Special Article

Death, Time and the Theory of Relativity

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Abstract

Many people believe that spending large amounts of money on end-of-life care is unjustified and even irrational. This fails to recognize that the value of time, particularly quality time, appears to increase as death draws near. Paying for treatment that merely allows patients and families to avoid confronting the inevitability of death is wrong. However, palliative care, which can bolster the quality of a patient’s remaining days, provides benefits that extend to the family and beyond. How can the notion of time gaining value toward the end of life be incorporated into conventional cost-benefit analyses? A standard QALY (Quality Adjusted Life Years) is the product of quality of life and time, without adjusting for any change in the value of time. An additional variable—a Valuation Index (Palliative) (or VIP)—needs to be factored into the equation, providing a rational explanation for what otherwise might be deemed irrational spending. When one recognizes the multitude of important things that happen as people approach the very end of life, the numbers start to add up. J Pain Symptom Manage 2011;42:460–463. © 2011 U.S. Cancer Pain Relief Committee. Published by Elsevier Inc. All rights reserved.

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Time Is Relative

According to Einstein’s celebrated theorem, time is relative. To prove his point, Einstein performed an ingenious thought experiment, involving a stationary observer, a passing train with an outer transparent wall, and a passenger tossing a ball in the direction of the moving train. While the ingredients of this experiment are innocent enough, their combination stymied Newtonian laws of motion, unhinging time itself from its stalwart cosmic moorings. As implausible as it seems, Einstein discovered that time expands or contracts relative to speed; while a person situated on earth will experience several days, a person traveling in a very fast spaceship experiences mere minutes or hours. In theory, if someone could travel at the speed of light, time would come to a standstill, leaving them trapped in timelessness.

While based on different theoretical considerations, people who work closely with the dying and anyone who has ever watched someone they love die, know that time is relative. People caught in the gravity of approaching death encounter a profound distortion of how time is experienced and valued. Each moment becomes increasingly precious as death...
draws near; while for the rest of the world, the clock marks time at its usual pace, with its usual indifference.

Consider the following thought experiment. Imagine yourself—or recall being—at the bedside of a dying loved one. What value would you place on being able to extend this time—with some assurances around lack of pain and suffering—by a month, perhaps just a week or even as little as a day? I assume it is difficult to arrive at an answer stated in terms of absolutes, given that the offer and what is at stake seem beyond measure, if not priceless. The results of this thought experiment suggest that time, and the value of quality time, changes in proximity to death.

There is evidence to support this notion of heightened value of time toward the end of life. Various studies, using time tradeoff or standard gamble techniques, have shown that patients who are ill tend to overvalue their current health, relative to those who are well. Furthermore, as death draws near, demand for more medical care and a willingness to pay for it appear to increase, even when the return on this investment—in terms of life extension—is marginal. This increasing valuation of time has been posited as a partial explanation for rising medical care expenditures at the end of life. Currently, about twenty percent of all health care costs are spent in the last six months of life. If absolute worth can be inferred based on the price paid, it would appear that the relative value of time increases as time itself is running out.

Why Spend on the Dying?

There is much ambivalence about spending a lot of money on people who are dying. Health care economists suggest that, based on conventional cost-benefit considerations, the magnitude of this spending hardly seems prudent. Few would argue that spending exorbitant amounts of money on treatments that essentially allow patients, families and health care providers to avoid confronting the inevitability of death is simply wrong. Such avoidance also can be costly. Patient-physician discussions about end-of-life wishes lower rates of intensive interventions (such as mechanical ventilation, resuscitation, or admissions to an intensive care unit), achieving better quality of life and reducing costs in the final weeks of life by as much as 35%.

Spending on palliative care buys dying patients and their families a higher quality of life for whatever time they have remaining. While time is normally valued for what it allows the patient to do, “in palliative care, perhaps it is valued simply for what it allows the patient to ‘be’ …” And what the patient can “be” might very well begin to explain the heightened value of time toward death. Until the patient has died, he or she remains part of a human drama, whose ending has not quite yet been written. Time offers the possibility for final words, a last embrace, finding spiritual peace and, occasionally, even reconciliation.

We also know that “dying right” can mitigate protracted grief, and quell doubt, guilt and regret that linger in the wake of poor end-of-life care. While not often considered in cost-benefit analyses, aggressive non-palliative medical care is associated with worse patient quality of life and higher risk of major depressive disorder in bereaved caregivers. Longer hospice stays, on the other hand, are associated with better patient quality of life and better caretaker quality of life.

There may be broader societal benefits, underscoring the value of end-of-life spending. Looking after the dying provides powerful assurance that care will be available for those whose turn to die has yet to come. Such perpetual assurance could be framed in terms of end-of-life care costs being amortized over the course of a lifetime. How we treat our dying also defines who we are as a society. Insufficient spending would mean accepting that bad things are allowed to happen to people when they are most vulnerable. This would have a chilling effect on our collective quality of life, challenging the assumption that we live in a moral and just society.

Finally, given that no one would suggest the dying ought not to be looked after, it is worth comparing the costs of good palliative care, rather than less optimal alternatives. On this front, the numbers speak for themselves. Palliative care programs can reduce hospital and intensive care unit expenditures by clarifying the goals of care and assisting patients and families to select treatments that are consistent with those goals. Hospital-based palliative care consultation teams also have been shown to
improve care for adults with serious illness, and do so with significant hospital cost savings.9

**Crunching the Numbers**

When all is said and done, considerable sums of money are spent on end-of-life care. Such spending is unwise if inconsistent with the goals of palliative care, whose raison d’etre is to improve quality of life for patients and families facing life-limiting illness. According to the World Health Organization, this can be achieved by early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual.10 Hence, spending that helps achieve these goals is justifiable, whether it be for neuroablative procedures to alleviate pain; radiation or chemotherapy to decrease tumor bulk causing symptom distress; or a period of ventilator support to enable final farewells.

Those who deem spending at the end of life irrational would argue that the amount and quality of time will always be confined within limits set by the underlying disease. Applying a standard Quality Adjusted Life Year (QALY) analysis, limited quality and limited time will always lead to pronouncements of “money poorly spent.” But this analysis fails to recognize that the value of time is not fixed, and that even a limited amount of quality time can provide the patient, family and society a multitude of benefits, as described.

So how might we redress the QALY approach, to demonstrate rationality for this seemingly irrational spending? What is missing is the ability to ascribe higher value, for the reasons outlined, to time, recognizing that its value increases in proximity to death. This suggests the need for a valuation index, or VI (Palliative) or simply, VIP. If we assume that the ever-increasing value of time as one moves toward death follows a pattern of exponential growth (other growth models are possible), then VIP could be expressed as follows:

\[
\text{VIP} = D^{t/m}
\]

where \(t = ([\text{prognosis at diagnosis}] - [\text{proximity to death}])\), and \(m\) is the length of time it would take to enhance valuation by a factor of \(D\). For example, let us consider a gentleman with a prognosis of 24 months at the time of his diagnosis. If value doubled in seven months, as he steadily moves toward death, three months into the course of his illness, VIP would be:

\[
\text{VIP} = 2^{(24-21)/7} = 2^{(3/7)} = 1.346
\]

meaning that the third month into illness could theoretically be ascribed 34.6% more value than the corresponding month three months earlier (this, of course, is strictly meant as an illustration, given there is no empirical data to support what the exponential growth in value might be).

With a way of defining VIP, the adjustment to the QALY approach would look as follows:

\[
\text{Palliative Adjusted Life Yardstick (PaLY)} = \frac{\text{QALY}}{\text{VIP}} = \frac{\text{QALY}}{V \times \text{QI} / \text{QI}}
\]

where \(\text{QI}\) is a quality index that ranges from 0 (death) to 1 (perfect state of health) and \(V\) is the value of one unit of healthy life (with time increments expressed in terms of years, months, weeks or days). (The term PaLY [Palliative Care Yardstick], while not previously mathematically defined, was first introduced into the literature by Charles Normand.) So for example, imagine that the gentleman previously described is now 13 months into his illness, with a QI of 50% (half his baseline quality of life). The PaLY calculation would look as follows:

\[
\text{PaLY} = V \times 0.5 \times 2^{(24-13)/7}
\]

\[
= V \times 0.5 \times 3.623
\]

\[
= 1.812 \ V
\]

whereas the QALY calculation would be:

\[
\text{QALY} = V \times \text{QI}
\]

\[
= 0.5 \ V
\]

Notice that while a conventional QALY approach leads to a 50% reduction in value, the PaLY method indicates a total value of nearly double its original (in spite of less than optimal quality of life), thereby providing rationale for significant end-of-life care expenditure—be it the cost of analgesics or aggressive surgical or radiation procedures required to achieve comfort.
The actual variation of time-dependent enhanced quality will depend on a multitude of factors, including—but not limited to—diagnosis, co-morbidity, culture, personal values and family needs. Any decision to crunch numbers in this way must be accompanied by an obligation to determine how these variables might influence the rate of quality enhancement. In general, it is likely that cognitive integrity, lack of symptom distress and a robust support network will favor heightened valuation, while cognitive disintegration, suffering and isolation will tend to mitigate the valuation effect. However, this calculus is highly nuanced, in that health care providers often infer great suffering and poor quality of life based on functional limitations and disability. Therapeutic nihilism can easily undermine the ability to see value beyond cure-oriented disease modification. On the other hand, palliative care must embrace a perspective as broad as the notion of quality of life itself.

While this mathematical approach may strike some as highly reductionistic, such is the nature of cost effectiveness analysis. Applying the VIP treatment, so to speak, to patients near the end of life provides a means of ascribing value to the multitude of things that take place when life is drawing to a close. The VIP does not justify wasteful spending on measures that are inconsistent with quality palliative care, i.e., those that do not target improved quality of life for dying patients and their families. Health care economists, health care authorities, and health care administrators rarely speak the language of existential growth, family reconciliation or societal morality. While introducing the concept of VIP is unlikely to make them conversant in these areas, it does force the acknowledgment that these things have value and must be taken into account when considering end-of-life care budgets and resource allocation. How much value you ask? There, I’m afraid, the answer will always be relative.

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References


