scared about my future	1	2	3	4
30.	I can recall happy/joyful times	1	2	3	4

31.	I have deep inner strength	1	2	3	4
32.	I am able to give and receive caring/love	1	2	3	4
33.	I have a sense of direction	1	2	3	4
34.	I believe that each day has potential	1	2	3	4
35.	I feel my life has value and worth	1	2	3	4

Please read each statement and then **circle the most appropriate number to the right** of the statement to indicate how much you agree with that statement. Try not to let your response to one statement influence your responses to other statements. There are no "correct" or "incorrect" answers. Answer according to your own feelings, rather than how you think "most people" would answer.

Statement		Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
36.	In uncertain times, I usually expect the best	1	2	3	4	5
37.	It's easy for me to relax	1	2	3	4	5
38.	If something can go wrong for me, it will.	1	2	3	4	5
39.	I'm always optimistic about my future	1	2	3	4	5
40.	I enjoy my friends a lot	1	2	3	4	5
41.	It's important for me to keep busy	1	2	3	4	5
42.	I hardly ever expect things to go my way.	1	2	3	4	5
43.	I don't get upset too easily	1	2	3	4	5
44.	I rarely count on good things happening to me	1	2	3	4	5
45.	Overall, I expect more good things to happen to me than bad	1	2	3	4	5

46. Did you find taking part in this study distressing?

☐ Not at all

☐ Somewhat

☐ Moderately

☐ Extremely

Please let us (the researchers, your doctor or nurse) know if you would like to talk about the information with your doctor or anyone else

Thank you for helping with this study. This is the last page.

Supplementary Text 4- Family member questionnaire

1. Age: __________

2. Sex: ☐ M ☐ F

3. Which of the following best describes your relationship to the patient: (please tick only one of the boxes):

- ☐ husband / wife / partner
- ☐ son / daughter
- ☐ son in law / daughter-in-law
- ☐ brother / sister
- ☐ mother / father
- ☐ niece / nephew
- ☐ care giver
- ☐ other (please specify) ____

Please circle one number for each line to show how you feel about that statement						
4.	**Having life expectancy explained as three possible scenarios:**	**Strongly Disagree**	**Disagree**	**Unsure**	**Agree**	**Strongly Agree**
a	was helpful	1	2	3	4	5
b	made sense (the information was clear and easy to understand)	1	2	3	4	5
c	was too complicated	1	2	3	4	5
d	helps me make plans for the future	1	2	3	4	5
e	gives me hope	1	2	3	4	5
f	was reassuring	1	2	3	4	5
g	was upsetting	1	2	3	4	5
h	improved my understanding	1	2	3	4	5
5.	**It was helpful to receive a printed summary of the three scenarios**	1	2	3	4	5

Supplementary Text 5 – Healthcare professional questionnaire

1. Age:	__ __ years	
2. Sex:	☐ Male	☐ Female
3. Specialty type (please tick only one of the boxes below):		
☐ Surgical	☐ Radiation oncology	☐ Medical oncology
☐ Palliative care	☐ Other internal medical	☐ Nurse
☐ Psychologist	☐ Social worker	☐ Other
4. What proportion of the patients in your care have been diagnosed with cancer?		
☐ less than one third	☐ one third to two thirds	☐ more than two thirds
5. The *best case* scenario was:		
☐ better than I expected	☐ worse than I expected	☐ about the same as I expected
6. The *worst case* scenario was:		
☐ better than I expected	☐ worse than I expected	☐ about the same as I expected
7. The *most likely* scenario was:		
☐ better than I expected	☐ worse than I expected	☐ about the same as I expected
8. The *median* survival time (time when 50% of the people have died) was:		
☐ better than I expected	☐ worse than I expected	☐ about the same as I expected

Please circle one number for each line to show how you feel about that statement						
9.	**Receiving the 1 page summary of life expectancy information for this patient:**	**Strongly Disagree**	**Disagree**	**Unsure**	**Agree**	**Strongly Agree**
a	makes sense (the information is clear and easy to understand)	1	2	3	4	5
b	will help me make management and treatment decisions	1	2	3	4	5
c	improves my understanding of their prognosis	1	2	3	4	5
d	will help me answer questions from my patient about prognosis	1	2	3	4	5
e	is more informative than the prognostic information I usually receive for my patients with advanced cancer	1	2	3	4	5
10.	**I found receiving this format of information on prognosis helpful**	1	2	3	4	5
11.	**It would be helpful for me to receive this information my other patients with advanced cancer**	1	2	3	4	5
12.	**I think my patients would find this information**					
a	helpful	1	2	3	4	5
b	distressing	1	2	3	4	5
c	reassuring	1	2	3	4	5
13.	**It would be helpful for other patients with advanced cancer to receive this information**	1	2	3	4	5

Is there any other information you would like to see included?

Supplementary Text 6- Oncologist questionnaire post study

The following questions are designed to determine your attitudes to using the iTool throughout the study when discussing prognosis with your patients.

Please circle one number for each line to show how you feel about that statement						
Statement		**Strongly Disagree**	**Disagree**	**Unsure**	**Agree**	**Strongly Agree**
1.	**I found using the iTool:**					
a	helpful	1	2	3	4	5
b	easy	1	2	3	4	5
c	made discussing prognosis easier	1	2	3	4	5
d	made me more prepared to discuss prognosis	1	2	3	4	5
e	makes me more likely to discuss prognosis	1	2	3	4	5
f	improved the way I explain prognosis	1	2	3	4	5
g	improved the way I document prognosis in my notes and letters	1	2	3	4	5
2.	**I would like to continue using the iTool**	1	2	3	4	5

Additional Supplementary Text 1 – Characteristics of Healthcare Professionals (N=140)

Characteristic	**Number (%)**
Age, median	48 (years)
Sex	
Male	99 (71)
Female	34 (24)
Missing	7 (5)
Specialty	
Other (including General Practitioner)	45 (32)
Surgery	33 (24)
Radiation Oncology	24 (17)
Other internal medicine	16 (11)
Palliative Care	11 (8)
Medical Oncology	4 (3)
Psychology	1 (1)
Missing	6 (4)
Proportion of patients in their care diagnosed with cancer	
Less than one third	82 (59)
One third to two thirds	10 (7)
More than two thirds	42 (30)
Missing	6 (4)

Additional Supplementary Text 2 – Characteristics of Family Members (N=102)

Characteristic	**Number (%)**
Age, median	63 (years)
Sex	
Male	29 (28)
Female	70 (69)
Missing	3 (3)
Relationship	
Partner	66 (65)
Son/daughter	17 (17)
Sibling	5 (5)
Caregiver	2 (2)
Other	9 (9)
Missing	3 (3)

9 DISCUSSION

9.1 Summary of principal findings

Oncologists' estimates of expected survival are well-calibrated.

This thesis provides evidence that oncologists' estimates of expected survival time for people with advanced cancer were well-calibrated (i.e., unbiased) in multiple, independent, prospective studies, challenging the dogma that oncologists are overly optimistic when estimating survival.

Simple multiples of the estimated median survival time can be used to estimate 3 scenarios for survival.

Simple multiples (1/4, 1/2, 2, and 3) of oncologists' estimates of expected survival times (EST) defined as 'the median survival of a group of similar patients', provided remarkably well-calibrated estimates of worst-case, typical, and best-case scenarios for survival.

- 1/4 x EST closely corresponded to the 90th percentile on a survival curve, representing the timepoint when 90% of the patients were alive and 10% had died. This can be considered a worst-case scenario.
- 1/2 to 2 x EST closely corresponded to the 75th to 25th percentiles, representing the range of the middle 50% of patients on a survival curve. This can be considered a typical scenario.
- 3 x EST closely corresponded to the 10th percentile on a survival curve, representing the timepoint when 10% of the patients are alive and 90% have died. This can be considered a best-case scenario.

Oncologists' estimates of expected survival time were independently associated with actual survival times.

Oncologists' estimates of expected survival time in 898 people with recurrent ovarian cancer were independently associated with their observed survival times, providing additional prognostic information above and beyond established prognostic factors. This supports the value of using oncologists' estimates to formulate and explain prognosis to patients.

There are several key timepoints when doctors should offer to discuss prognosis with people with advanced cancer.

Doctors and patients agree on many timepoints that are appropriate to initiate discussions of prognosis. These include: at first consultation after diagnosis of advanced cancer; when the patient asks; upon disease progression; when there are no further anti-cancer treatments; and when recommending palliative care. These timepoints largely correspond to recommendations from guidelines and experts. The optimal timing of prognostic discussions needs to be individualised, and there are many timepoints that should be considered as appropriate opportunities for doctors to ask their patients about their preferences for information about prognosis. For each individual, prognosis may need to be discussed at several timepoints, and in different ways, depending on their circumstances and preferences.

Patients, family members and healthcare professionals found it helpful to receive estimates of survival time formatted as 3 scenarios for survival.

This information was useful for patients, family members, and other healthcare professionals. Patients preferred to hear each of the three scenarios, rather than to be told just the estimated median survival time. Healthcare professionals found the three scenarios more informative than the prognostic information they usually received.

Oncologists found it helpful to estimate and explain 3 scenarios for survival to their patients with advanced cancer, and a web-based tool facilitated this in the clinic.

A simple web-based tool using multiples of the oncologists' estimates of expected survival time to formulate worst-case, typical, and best-case scenarios for survival was feasible to use in routine clinical practice. The tool was easy to use and did not significantly lengthen consultation times.

9.2 Significance and clinical implications

Oncologists' estimates of expected survival time are meaningful and can be used when communicating prognosis in advanced cancer.

We found that oncologists' estimates of expected survival time were useful, informative, and prognostically significant. Oncologists in these studies did not systematically over-estimate or under-estimate life expectancy, and these estimates were independently prognostic, even after accounting for other, established prognostic variables. It is possible the oncologists participating in these studies may differ from the general population of oncologists, so our findings may represent the usefulness of estimates of survival time made by oncologists participating in clinical trials. However, our findings were consistent across several studies, with different patient populations, ranges of cancer types, survival times, and different timepoints. The heterogeneity of the studies supports the wider applicability of our findings. This should provide oncologists with greater confidence to use their estimates of expected survival time, defined as the estimated median survival time in a group of similar patients, when thinking and talking about prognosis in their patients with advanced cancer.

Estimating and explaining 3 scenarios for survival was a helpful way to discuss prognosis.

This thesis supports the use of multiples of the expected survival time to formulate worst-case, typical, and best-case scenarios to explain life expectancy in people with advanced cancer. Instead of providing a single point-estimate that conveys unwarranted precision and is less informative for patients, providing ranges for three scenarios conveyed appropriate uncertainty, proved more accurate, and allowed oncologists to be both honest and hopeful. The three scenarios format of prognostic information was preferred by patients and their family members and has the potential to improve prognostic awareness, goal-concordant care and patient and family satisfaction at the end of life. Other healthcare professionals (e.g., general practitioners, surgeons, radiation oncologists, and palliative care physicians) found the three scenarios more informative than the prognostic information they usually received. It is important for all members of the healthcare team caring for a patient to be aware of the patient's prognosis, and what the patient has been told about their prognosis, to ensure the patient receives consistent information and appropriate care.

Oncologists can use the "3 Scenarios for Survival" website to communicate prognosis.

The effective implementation of our findings into clinical practice is an important and challenging step. Although oncologists recognise the importance of discussing prognosis in advanced cancer, many find it hard to integrate this as part of their routine care, and it is important to develop ways to facilitate this. Communication interventions can often be complex, requiring a lot of resources for training and coaching, and therefore may not be widely implemented outside the institutions they are developed in.[67] Simple, accessible tools should help oncologists formulate and explain life expectancy during their consultations in routine clinical practice. The "3 Scenarios for Survival" website (https://ctc.usyd.edu.au/3scenarios/) is freely available, provides necessary instructions and background, and can be used without registration or training (Appendix 1). It does not require special assessments or tests that are not available everywhere; oncologists can use whatever preferred method to estimate a patient's survival time and then use the "3 Scenarios for Survival" website to explain the worst-case, typical, and best-case scenarios based on that estimate. It provides a framework to explain prognostic information, making it very transferrable and easy to use broadly. The body of work in this thesis indicates that this is a valuable resource that could improve oncologists' confidence and capacity to both think and talk about prognosis with their patients with advanced cancer, and has been recommended by groups such as The Lancet Breast Cancer Commission.[84]

The website also provides a quick and simple means for oncologists to print a one page summary of the scenarios for survival that can be used as an aid during the conversation and given to the patient and family to take home to help them remember what was discussed. In our study most patients found the printed summary helpful.

Oncologists should offer to discuss prognosis regularly at several timepoints.

Preferences regarding the timing of discussions of prognosis appear to be variable and highly individualised, so it is important for doctors to offer these discussions repeatedly over the course of a person's illness. Although waiting for a patient to initiate these discussions may ensure they receive information that they desire, at a time they prefer, it cannot be assumed that all patients have the courage to ask this particularly difficult question.[7] Even if a discussion occurs, a patient's understanding of the information may not be complete, and they may need several discussion to truly comprehend and appreciate their situation. Therefore, it is important for doctors to be aware of timepoints that provide opportunities to check prognostic understanding. Increasing awareness of these key timepoints in communication training programs for oncologists may trigger more discussions about prognosis. These timepoints can also be used to introduce prompts for both patients and oncologists. For example, including a reminder to offer to discuss prognosis in a patient consent form may be a way to prompt oncologists at recommended timepoints in the study in Chapter 7, ‘prior to commencing treatment’, or ‘when treatment decisions needed to be made’. Developing automatic prompts within an electronic medical record system (such as after a CT scan is reported), may help oncologists initiate a discussion of prognosis at key timepoints of transition, ‘disease progression, stopping anti-cancer therapies’. Improving the frequency of discussions about prognosis and using helpful information, such as “3 Scenarios for Survival,” should improve prognostic awareness.

9.3 Strengths

This research included studies with large sample sizes, many types of advanced cancer, and a broad range of survival times. Oncologists were asked to estimate expected survival times prospectively for individual patients who were subsequently followed to determine their actual survival time. These studies rectify the lack of rigorous data about estimated survival times in people with advanced cancer who are not yet in the last few weeks of their life, and support the applicability of our findings to oncology outpatients in general.

We also sought the views of not only patients, but other important stakeholders such as family members, oncologists, and other healthcare professionals.

9.4 Limitations

Oncologists who participated in our studies of estimating and communicating expected survival time may have had greater than average interest and expertise in this area and may not be representative of oncologists in general. The survival data came from participants in a range of clinical trials, some of which required a minimum life expectancy of greater than three months. It is therefore possible that the estimated and observed survival times of patients participating in our studies were longer than those of patients not participating in our studies. However, there is no reason to believe that estimates of expected survival time would be less accurate or useful in the wider population of patients who did not participate in our studies.

In the study in Chapter 8, despite the high chance that the 33 participating oncologists would have seen many more patients with advanced cancer over the study period, there were only 222 discussions about prognosis using the iTool. The number of times oncologists used the iTool was relatively low with a median of 4 (range 1 – 50); most oncologists used it only a few times, and a small number of oncologists used it a lot. This suggests that despite having an easily accessible web-based tool, and a clinical trial designed to help oncologists explain prognosis, conversations about prognosis do not happen frequently.

Our studies and included reviews were all conducted in English, and may not reflect practice and attitudes from other cultures and linguistic backgrounds. The majority of patients in our studies receiving anticancer treatment were receiving chemotherapy. There are limited data about estimating and explaining life expectancy, and the accuracy or survival estimates, in people being treated with targeted therapies and immune checkpoint inhibitors. Other specific limitations of each study were addressed individually in chapters 4, 5, 7, and 8.

9.5 Future directions

The accuracy of using multiples of the estimated median survival time in a group of similar patients to formulate worst-case, typical, and best-case scenarios for survival needs to be evaluated in people with advanced cancer receiving treatments other than chemotherapy (such as immunotherapy and/or targeted therapies). These treatments may result in some patients having much longer survival times and the resulting survival curves may be shaped quite differently. In fact, for some with durable complete responses (measured in years), these treatments have introduced the possibility of "cure" in advanced cancer. It is important to determine the applicability of our methods to this growing population of patients being treated with novel therapies, and if necessary, develop different approaches that are more suitable.

Although patients found it useful to receive prognostic information formatted as three scenarios for survival, further research is needed to evaluate the extent to which this translates into improved prognostic awareness, and improved outcomes, particularly the use of goal-concordant treatments during care at the end of life. The broader implementation of tools to improve discussions of prognosis remains a challenge. It remains unclear whether incorporating resources such as the "3 Scenarios for Survival" website into communication workshops for oncologists will increase its use and lead to more frequent or better discussions about prognosis and life expectancy.

The attitudes, needs, and prognostic awareness of people from culturally and linguistically diverse populations remain under-researched. Further studies are needed in order to communicate prognosis in culturally sensitive ways, that considers a person's values, family relationships, beliefs about their health and healthcare, expectations of the oncologists' role and preferred communication methods.

More research is needed to address the gap between evidence-based recommendations and the actual practice of oncologists. Methods to prompt oncologists to initiate discussions of prognosis at appropriate timepoints also warrant study. Future studies should evaluate the efficacy of prompts given to patients as part of standard of care information, or the use of SMS-text messages to prompt oncologists and patients to consider discussing prognosis at appropriate timepoints.

9.6 Conclusion

Communicating about prognosis with people affected by advanced cancer is a fundamental skill for oncologists, but is challenging, even for the most experienced. The body of work in this thesis increases our knowledge about: the accuracy and usefulness of oncologists' estimates of expected survival time (i.e., the "what"); optimal timepoints when oncologists should offer to discuss prognosis (i.e., the "when"); and ways to formulate and communicate this information (i.e., the "how"). Oncologists should value their estimates because, when based on the estimated median survival time in a group of similar patients, they were unbiased, prognostically significant, and useful to formulate remarkably accurate estimates of worst-case, typical, and best-case scenarios for survival. Formatting estimates of life expectancy in this way achieved a good balance between being honest, hopeful, and realistic, and was preferred by patients seeking quantitative information about their life expectancy. It is important for oncologists to regularly think and talk about life expectancy with their patients affected by advanced cancer, and to continue seeking ways to improve this process for the benefit of their patients and their loved ones.

10. REFERENCES FOR CHAPTERS 1, 2, 3, 9

1. Russell BJ, Ward AM. Deciding what information is necessary: do patients with advanced cancer want to know all the details? *Cancer Manag Res.* 2011;3:191-199.
2. van der Velden NCA, Meijers MC, Han PKJ, van Laarhoven HWM, Smets EMA, Henselmans I. The Effect of Prognostic Communication on Patient Outcomes in Palliative Cancer Care: a Systematic Review. *Current Treatment Options in Oncology.* 2020;21(5):40.
3. Epstein AS, Prigerson HG, O'Reilly EM, Maciejewski PK. Discussions of Life Expectancy and Changes in Illness Understanding in Patients With Advanced Cancer. *J Clin Oncol.* 2016;34(20):2398-2403.
4. Paladino J, Bernacki R, Neville BA, et al. Evaluating an Intervention to Improve Communication Between Oncology Clinicians and Patients With Life-Limiting Cancer: A Cluster Randomized Clinical Trial of the Serious Illness Care Program. *JAMA Oncol.* 2019;5(6):801-809.
5. Back AL, Arnold RM. Discussing Prognosis: “How Much Do You Want to Know?” Talking to Patients Who Do Not Want Information or Who Are Ambivalent. *Journal of Clinical Oncology.* 2006;24(25):4214-4217.
6. Mori M, Shimizu C, Ogawa A, Okusaka T, Yoshida S, Morita T. A National Survey to Systematically Identify Factors Associated With Oncologists' Attitudes Toward End-of-Life Discussions: What Determines Timing of End-of-Life Discussions? *Oncologist.* 2015;20(11):1304-1311.
7. Henselmans I, Smets EMA, Han PKJ, de Haes H, Laarhoven H. How long do I have? Observational study on communication about life expectancy with advanced cancer patients. *Patient Educ Couns.* 2017;100(10):1820-1827.

8. Australia C. Relative survival by stage at diagnosis (female breast cancer). 2019; https://ncci.canceraustralia.gov.au/relative-survival-stage-diagnosis-female-breast-cancer. Accessed 4 June, 2024.
9. Australia C. Relative survival by stage at diagnosis (colorectal cancer). 2019; https://ncci.canceraustralia.gov.au/outcomes/relative-survival-rate/relative-survival-stage-diagnosis-colorectal-cancer. Accessed 4 June, 2024.
10. Australia C. Relative survival by stage at diagnosis (lung). 2019; https://ncci.canceraustralia.gov.au/outcomes/relative-survival-rate/relative-survival-stage-diagnosis-lung-cancer. Accessed 4 June, 2024.
11. Polacek LC, Saracino RM, Walsh LE, et al. How patients with advanced cancer conceptualize prognosis: A phenomenological qualitative inquiry. *Palliat Med.* 2023;37(7):1006-1015.
12. Chen CH, Kuo SC, Tang ST. Current status of accurate prognostic awareness in advanced/terminally ill cancer patients: Systematic review and meta-regression analysis. *Palliat Med.* 2017;31(5):406-418.
13. Nahm SH, Subramaniam S, Stockler MR, Kiely BE. Timing of prognostic discussions in people with advanced cancer: a systematic review. *Support Care Cancer.* 2024;32(2):127.
14. Mone S, Kerr H. Prognostic awareness in advanced cancer: an integrative literature review. *BMJ Support Palliat Care.* 2021;11(1):53-58.
15. Nipp RD, Greer JA, El-Jawahri A, et al. Coping and Prognostic Awareness in Patients With Advanced Cancer. *J Clin Oncol.* 2017;35(22):2551-2557.
16. Gray TF, Forst D, Nipp RD, Greer JA, Temel JS, El-Jawahri A. Prognostic Awareness in Caregivers of Patients with Incurable Cancer. *J Palliat Med.* 2021;24(4):561-569.

17. Nysaeter TM, Olsson C, Sandsdalen T, Hov R, Larsson M. Family caregivers' preferences for support when caring for a family member with cancer in late palliative phase who wish to die at home - a grounded theory study. *BMC Palliat Care.* 2024;23(1):15.

18. Lewis S, Broom A, Kenny K, Kirby E. Cancer caregivers' experiences of prognosis in Australia: a qualitative interview study. *BMJ Open.* 2020;10(1):e032361.

19. Rich BA. Prognosis terminal: truth-telling in the context of end-of-life care. *Camb Q Healthc Ethics.* 2014;23(2):209-219.

20. Butow PN, Clayton JM, Epstein RM. Prognostic Awareness in Adult Oncology and Palliative Care. *J Clin Oncol.* 2020;38(9):877-884.

21. Zhang B, Wright AA, Huskamp HA, et al. Health care costs in the last week of life: associations with end-of-life conversations. *Arch Intern Med.* 2009;169(5):480-488.

22. Simmons CPL, McMillan DC, McWilliams K, et al. Prognostic Tools in Patients With Advanced Cancer: A Systematic Review. *J Pain Symptom Manage.* 2017;53(5):962-970 e910.

23. Kirkeboen G. "The median isn't the message": How to communicate the uncertainties of survival prognoses to cancer patients in a realistic and hopeful way. *Eur J Cancer Care (Engl).* 2019;28(4):e13056.

24. Kostos L, Hong W, Lee B, et al. Cancer clinical trial vs real-world outcomes for standard of care first-line treatment in the advanced disease setting. *Int J Cancer.* 2021;149(2):409-419.

25. Green AK, Curry M, Trivedi N, Bach PB, Mailankody S. Assessment of Outcomes Associated With the Use of Newly Approved Oncology Drugs in Medicare Beneficiaries. *JAMA Netw Open.* 2021;4(2):e210030.

26. Health C. CancerSurvivalRates.com. 2022; www.cancersurvivalrates.com. Accessed 6th November 2024, 2024.

27. Hagerty RG, Butow PN, Ellis PA, et al. Cancer patient preferences for communication of prognosis in the metastatic setting. *J Clin Oncol.* 2004;22(9):1721-1730.

28. Fallowfield LJ, Jenkins VA, Beveridge HA. Truth may hurt but deceit hurts more: communication in palliative care. *Palliat Med.* 2002;16(4):297-303.

29. Kirk P, Kirk I, Kristjanson LJ. What do patients receiving palliative care for cancer and their families want to be told? A Canadian and Australian qualitative study. *Bmj.* 2004;328(7452):1343.

30. Butow P, Dowsett S, Hagerty R, Tattersall M. Communicating prognosis to patients with metastatic disease: What do they really want to know? *Supportive Care in Cancer.* 2002;10(2):161-168.

31. Clayton JM, Butow PN, Arnold RM, Tattersall MH. Fostering coping and nurturing hope when discussing the future with terminally ill cancer patients and their caregivers. *Cancer.* 2005;103(9):1965-1975.

32. Hui D, Paiva CE, Del Fabbro EG, et al. Prognostication in advanced cancer: update and directions for future research. *Support Care Cancer.* 2019;27(6):1973-1984.

33. Fenton A, Fletcher KM, Kizildag D, et al. Cancer Caregivers' Prognostic and End-of-Life Communication Needs and Experiences and their Impact. *J Pain Symptom Manage.* 2023;65(1):16-25.

34. Mystakidou K, Parpa E, Tsilila E, Katsouda E, Vlahos L. Cancer information disclosure in different cultural contexts. *Support Care Cancer.* 2004;12(3):147-154.

35. Centeno-Cortes C, Nunez-Olarte JM. Questioning diagnosis disclosure in terminal cancer patients: a prospective study evaluating patients' responses. *Palliat Med.* 1994;8(1):39-44.

36. Mystakidou K, Parpa E, Tsilika E, Kalaidopoulou O, Vlahos L. The families evaluation on management, care and disclosure for terminal stage cancer patients. *BMC Palliat Care.* 2002;1(1):3.

37. Blackhall LJ, Murphy ST, Frank G, Michel V, Azen S. Ethnicity and attitudes toward patient autonomy. *JAMA.* 1995;274(10):820-825.

38. Hancock K, Clayton JM, Parker SM, et al. Truth-telling in discussing prognosis in advanced life-limiting illnesses: a systematic review. *Palliat Med.* 2007;21(6):507-517.

39. Gattellari M, Voigt KJ, Butow PN, Tattersall MH. When the treatment goal is not cure: are cancer patients equipped to make informed decisions? *J Clin Oncol.* 2002;20(2):503-513.

40. Vasista A, Stockler MR, Martin A, Lawrence NJ, Kiely BE. Communicating prognostic information: what do oncologists think patients with incurable cancer should be told? *Intern Med J.* 2020;50(12):1492-1499.

41. Clayton JM, Hancock KM, Butow PN, et al. Clinical practice guidelines for communicating prognosis and end-of-life issues with adults in the advanced stages of a life-limiting illness, and their caregivers. *Med J Aust.* 2007;186(S12):S77-S105.

42. Clayton JM, Butow PN, Tattersall MH. When and how to initiate discussion about prognosis and end-of-life issues with terminally ill patients. *J Pain Symptom Manage.* 2005;30(2):132-144.

43. Peretti-Watel P, Bendiane MK, Obadia Y, et al. Disclosure of prognosis to terminally ill patients: attitudes and practices among French physicians. *J Palliat Med.* 2005;8(2):280-290.

44. Kiely BE, Martin AJ, Tattersall MH, et al. The median informs the message: accuracy of individualized scenarios for survival time based on oncologists' estimates. *J Clin Oncol.* 2013;31(28):3565-3571.

45. Kiely BE, McCaughan G, Christodoulou S, et al. Using scenarios to explain life expectancy in advanced cancer: attitudes of people with a cancer experience. *Support Care Cancer.* 2013;21(2):369-376.

46. Kiely BE, Tattersall MHN, Stockler MR. Certain death in uncertain time: Informing hope by quantifying a best case scenario. *Journal of Clinical Oncology.* 2010;28(16):2802-2804.

47. Stockler MR, Tattersall MH, Boyer MJ, Clarke SJ, Beale PJ, Simes RJ. Disarming the guarded prognosis: predicting survival in newly referred patients with incurable cancer. *Br J Cancer.* 2006;94(2):208-212.

48. Selim S, Kunkel E, Wegier P, et al. A systematic review of interventions aiming to improve communication of prognosis to adult patients. *Patient Educ Couns.* 2020;103(8):1467-1497.

49. Clayton JM, Butow PN, Tattersall MH, et al. Randomized controlled trial of a prompt list to help advanced cancer patients and their caregivers to ask questions about prognosis and end-of-life care. *Journal of Clinical Oncology.* 2007;25(6):715-723.

50. Epstein RM, Duberstein PR, Fenton JJ, et al. Effect of a Patient-Centered Communication Intervention on Oncologist-Patient Communication, Quality of Life, and Health Care Utilization in Advanced Cancer: The VOICE Randomized Clinical Trial. *JAMA Oncology.* 2017;3(1):92-100.

51. Loucka M, Vlckova K, Tuckova A, et al. Prognostic awareness in advanced cancer patients and their caregivers: A longitudinal cohort study. *Psychooncology.* 2021;30(9):1449-1456.

52. Enzinger AC, Zhang B, Schrag D, Prigerson HG. Outcomes of Prognostic Disclosure: Associations With Prognostic Understanding, Distress, and Relationship With Physician Among Patients With Advanced Cancer. *Journal of Clinical Oncology.* 2015;33(32):3809-3816.

53. Fletcher K, Prigerson HG, Paulk E, et al. Gender differences in the evolution of illness understanding among patients with advanced cancer. *J Support Oncol.* 2013;11(3):126-132.

54. Shin JA, El-Jawahri A, Parkes A, Schleicher SM, Knight HP, Temel JS. Quality of Life, Mood, and Prognostic Understanding in Patients with Metastatic Breast Cancer. *J Palliat Med.* 2016;19(8):863-869.

55. Cripe LD, Rawl SM, Schmidt KK, Tong Y, Monahan PO, Rand KL. Discussions of life expectancy moderate relationships between prognosis and anxiety or depression in men with advanced cancer. *J Palliat Med.* 2012;15(1):99-105.

56. Horlait M, Chambaere K, Pardon K, Deliens L, Van Belle S. What are the barriers faced by medical oncologists in initiating discussion of palliative care? A qualitative study in Flanders, Belgium. *Supportive Care in Cancer.* 2016;24(9):3873-3881.

57. Maya S, Banerjee SC, Chawak S, Parker PA, Kandikattu S, Chittem M. Oncologists' experience with discussing cancer prognosis with patients and families: perspectives from India. *Transl Behav Med.* 2021;11(10):1896-1904.

58. Al-Issa K, Helft PR. Narrative review of prognosis related communication in advanced cancer patients. *Ann.* 2021;10(8):9239-9250.

59. Mack JW, Smith TJ. Reasons why physicians do not have discussions about poor prognosis, why it matters, and what can be improved. *J Clin Oncol.* 2012;30(22):2715-2717.

60. Weeks JC, Cook EF, O'Day SJ, et al. Relationship between cancer patients' predictions of prognosis and their treatment preferences. *JAMA.* 1998;279(21):1709-1714.

61. Wright AA, Zhang B, Ray A, et al. Associations between end-of-life discussions, patient mental health, medical care near death, and caregiver bereavement adjustment. *JAMA.* 2008;300(14):1665-1673.

62. Abernethy ER, Campbell GP, Pentz RD. Why many oncologists fail to share accurate prognoses: They care deeply for their patients. *Cancer.* 2020;126(6):1163-1165.

63. Shilling DM, Manz CR, Strand JJ, Patel MI. Let Us Have the Conversation: Serious Illness Communication in Oncology: Definitions, Barriers, and Successful Approaches. *Am Soc Clin Oncol Educ Book.* 2024;44(3):e431352.

64. Green A, Jerzmanowska N, Green M, Lobb EA. 'Death is difficult in any language': A qualitative study of palliative care professionals' experiences when providing end-of-life care to patients from culturally and linguistically diverse backgrounds. *Palliat Med.* 2018;32(8):1419-1427.

65. Forster LE, Lynn J. Predicting life span for applicants to inpatient hospice. *Arch Intern Med.* 1988;148(12):2540-2543.

66. Glare P, Virik K, Jones M, et al. A systematic review of physicians' survival predictions in terminally ill cancer patients. *Bmj.* 2003;327(7408):195-198.

67. Kiely BE, Stockler MR. Discussing Prognosis, Preferences, and End-of-Life Care in Advanced Cancer: We Need to Speak. *JAMA Oncol.* 2019;5(6):788-789.

68. Vasista A, Stockler M, Martin A, et al. Accuracy and Prognostic Significance of Oncologists' Estimates and Scenarios for Survival Time in Advanced Gastric Cancer. *Oncologist.* 2019;24(11):e1102-e1107.

69. Kiely BE, Alam M, Blinman P, Tattersall MH, Stockler MR. Estimating typical, best-case and worst-case life expectancy scenarios for patients starting chemotherapy for advanced non-small-cell lung cancer: a systematic review of contemporary randomized trials. *Lung Cancer.* 2012;77(3):537-544.

70. Kiely BE, Soon YY, Tattersall MH, Stockler MR. How long have I got? Estimating typical, best-case, and worst-case scenarios for patients starting first-line chemotherapy for metastatic breast cancer: a systematic review of recent randomized trials. *J Clin Oncol.* 2011;29(4):456-463.

71. Higginson IJ, Costantini M. Accuracy of prognosis estimates by four palliative care teams: a prospective cohort study. *BMC Palliat Care.* 2002;1(1):1.

72. Fairchild A, Debenham B, Danielson B, Huang F, Ghosh S. Comparative multidisciplinary prediction of survival in patients with advanced cancer. *Support Care Cancer.* 2014;22(3):611-617.

73. Kent M. calibration. Oxford University Press; 2007.

74. Dictionary OE. precision, n. & adj. *Oxford English Dictionary*: Oxford University Press; 2024.

75. Faraggi D, Simon R. A simulation study of cross-validation for selecting an optimal cutpoint in univariate survival analysis. *Stat Med.* 1996;15(20):2203-2213.

76. Lee YC, King MT, O'Connell RL, et al. Symptom burden and quality of life with chemotherapy for recurrent ovarian cancer: the Gynecologic Cancer InterGroup-Symptom Benefit Study. *Int J Gynecol Cancer.* 2022;32(6):761-768.

77. Aaronson NK, Ahmedzai S, Bergman B, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst.* 1993;85(5):365-376.

78. Greimel E, Bottomley A, Cull A, et al. An international field study of the reliability and validity of a disease-specific questionnaire module (the QLQ-OV28) in assessing the quality of life of patients with ovarian cancer. *Eur J Cancer.* 2003;39(10):1402-1408.

79. Marteau TM, Bekker H. The development of a six-item short-form of the state scale of the Spielberger State-Trait Anxiety Inventory (STAI). *Br J Clin Psychol.* 1992;31(3):301-306.

80. Herth K. Abbreviated instrument to measure hope: development and psychometric evaluation. *J Adv Nurs.* 1992;17(10):1251-1259.

81. Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the Life Orientation Test. *J Pers Soc Psychol.* 1994;67(6):1063-1078.

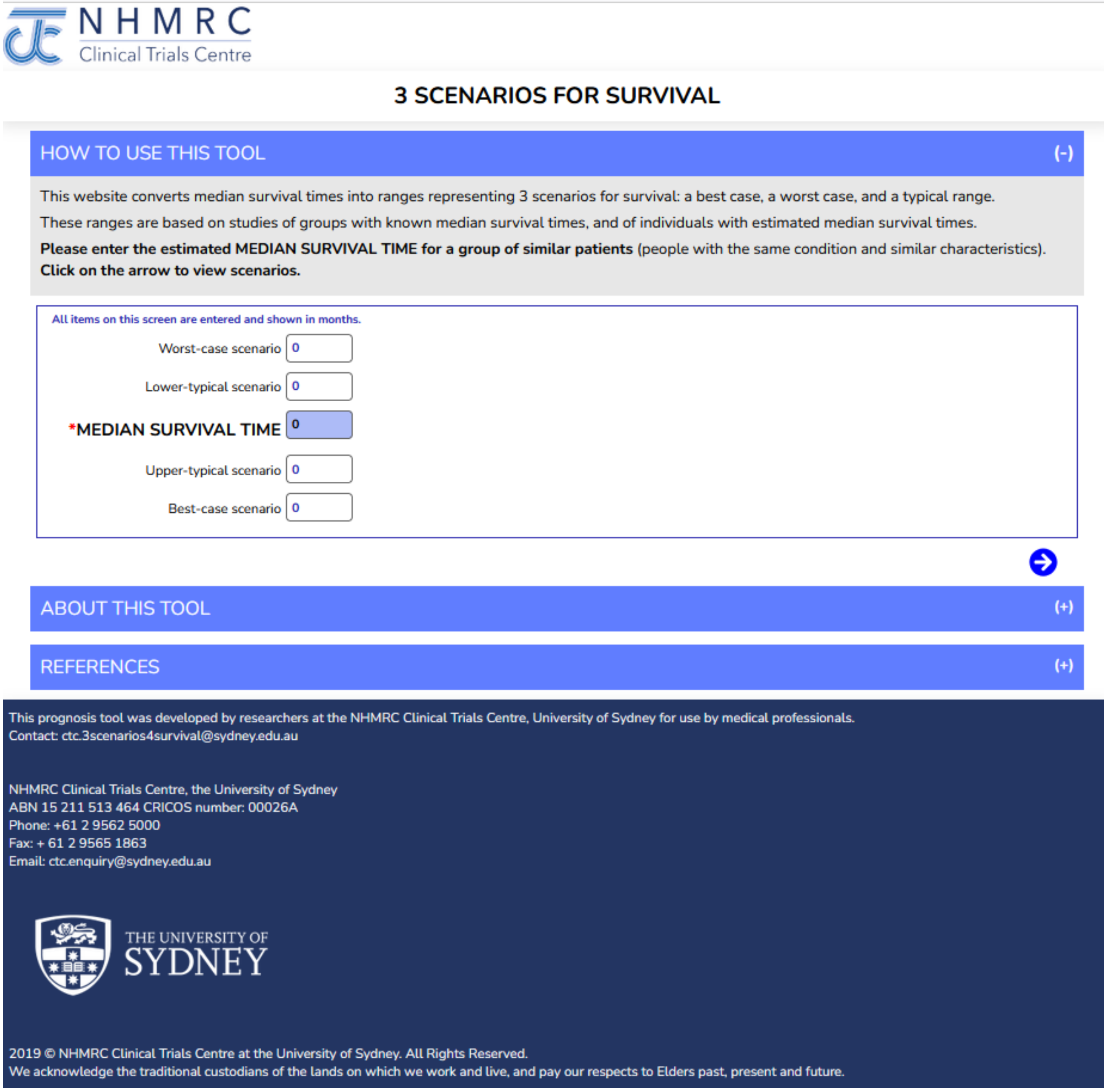
82. Anderson RJ, Stone PC, Low JTS, Bloch S. Managing uncertainty and references to time in prognostic conversations with family members at the end of life: A conversation analytic study. *Palliat Med.* 2020;34(7):896-905.

83. Lee S, Smith, A. Survival estimates in advanced terminal cancer. In: Morrison RS, ed. *UpToDate*: UpToDate, Waltham, MA. (Accessed on June 26th, 2024); 2022.

84. Coles CE, Earl H, Anderson BO, et al. The Lancet Breast Cancer Commission. *Lancet.* 2024;403(10439):1895-1950.

11. APPENDICES

Appendix 1. Examples of screenshots from the "3 Scenarios for Survival" website (https://ctc.usyd.edu.au/3scenarios/).



3 SCENARIOS FOR SURVIVAL

HOW TO USE THIS TOOL (-)

This website converts median survival times into ranges representing 3 scenarios for survival: a best case, a worst case, and a typical range.

These ranges are based on studies of groups with known median survival times, and of individuals with estimated median survival times.

Please enter the estimated MEDIAN SURVIVAL TIME for a group of similar patients (people with the same condition and similar characteristics).
Click on the arrow to view scenarios.

All items on this screen are entered and shown in months.

Worst-case scenario 0
Lower-typical scenario 0
*MEDIAN SURVIVAL TIME 0
Upper-typical scenario 0
Best-case scenario 0

ABOUT THIS TOOL (+)

REFERENCES (+)

This prognosis tool was developed by researchers at the NHMRC Clinical Trials Centre, University of Sydney for use by medical professionals.
Contact: ctc.3scenarios4survival@sydney.edu.au

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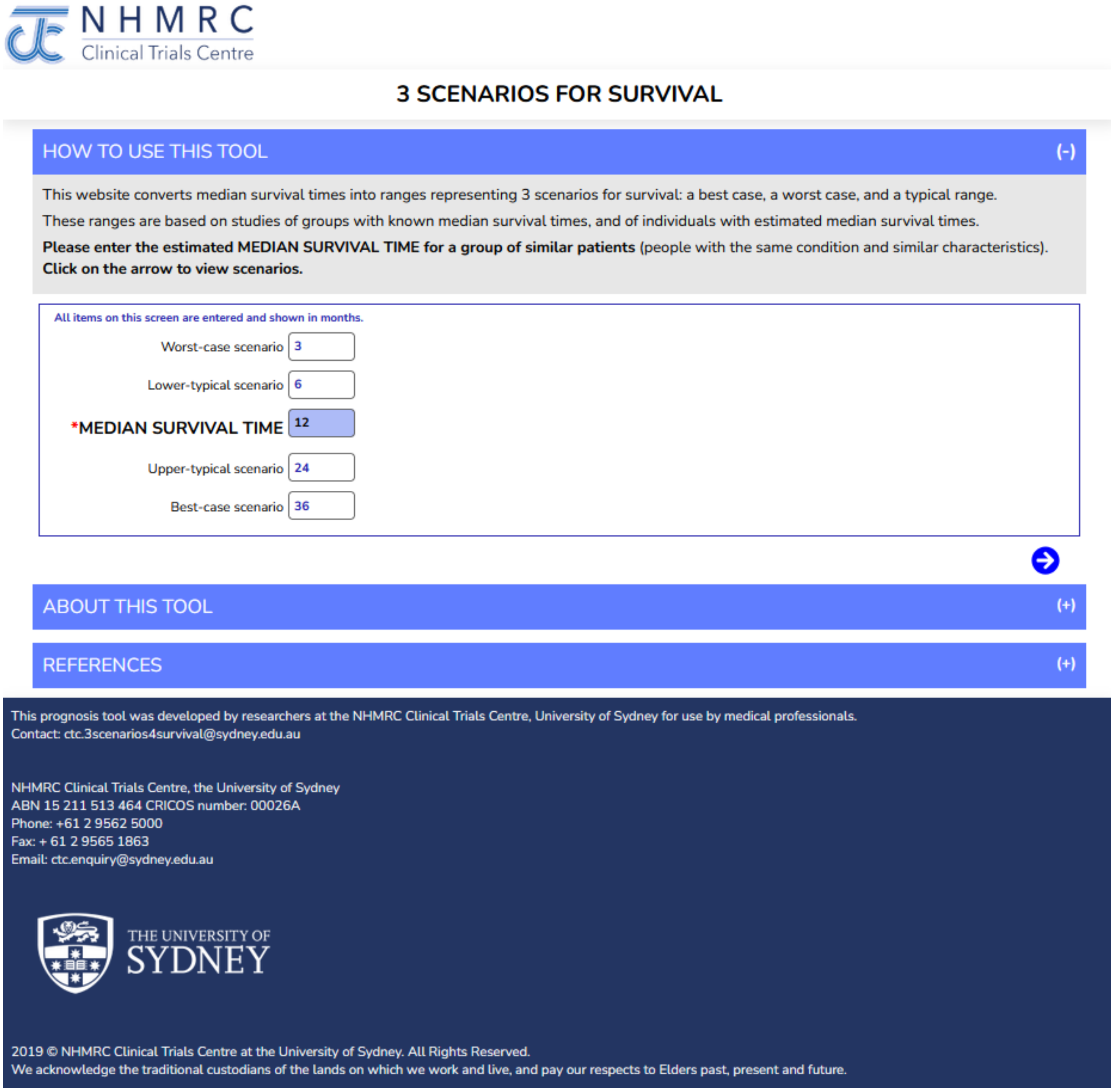
We acknowledge the traditional custodians of the lands on which we work and live, and pay our respects to Elders past, present and future.



3 SCENARIOS FOR SURVIVAL

HOW TO USE THIS TOOL

This website converts median survival times into ranges representing 3 scenarios for survival: a best case, a worst case, and a typical range.

These ranges are based on studies of groups with known median survival times, and of individuals with estimated median survival times.

Please enter the estimated MEDIAN SURVIVAL TIME for a group of similar patients (people with the same condition and similar characteristics).
Click on the arrow to view scenarios.

All items on this screen are entered and shown in months.

Worst-case scenario 3
Lower-typical scenario 6
***MEDIAN SURVIVAL TIME** 12
Upper-typical scenario 24
Best-case scenario 36

ABOUT THIS TOOL

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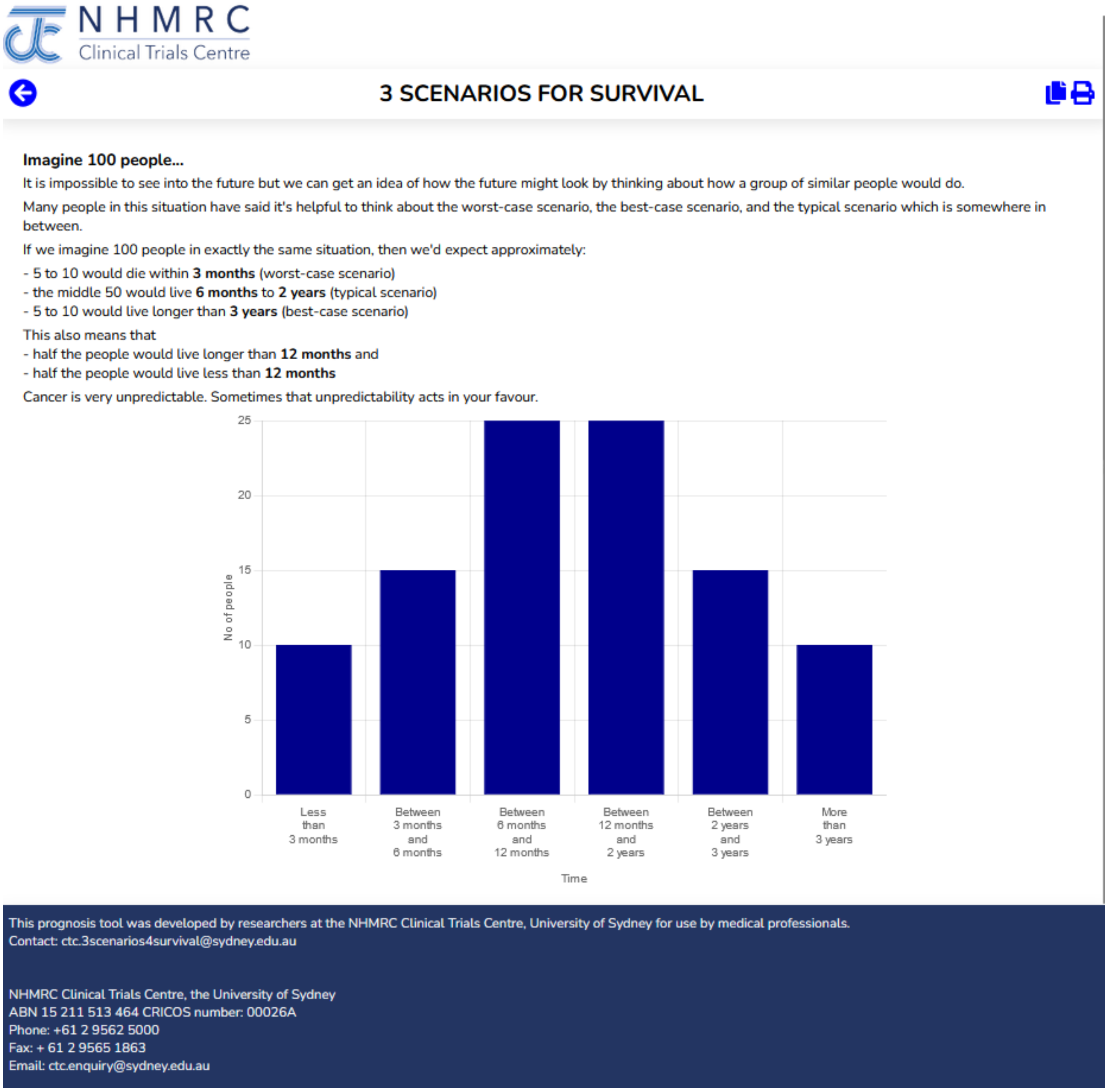

NHMRC
Clinical Trials Centre

3 SCENARIOS FOR SURVIVAL

Imagine 100 people...

It is impossible to see into the future but we can get an idea of how the future might look by thinking about how a group of similar people would do.

Many people in this situation have said it's helpful to think about the worst-case scenario, the best-case scenario, and the typical scenario which is somewhere in between.

If we imagine 100 people in exactly the same situation, then we'd expect approximately:

- 5 to 10 would die within **3 months** (worst-case scenario)
- the middle 50 would live **6 months** to **2 years** (typical scenario)
- 5 to 10 would live longer than **3 years** (best-case scenario)

This also means that
- half the people would live longer than **12 months** and
- half the people would live less than **12 months**

Cancer is very unpredictable. Sometimes that unpredictability acts in your favour.

This prognosis tool was developed by researchers at the NHMRC Clinical Trials Centre, University of Sydney for use by medical professionals.
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