Introduction

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The field of modern-day bioethics is relatively young and continues to constantly evolve in parallel with the ever-increasingly complex nature of contemporary medical practice. These advances present clinicians with an array of therapeutic options that would have not seemed possible only a generation ago. Given these medical advances and the expansion of the academic and medicolegal field of bioethics, one would have thought that clinical decision-making would have become easier. However, paradoxically, this has not proved to be the case. Each advance may provide an answer to a particular clinical question, which is almost immediately replaced by a whole new set of ethical problems that require consideration.

The field of neurosurgery provides a particularly good example of how the ethical landscape has changed over a relatively short period of time. Advances in radiology have seen the grainy appearances of the early CT scans acquired over a 45-minute period replaced with the rapid sequence acquisition, high resolution, whole-body trauma scans of today. The development and refinement of MRI scanning combined with the widespread use of the operative microscope, image-guided technology, and a whole host of other technological advances has led to the development of a field of surgery that would previously have been almost unrecognisable. In addition to these surgical developments, there have been significant advances in intensive care management, oncology treatment, and infection control, to name but a few.

Notwithstanding these developments, there will always come a time when a disease or injury has progressed to a certain point, or a person has reached a certain age where therapy is providing limited benefit and indeed may be becoming overly burdensome. Managing patient expectations and the expectations of families in these circumstances can be ethically challenging.

My own interest in bioethics came about initially because of my experience with long-term outcomes following decompressive craniectomy in the context of severe traumatic brain injury when I moved to Perth, Western Australia, more than 15 years ago. Perth is geographically isolated and has two major neurosurgical centres that service a population of 2.2 million. At around that time, there had been a resurgence of interest in decompressive craniectomy, and a number of studies had demonstrated the successful management of intractable intracranial hypertension and reduction in mortality that could be achieved. However, as demonstrated in subsequent randomised controlled trials, this reduction in mortality comes at the expense of an increase in the number of survivors with severe neurocognitive disability and dependency, and I witnessed firsthand the effect this outcome had on the patients and their families.

I also came across the CRASH (Corticosteroid Randomization after Significant-Head injury) collaborators outcome prediction model. This is a web-based user-friendly outcome
prediction model that is based on the CRASH study, which investigated the role of steroids in traumatic brain injury and is described in detail in Chapter 13. The model combines the prognostic significance of certain clinical and radiological features in order to provide a percentage prediction of unfavourable outcome. The use of this model allows patients to be stratified according to injury severity, and comparing the predicted outcome with the observed long-term outcome provided an objective assessment of the most likely outcome following surgical decompression for severe traumatic brain injury. Once the percentage prediction reaches a certain level, the most likely outcome is severe dependency, and on initial examination, this would appear to provide clinically useful information. However, as with other surgical advances, it has in many ways made the clinical decision-making and ethical discussion more complex. Once it has been established that the most likely outcome is severe disability, every effort must be made to determine that this would be acceptable to the person on whom the procedure is being performed. This requires the exploration of a number of ethical concepts, such as consent, withholding and withdrawing treatment, adapting to survival with disability, the disability paradox, and the rule of rescue. I went on to collaborate with Grant Gillett and Kwok Ho on a number of publications, and the more I explored these issues in the context of severe traumatic brain injury, the more aware I became of ethical issues in the field of neurosurgery in general. This prompted the project that led to Ethics in Neurosurgery.

The book is set out in three sections and is intended as an introduction to practical ethics for all healthcare professionals involved in the management and care of neurosurgical patients. There is a wide variety of contributors from around the world, including clinical ethicists, legal experts, intensive care physicians, and neurosurgeons.

The first section deals with some general principles of bioethics and aims to focus on aspects that are particularly relevant to neurosurgery, such as consent and withholding life-preserving treatment. The second section looks at subspecialty specific fields. The aim is not to cover all aspects of neurosurgery but rather to focus on areas where there are particularly important ethical issues. The final section deals with the future possibilities and covers issues such as surgical innovation, possible application of stem-cell therapies, and the evolving development of brain-machine interface.

I hope the book provides educational benefit as well as general interest, and it may well serve as a stimulus to further explore the field of bioethics, which is an area of increasing importance. I would like to thank all of the contributors, without whom none of this would have been possible.
1.1 Introduction

Clinicians, and their patients, live and practice in a world characterised by illness, sickness, disease, and suffering. Theirs is not an abstract or theoretical world, but a very real one. And in this world their concern is how healthcare can cure, ameliorate, or palliate these symptoms and maladies. For all of these reasons, medicine has been concerned with determining what works and what doesn’t, what provides benefit and what is harmful, and what should be done in any given situation. This concern has always been a feature of medicine, even in its pre-scientific manifestations, but over the past 40 years has become a central feature of both evidence-based medicine and personalised medicine.

But while evidence undoubtedly informs decision-making and policy development, it does not, of itself, tell us what we should do. This point has been made most eloquently by the Scottish enlightenment philosopher David Hume and by the Austrian philosopher of logic Ludwig Wittgenstein.

Hume articulated this as the ‘is-ought’ problem, in which he suggested that there is no logical way to go from a statement about how the world is to a statement about how it ought to be, or what we ought to do to get it there. Wittgenstein agrees, ‘You cannot lead people to what is good: you can only lead them to some place or another. The good is outside the space of facts.’ These are important insights because they remind us that data or ‘evidence’ (which can be loosely defined as data to which we attach value) does not tell us how we should act, that decisions are inevitably issues of value and judgement, and that our decisions and actions are influenced as much by our values, perspectives, and our processes of reasoning and reflection as the concepts and ideas we use and the data we draw from.

This does not, however, mean that data are irrelevant to ethical judgements. Indeed, evidence is relevant to ethical thinking and reasoning in at least four ways:

- it can provide descriptive information about ethically fraught issues (e.g., how many people have completed advance care plans, what public support there is for medical assistance in dying, or if patients experience distress if nutrition is discontinued at the end of life);
- it can measure the impact of ethical policies (e.g., the impact of legislation of stem cell research, termination of pregnancy, or organ donor rates);
- it can interrogate the value-laden aspects of medical care, medical ‘facts’ and medical terms (such as ‘quality of life’ or ‘futility’); and
- it can provide a rich description of an area or domain of experience (e.g., a sociological study of cancer in adolescents or the healthcare experiences of people who survive major brain injury).
The point here is that medicine is inevitably a moral exercise – not simply a practical or technical one. It is as much about ethics as it is about evidence.

The other logical error that healthcare providers often make when thinking about how they should act and health services should be organised is to characterise each of these in terms of meeting or fulfilling a patient’s preferences or rights. This is particularly problematic because while there is broad recognition that rights are important in healthcare and in society more generally, there is ongoing disagreement regarding what rights are, how they relate to ethics, and whether they are a fundamental part of human existence or only exist when recognised by government.  

The idea of universal human rights can be traced back to Plato and Aristotle, and to philosophical doctrines of natural law (particularly the works of John Locke and Immanuel Kant). More contemporary formulations of civil and political rights can be traced to the English Bill of Rights in 1689 and the American Declaration of Independence of 1776, which argued for the right of individuals to be free from arbitrary interference by the state. The modern understanding of human rights, however, really emerged following World War II and the Holocaust, when the international community moved to establish both a collective expression of human conscience and a mechanism for mediating disputes between nations and defusing international crises. The principal international statement of human rights is the Universal Declaration of Human Rights (UDHR), which was approved by the United Nations in 1948. While the UDHR has been the subject of extensive political, ethical, and cultural criticism, there is no question that it has profoundly influenced the way we think about politics, social order, and the meaning and value of rights.

In conceptual terms, rights can be defined as justifiable claims that individuals or groups can make upon society or upon other individuals. They may be expressed as positive rights or negative rights. A positive right is a right to be provided with a particular good or service by others, whereas a negative right constrains others from interfering with an individual’s exercise of that right. Thus the right of liberty is a negative right because it merely suggests that no one should hold one against one’s wishes. The right to education is a positive right, as it means that someone must teach. In other words, the concept of ‘rights’ also entails a definite but often ill-defined notion of associated obligations. For example, if one person possesses a right to life, this imposes an obligation upon others not to deprive that person of life. The extent of this obligation is defined by the specific context and by consideration of the wishes, beliefs, and values of each party. Thus a right to life does not necessarily prevent an individual being killed in war, or by another in self-defence, or an individual contracting with another to assist them to die.

Ethics and rights share much in common. Each are founded on, or express, similar ideas:

- that respect for persons is key to civil society;
- that everyone, and particularly the most vulnerable in society, should be cared for and protected;
- that people should have control over their own futures and should be able to make decisions for themselves;
- that harm should be avoided and ameliorated where possible;
- that privacy and confidentiality should be recognised and respected; and
- that justice and fairness are important.

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But ethics and human rights are not identical. Human rights principally establish the obligations of the state (and other institutions) towards people and act through interna-tional treaties, declarations, and national laws. Ethics, on the other hand, is principally concerned with the relationships between individuals and communities and acts through personal reflection, conscience, codes of ethics, guidelines, regulations, and law. But despite these differences, ethics and human rights infrequently conflict with each other – more often adding richness and depth to ethical deliberation.

Irrespective of how we understand the relationship between ethics and rights, it is undeniable that the language of rights has been critical to the development of ethics and, at least since WWII, has played a vital role in protecting individuals from the excesses of the state. The question of what role rights should play in defining law, morality, and political organisation, and what role they should play in the design and delivery of healthcare, however, remains controversial.

Thus, even to properly understand the role that rights and evidence play in healthcare, therefore, we must understand something about ethics.

So what then is ethics?

The word ‘ethics’, which is derived from the ancient Greek ethikos – meaning relating to one’s character – can refer to several things including the study of how one should live (known as philosophical ethics or moral philosophy) and the human capacity for, interest in and reflection on what it is we value and how we should act or behave. While these two understandings of ethics are often talked of as very distinct things, in fact they are deeply interrelated. The development of philosophical ethics is, for example, not an academic abstraction isolated from the ‘real world’ but has been shaped by culture, politics, economics, law, religion, and science. In other words, ethics is historically and culturally embedded. Ethical ideas, for example, are present in the poems of Homer (800 BCE), which emphasise heroism and nobility; in Jewish ethics (1300 BCE), which outline ethical duties and processes for ethical analysis; and in Eastern philosophical scriptures, including the Vedas, an ancient Indian religious text (1500 BCE) that identified morally good actions as those that are harmonious with the universe.

In broad terms, therefore, ethics describes both the branch of philosophy and the domain of enquiry concerned with how people should live their lives in order that they, those around them, and society in general should flourish. This means that ethics is concerned with questions surrounding the distinction between right and wrong, virtue and vice, justice and crime, the definition of rights and responsibilities, the means by which we may make good or bad decisions and the means by which we may live a good life.

Ethics is traditionally divided into three areas: metaethics, normative ethics, and practical (or applied) ethics.

- **Metaethics** deals with nature of moral judgement and with the nature and status of moral ‘things’ and examines what we mean when we say that something is right or wrong.
- **Normative ethics** is concerned with the theoretical and practical means by which we determine a moral course of action.
- **Practical or applied ethics** is concerned with how people should act in particular situations or contexts, such as in healthcare settings, business, law, and so forth.

This chapter will provide a brief introduction to normative approaches to ethics and to ethical principles.
1.2 Ethical Principles

1.2.1 Deontology

One of the major schools of moral philosophy is known as deontology. Deontology embodies the notion that things or actions are right or wrong in and of themselves. For example, a deontological theory might maintain that there is something intrinsically wrong with acts of lying, murder, or rape that is independent of outcome or consequences. Many religions are based on deontological theories.

The central theoretical focus of deontological theories is on doing one's duty, which may be expressed by certain universal statements or action guides. These central rules find expression in laws (such as 'Do not kill'); principles (such as respect for human life); institutions (such as the legal system); and 'relational laws' (such as respect for one's parents).

In order to determine what action is required in a particular circumstance, the deontological approach to moral reasoning involves the application of the appropriate universal statement to the specific situation. An example of such reasoning would be:

killing is wrong; giving potassium chloride to this patient is killing; therefore this action is wrong.

Exactly where these moral rules or principles come from is a matter of some debate. Theological arguments justify rules by appeal to divine revelation, societal approaches argue that the correct moral rules are those believed in by most members of society, intuitionist approaches suggest that the proper moral rules or actions are those that possess the intrinsic property of 'rightness', while the philosopher Immanuel Kant (1724–1804) argued that the basis of moral rules is pure reason (i.e., without the need for empirical observation).

Kant proposes that the moral rules (or imperatives) that we choose to live by should be absolute and binding and that they should be 'univeralisable' – that is, they should be able to be applied to everyone. This is made clear in a series of 'categorical imperatives', which are often familiar even to those who have never studied philosophy. These include:

• 'act in such a way that you treat humanity, whether in your own person or in the person of another, always at the same time as an end and never simply as a means'; and
• 'act as if the maxim of your action were to become through your will a universal law of nature'.

The value of deontological theories is that they remind us of the importance of rationality in moral judgement and of moral standards independent of consequences. They have tremendous appeal for those who seek certainties in life and for institutions (such as the church or government) that have a need to bind together groups of people under some identifiable moral code.

But while deontological theories provide the basis for many moral codes and faith traditions, they are often criticised because the rules and principles are controversial, vague, or difficult to define and may come into conflict. For instance, even if it is accepted that is wrong to kill, or lie, it is not clear whether this means that killing or lying is always wrong in every circumstance. Likewise, where one is contemplating the morality of abortion, what rule takes precedence: the foetus’s right to life or the woman’s right to bodily autonomy?
1.2.2 Consequentialist Theories and Utilitarianism

Consequentialist theories propose that the rightness or wrongness of an action is based solely on the consequences of performing it and that the nature of the action or the motives and intention of the agent are largely irrelevant.

The most prominent consequentialist theory is utilitarianism, which states that the single fundamental principle of ethics should be the ‘principle of utility’ – that the morally right action is the action that produces the best possible outcome. Utility is conceived of in different ways by different thinkers. The classical utilitarians, Jeremy Bentham (1748–1832) and John Stuart Mill (1806–73), conceived utility entirely in terms of happiness or pleasure, while others have contended that values other than happiness (such as friendship, health, or autonomy) have intrinsic worth, or that utilitarianism should focus not on happiness but the satisfaction of preferences.

While consequentialist approaches to ethics appear to provide a simple, rational process for moral reasoning, this simplicity is illusory. A number of methodological criticisms have been made of consequentialism.

The first is that it is difficult, if not impossible, to quantify variables such as ‘happiness’ or ‘quality of life’ and to compare all the possible outcomes of an action. The second is that it is often unclear as to who are the parties involved in any moral action and what moral significance each of their interests should have. The third is that it is often difficult to predict or to determine outcomes in advance – making ranking or prioritisation of consequences impossible. In medicine, in particular, outcomes are generally not known with any certainty but are expressed as probabilities drawn from epidemiological data and generalised to an individual, and there are certain times that outcomes are not even imaginable at the time that a decision is made or action is taken.

But even if none of these methodological challenges hold true, consequentialist theories are still open to a series of major philosophical criticisms. The first is that consequentialism (by definition) is concerned only with consequences and does not account for certain aspects of ordinary moral thinking (such as the importance of individual rights) in deciding moral issues. The second is that it can lead to actions that would seem morally unacceptable, such as discrimination, imprisonment, torture, or killing if these actions result in the best net balance of good over evil. (This problem is made clear in thought experiments like the famous ‘trolley problem’.) And finally, because consequentialism emphasises net satisfaction rather than considerations of justice or equality, consequentialist theories can sanction unjust rules and allow the interests of the majority to override those of the minority.

1.2.3 Virtue Theory

An alternative approach to ethics emphasises not rules, consequences, or principles but moral virtue (i.e., the notion that the rightness or wrongness of an action is derived from the virtues or underlying motives of the person making that action).

The concept of moral virtue derives from ancient philosophical traditions. To Plato, virtue was an intellectual trait synonymous with excellence in living a good life, and it could be attained and maintained by practice. To Aristotle, and later Aquinas, virtue was expressed as a disposition to act in the right way and was the result of a balance between intellect, feeling, and action. Aristotle used the term *ethika arête* to mean ‘matters having to do with character’, the right character being modelled on a person of virtue or excellence. Aristotle considered happiness, or *eudaemonia*, to be the highest form of goodness and
argued that this was gained through excellence of function, which, in man’s case, was the capacity to reason. This, in turn, was manifest through a life-long practice of making virtuous choices and acting in virtuous ways. For Aristotle, this involved choosing, and acting between two extremes of vice. (This is known as the rule of the ‘Golden Mean’.) Thus, for example, the virtuous person would choose to act in a way that was courageous – as this is the virtue that lies between rashness and cowardice. Such a choice was voluntary and rational and was made possible by the development of phronesis (practical wisdom). In other words, virtue was not regarded as an innate capacity but was felt to be a disposition cultivated by proper training, experience, and critical reflection. These notions, particularly the idea that practical wisdom is developed through training and through considered decisions and actions, are often immediately recognisable, and appealing, to those working in the health professions.

Unfortunately, it is not at all clear that virtues are a sufficient basis for decision-making or that consideration of virtues should take precedence over rights, principles, or ethical obligations or considerations of the consequences of one’s actions. Virtue ethics is also subject to criticism that it is simplistic and imprecise, does not tell us what we should do or how we should act, relies on circular reasoning (a virtuous person is defined as a person who does good things, and good things are those acts a virtuous person does), and, at least in medicine, emphasises the moral character of the doctor over what is owed to the patient.

1.2.4 Continental Philosophy and Postmodernism in Ethics

‘Continental philosophy’ is the name given to a large number of philosophies to emerge from Europe since the work of Immanuel Kant at the end of the eighteenth century. In many ways, it is a confusing term because it does not refer to a single philosophical method, style, concern, and tradition, and includes a number of philosophical movements and philosophers, such as Hegel, Kierkegaard, Marx, Nietzsche, Husserl, Heidegger, Merleau-Ponty, Gadamer, Sartre, Adorno, Marcuse, Barthes, Bauman, and Levi-Strauss. A number of these thinkers have had a profound influence on contemporary ethics and medical ethics, including the French philosopher Emmanuel Levinas, who argued that ethics is principally about our responsiveness to the ‘other’ that we encounter in ‘face-to-face’ relationships, and Jacques Derrida, who argued the most important feature of ethics is ‘hospitality’, by which he meant openness to the ‘other’ (the ‘arrivant’) and acceptance of the possibility of our own transformation as a consequence of our interaction with others.

The other thinker to have had a major influence on contemporary ethics is the French philosopher, historian, and sociologist Michel Foucault, whose critiques of social institutions, including hospitals, psychiatric facilities, and prisons, and of human experiences, including sexuality and power, undoubtedly enriched our understanding of how ethics ‘plays out’ in healthcare. The extent of Foucault’s influence can be measured by the fact that many of the terms and concepts he coined, such biopolitics, governmentality, state racism, and the ‘medical gaze’, have become a part of both academic and lay discourse.

Continental philosophy is often confused with postmodernism, which in itself is a term that generates enormous confusion. While the term ‘postmodernism’ has entered into popular culture, there is very little agreement about what it actually means. Very simply, it describes a philosophical and political movement that arose in the nineteenth and twentieth century that rejected the tenets of the ‘modern’ societies that developed in Europe and North America following the Enlightenment – notably capitalism (the free
market), liberal democracy, secularism, rationalism, humanism, science, industry, and technology.

While postmodern theories and approaches are extraordinarily diverse, they share two common features. First, they reject the idea that truth is discoverable through human reason and scientific method. And second, they reject the idea that there should be a single (best) perspective, system of knowledge, value system, or system of norms. Postmodern ethics, therefore, rejects the ideologies and theoretical traditions of both medicine and ethics, addressing each through a diverse set of new perspectives, new languages, and new paradigms grounded in and formed by their social and clinical context.

1.2.5 Feminist Moral Philosophy

Contemporary feminist philosophers have challenged the inherent (‘masculinist’) sexism of ‘traditional’ Western moral philosophy and the historical tendency to devalue women’s experiences and lives. While there is enormous variability in the approaches taken by feminist ethicists, most share a number of features, including:

- rejection of the overemphasis on autonomy and individual rights;
- criticism of the philosophical dualisms that have furthered the subordination of women (e.g., mind-body, reason-emotion, objective-subjective, public-private, etc.);
- rejection of the idea that ethics should be value-neutral;
- emphasis of values such as empathy, interdependence, and caring, and the importance of community and solidarity; and
- emphasis on the importance of context and the relevance of politics and power to understanding ethics and healthcare.

Although feminist approaches to ethics do not provide a single moral theory, they have been enormously influential because they have refocused attention on caring and relationships in healthcare, revealed the diverse nature of the oppression of women, and demonstrated how political will is required to reduce inequity and eliminate oppression.

1.3 Ethical Frameworks and Principles in Healthcare

Many philosophers (and clinicians) are sceptical of the ability of any ethical theory to explain or guide behaviour. Instead, they suggest that while ethical theories may provide useful tools or frameworks, ethical decision-making is informed by consideration of many factors – any one of which may assume greater or lesser importance in different situations. These include the ethical probity of the action or decision itself, the consequences that follow that decision or action and the virtues of the ‘actor’, as well as views about the dignity and rights of persons, the relationships between persons and communities, and the organisation of society. As a result, in recent years the focus of ethics has shifted away from the elaboration of theories to a focus on values (the field of scholarship known as axiology), metaethics, empirical (evidence-based) ethics, and practical (or applied) ethics. This, in turn, has led to the elaboration of many different ‘frameworks’ for ethical deliberation that emphasise not so much ethical assumptions or rules but a series of ethical principles or concepts or a series of questions that can be used to clarify what is at ‘stake’.

Principle-based approaches to ethics begin not with theory but with consideration of the values that we are striving to protect and the principles by which our actions should be guided. The most common formulation of a principle-based approach to ethics in medicine
(Beauchamp & Childress, 2012) assumes that medicine is concerned with ‘right’ and ‘good’ actions, decisions, and outcomes, and that this is achieved through attention to six fundamental ethical principles: respect for autonomy, non-maleficence (avoiding harm), beneficence (doing good or providing benefit), justice, veracity (truth-telling), and privacy/confidentiality.

Each of these principles have prima facie standing, or worth, and they need to be taken into account, balanced, and specified in any clinical setting.

This process of reflective thinking about principles (rather than simply ‘applying’ them to a clinical situation in an unsophisticated or unreflective way) is critically important because even if we agree on our moral commitment to these principles, this does not necessarily mean we will agree on their importance, prioritisation, or scope of application. We may, for example, disagree about what, or to whom, we owe moral obligations arising from these principles. For example, we clearly do not owe a duty of beneficence to everyone and everything, so whom or what do we have a moral duty to help, and how much should we help them? And who or what falls within the scope of our obligation to distribute scarce resources fairly and according to the principle of justice?

While a principle-based approach to ethics is not unproblematic and does not generally provide a single or incontrovertible ‘answer’ to challenging or controversial situations, it does provide a means for systematically working through problems in practice.

1.4 Conclusion: The Value of Ethics to Clinical Practice

Since its origins, medicine has become increasingly complex and increasingly powerful. And there is no reason to believe that this will not continue. At the same time, the world in which illness is experienced, disease defined, and healthcare delivered has become more diverse, with far greater pluralism in faith traditions, culture, and political and social behaviour. It is essential, therefore, that health practitioners understand how ethical ideas, concepts, values, and principles can shape and inform their professional practice. Specifically, this means the following:

- We should understand that medicine is fundamentally an ethical enterprise – concerned with the security and flourishing of individuals and communities, with important ideals, and with concepts like justice.
- We should acknowledge that ethical concepts or values can inform and shape practice. Ideas about efficacy, care, social justices, and reciprocity, for example, underpin the way we organise our healthcare systems, vaccination programmes, and organ donation and transplantation services.
- We should consider how ethical theories and frameworks may help us navigate and think through difficult problems.
- Finally, we should use an ethical ‘lens’ to consider other ways of seeing the world and other ways of prioritising values. Even if we lack the time, energy, or interest to study the origins and ideas that characterise postcolonial, human rights, disability, or feminist approaches to ethics, we can appreciate the insights they have provided into the impact of power imbalances, discrimination, and inequity on healthcare, health policy, and health outcomes.

Importantly, ethics requires of clinicians both that they appreciate and sensitively respond to difference, but also that they acknowledge that individuals and communities also share many things in common. Chief among these is a desire to have a good life, to achieve one’s
goals and dreams, to feel secure, to live with others, to nurture and love, and to be treated and to treat others fairly and respectfully. Because clinicians play a major role in the design and delivery of healthcare and have close and often ongoing relationships with patients during their illness experience, they have a profound influence on a patient’s experience of illness and healthcare.

Understanding the profoundly ethical nature of healthcare and recognising and respecting the values that are shared by different patients and across different cultures and faith traditions is an important starting point for the delivery of optimal healthcare and for dialogue about goals of treatment.

References