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Individualising Life Expectancy Is Necessary for Optimal Prescribing

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Abstract. One possible cause of overprescribing (or insufficient deprescribing) is the failure to explicitly address the individual's life expectancy (LE). For example, if a LE estimate shows the person has six months to live, this should influence the prescribing of a medication that offers benefits only over a much longer LE. Predicting exactly the number of years a person will live is impossible, but probabilistic forecasting is possible and arguably essential, both for the selection of the optimal intervention and for meeting the 'reasonable patient' standard of information about the harms and benefits of alternative options. One side-effect of the COVID-19 pandemic has been to bring mortality into greater prominence, hopefully facilitating its discussion in the clinic as part of the 'new normal'. This paper outlines the case for introducing LE into prescribing decisions as a way of making more individualised decisions and potentially reducing overprescribing. It concentrates on how the clinical task of arriving at individualised estimates of LE might be tackled, especially in the case of the growing number of older patients with heterogeneous sociodemographic characteristics who are experiencing multiple long term conditions of varying severity and are frequently subject to 'polypharmacy'.

Keywords: Life expectancy, overtreatment, undertreatment, individualisation, personalisation, all-cause mortality, decision support, intuition-analysis.

1. Introduction

The COVID-19 pandemic has brought a focus on mortality at a *population* level, such as the analysis of geographical clusters of raised mortality over time in England and Wales [1]. We need to exploit this increased attention to improve our *clinical* practice by explicitly talking about life expectancy. A clinician reviews a patient's results in the context of the clinical history and considers changes, such as introducing medication. This decision has to take into account all benefits and harms to a person in order to meet the clinician's ethical and legal responsibilities when prescribing any course of action [2]. The decision has to reflect all the things that matter most to the patient. To do this, it has to be established how well each possible medication performs (rates) on each of these criteria in this person's case. It is not a good idea to prescribe something which is very effective, but for something that is not important to the person (personalisation), or, is of little relevance to their condition (individualisation) [3].

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Two things very important to most of us are, how long we will live, and how healthy we will be during that lifetime. While we all - patients and clinicians alike - find it difficult to talk about *mortality*, feeling more comfortable talking about *health*, we do need to make sure that the benefits and harms of any changes are assessed over their remaining life, including how long it will be. This is essential to make the best trade-off between the shorter-term benefits and longer-term harms - or shorter-term harms and longer-term benefits - that many medications, or other interventions, involve. We have previously explored the many issues surrounding communicating with patients about mortality [4].

A possible cause of overprescribing [5], or insufficient deprescribing, is the failure to explicitly address the individual's life expectancy (LE), and the effect of prescribing and deprescribing on this LE. For example, if a LE estimate shows the person has six further months to live, this should influence the prescribing of a medication that offers little prognostic benefit compared with what it would probably yield given a much longer LE. If LE is overestimated, over treatment is likely to result. A parallel argument can be made in relation to underestimation and insufficient prescribing, but we highlight the 'over' possibilities, such as over prescribing, because of the greater concern about it currently.

Life expectancy is defined by the Office for National Statistics (ONS) as "How long, on average, people can expect to live using estimates of the population and the number of deaths." [6]. This is all-cause mortality, all deaths regardless of the cause. Swapping often occurs between framing LE as expected year of death, e.g. 87 years, and as expected remaining years of life, e.g. 13 years. We will be stressing the latter, remaining LE (rLE) and note that choice of framing can be very significant psychologically in communicating with patients.

Predicting the exact number of years an individual person will live is impossible, but *forecasting* their rLE is possible, and arguably essential, both to optimise prescribing and to meet the 'reasonable patient' standard of information provision about the harms and benefits of alternative options. Clinicians considering options may not think of LE, at all. In some cases, they know intuitively that a person is deteriorating and nearing the end of life; this is when LE is most likely to be consciously considered in prescribing decisions [6]. We will argue that introducing LE is essential for optimal health decisions at *all* ages. Introducing LE in younger people is essential, since over their greater number of remaining years of life, there will be more competing risks.

This paper concentrates on how the necessary clinical task of arriving at individualised estimates of LE might be tackled. This is particularly challenging for the growing number of heterogeneous older patients experiencing multiple long term conditions of varying severity. This means that most prognostic studies and scoring systems, which are for single conditions (such as diabetes and COPD), have only indirect relevance, especially when they do not focus on all-cause mortality.

2. Method

We outline two broad approaches to arriving at what we call individualised life expectancy/remaining individualised LE (iLE/riLE). This is the average of a person's individual probabilities for living to each future year, ranging from the chance of being run over by a bus tomorrow, to dying peacefully in their sleep at, say, over 100. Both strategies assume the central point estimate will draw on two types of source - more

analytical ones (e.g. meta-analyses, prognostic scoring systems) and more *intuitive* ones (e.g. expert surveys, clinical experience) - but draw on them to different degrees depending on the case, in line with Hammond's Cognitive Continuum theory [7].

In most countries there is an official estimate of a person's life expectancy and in the UK it is from the Office for National Statistics (ONS). But this is the average, given only a person's age and sex. We know that many other things, especially personal characteristics, current health, and past, present and future health-related behaviours, mean this estimate may more or less under- or over-estimate iLE. In some cases, there are analytical estimates which take account of additional factors and emerging registry-based studies are providing increasingly solid data on diagnosis-related mortality metrics [8]. These can potentially improve riLE, given their accessing can be made practical in primary care. However, their restriction to established diagnoses and particular populations needs to be borne in mind. It must also be confirmed that the estimates relate to all-cause mortality, as opposed to that from specific conditions, even when the estimate relates to those with that condition.

To keep our illustration of the two strategies simple, we limit ourselves to drawing on the official (ONS) estimate to provide our 'baseline' iLE and riLE. We demonstrate each as a highly-stylised conversation with a male patient aged 74 years. These are the alternative approaches to support optimal personalised prescribing.

3. Results

Strategy 1: Analysis-adjusted Intuition

"In order not to be unduly influenced by the official estimate, reflecting only your age and sex, I'm going to start by making *my* estimate of your (remaining) individualised life expectancy, based on my knowledge of you and my clinical experience. I will do some brief mental checking of your key health indicators, but this is to help me arrive at my best holistic estimate, not to undertake a calculation of any sort.

My best estimate of your rLE is 20 years, which has you reaching the age of 94 - remember this is an average, which means I give you a roughly 50% chance of reaching this age. Now, I am going to look up the ONS estimate, to see to what extent I am rating you above or below their average.

For a male aged 74 years the LE is 87 years, making rLE 13 years. Well, I would have expected that to be higher. While I see you as considerably above average for your age and sex, I'm aware of the various biases we are all prone to, so I'm going to adjust my intuitive estimate down to 16 years, with a LE of 90 years. We will use this as your baseline in our decision making."

Strategy 2: Intuition-adjusted Analysis

"While I have my knowledge of you and my clinical experience to go on, I'm aware of the various biases we are all prone to, so I'm going to start with the official estimate, based only on your age and sex, and then adjust this up or down.

For a male of 74 years the ONS gives a LE of 87 years with an rLE of 13 years, on average. I'm a little surprised by that. However, I see you as considerably *above* average health for your age and sex, so I'm going to adjust it up to 16 years (reaching an age of 90 years), which we will use as your baseline in our decision making."

Both these examples avoid the more challenging situation for both clinician and patient. While there is no evidence on this, it seems reasonable to assume that a significant number of patients coming for symptomatic consultations, will have a below average riLE. In this case, the previous paragraph would need to read:

"For a male of 74 years the ONS gives a LE of 87 years with an rLE of 13 years, on average. I'm a little surprised by that. Unfortunately, I see you as in considerably *below* average health for your age and sex, so I'm going to adjust it down to 10 years, reaching an age of 84 years, which we will use as your baseline in our decision making."

Neither of these approaches involves the patient contributing their own intuitive irLE to the discussion. There is evidence to suggest that self-rated health and healthy life expectancy has considerable validity [9], but we are not dealing with the complications it would introduce on this occasion.

4. Discussion

Either strategy enables a clinician to provide the required numerical estimate of a patient's baseline iLE and riLE. Using more data to adjust these estimates, such as long checklists of different characteristics, will be impractical, so either of the above approaches is advanced as being of sufficient rigour to enable a clinician to ensure LE is incorporated in decision making practice, rather than avoided or evaded. Neither can avoid the situation where different clinicians will arrive at different estimates for the same patient. That is the reality of clinical practice.

It may be suggested that some options have only short term effects and do not affect mortality, so we can ignore LE. But one should be aware that this is a very strong statement about LE and needs to be registered in an informed consent process.

In addition to LE, the ONS provides selected chances of living beyond it, such as in our example (with an rLE of 13), a 1 in 4 chance of surviving for 18 years, a 1 in 10 chance of surviving for 22 years and a 2.6 in 100 chance of surviving for 26 years. Such parameters of surviving beyond LE (and iLE) may well be introduced into clinical discussions, but this should be done in awareness that acting on their basis will, on average, lead to what is conventionally constructed as overtreatment. Ethically, they should be accompanied by equivalent chances, interestingly not published by ONS, of not surviving until LE (e.g. a 1 in 4 chance of not surviving more than 7 years).

In this paper we focus entirely on the baseline riLE estimate, because this is the major deficiency in clinical decision making, verging on being the 'elephant in the room'. Comparatively speaking, there is a vast amount of information surrounding the estimated effect of specific interventions, such as medications, albeit often only on 'restricted' life expectancy rather than lifetime all-cause mortality [4]. A notable exception is a recent meta-analysis on the effects of various nutritional inputs on LE, accompanied by an online calculator that makes the results accessible in practice (https://food4healthylife.org/) [10]. Future research should explore how each broad approach can be elaborated in relation to specific clinical situations. Preferences of various sorts will necessarily play a part in deciding which of these is likely to produce the estimate in the best interests of the specific patient, given that, by definition, there can be no definitive answer for any individual.

5. Conclusion

Ethical and legal prescribing requires individualisation of harms and benefits, which cannot be done without explicit attention to all-cause mortality. Life expectancy (LE) is the single best mortality indicator, but it must be individualised. We offer two possible approaches.

While hugely important, mortality is only one criterion of many in considering options, alongside criteria such as health benefits, side effects, and treatment burden. Simply being informed of remaining individual life expectancy (riLE) without knowing how to process it in decision-making is of dubious value. In our view the numerical estimate needs to be embedded in a decision support framework. The one we prefer is a Multi-Criteria Decision Analysis-based Decision Support Tool, in which the weighting of the criteria by the person ensures the support meets the requirements of informed and preference-based consent [11] [12].

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