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# Euthanasia: the fear of becoming a burden*

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**Abstract**

It has been widely documented in the medical literature that terminal patients often choose to end their lives out of the fear of becoming a burden to their family. But the real size of the burden, in particular its emotional component, is only known by the patient's family. I analyze the impact of legalizing euthanasia on the ability of the family to communicate with the patient through a cheap talk model. I argue that, if euthanasia is legalized, either the patient makes his decision (of whether or not to commit suicide) uninformed of the size of the burden; or chooses what his family would have chosen if it had the power, and not necessarily what he would have preferred. I also consider the role of the physician and argue that, if the physician anticipates the family's influence in the patient's decision, providing incentives for the physician's interests to be aligned with the patient's might not be on the patient's best interest.

JEL classification: D8, I12

Keywords: euthanasia, cheap talk

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## 1 Introduction

Should a patient with a terminal illness be allowed to prematurely end his life in order to avoid the ordeal of continuing to live under extremely unpleasant circumstances? This is a question that goes back to ancient times and that has rendered attention from a myriad of philosophers and thinkers of different civilizations, with different cultures and beliefs. Despite this, there does not seem to be a consensus and it is easy to find articles defending either side. In recent years, public opinion seems to be shifting its allegiance towards the legalization of some form of assistance in dying (recent polls in the United States report that around 70% of people support the legalization of euthanasia[1]), which has led to changes in the legislation of some countries - for example, euthanasia has been legalized and regulated in the Netherlands since 2002 under the "Termination of Life on Request and Assisted Suicide (Review Procedures) Act" and, in the United States, Oregon's Death with Dignity Act regulating assisted suicide was passed in 1994.[2]

The typical argument in favor of legalizing euthanasia and/or assisted suicide is one that economists can certainly relate to and understand: giving more options to patients enlarges the set of choices they have, and so cannot diminish their wellbeing. As is well known, there are many arguments against legalizing euthanasia, some of them largely accepting a utilitarian framework, while others not so much: an argument that defends that a dying patient cannot be trusted to make a reasonable decision regarding his life would be an example of the former;[3] while an argument defending that one's life is inherently valuable and, as such, should be protected would be an example of the latter.[4]

The purpose of this paper is to scrutinize one such argument in particular. One of the concerns with legalizing euthanasia is that patients might be too vulnerable to being persuaded by those who surround them. A dying patient, knowing that he has but only a few months to live, may be tempted to commit suicide in order to spare his family of not only the financial difficulties that come with palliative treatment, but also the pain and suffering of witnessing his decay. According to data gathered in the state of Oregon, this concern seems justified, as around 40% of the terminal patients who have requested assistance in committing suicide mentioned the concern over becoming a burden to their family and friends as a reason for such request.[5] Furthermore, in a survey conducted by Steinhauser et al. (2000), 89% of terminal patients deemed as important not being a burden to their family when dying and

[1] According to a Gallup poll from May, 2014.

[2] The distinction between assisted suicide and euthanasia is that in the former, the physician simply provides the lethal means (usually pills) to the patient, while, in the latter, the physician directly causes the patient's death, usually by intravenously administrating a lethal drug. Throughout the paper I generally do not distinguish between the two as my argumentation holds for both. In particular, I often refer to the patient's decision of ending his life as committing suicide, which is only technically correct in the case of assisted suicide.

[3] See Golden and Zoanni (2010).

[4] See Gorusch (2006), chapter 9.

[5] According to the 2014 Death with Dignity Act Annual Report.

85% considered important believing their family is prepared for their death.

But how does a patient know the burden he causes? Or, more precisely, how does a patient infer his family's wishes? Only the family knows whether the patient is indeed a burden or rather, if his survival, if only for a few more months, more than outweighs whatever burden might exist. The patient can certainly attempt to obtain this information by communicating with his family, but it is not obvious that such interaction will be informative. It is easy to conceive of a scenario where, even though the family is suffering, it might hide this from the patient, precisely to prevent him from committing suicide. This means that, not only might patients commit suicide because they are a burden to their loved ones, but, even more disturbingly, patients might commit suicide because they *believe* they are a burden, and their families have no credible way of correcting this belief.

My aim is to study how an arbitrary terminal patient's decision to end his life is affected by his interaction with others, should euthanasia be legalized. I model this interaction using a cheap talk model, where the informed party - the patient's family - sends a message to the patient regarding how the family is affected by the patient's decision. Upon receiving this message, the patient decides whether or not to commit suicide.

As in all cheap talk models, there is always a "babbling" equilibrium, where the patient does not retrieve any information from the interaction. However, as it is known at least from Crawford and Sobel (1982), it is very well possible that other equilibria exist, provided the preferences of the informed and uninformed party are not too different. What makes this particular application special is the fact that the decision maker's choice set is binary - the patient either chooses to live or to commit suicide. This very feature is the origin of a particular result, which, I believe, provides insight on the euthanasia debate, as the following example illustrates.

Let $y \in [-1, 1]$ denote the degree to which the patient's family wishes for him to remain alive and not commit suicide. Suppose that the family wishes the patient to remain alive if and only if $y \geq 0$. The patient has his own preferences, but he also takes into account how his family is feeling. Assume that his preferences are such that he prefers to stay alive if and only if $y \geq -\frac{1}{4}$. Finally, assume $y$ is privately known by the family, that the ex-ante distribution of $y$ is uniform and that the patient is risk neutral. Figure 1 displays the agents' preferences.

Family and patient always agree on what course of action to take except if $y \in \left[-\frac{1}{4}, 0\right)$. In this set, the family would prefer the patient to commit suicide, but the patient would prefer to live. Suppose an equilibrium exists where the patient is able to obtain some information about $y$ from the family. Given that the patient only has two possible actions, it must be that, after a certain message, the patient chooses to live, while, for some other distinct message, the patient chooses to commit suicide, for if he was to do the same regardless of the message

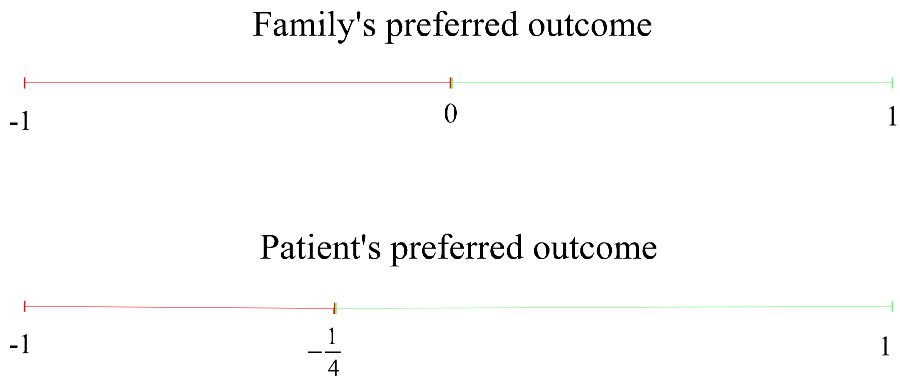


Figure 1: In the red intervals, the agent (family and patient respectively) prefers the patient to commit suicide, while in the green ones prefers him not to

received, the content of that message would be irrelevant. Therefore, there is one message, which we may label as "*yes*", after which the patient chooses to commit suicide; and another distinct message labeled as "*no*", after which the patient chooses to live. When will the family say *yes*, knowing that the *no* message is also available? Only if $y < 0$. And it will choose to say *no* if $y \geq 0$. This means that, after receiving a *yes*, the patient infers that the expected $y$ is $-\frac{1}{2}$ and so prefers to commit suicide (because $-\frac{1}{4} > -\frac{1}{2}$). After receiving a *no*, the patient infers that the expected $y$ is $\frac{1}{2}$ and prefers to stay alive (because $\frac{1}{2} > -\frac{1}{4}$). Because the patient always prefers to follow his family's advice, and the family correctly anticipates he will, this type of behavior indeed forms an equilibrium.

Notice that the labels on the messages do not need to be expressed literally by the patient's family (it is hard to imagine the family directly telling the patient he should commit suicide). What matters is how such messages are interpreted by the patient, in particular, whether he interprets a *yes* as the family acquiescing to the patient's desire to commit suicide. And such interactions do not seem so farfetched if euthanasia is legalized and commonplace:

> *Family members may want a loved one to remain alive as long as possible, while also harboring secret desires to be done with this painful process. Many people today are ashamed of such secret desires. . . . But if assisted suicide becomes legal, such desires will cease to be wrongful in such an obvious way. If patients themselves may decide to put an end to this painful process of dying, then it is not blameworthy for relatives of such a patient to inquire whether he or she may be thinking along these lines, and to offer sympathetic support for the idea. . . . Once assisted suicide ceases to be illegal, its many advantages to busy relatives will become readily apparent. More than merely an acceptable form of ending,*

*relatives and friends may come to see it as a preferred or praiseworthy form of death. Mann (1998)*

The previous example illustrates that only one of two things may happen in equilibrium. Either the patient makes his decision uninformed about how his family feels; or ends up deciding exactly what his family would have decided if it had the power. In particular, in the example, if $y \in \left[-\frac{1}{4}, 0\right)$ the patient ends up choosing to commit suicide, which is *not* what he would have preferred had he known the true value of $y$, but *is* what the family would have wanted.

Even though this result is extremely simple, I believe it can be understood as an argument against the legalization of euthanasia. Imagine that, instead of the current debate over euthanasia, where the issue is whether the *patient* should have the choice to receive assistance in ending his own life, the debate was on whether the *family* should be allowed to independently make this decision. It is my impression that an overwhelming majority of people would prefer patients not be allowed to die prematurely, rather than allowing their family to have full control. What I argue in this paper is that, if one is against granting the decision power to the family, then one should also be reluctant to legalize euthanasia, because granting it to the patient would lead to the same outcome, at least when an informative equilibrium exists.[6]

Notice, however, that the expected utility of the patient increases by legalizing euthanasia. If euthanasia is not allowed, there is a 37.5% probability the patient lives when he would have preferred to commit suicide; while, if it is allowed, there is only a 12.5% probability the patient commits suicide when he would have preferred not to. The reason for this is the argument above about how increasing the patient's options cannot decrease his expected utility, at least if it is assumed that he has rational expectations. But if that was the relevant criterion, there would be no reason not to shift the decision power to the family. The patient's family is likely to be concerned about the wellbeing of the patient, so letting it decide increases the patient's expected utility. Of course, there could be some concern that the family might be spiteful towards the patient, for whatever reason, but safeguards could be arranged to mitigate this danger - for example, the decision power could be given only to the next of kin; or maybe only to the family members that are on the patient's will. But, I believe that most people would frown upon the idea that someone other than the patient should have the power to decide.

If the impact on the expected utility of the patient should not be the sole criterion on whether euthanasia should be legalized, what should? If there was no uncertainty over the decision of the patient, this would be a mute question. The feedback the patient receives from his family would be irrelevant as he would already know all there is to know about how to

[6] In the text, I discuss in more detail when might the communicative equilibrium not exist and the implications of that.

make his decision and would unequivocally be better off by having the option of committing suicide. But that is not the case, and mistakes are bound to happen. In the previous example, it is true that the wrong outcome is achieved only with a probability of 12.5% if euthanasia is legalized as opposed to the 37.5% if it is not. But I would suggest that these two "errors" are not equal in nature: remaining alive when suicide is preferred and committing suicide when remaining alive is preferred. Just like in criminal law, where the concern over wrongly convicting is much greater than acquitting a guilty person, it seems reasonable to me that society should give more weight to the latter type of mistake. In the text, I further explore this question and investigate what may cause these two types of mistakes to be more or less prevalent.

In section 2, I present a simple three stage model, from which I draw my main results. There are three actors in the model: the patient, the patient's family and the patient's physician. In the first stage, the physician, who is assumed to be privately informed about the medical diagnosis of the patient, sends a cheap talk message to the patient. In the second stage, following the diagnosis of the physician, the patient's family, privately informed of the impact the patient's decision has on it, sends its own cheap talk message to the patient. In the final stage, the patient, having received the feedback from both physician and family decides on whether to commit suicide.

In section 3, I analyze the model under the assumption that the physician is always honest. I discuss when informative equilibria exist and what might influence the magnitude of the mistakes described above.

The assumption that physicians are always honest has been put into question. For example, there is a fear that physicians exaggerate the circumstances that the patient will face on his dying days in order to save resources, given that assisted suicide is a lot cheaper than extensive palliative care; or it could be that physicians have their own personal beliefs about what is best for the patient (see Gorusch (2006), chapter 7.3). In light of this discussion, in section 4, I explicitly consider the physician's incentives when communicating with the patient. The physician's problem is particularly complex as not only must he infer how will the patient react to his message, but also how that might influence the patient's family and what they choose to share with the patient. In the text, I argue that, in general, one must not expect physicians to be completely honest about the diagnosis and some degree of ambiguity in the physician's discourse should be expected. Furthermore, I suggest that it is virtually impossible to create incentives that induce honesty by the physician. In particular, because the physician anticipates the family's intervention, it does not follow that creating incentives for physicians to have the patient's best interests in mind leads to a completely honest and transparent diagnosis. In fact, I argue that it is even possible that aligning the physician's interests with the patient's family, rather than the patient's, might lead to an ultimately more informed decision.

Throughout the paper, I assume that the patient himself is always honest. This implies that the patient shares with both his physician and his family whatever information he has, in particular what he would prefer to do for different diagnosis and different sizes of the burden he causes. The implication of this to my analysis is that it allows me, without loss of generality, to assume that the patient has no source of information other that what his physician and family report to him.

I make this assumption because I do not find it reasonable that a dying patient, going through all the emotional trials that come with such state, would be able, at all times, to hide what he is feeling from either his loved ones, or even possibly his physician, in order to get any of these to be more honest. This type of strategic behavior does not seem compatible with the state of mind of dying patients. At this point, the reader might also be tempted to apply the same logic to the patient's family. The family also goes through an emotionally trying process, so they too might be unable to hide how they are feeling. I would argue that the two are not the same. The patient's family is aware that it is the patient making the decision and that any wrong word might be interpreted as consent. It seems natural to me that families are not indifferent to this, and that would cause them to be careful in how they interact with the dying patient, anticipating how their words will be perceived. I do not think the patient has the same level of concern. The patient knows that it has the final say over his decision, and so it seems unlikely that he would have the presence of mind to strategically communicate with his family, in order to obtain more information from them. Furthermore, the very process of expressing one's emotions might, in and of itself, make the patient more comfortable and at ease with the process of dying.[7]

In section 5, I conclude by discussing the implications of my results to the debate over whether euthanasia should be legalized.

## 2 The Model

There are three agents in the model: the patient, the patient's family and the patient's physician. Family and physician have some information that is relevant for the patient's decision of whether to commit suicide. In particular, I assume that the private information that the physician holds is embedded in random variable $x \in [\underline{x}, \overline{x}]$, while the private information that the family holds is embedded in random variable $y \in [\underline{y}, \overline{y}]$, where $x$ and $y$ are assumed to be independent.

If the patient chooses to commit suicide, the utility of each agent is normalized to 0. If the patient chooses to remain alive, then I assume that the utility of the patient is given by $u^p(x, y) = x + \alpha y$, the utility of the family is given by $u^f(x, y) = x + y$, while the utility of the physician is given by $u^d(x, y) \in \mathbb{R}$.[8]

[7] According to Steinhauser et al (2000), more than 90% of the patients surveyed mentioned as important having someone to listen when going through the process of dying.

[8] I reserve the discussion on $u^d$ to section 4.

The random variable $x$ is supposed to incorporate information specific to the medical condition of the patient, in particular, what he should expect from his last few months of life: how much pain he will be in, how much autonomy he will have, how the state of mind of other patients with the same condition has evolved, etc. A large value of $x$ means that the discomfort of the last few months of life are anticipated to be small. The random variable $y$ is supposed to incorporate information that is specific to the family's state of mind and its relationship with the patient. For example, a large value of $y$ could mean that the family values highly the possibility of being with the patient for as long as possible, it could also represent the family's strong moral opposition to euthanasia, etc.

Variable $x$ can be interpreted as determining the patient's decision if he was not influenced by his family - he would choose to commit suicide if and only $x < 0$. The family's utility, in case of survival, might be different and is given by $u^f$. Variable $y$ can then be thought of as the difference between $u^f$ and $x$. The assumption that $x$ and $y$ are independent simply means that, whatever makes patient and family have different preferences is independent of the patient's condition, but rather depends on the type of relationship that the family has with the patient and its views on euthanasia. Because the patient is altruistic and cares about how his family is affected by his decision, he gives weight $\alpha > 0$ to $y$, even though $y$ is not thought to influence the patient directly.

An alternative way to understand the specific functional form assumed for $u^p$ is by thinking that the patient cares directly about $u^f$ and not about $y$. In this case, one can think of the patient's utility of staying alive as being given by $\theta_1 x + \theta_2 u^f(x, y) = (\theta_1 + \theta_2) x + \theta_2 y$, which, after normalizing by $(\theta_1 + \theta_2)$, becomes $x + \alpha y$ where $\alpha = \frac{\theta_2}{\theta_1 + \theta_2}$. The caveat of this interpretation is that it restricts $\alpha$ to the interval $[0, 1]$, unlike the former interpretation.

To me it is not clear which of the two interpretations has more merit. One would more naturally be inclined to favor the second one, as it has been used in different papers in Economics.[9] However, for this application, restricting $\alpha$ to belong to $[0, 1]$ may sometimes not be that intuitive. Consider an example where the family is very poor and palliative care treatment is much more expensive than euthanasia. Suppose that this leads to $y = -\frac{1}{2}$. Suppose also that $x = 1$. This means that, if the patient did not care about the impact of his decision on his family, he would prefer to remain alive. It also means that the family's desire that the patient remains alive is bigger than the burden such survival causes (because $1 - \frac{1}{2} > 0$). It follows that, under the second interpretation of $u^p$, the patient should choose to remain alive as both him and his family prefer it. However, in my opinion, it is conceivable to think that the patient would choose to commit suicide because he may value the burden he causes more than his family does. Even though the patient knows his family prefers him to stay alive, he may still be tempted to commit suicide to avoid the guilt of leaving his loved ones in an even more troublesome financial situation.

In what follows, the reader should keep in mind that all results concerning $\alpha > 1$ are only

[9] See, for example, Bester and Guth (1998).

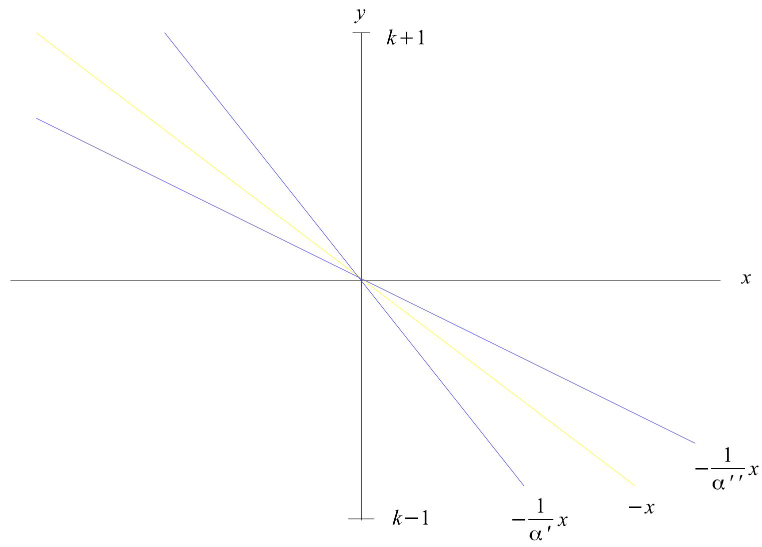


Figure 2: The yellow line represents the indifference line of the family, while the blue line the patient's when $\alpha = \alpha'$ and $\alpha = \alpha''$, where $\alpha'' > 1 > \alpha'$. It is assumed that $\overline{y} = k + 1$ and $\underline{y} = k - 1$.

meaningful under the first interpretation.

Figure 2 compares patient and family's preferences. If $\alpha = 1$, patient and family agree over the course of action for all $(x, y)$. In this case, the family should have no problem in credibly reporting $y$ to the patient, as the patient knows that they both have the same preferences, and so the family would have no reason to lie. If $\alpha \neq 1$, that does not necessarily happen as patient and family not always agree.

The game is as follows. It starts with the physician being privately informed of $x$ and the family being privately informed of $y$. In the first stage, the physician sends a cheap talk message $m_x \in M_x$, where $M_x$ is assumed to be arbitrarily large, that is received by both patient and family. The assumption here is that the message would be delivered to the patient, but because he is assumed to be honest with his family, he would always fully reveal the content of the message. In the second stage, after observing $m_x$, the family chooses to send its own cheap talk message $m_y \in M_y$, where $M_y$ is assumed to be arbitrarily large, that is received by the patient. Finally, in the third stage, having observed $m_x$ and $m_y$, the patient attempts to infer $x$ and $y$ and decides on whether to commit suicide. The outcome of the game is a decision for each pair $(x, y)$, which I denote by $\tau(x, y) \in [0, 1]$ and interpret as the probability that the patient chooses to remain alive.

Finally, and for simplicity, I assume that $y$ is uniformly distributed, $\underline{y} = k-1$ and $\overline{y} = k+1$ where $k = E(y) \in (-1, 1)$.

## 3 Family and Patient

In this section, I assume that the physician is always honest and that this is common knowledge. This means that, at the beginning of the second stage, both family and patient know $x$. Consider the subgame that starts with the family's decision for each $x$.

A strategy for the family is a function $\sigma^f : [k-1, k+1] \to \Delta(M_y)$, where the type of each family is mapped into a distribution over the message space; and a strategy for the patient is a function $\sigma^p : M_y \to [0,1]$, where, for each message received, the patient selects a probability of survival.

**Definition 1** *A Perfect Bayesian Equilibrium (PBE)* $(\sigma^f, \sigma^p)$ *of the subgame is such that*

*i) For all* $m \in M_y$ *such that there is* $y \in [k-1, k+1]$ *where* $\sigma^f(y)(m) > 0$,

$$\sigma^p(m) \in \arg\max_{a \in [0,1]} \{aE(x + \alpha y | x, m)\}$$

*ii) For all* $y \in [k-1, k+1]$ *and for all* $m \in M_y$ *such that* $\sigma^f(y)(m) > 0$,

$$m \in \arg\max_{m' \in M_y} \left\{\sigma^p(m')(x+y)\right\}$$

*iii)* $E(x + \alpha y | x, m)$ *is calculated by Bayes' rule.*

It is trivially shown in Lemma 2 that, as long as the preferences of patient and family are different, one can restrict attention to the set of PBEs where only two messages are available to the family: *yes* and *no*. Without loss of generality, I assume $\sigma^p(yes) \leq \sigma^p(no)$.

Let $T_y(M_y)$ denote the set of outcomes $\tau(x, y)$ that are induced by some PBE for a given message set $M_y$.

**Lemma 2** $T_y(\{yes, no\}) = T_y(M_y)$ *for all* $M_y$ *that contains at least two elements, as long as* $\alpha \neq 1$ *and* $x \neq 0$.[10]

**Proof.** See appendix. ■

A "babbling" PBE, where $\sigma^f(y)$ is independent of $y$, always exists. In such an equilibrium, the patient is left uninformed about $y$, and so, must refer to his prior $k$ to make his decision. This PBE is not that appealing to the patient, as the odds of making a mistake are significant.

[10] If $x = 0$ it is easy to show, by simply following the proof of Lemma 2, that one can restrict attention to three messages, where the third message is sent only by type $y = 0$.

For a PBE to be informative two things must happen. First, it must be that the family does not send the same message regardless of $y$: for a set of circumstances, the family must choose to send message *yes*, while for some other set of circumstances to send message *no*. Second, the decision made by the patient, after receiving each message, must be distinct, for, otherwise, the decision would be independent of the message, which would mean its content would not be relevant.

Formally, a PBE is defined to be informative if and only if i) for $m \in \{yes, no\}$, $\sigma^f(m)(y) > 0$ for some $y \in [k-1, k+1]$ and ii) $\sigma^p(yes) < \sigma^p(no)$.

Because the family's utility, in case the patient does not commit suicide, is strictly increasing with $y$, there is a cutoff $\widehat{y}(x)$ below which the family prefers the patient to commit suicide, where

$$\widehat{y}(x) = \begin{cases} k-1 \text{ if } x+y>0 \text{ for all } y \in [k-1,k+1] \\ k+1 \text{ if } x+y<0 \text{ for all } y \in [k-1,k+1] \\ -x \text{ otherwise} \end{cases}$$

It follows that the *yes* message is sent if $y < \widehat{y}(x)$ and the *no* message is sent if $y \geq \widehat{y}(x)$, where, without loss of generality, if the family is indifferent between the two messages, I assume it picks *no*. This means that, after a *yes* message, the patient's expectation about $y$ is given by $\frac{k-1+\widehat{y}(x)}{2}$, while after a *no* message, it is $\frac{k+1+\widehat{y}(x)}{2}$. It follows that, for such an informative PBE to exist, it must be that

$$x + \alpha\frac{k-1+\widehat{y}(x)}{2} \leq 0 \leq \frac{k+1+\widehat{y}(x)}{2} \tag{1}$$

so that the patient does not make the same decision regardless of the message received. If (1) is satisfied with two strict inequalities, then the informative PBE exists and is such that the patient chooses to commit suicide if he receives message *yes* and to remain alive if he receives message *no*. If (1) is satisfied with one equality, the patient is indifferent after one of the two messages. Given this event has zero probability of happening, I only consider equilibria where the patient chooses to commit suicide if and only if he receives message *yes*.

**Proposition 3** *An informative PBE exists if and only if*

$$\sigma^p(m) = \begin{cases} 1 \textit{ if } m = yes \\ 0 \textit{ if } m = no \end{cases}$$

*and*

$$\sigma^f(y)(m) = \begin{cases} 1 \textit{ if } \{y < \widehat{y}(x) \textit{ and } m = yes\} \textit{ or } \{y \geq \widehat{y}(x) \textit{ and } m = no\} \\ 0 \textit{ otherwise} \end{cases}$$

*and (1) holds.*

Taking a closer look at condition (1), there are a few remarks in order.

Consider the case where the patient's preferences are such that, regardless of what the family is feeling, he prefers either to commit suicide ($x+\alpha y<0$ for all $y$) or not to ($x+\alpha y>0$ for all $y$). In this case, (1) cannot hold, because the patient would want to take the same action after either message. But this is not a problem, as the information that the family holds is irrelevant for the patient's decision.

A more problematic case happens when it is the family that, regardless of $y$, wishes the same outcome. Also in this case, (1) does not hold. This is more troublesome as it may be the case that the information contained on $y$ is relevant for the patient's decision as the following example illustrates:

**Example 4** *Let $k=-\frac{1}{2}$, $x=\frac{3}{2}$ and $\alpha=4$. The patient's preferences are such that he would prefer to commit suicide if and only if $y<-\frac{3}{8}$, while his family prefers him not to commit suicide, regardless of $y$. Because the patient is aware of this fact, he knows that anything that his family says is only to convince him not to commit suicide, and conveys no information regarding $y$. Therefore, his best guess about $y$ is $k=-\frac{1}{2}$. Given that $-\frac{1}{2}<-\frac{3}{8}$, the patient chooses to commit suicide, thus making a mistake for all $y<-\frac{3}{8}$.*

Proposition 5 identifies when such a problem occurs in general.

**Proposition 5** *If the family wants the same outcome for any $y$, then the patient makes a wrong decision for some $y$ if and only*

$$\alpha>1 \text{ and } x\in\{((1-k),\alpha(1-k))\cup(-\alpha(1+k),-(1+k))\}$$

**Proof.** Simple algebra. ■

Notice that a necessary condition for this phenomenon to happen is that $\alpha>1$, so that, to some extent, the patient cares more about the impact of his decision on his family than on himself - a kind of overaltruism. But it seems to me that, if there ever was an application where overaltruism was a reasonable assumption, it was this one. The general message from this simple result is almost paradoxical: if the two agents care too much about one another and this is commonly known and understood by both, communication may get compromised, and the patient may end up making an uninformed decision.

In order to investigate how the patient's decision outcome $\tau$ changes for different $(x,y)$, it is necessary to select between the different PBEs. In the cheap talk literature, the equilibrium refinement that is most commonly used is that of "neologism proofness" - see Farrell (1993). The idea is that a PBE is not neologism proof if i) for some set of $y-$types, the family strictly prefers to send a message that is not sent in the PBE, as long as the patient is able to correctly identify this; and ii) no other $y-$type outside of such set has an incentive to send that same message.

**Proposition 6** *i) For all $x \in [\underline{x}, \overline{x}]$ such that the informative PBE exists, it is neologism proof.*

*ii) The non-informative PBE is neologism proof if and only if the informative PBE does not exist.*

**Proof.** See appendix. ■

Imagine that $x$ is such that both PBEs exist and that, in the uninformative one the patient chooses to commit suicide. The uninformative PBE would not seem plausible because it would simultaneously be the case that, whenever the family's type $y$ is bigger than $\widehat{y}(x)$, the family would like to warn the patient, but if it is smaller it would not. Given this separation, the patient would have no reason to doubt the warning. Because the informative PBE exists, it follows that receiving this warning is enough to make the patient choose not commit suicide. It is this argument that leads to Proposition 6.

Following Proposition 6, when analyzing $\tau$, I assume that, whenever it exists, the informative PBE is played. It is convenient to divide the analysis into two cases: $\alpha < 1$ and $\alpha > 1$.

**Case 1:** $\alpha < 1$

By simply applying propositions 3 and 6, it follows that

$$\tau(x, y) = \begin{cases} 0 \text{ if } x < -\frac{\alpha(k+1)}{2-\alpha} \\ 0 \text{ if } x \in \left[-\frac{\alpha(k+1)}{2-\alpha}, \frac{\alpha(1-k)}{2-\alpha}\right] \text{ and } y < -x \\ 1 \text{ if } x \in \left[-\frac{\alpha(k+1)}{2-\alpha}, \frac{\alpha(1-k)}{2-\alpha}\right] \text{ and } y \geq -x \\ 1 \text{ if } x > \frac{\alpha(1-k)}{2-\alpha} \end{cases}$$

If $x < -\frac{\alpha(k+1)}{2-\alpha}$, the informative equilibrium does not exist. The patient makes his decision based on his prior belief about $y$. Given that $x$ is sufficiently small, he chooses to commit suicide. If $x \in \left[-\frac{\alpha(k+1)}{2-\alpha}, \frac{\alpha(1-k)}{2-\alpha}\right]$, the informative equilibrium does exist, and so, the patient commits suicide if and only if he receives the *yes* message. If $x > \frac{\alpha(1-k)}{2-\alpha}$, the informative equilibrium no longer exists but, because $x$ is now large, the patient chooses to live.

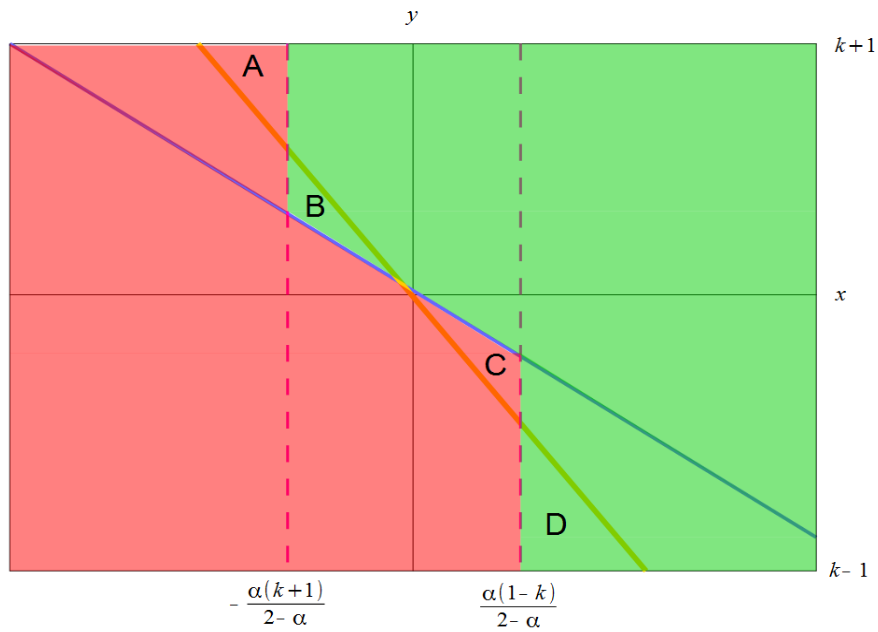


Figure 3: Description of $\tau$ for $\alpha < 1$. The patient chooses to commit suicide in the red areas, and to remain alive in the green ones.

Figure 3 illustrates $\tau$. The blue line represents the indifference line of the family, which is given by $-x$, while the yellow line is the indifference line of the patient, which is given by $-\frac{1}{\alpha}x$. The patient chooses to commit suicide if $(x, y)$ belongs to the red area and chooses not to if $(x, y)$ belongs to the green area.

If the patient was able to decide based on his own preferences, the decision threshold would be represented by the yellow line. However, we see that such threshold is only the one that ends up being used in the decision when $x$ is either very large or very small, enough so that the information that the family holds becomes irrelevant. If $x \in \left[-\frac{\alpha(1+k)}{2-\alpha}, \frac{\alpha(1-k)}{2-\alpha}\right]$, the phenomenon alluded to in the Introduction happens, where the decision is based not on the patient's indifference line, but rather on the family's. Even though the decision is the patient's to make, he ends up deciding as if he had his family's preferences. This result illustrates the amount of power the family of the patient holds. Even though the patient's expected utility is larger when he has the option to end his life, I find it it somewhat disturbing that the benefits of having this option are so unevenly distributed, and it is the family, not the patient, who gets the most benefit.

One aspect of this analysis that is markedly different than most economic applications has to do with the appropriate welfare measure. If, instead of a patient making a life or death decision under the advice of his family, there was an abstract decision maker making an abstract decision after having consulted with an expert, it would be more or less consensual that a proper welfare measure would have to somehow depend on both agents' wellbeing. However, for this particular case, this does not seem appropriate as one would think that the welfare should depend very little on what the family gets out of it. Evidence of that is that the existing legislation in Oregon and some countries in Europe gives the *patient* the right to choose whether to live, not his family.

On the other hand, what also seems clear to me is that society is paternalistic to some extent, in that it seems to take the stand that it is better to exert caution when allowing patients to commit suicide. In the several countries or states where either assisted suicide or euthanasia are allowed, there are a series of safeguards designed precisely to guarantee that the patient is sound minded, has a terminal disease and/or is in considerable amount of pain, is not depressed, has had time to think about his decision and has not been coerced. It is often the case that these safeguards prevent access to suicide for readily patients - for example, a patient must make several requests, separated in time, to be allowed to commit suicide. This suggests to me that society views differently the two types of mistakes that the patient may make: a patient who commits suicide but would have rather not if he had been fully informed is more undesirable than a patient who does not commit suicide but would have if he had been fully informed.

Figure 3 depicts the extent of these two types of errors. Regions $A$ and $C$ represent the set of patients who decide to commit suicide but would have preferred not to had they known $y$, while regions $B$ and $D$ represents the set of patients who would have preferred to commit suicide, but end up not to. Following the previous discussion, the more disturbing scenario would be one where the weight of $A+C$ is larger than the weight of $B+D$.

**Example 7** *If $x \sim U(-T,T)$, where $T > \max\{\alpha(1-k), \alpha(1+k)\}$, then through some algebra we get that*

$$A + C - B - D = -\frac{1}{2T}\frac{\alpha^2(1-\alpha)}{(2-\alpha)^2}k$$

*which is positive if and only if $k < 0$ and decreasing with $k$.*

The previous example, with the uniform assumption on $x$, is such that the weight of each region is equal to its area. In that case, we see that if $k < 0$ (if there is an expected burden) there are more of the "wrong" type of mistakes ($A+C$ is larger than $B+D$). Furthermore, as the size of the expected burden increases, the difference between the two types of mistakes also increases. So, for example, if euthanasia is introduced with a very low price when compared to the palliative care cost, (as is the case in the Netherlands or in Oregon), this would not only lead to more suicides, but also to an increase in the frequency of wrongful suicides relative to the wrongful decisions of not committing suicide.[11]

[11] Euthanasia is not legal in Oregon, only assisted suicide, but its cost is far inferior to the palliative care cost.

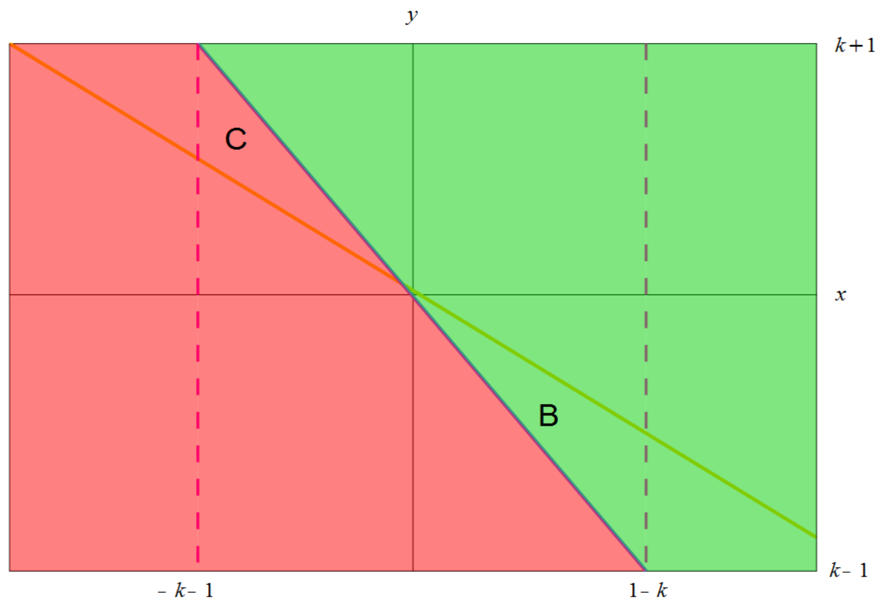


Figure 4: Description of $\tau$ for $\alpha \in (1,2]$

**Case 2:** $\alpha > 1$

In this case, the two indifference lines in Figure 3 switch. If $\alpha \in (1,2]$ the characterization of the decision pattern of the patient is similar to the previous case. According to Proposition 3, there is meaningful communication if $x \in [-k-1, 1-k]$, the patient chooses to commit suicide if $x < -k-1$ and chooses not to if $x > 1-k$ - see Figure 4. In region $B$, the patient would rather commit suicide but ends up not to while in region $C$ the opposite happens. Notice also that, in this case, for all $(x, y)$ the decision that the patient makes in equilibrium is exactly the one that his family prefers.

If $\alpha > 2$, it is possible that a peculiar phenomenon occurs that Figure 5 describes. One should interpret this characterization as the patient caring substantially more about how his family is affected by his decision than about the direct consequences of it on himself - a rather demanding assumption for most applications but not unreasonable for this one. Consider a case where $k < 0$ and sufficiently small so that there is a considerable expected burden. The black vertical line at $(-\alpha k)$ represents the threshold for the patient if he obtains no information from his family, i.e. if the patient obtains no information regarding $y$, he chooses to commit suicide if and only if $x < -\alpha k$. As before, the two pink lines delimit the range for which an informative equilibrium can occur. Therefore, for all $x$ between the second pink line and the black line, the patient decides to commit suicide without being able to obtain any

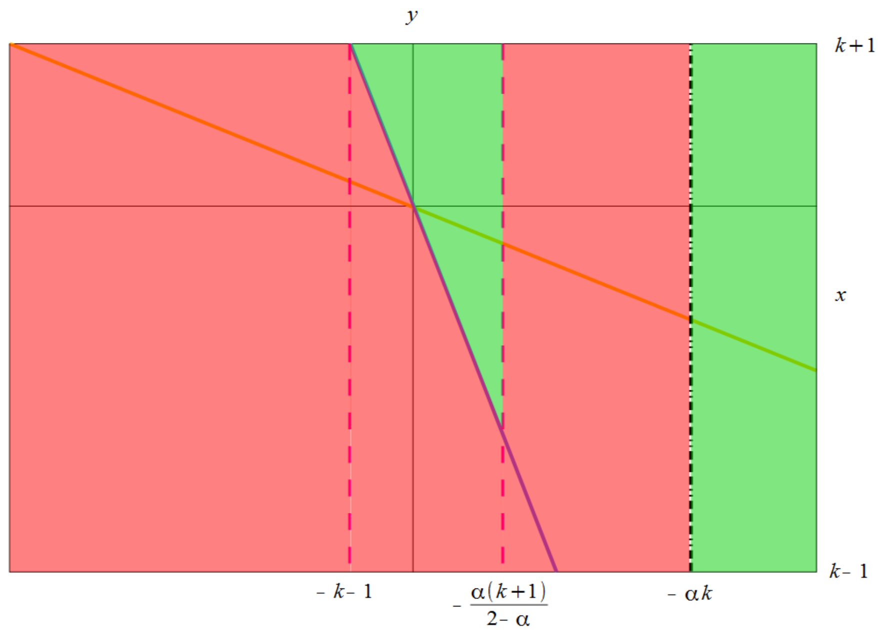


Figure 5: Description of $\tau$ for $\alpha > 2$ and $k < -\frac{1}{\alpha-1}$

advice from his family. The reason is the following. For there to be an informative equilibrium, it is necessary that the patient wishes to continue to live after message *no*. Given that the family cares relatively more about $x$ than $y$, it would report *no* for all or almost all levels of $y$, which would lead to the patient believing that the burden was too high even after a *no*. However, as $x$ decreases, the family would be willing to report *yes* for more levels of $y$, which would increase the conditional expectation of $y$ after a *no*.

Proposition 8 below identifies the conditions under which similar patterns to Figure 5 occur. Notice that what is striking about this description is the non-monotonicity of the patient's decision with respect to $x$. According to this theory, it is possible that an agent with a less severe condition chooses to commit suicide because he cannot obtain any credible information about whether he is a burden to his family; but a patient with a more severe condition chooses not to commit suicide simply because the feedback he receives from his family is credible.

**Proposition 8** *i) If $\alpha > 2$ and $k > \frac{1}{\alpha-1}$ then*

$$\tau(x,y) = \begin{cases} 0 \text{ if } x < -\alpha k \\ 1 \text{ if } x \in \left[-\alpha k, \frac{\alpha(1-k)}{2-\alpha}\right) \\ 0 \text{ if } x \in \left[\frac{\alpha(1-k)}{2-\alpha}, 1-k\right] \text{ and } y < -x \\ 1 \text{ if } x \in \left[\frac{\alpha(1-k)}{2-\alpha}, 1-k\right] \text{ and } y \geq -x \\ 1 \text{ if } x > 1-k \end{cases}$$

*ii) If $\alpha > 2$ and $k < -\frac{1}{\alpha-1}$ then*

$$\tau(x,y) = \begin{cases} 0 \text{ if } x < -k-1 \\ 0 \text{ if } x \in \left[-k-1, -\frac{\alpha(k+1)}{2-\alpha}\right] \text{ and } y < -x \\ 1 \text{ if } x \in \left[-k-1, -\frac{\alpha(k+1)}{2-\alpha}\right] \text{ and } y \geq -x \\ 0 \text{ if } x \in \left(-\frac{\alpha(k+1)}{2-\alpha}, -\alpha k\right) \\ 1 \text{ if } x \geq -\alpha k \end{cases}$$

*iii) If $\alpha > 2$ and $k \in \left[-\frac{1}{\alpha-1}, \frac{1}{\alpha-1}\right]$, then*

$$\tau(x,y) = \begin{cases} 0 \text{ if } x < -k-1 \\ 0 \text{ if } x \in [-k+1, 1-k] \text{ and } y < -x \\ 1 \text{ if } x \in [-k-1, 1-k] \text{ and } y \geq -x \\ 1 \text{ if } x \geq 1-k \end{cases}$$

**Proof.** i) If $k > \frac{1}{\alpha-1}$, there is an informative equilibrium if $x \in \left[\frac{\alpha(1-k)}{2-\alpha}, 1-k\right]$ and $-\alpha k < \frac{\alpha(1-k)}{2-\alpha}$.

ii) If $k < -\frac{1}{\alpha-1}$, there is an informative equilibrium if $x \in \left[-k-1, -\frac{\alpha(k+1)}{2-\alpha}\right]$ and $-\alpha k > -\frac{\alpha(k+1)}{2-\alpha}$.

iii) If $k \in \left[-\frac{1}{\alpha-1}, \frac{1}{\alpha-1}\right]$, there is an informative equilibrium if $x \in [-k-1, 1-k]$ and $-\alpha k \in [-k-1, 1-k]$. ■

# 4 Strategic Physician

In the previous section, the physician was assumed to always report honestly to the patient. However, there is the concern that, if euthanasia is legalized, communication between the two might become compromised. It is often the case that physicians fear that they have different preferences than patients over the optimal course of action, and so refrain from being open with them (Morrison (1998), chpt 5). There is also the concern that, because palliative care requires more resources than euthanasia, doctors might be tempted to influence their patients to shorten their lives (Gorsuch (2009), chpt 7). In light of this, in this section, I relax this assumption and address directly the physician's incentives to provide information.

I endow the physician with preferences over the decision of the patient, that may depend on $(x, y)$. In particular, I assume that the physician's utility, in case of suicide, is equal to 0, while, if the patient does not commit suicide, it is given by $u^d(x, y)$. I make the additional assumption that $x$ is a continuous random variable with full support.

The addition of a strategic physician opens up a new source of uncertainty for the patient in that he is aware that the information that he receives from his physician might not be truthful. Because the physician has his own set of preferences, he is only expected to be honest insomuch as it benefits him. This does not necessarily mean that the physician is thought of as "selfish" as his preferences allow for altruism towards the patient. Nevertheless, even when he has the patient's best interests in mind, his decision of what to communicate to the patient is not a trivial one, as he also considers the impact that the information shared with the patient will have on the patient's family and their ability to influence the patient's decision.

Consider the patient's problem. After observing $(m_x, m_y)$, the patient will form a belief about $x$ and $y$ denoted by $(\mu_x, \mu_y)$. Given his preferences and beliefs, the patient chooses to commit suicide if and only if $\mu_x + \alpha\mu_y < 0$.

Now consider the family's decision. Because $m_x$ is publicly known and the family is risk neutral, the expected payoff of sending any given message $m_y$ for family $y$, is exactly the same as when $x$ is known and equal to $\mu_x$. Therefore, the set of PBE of the subgame that starts with the family's decision, for every set of beliefs about $x$ the family may have, is equal to the set of PBE of the previous section. In light of the previous discussion on the robustness of each of those PBE, I assume that the family always chooses the PBE that is neologism proof - the informative PBE if available and the non-informative PBE otherwise.

Let $[x_-, x_+]$ denote the interval of $x$ for which the informative equilibrium exists when $x$ is known, which is described in the previous section. It follows that if $\mu_x \in [x_-, x_+]$, the family sends message *no* if $y \geq -x$ and *yes* otherwise. On the contrary, if $\mu_x \notin [x_-, x_+]$, the family sends the same message $m_y = \emptyset$ regardless of type, and so $\mu_y = k$.

Finally, being aware that the disclosure of $x$ has an impact on the family's behavior, the physician decides what message $m_x$ to send.

Let $(\sigma^d, \sigma^f, \sigma^p)$ denote the set of strategies of physician, family and patient respectively. The physician's strategy is a mapping from his type $x$ to a distribution over the message space $M_x$ - $\sigma^d : [\underline{x}, \overline{x}] \rightarrow \Delta(M_x)$, the family's strategy is a mapping from beliefs over $x$ and its type $y$ to a message $m_y \in M_y = \{yes, no, \emptyset\}$ - $\sigma^f : [\underline{x}, \overline{x}] \times [k-1, k+1] \to M_y$, and the patient's strategy is a mapping from his beliefs about $x$ and $y$ to a decision about staying alive - $\sigma^p : [\underline{x}, \overline{x}] \times [k-1, k+1] \to \{0, 1\}$.

**Definition 9** *An equilibrium* $\left(\sigma^d, \sigma^f, \sigma^p\right)$ *of this game is such that*

*i) For all* $\left(\mu_x, \mu_y\right) \in [\underline{x}, \overline{x}] \times [k-1, k+1]$,

$$\sigma^p\left(\mu_x, \mu_y\right) = \begin{cases} 1 \text{ if } \mu_x + \alpha\mu_y \geq 0 \\ 0 \text{ otherwise} \end{cases}$$

*ii) For all* $(\mu_x, y) \in [\underline{x}, \overline{x}] \times [k-1, k+1]$,

$$\sigma^f\left(\mu_x, y\right) = \begin{cases} no \text{ if } \mu_x \in [x_-, x_+] \text{ and } y \geq -\mu_x \\ yes \text{ if } \mu_x \in [x_-, x_+] \text{ and } y < -\mu_x \\ \emptyset \text{ if } x \notin [x_-, x_+] \end{cases}$$

*iii) For all* $x \in [\underline{x}, \overline{x}]$ *and for all* $m_x \in M_x$ *such that* $\sigma^d(x)(m_x) > 0$,

$$m_x \in \arg\max_{m'_x \in M_x} \begin{cases} 0 \text{ if } \mu_x(m'_x) < x_- \\ \int_{-\mu_x(m'_x)}^{k+1} u^d(x, y)\, dy \text{ if } \mu_x(m'_x) \in [x_-, x_+] \\ u^d(x, y) \text{ if } \mu_x(m'_x) > x_+ \end{cases}$$

*iv) All beliefs are updated according to Bayes' rule whenever possible.*

The first question I address has to do with what type of incentives should be put in place in order for the physician to want to report $x$ truthfully. In particular, by thinking of $u^d$ as a reduced form utility function that already incorporates all the relevant incentives (financial, moral, etc.), I ask what shape must $u^d$ have in order for there to be an equilibrium where the physician reveals $x$ truthfully. In general, it is not difficult to find such a function if one imposes no restrictions. For example, if $u^d = 0$ for all $(x, y)$, the physician is indifferent to the patient's decision and so he has no reason not to be honest. However, as I show in Proposition 10, simple and intuitive requirements make honesty virtually impossible.

Let $u^* : [\underline{x}, \overline{x}] \times [k-1, k+1] \to \mathbb{R}$ represent a utility function for the physician, should the patient choose not to commit suicide, which induces truthful reporting by the physician in equilibrium. Notice that the family's reporting strategy is such that, once the physician reports some $x$, the patient ends up choosing to commit suicide if and only if he believes $y$ is lower than some threshold. Therefore, one can think of the physician's message choice as choosing which of the available thresholds over $y$ he prefers, given $x$. If one imposes that $u^*$

is (weakly) increasing with $y$, for each $x$, then

$$\overline{Y}(x) = \left\{ y \in \arg \max_{\overline{y} \in [k-1,k+1]} \int_{\overline{y}}^{k+1} u^*(x,y)\, dy \right\}$$

defines the set of thresholds the physician would prefer, if all were available to him.

**Proposition 10** *i) For all $\alpha > 0$, if $u^*$ is (weakly) increasing with $y$, then, for all $x \in (x_-, x_+)$, $\widehat{y}(x) \in \overline{Y}(x)$.*

*ii)*

*a) If $\alpha < 1$, there does not exist $u^*$ that is strictly increasing and continuous with $x$ and $y$.*

*b) If $\alpha > 2$ and $k \notin \left[-\frac{1}{\alpha-1}, \frac{1}{\alpha-1}\right]$, there does not exist $u^*$ that is strictly increasing with $x$ and weakly increasing with $y$.*

**Proof.** See appendix. ■

Part i) states that, at least for $x \in (x_-, x_+)$, the preferred threshold of the patient's family $\widehat{y}(x)$ must also be preferred by the physician for truthful reporting to be an equilibrium. The argument is similar to Melumad and Shibano (1991) and follows because the physician's expected utility, conditional on the decisions of family and patient, is single peaked with respect to the physician's report. If, by reporting thuthfully the physician does not get his preferred threshold, he always has a better alternative available by either deviating slightly to the left or to the right on his report. The implication of this result is that, if one hopes to provide incentives for physicians to report truthfully, one must design them in order to align the physician's interests with the patient's family rather than the patient himself.

The second part adds that, in general, there must be some discontinuity in the physician's preferences for truthful reporting to be an equilibrium. The intuition is easy to understand by taking another look at Figure 3. From i), it must be that the physician has the same preferred threshold as the family, at least when $x \in (x_-, x_+)$, which is represented by the blue line. If one is close enough to $x_- = -\frac{\alpha}{2-\alpha}(k+1)$ from the left and the physician's preferences are continuous, it has to be that his preferred threshold is close to $\widehat{y}(x_-)$. But if that is the case, when the physician is of such type, he would prefer to report $x_-$ instead, because reporting truthfully would lead to the patient committing suicide, regardless of $y$.

Finally, notice also that, if $u^d$ is increasing with $x$ and $y$ the phenomenon of non-monotonicity of the patient's decision, identified in Figure 5, cannot occur, for the physician, knowing that the "wrong" report of $x$ would lead the patient to commit suicide with certainty, would prefer to lie and exaggerate the patient's condition, in order for meaningful communication with its family to be possible.

I interpret these results as providing two main insights. First, it is virtually impossible to design a mechanism that provides incentives for physicians to truthfully report their diagnosis, unless such efforts target honesty directly (for example by having some type of supervision over the patient/doctor interaction). In the states where euthanasia and/or assisted suicide are legal, there generally is some type of requirement that the patient is advised by multiple physicians, but it is also the case that, often times, failure to satisfy such requirements leads to no punishment, which questions the role of such safeguards (Golden and Zoanni (2010)).

The second insight is that the notion, for example expressed in the Hippocratic Oath, that physicians should have the patient's best interests in mind may not be in the patient's own interest. The argument is that, if this concern is commonly known, it may prevent a sophisticated physician from being honest out of fear that the impact of full disclosure might influence the patient's family to exert an influence on the patient that would harm him. In particular, as long as $\alpha \neq 1$ (family and patient have different preferences), there is no equilibrium where the physician reports truthfully if $u^d = u^p$.

Proposition 10 does not allows for a categorical statement that it is best that the physician has the family's best interests in mind rather than the patient's. First, because it only refers to conditions for honesty by the physician, which does not necessarily imply that the patient's expected utility is maximized; and second because if there is no truthful equilibrium, it is not clear whether the same intuition follows for other equilibria. So there is the need to analyze these other equilibria. As I have alluded to above, one may look at this problem by thinking of the physician as the expert, with information about $x$; and the family as the decision maker, making a decision about the threshold over $y$ below which the patient chooses to commit suicide. Such a setup is very similar to standard cheap talk models with a continuous decision variable, and leads to a multitude of equilibria - see Crawford and Sobel (1982). By assuming a specific functional form for the physician's preferences, in particular $u^d(x, y) = x + \beta y$, where $\beta > 0$, I illustrate by way of example, in Figure 6, that neither making $\beta$ closer to $\alpha$ or 1 always increases the patient's expected utility. In fact, it does seem as though the optimal $\beta$ would be somewhere in the middle, at least for the particular set of parameters chosen. The details on how to build the equilibria, which essentially follow Crawford and Sobel (1982), are described in the Appendix, as well the equilibrium selection criterion used.

Figure 7 illustrates the decision of the patient for the case when $\beta = \alpha = \frac{1}{2}$ with the parameterization used to construct Figure 6. In this equilibrium, there are 4 distinct messages sent by the physician depending on the value of $x$. If $x < \gamma^1$, the physician sends a message that leads to the patient committing suicide, regardless of $y$. If $x \in (\gamma^1, \gamma^2)$, the physician sends a message that leads to suicide only if the family sends message *yes*. If $x \in (\gamma^2, \gamma^3)$, the same happens except that the family is less likely to report *yes*. Finally, if $x > \gamma^3$, the physician sends a message after which the patient always chooses not to commit suicide.

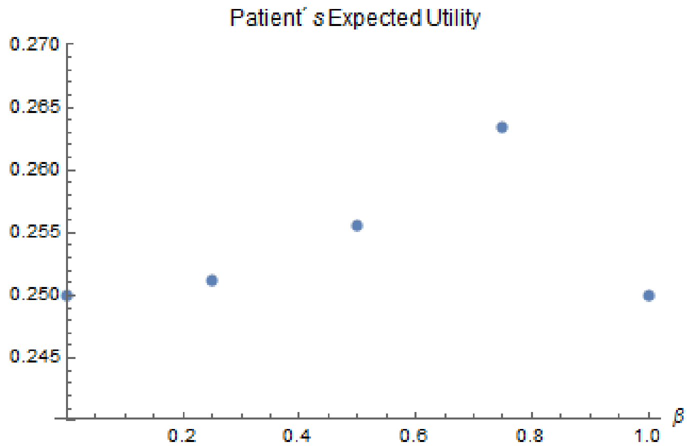


Figure 6: Patient's Expected Utility in Equilibrium for 5 values of $\beta$. I have assumed that $\alpha = \frac{1}{2}$, $k = 0$ and $x \sim U(-1, 1)$. If $\beta = \frac{3}{4}$, the expected utility of the patient is larger than $\beta = \frac{1}{2}$ (when the physician has the same utility as the patient) and $\beta = 1$ (when the physician has the same utility as the family).

I end this section with the analysis of two special cases.

The first one is when $\alpha = 1$: family and patient have the same preferences. When this happens, the family is able to communicate the true value of $y$ to the patient as it knows that the patient will always choose the family's preferred action. Therefore, this scenario is equivalent to one where the family does not influence the patient's decision but the patient is fully informed of $y$. The interpretation of this result in this setting would be that, if we exclude the patient's family from the analysis, the physician fully reveals his information if he has the same preferences of the patient. This means that the practice of trying to make the doctor act in the best interest of the patient leads to an honest relay of information if and only the family plays no role in the patient's decision.[12]

The second case is when $u^d(x, y) = v^d(x)$ for all $(x, y)$: the physician's utility is independent of $y$. I interpret these preferences as the physician only being affected by the patient's direct wellbeing, i.e. the physician would care about how much pain and discomfort the patient would be in if he chooses not to commit suicide, but does not care about the burden this may cause to the patient's family. These particular preferences are relevant as they seem to be in line with the views that public opinion has on euthanasia. Even though public opinion is, in general, in favor of legalizing euthanasia and/or assisted suicide, this desire seems to be conditional on who should have the right to commit suicide. If the intended users are terminally ill patients who are in pain and have a reduced quality of life, the consensus seems

[12]If one was to assume that the patient was strategic rather than always honest, and if the physician's preferences were equal to the patient's, the physician would always have an incentive to report truthfully to the patient, because the patient would only relay this information to his family if that was advantageous to him.

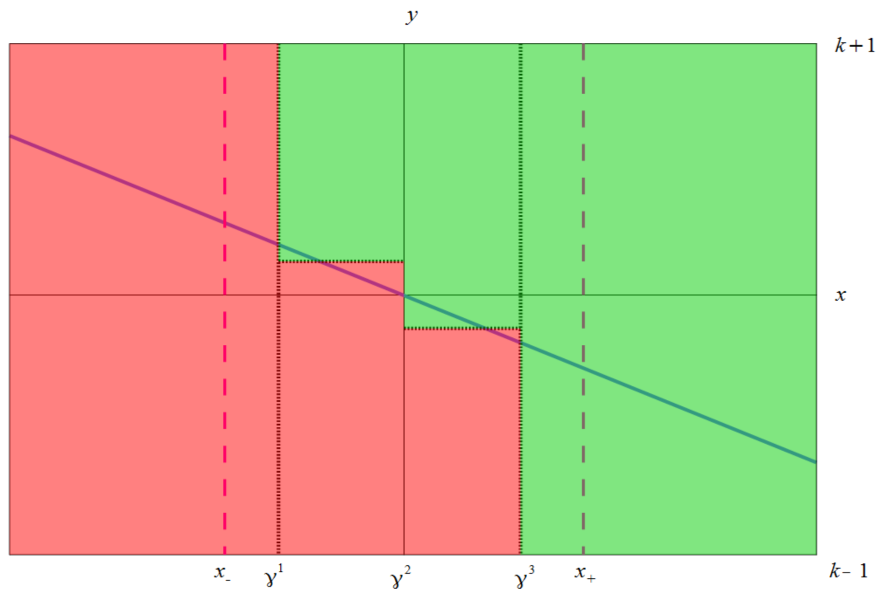


Figure 7: Description of $\tau$ for the equilibrium depicted in Figure 6, when $\beta = \alpha = \frac{1}{2}$. The blue line represents the patient's indifference line.

to be that euthanasia should be permitted. But when asked if euthanasia should be permitted to terminal patients who give as their reason not wanting to become a burden to others, only around 35% of the respondents agree[13].

Figure 8 depicts the equilibrium outcome if $v^d(x) > 0$ for all $x \in [\underline{x}, \overline{x}]$ or $v^d(x) < 0$ for all $x \in [\underline{x}, \overline{x}]$, under the assumption that $x$ is symmetrically distributed around 0. One example of such preferences is that of a physician who is morally opposed to euthanasia and does not wish the patient to request it, regardless of his condition. In this case, because the physician has the same preferred threshold over $y$ regardless of $x$, there is not an equilibrium where the patient obtains any information about $x$. The physician will either report whatever message leads to a larger survival rate, or to a larger suicide rate, respectively. If $x$ is symmetric around 0, the best guess made by both family and patient about $x$ will be 0. After receiving the uninformative message from the physician, the family proceeds to send a *yes* message if $y < 0$ and a *no* message otherwise. The interesting feature of this case is that the patient ends up deciding while being completely uninformed of $x$, i.e. having only a vague idea of what he should expect from the last few months of life. In fact, it is the case that the patient chooses to commit suicide if and only if $y < 0$. We go from the patient *also* caring about the burden he causes, to the patient *only* caring about the burden he causes.

[13] See Emanuel (2002) and the survey conducted by the Pew Research Center from 2005 in the United States.

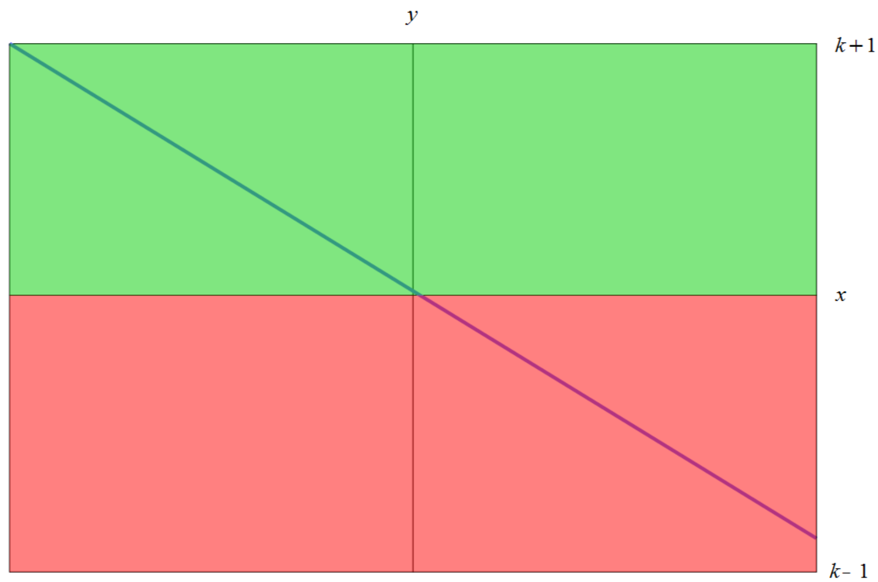


Figure 8: Description of $\tau$ when $v^d(x) > 0$ for all $x \in [\underline{x}, \overline{x}]$ or $v^d(x) < 0$ for all $x \in [\underline{x}, \overline{x}]$

Now consider the case where $v^d(x) > 0$ for all $x > 0$ and $v^d(x) < 0$ for all $x < 0$. This represents a case where the physician prefers the patient to commit suicide if and only if $x < 0$, which is what the patient would have preferred if he was not concerned with the impact of his decision on his family. In this case, if $x < 0$, the physician prefers the patient to commit suicide and so will select the message that leads to the largest probability of suicide. If $x > 0$, the opposite happens. This implies that if $\underline{x}$ is sufficiently small, and $\overline{x}$ is sufficiently large, the equilibrium outcome is the one depicted in Figure 9, where the patient commits suicide if and only if $x < 0$.

After receiving the message sent by the physician when $x < 0$, patient and family believe that $x$ is small enough that it is best that the patient commits suicide, regardless of the value of $y$. Similarly, after receiving the message sent by the physician when $x > 0$, the best decision for the patient is not to commit suicide. Notice that Figure 9 represents the reverse of Figure 8. Now, the patient chooses to commit suicide if and only if $x < 0$. The physician ends up getting exactly the outcome he desires, which is also the outcome the patient would have preferred had he chosen to ignore the impact on his family. Even though this may seem like a good thing, at least for those who believe that choosing to commit suicide to avoid burdening one's family is not a good enough reason, it contains in itself a perversity towards the patient. If euthanasia is not legal, there is no reason for the physician not to be completely honest about the patient's condition and what he should expect, as there is

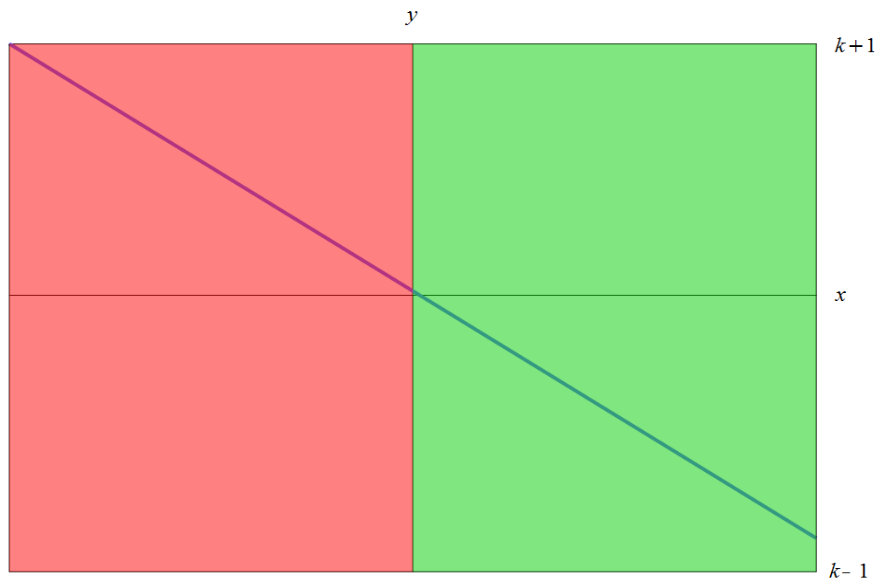


Figure 9: Description of $\tau$ when $v^d(x) > 0$ for all $x > 0$ and $v^d(x) < 0$ for all $x < 0$

no decision for the patient to make regarding his hypothetical suicide. But, by allowing euthanasia, a physician who is only concerned with the wellbeing of his patient in the sense described, is bound to transmit much less information to the patient. This analysis shows that the physician goes from being honest about what the patient should expect from his illness to a simple recommendation on a course of action, should euthanasia be legalized. This ends up leaving the patient with a sense of insecurity and fear that is a result of the lack of information he receives.

> *Trust will suffer profoundly in more subtle ways. Should physician-assisted suicide become a legal option, it will enter unavoidably - sometimes explicitly, sometimes tacitly - into many doctor-patient encounters.... Ineluctably, patients will now be forced to wonder about their doctor, regardless of how he handles the situation (of presenting the patient with the option of assisted suicide). Did he introduce the subject because he secretly or unconsciously wishes to abandon me, or worse, because he wishes I were dead? Does he avoid the subject for the same reasons, fearing to let me suspect the truth, or conversely, is it because he wants me to suffer.... Anyone who has experienced the subtle psychodynamics of the doctor-patient relationship should see immediately the corrosive effects of doubt and suspicion that will be caused by explicit (or avoided) speech about physician-assisted death.* *Lund (1996)*

# 5 Discussion

The most commonly given reason for the legalization of euthanasia relies on the simple principle that it cannot harm to have more options. If euthanasia is legalized, whenever a patient commits suicide, it must be that he is made better off, for otherwise he could have chosen not to. It then follows, if one assumes patients are expected utility maximizers with rational expectations, that euthanasia (weakly) increases their expected utility. I have two objections to this approach: first, I do not believe that it is necessarily true that the patients' expected utility is bound to increase should euthanasia be legalized; and second, I am not fully convinced of the assertion that euthanasia should be legalized if and only if the expected utility of the patients is increased.

Starting with my first objection, if an agent has more options he is only guaranteed to be made better off as long as the fact that he has those additional options does not affect the quality of the original ones. If euthanasia is not legal, patients essentially have no option as they are not able request for assistance in dying. But the whole motivation of this paper was to show that granting the patient the option to end his life is bound to impact the communication between himself and other interested parties. In particular, I have shown that the amount of information the patient is able to obtain from his family and physician will be greatly reduced should euthanasia be permitted. Knowing that having someone to talk to, trusting one's physician and being able to discuss with him all issues regarding the end of life are three of the most important things for terminal patients (Steinhauser et al. (2000)), one must wonder if the deterioration of the communication between patient and physician is enough to overturn the benefits of legalizing euthanasia. I believe the argument is clearer with a simple example based on this paper's model:

**Example 11** *Consider the interaction between the patient and his physician only (assume that $y = 0$ and is publicly known). The physician, privately informed of $x$, sends a cheap talk message $m_x$ to the patient, who then chooses whether to commit suicide. Take the physician's utility to be $u^d(x) = x - x^*$, with $x^* \neq 0$, if the patient does not commit suicide, and $0$ if he does.*

*Now suppose that the patient is affected by how transparent the physician is. In particular, imagine that, after receiving the physician's message, the patient experiences a loss of $\delta\widehat{Var}$, where $\delta \geq 0$ and $\widehat{Var}$ represents the posterior variance of $x$, conditional on the physician's message. If the physician is transparent (if there is truthful reporting), then $\widehat{Var} = 0$, while if there is no information transmitted (in the case of the "babbling" equilibrium) then $\widehat{Var} = Var(x)$. This loss is irrelevant for the patient's decision as it occurs regardless of it and is merely a function of the physician's actions. In particular, assume that $u^p = x - \delta\widehat{Var}$ if the patient does not commit suicide, while, if he does, his utility is given by $-\delta\widehat{Var}$. It follows* *that the patient commits suicide if and only if $E(x|m_x) < 0$, which implies that the set of equilibria is the same for all $\delta$, and is the one characterized in section 3: there are essentially two equilibria.*

*Assuming $x \sim U(-1,1)$ and $x^* \in (-1,1)$, it is easy to calculate the expected utility of each of them. The uninformative equilibrium, where the physician sends the same message regardless of $x$, leads to the patient being indifferent and an expected utility of $-\delta Var(x) = -\frac{\delta}{3}$. The informative equilibrium, where the physician sends message "yes" if $x < x^*$ and "no" otherwise, is such that the patient commits suicide if and only if $x < x^*$. His expected utility is then given by*

$$\begin{aligned}\Upsilon(x^*,\delta) &= -\frac{1}{2}\int_{-1}^{x^*}\delta Var(x|yes)\,d\widetilde{x} + \frac{1}{2}\int_{x^*}^{1}(\widetilde{x} - \delta Var(x|no))\,d\widetilde{x} \\ &= \frac{1-(x^*)^2}{4} - \frac{\delta}{24}\left[(x^*+1)^3 + (1-x^*)^3\right]\end{aligned}$$

*Notice that the informative equilibrium is always preferred to the uninformative one as it leads to a more informed decision.*

*If euthanasia is not legal there is no reason for the physician not to report truthfully, so the expected utility of the patient is 0. It is then clear that if $\delta = 0$, legalizing euthanasia increases the expected utility of the patient because $\Upsilon(x^*,0) > 0$ for all $x^* \in (-1,1)$. However, if $\delta > 0$, that may no longer be the case. In particular, for all $x^* \in (-1,1)$, there is $\delta > 0$ such that $\Upsilon(x^*,\delta) < 0$.*

Let us assume, for the sake of argument, that the expected utility of terminal patients is certain to increase with the legalization of euthanasia. Should this be the only relevant criterion? Or, in other words, should the increase in patients' expected utility be a necessary and sufficient condition for the legalization of euthanasia? I confess to have some doubts. It seems quite reasonable to me that such a condition should be necessary but the claim it should also be sufficient is harder to accept. In section 3, under the assumption that the physician is honest, I have argued that legalizing euthanasia would be equivalent to delegating the decision to the patient's family for a large range of diagnoses (if $x \in [x_-, x_+]$). Therefore, granting the decision power to the family instead of the patient also increases the patient's expected utility. If this condition is sufficient, then between maintaining the status quo of not allowing the patient to die prematurely and granting the decision power to the patient's family, one should prefer the latter. But it is my impression that few people would support that view. So much so that involuntary euthanasia is not legal anywhere in the western world[14].

[14] Involuntary euthanasia occurs when euthanasia is performed without the consent of the patient, even though he would be able to provide it. It is different than non-voluntary euthanasia because, in the latter case, the patient is unable to give his informed consent, which happens, example, in the case of children.

It is my opinion that the impact on patients' expected utility should be one very important criterion in deciding whether euthanasia should be legalized or not, but not the only one. I have suggested in section 3 that one way to incorporate the special concerns society has with patients committing suicide "by mistake" would be to give these mistakes more weight than the ones that lead patients to remain alive when they preferred to commit suicide. If the legalization of euthanasia leads to a disproportional increase of wrongful suicides with respect to wrongful choices to remain alive, then it is my impression that the case for legalizing euthanasia is severely compromised. I have suggested that, the more patients believe *a priori* that they are a burden towards others, the bigger the relative magnitude of wrongful suicides will be. This suggests that, if euthanasia is to be legalized, efforts should be put into place so that this perception does not exist. Charging such a reduced price for the practice of euthanasia, when compared to the cost of continued palliative care, seems particularly damaging in this respect. It would be interesting, for future research, to investigate empirically the magnitude of the two types of errors that might be made, should euthanasia be legalized. Having an estimate of the actual number of patients that would commit suicide when they would have preferred not to would certainly provide a more concrete foundation for the debate.

One last issue I wish to address, which is related to the debate over the legalization of euthanasia, is that of the patients' right to refuse treatment. In my analysis, there is no fundamental difference between the two debates. In practical terms, when the patient refuses treatment, knowing that such a refusal will lead to a quicker death, it is as if he is committing suicide. However, despite the similarity of the two, it is widely accepted that the patient should have the right to refuse treatment much more so that the right to commit suicide, and even less the right to request someone else to end his life.

I believe that there are enough reasons for it to be perfectly logic to be in favor of the patient's right of refusal of treatment but against the legalization of euthanasia. A first reason is that, while the latter involves *killing*, the former only involves *letting die*. The distinction between the two is not the object of this paper but there are those who believe that the former is morally worse than the latter.[15] Therefore, if one believes that assertion, one would be more reluctant to agree with the legalization of euthanasia then to allow patients the right to refuse treatment.

More related to my paper is the fact that the patients' motivations are likely to be different in the two circumstances considered. A common misperception of public opinion is that patients commit suicide because they are in pain. According to data collected in Oregon, only 23% of the patients who made the request for assistance in suicide mentioned "inadequate pain control or concern about it" as a reason for the request. By comparing this number to the percentages of some other responses - in particular, loss of autonomy

[15] There are several sources for the interested reader to consult, for example Rachels (1997) and Thomson (1976) express two somewhat opposing views on the matter.

(91%), loss of dignity (81%), burden on friends/family and caregivers (40%) - it seems that the patient is much more concerned about how his choice to remain alive might impact others and what image of him might they have. On the contrary, patients who must decide whether to refuse treatment are much more likely to be influenced by how much pain will such treatment cause - according to Steinhauser et al. (2000), 93% of terminally ill patients mentioned "to be free of pain" as something important in the end of their lives. Hence, my analysis on the whole issue of the burden is much more pertinent when discussing euthanasia than the right to refuse treatment.

# 6 Appendix

## 6.1 Proof of Lemma 2

First, notice that if there is a PBE where two messages induce the same decision by the patient ($m$ and $m'$ such that $\sigma^p(m) = \sigma^p(m')$) it is possible to eliminate one of them, while shifting its weight to the one that remains, and still obtain the same outcome. Therefore, one may assume that all messages in a PBE lead to a different decision.

Next, notice that all family types $y > -x$ prefer the same message from the ones available - the one with the highest survival probability. All family types $y < -x$ prefer the same message but now it is the one with the lowest survival probability. This means that it is possible to restrict attention to message sets with at most 3 messages.

Finally, if there are exactly 3 messages sent in a PBE, it must be that one of them is sent only by type $-x \in (k-1, k+1)$. Because $\alpha \neq 1$ and $x \neq 0$, upon receiving such message, the patient would not be indifferent, which means that the probability of survival would be either 0 or 1. But in that case, one of the other groups would also strictly prefer to send that message, which contradicts the message being sent only by type $-x$.

## 6.2 Proof of Proposition 6

i) Consider an $x$ for which the informative PBE exists. There must not be any neologism available for each family type that makes the family strictly better off, as the family is already getting its maximum expected payoff.

ii) Consider any $x$ for which the informative PBE exists and consider neologisms $A = \{y : y > -x\}$ and $B = \{y : y < -x\}$. Suppose first that, for the given $x$, the uninformative equilibrium leads to suicide. Given that an informative equilibrium exists, upon receiving the neologism $A$, the patient would prefer to remain alive. This is strictly preferred by all elements of $A$, while all non-members of $A$ weakly prefer suicide. Thus, the non-informative

PBE is not neologism proof. The same argument goes for the case when the uninformative equilibrium leads to survival by using neologism $B$.

If the informative PBE does not exist, neither does a deviating neologism. WLOG, suppose that the uninformative PBE leads to suicide. If there was a neologism that would lead to some other outcome it would be strictly preferred by all elements of $A$. Hence, by the definition, the only possible neologisms that lead to deviations are $A$ and $B$, which are only believed if an informative equilibrium exists.

### 6.3 Proof of Proposition 10

i) Fix any $\alpha$ and take $x \in (x_-, x_+)$. Notice that $\overline{Y}(x)$ is always a non-empty interval, for any $u^*$. Suppose $\widehat{y}(x) \notin \overline{Y}(x)$ so that there is $\overline{y}(x) \in \overline{Y}(x)$ such that $\overline{y}(x) \neq \widehat{y}(x)$. Let $\widetilde{x} \in [\underline{x}, \overline{x}]$ be such that $\widehat{y}(\widetilde{x}) = \overline{y}(x)$ and notice that, by definition, it exists. If $\overline{y}(x) \in [\widehat{y}(x_+), \widehat{y}(x_-)]$, then the physician strictly prefers to report $\widetilde{x} \in [x_-, x_+]$ instead of $x$, which is a contradiction to truthful reporting. Assume, then, that $\overline{y}(x) \notin [\widehat{y}(x_+), \widehat{y}(x_-)]$. Suppose $\overline{y}(x) > \widehat{y}(x_-)$. The payoff increment of reporting $x_-$ is given by

$$\int_{\widehat{y}(x_-)}^{k+1} u^*(x, y)\, dy - \int_{\widehat{y}(x)}^{k+1} u^*(x, y)\, dy = -\int_{\widehat{y}(x)}^{\widehat{y}(x_-)} u^*(x, y)\, dy > 0$$

This contradicts truthful reporting by the physician, as he would prefer to report $x_-$. The same reasoning applies if $\overline{y}(x) < \widehat{y}(x_+)$, using $x_+$ as the deviating report.

ii) a) If $u^*$ is strictly increasing with $x$ and $y$, it implies that $\overline{Y}(x) = \{\overline{y}(x)\}$ for some $\overline{y}(x) \in [k-1, k+1]$. Recall that $u^*(x, y) > 0$ for all $y > \overline{y}(x)$. By continuity of $u^*$, it follows that $\overline{y}(x)$ must be continuous for all $x$. Finally, using i), it follows that $\overline{y}(x) = \widehat{y}(x)$ for all $x \in [x_-, x_+]$. Notice that, for all

$$\varepsilon \in \left(0, \int_{\widehat{y}(x_-)}^{k+1} u^*(x_-, y)\, dy\right)$$

there is $\widetilde{x} < x_-$, such that

$$\int_{\widehat{y}(x_-)}^{k+1} u^*(\widetilde{x}, y)\, dy > \int_{\widehat{y}(x_-)}^{k+1} u^*(x_-, y)\, dy - \varepsilon > 0$$

which is a contradiction, because the physician of type $\widetilde{x}$ would prefer to report $x_-$. The same reasoning applies to $x > x_+$ and so the result follows.

ii) b) Consider $\tau$ described in Figure 5. Consider type $\widetilde{x} \in \left(-k-1, -\frac{\alpha}{2-\alpha}(k+1)\right)$. Following i), threshold $\widehat{y}(\widetilde{x}) \in (k-1, k+1)$ is preferred to threshold $k+1$ by type $\widetilde{x}$. Because $u^*$ is strictly increasing with $x$ and weakly increasing with $y$, it follows that type $x \in \left(-\frac{\alpha}{2-\alpha}(k+1), -\alpha k\right)$ strictly prefers $\widehat{y}(\widetilde{x})$ to $k+1$, because $x > \widetilde{x}$. This is a contradiction to truthful reporting as type $x$ would strictly prefer to report $\widetilde{x}$.

### 6.4 Figure 6 - details

In the construction of Figure 6, I assume $u^d(x,y) = x + \beta y$, where $\beta > 0$ and $\alpha < 1$. Let

$$V(x,z) = \int_z^{k+1} (x + \beta y)\, dy$$

When the physician sends a message $m_x$, this induces a certain report by the family, which leads to the patient choosing to commit suicide if he believes that $y$ is below some threshold $z(m_x)$. Hence, the physician's expected utility of sending message $m_x$ is simply $V(x, z(m_x))$.

Let $\mu_x$ be the conditional expectation of $x$, after $m_x$ is observed. Notice that the behavior of the family only depends on $\mu_x$, due to the linearity assumption. In particular, it follows that

$$z(m_x) = \begin{cases} -\mu_x \text{ if } \mu_x \in [x_-, x_+] = \left[-\frac{\alpha(k+1)}{2-\alpha}, \frac{\alpha(1-k)}{2-\alpha}\right] \\ k+1 \text{ if } \mu_x < x_- \\ k-1 \text{ if } \mu_x > x_- \end{cases}$$

This means that, without loss of generality, it is enough to consider equilibria for which each message $m_x$ sent by the physician leads to a distinct threshold $z(m_x)$.

**Lemma 12** *In equilibrium, if there are $m'_x, m''_x \in M_x$ sent with positive probability, such that $z(m'_x) < z(m''_x)$, then, for any $\widehat{x} \in [\underline{x}, \overline{x}]$ where $\sigma^p(\widehat{x})(m'_x) > 0$, $\sigma^p(x)(m''_x) = 0$ for all $x > \widehat{x}$.*

**Proof.** The result follows because, for all $\widehat{x} \in [\underline{x}, \overline{x}]$,

$$V\left(x', z\left(m'_x\right)\right) \geq V\left(x', z\left(m''_x\right)\right) \Rightarrow V\left(x, z\left(m'_x\right)\right) > V\left(x, z\left(m''_x\right)\right) \text{ for all } x > \widehat{x}$$

■

The previous lemma allows me to restrict attention to equilibria where each $x$ type sends a unique message and each message is sent by an interval of $x$ types. In Crawford and Sobel (1982), this leads to partition equilibria because the preferences of sender and receiver are assumed to be different for any value of the private information of the sender. However, in this case, if $x = 0$, physician and family have the same preferences, which is why it is possible to have equilibria with infinitely many such intervals.

If $\underline{x}$ is sufficiently small and $\overline{x}$ is sufficiently large, an equilibrium always exists where, for all $x < -\beta k$, the physician reports $\underline{m}$ and if $x > -\beta k$ reports $\overline{m}$; the family always sends an uninformative message, and the patient chooses to remain alive after receiving $\underline{m}$ and to commit suicide after $\overline{m}$. This equilibrium then entails two reporting intervals for the physician.

Consider now an equilibrium with $N > 2$ intervals, with $N-1$ indifference points, denoted by $\{\gamma^n\}_{n=1}^{N-1}$. Assuming that $x \sim U(\underline{x}, \overline{x})$, it must be that

$$V\left(\gamma^1, k+1\right) = V\left(\gamma^1, -\frac{\gamma^1 + \gamma^2}{2}\right) \tag{2}$$

$$V\left(\gamma^n, -\frac{\gamma^{n-1} + \gamma^n}{2}\right) = V\left(\gamma^n, -\frac{\gamma^n + \gamma^{n+1}}{2}\right) \text{ for all } n \in \{2, N-2\} \tag{3}$$

$$V\left(\gamma^{N-1}, -\frac{\gamma^{N-2} + \gamma^{N-1}}{2}\right) = V\left(\gamma^{N-1}, k-1\right)\gamma^{N-1} \tag{4}$$

For the equilibrium to exist it must also be that

$$-\frac{\gamma^1 + \gamma^2}{2} \geq x_- \tag{5}$$

$$-\frac{\gamma^{N-2} + \gamma^{N-1}}{2} \leq x_+ \tag{6}$$

together with the assumptions that $\underline{x}$ is small enough so that $\frac{\gamma^1 + \underline{x}}{2} < x_-$ and that $\overline{x}$ is large enough so that $\frac{\gamma^{N-1} + \overline{x}}{2} > x_-$.

The expected utility for the patient in an equilibrium with $N > 2$ intervals is given by

$$\frac{1}{2\left(\overline{x} - \underline{x}\right)}\left[\sum_{n=1}^{N-2} \int_{\gamma^n}^{\gamma^{n+1}} \int_{-\frac{\gamma^n + \gamma^{n+1}}{2}}^{k+1} (x + \alpha y)\, dy dx + \int_{\gamma^{N-1}}^{\overline{x}} \int_{k-1}^{k+1} (x + \alpha y)\, dy dx\right]$$

In the construction of Figure 6, I have assumed that $\alpha = \frac{1}{2}$, $k = 0$, $\underline{x} = -1$ and $\overline{x} = 1$. For each value of $\beta$ there are infinitely many equilibria - one for each $N$. Consider, as an illustration the case where $\beta = \frac{1}{2}$. The following table illustrates how the thresholds change when $N$ increases.

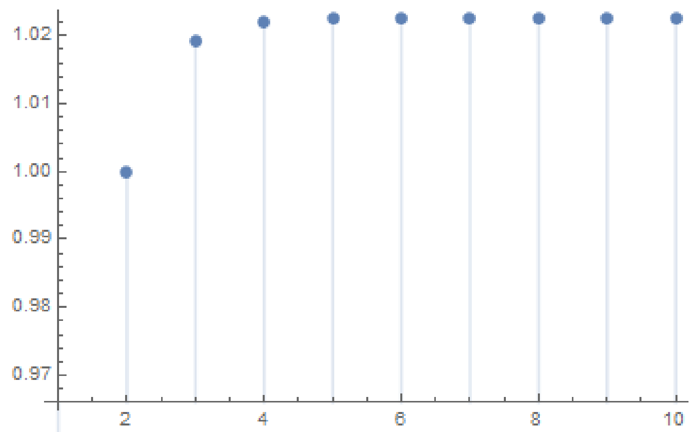


Figure 10: Expected utility of the patient as $N$ grows, under the assumption that $\beta = \frac{1}{2}$

| $N$ | $\gamma^1$ | $\gamma^2$ | $\gamma^3$ | $\gamma^4$ | $\gamma^5$ | $\gamma^6$ | $\gamma^7$ | $\gamma^8$ | $\gamma^9$ |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 0 | | | | | | | | |
| 3 | −0.25 | 0.25 | | | | | | | |
| 4 | −0.2857 | 0 | 0.2857 | | | | | | |
| 5 | −0.2916 | −0.0416 | 0.0416 | 0.2916 | | | | | |
| 6 | −0.2926 | −0.0487 | 0 | 0.0487 | 0.2926 | | | | |
| 7 | −0.2928 | −0.05 | −0.0071 | 0.0071 | 0.05 | 0.2928 | | | |
| 8 | −0.2928 | −0.0502 | −0.0083 | 0 | 0.0083 | 0.0502 | 0.2928 | | |
| 9 | −0.2928 | −0.0502 | −0.0085 | −0.0012 | 0.0012 | 0.0085 | 0.0502 | 0.2928 | |
| 10 | −0.2928 | −0.0502 | −0.0086 | −0.0014 | 0 | 0.0014 | 0.0086 | 0.0502 | 0.2928 |

It is possible to see that, as $N$ grows, an increasing number of intervals fits into a very small interval around 0 and so the increment in the expected utility of increasing $N$ quickly converges to 0. Figure 10 confirms that the expected utility of the patient is more or less constant after a small value of $N$.

For all other parameters used in Figure 6, except $\beta = 1$, the pattern is the same, and so the equilibria I have used to build Figure 6 is the one with $N = 6$, precisely because the changes for larger $N$ are very small numerically. When $\beta = 1$, there is no equilibrium for $N > 4$, and so I use $N = 4$ to obtain the corresponding expected utility.

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