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Possible, but Ethical?

A Bioethical Investigation of Medical Manipulation,
Emerging Technologies and Moral Consequence

By

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An Honors Thesis Submitted in Partial Fulfillment
of the Requirements for Gradation from the
Western Oregon University Honors Program

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Abstract

The scope of medical practice is rapidly advancing due to the technology boom that has occurred over the last twenty years. Procedures that were once thought impossible are now possible, causing ethical debates between multiple disciplines. This study specifically focused on human enhancement technologies (HET's) and how professionals in the medical field evaluate them on an ethical basis. It was hypothesized that participants would be generally in favor of using human enhancement technologies as therapeutic tools but would be against their use as enhancers. In order to determine this, 106 medical and scientific professionals from Oregon and Washington participated in an online survey. Results were subjected to statistical analysis using Microsoft Excel software. It was demonstrated that participants were significantly in favor of HET's when used for therapy but were not in favor of their use as enhancers. Participants also felt that a new ethical code specifically designed for HET's should be implemented. How the attitudes of medical and research professionals are shaped with regard to HET's will undoubtedly influence their future use and acceptance.

In the past decade, technology has dramatically changed the world, as we know it. Advancements made to improve the quality of life have changed how we as humans, work, play, communicate and live. One area that remains largely influenced by these developments is the healthcare industry. Advancements in medical technology¹ have transformed medicine, making what was once impossible, possible. However, a fundamental question needs to be answered: just because it can be done, should it be done? This thesis will investigate the rapid advancements made in the field of human enhancement and what these developments could mean for the medical community, as well as the public.

Human enhancement encompasses a large number of ideas, technologies and applications, making an agreeable definition hard to pin down. One definition prepared for the U.S. National Science Foundation offers that it is to refer to “any activity by which we improve our bodies, minds, or abilities—things we do to enhance our well-being” (Allhoff, Lin, Moor, Weckert, 2009).

Another study attempts a more specific definition, stating that human enhancement is “any attempt to temporarily or permanently overcome the current limitations of the human body through natural or artificial means” (Hughes, 2004).

A science and technology options assessment study even more narrowly suggests that human enhancement is “any modification aimed at improving individual human performance and brought about by science-based or technology-based interventions in the human body” (Coenen et al., 2009).

¹Defined as a wide range of health care products used to diagnose, monitor or treat every disease or condition that affects humans. (Advanced Medical Technology Association. September 2004).

With these definitions alone, one can see that there are many complimentary and many opposing ideas within the study of human enhancement.

Before delving into the different views surrounding human enhancement, some specifics still need to be defined. Because human enhancement is a huge area of focus, what it encompasses may seem unclear.

One distinction that needs to be made early on is between “natural” and “artificial” means of augmentation. Natural improvements include those that cannot push a human body or mind past a normal range of function and that remain morally unproblematic. Again, this is a definition that warrants more explanation. The best way of illustrating the natural means of enhancement is through example. Natural enhancements would include eating healthy meals to improve one’s diet, exercising to improve bodily fitness and reading a book to improve cognition (Allhoff, Lin, Moor, Weckert, 2009). As one can see, these methods of enhancement do not demand a need for further study, as it was readily agreed upon across many disciplines that they do not seem to prompt any ethical or moral problem. They will therefore not be discussed further.

This leaves **artificial enhancements** as the focus of study. Artificial enhancements refer to the development of technologies and techniques aimed at overcoming current limitations of human cognitive and physical abilities (Brey, 2008). The technologies being used are collectively called human enhancement technologies (HET’s). They include progression in the fields of nanotechnology, genetic engineering, robotics, cognitive science, pharmacology, bioengineering and more.

The developments being made are now beginning to close the gap between reality and science fiction. What was once thought to be “the stuff of movies” is now becoming

the future of medicine. These advancements are allowing for the possibility to boost human capabilities beyond the species-typical level or statistically normal range of function for an individual (Daniels, 2000).

A second distinction that needs to be made is the natural vs. artificial discrepancy, though helpful, it is not complete². This new categorization involves a reworking of the way the field of medicine is approached.

Typically, medicine is viewed as a way to treat illness, disease and injury, otherwise stated as therapy.

Therapy focuses on treatments aimed at pathologies that compromise health or reduces one's level of functioning below the species-typical or statistically normal level (Juengst, 1997). The area of interest here is the statement "*below* the species-typical or statistically normal level." This statements concludes that therapy works to bring one's body back to a normal level of function, where HET's are working to move beyond a mere state of normal function.

For example, if a person were to begin taking anabolic steroids to stimulate their appetite and increase their muscle mass, all of which had been affected by a disease such as cancer, this would be seen as therapy. They are trying to treat something compromising their health to return to a normal state of being. On the other hand, if an otherwise healthy athlete were to begin taking steroids to increase their endurance, strength and speed beyond normal capabilities this would be seen as enhancement.

Now that a clearer distinction has been made surrounding the meaning of enhancements, some specific applications can be discussed.

²Arguements have been made about what the clear line between artificial and natural actually is (Allhoff et al., 2009).

Broadly speaking, there are two types of enhancement: physical and mental.

Physical enhancements can be further broken down into physical performance enhancers and cosmetic enhancers. Physical enhancements would include increased strength, speed, endurance, resistance, etc. Cosmetic enhancers include cosmetic surgery (non-corrective), orthodontia and prosthetics. Mental enhancements would increase memory, perception, creativity and problem solving. Some even create a third distinction including the enhancement of mood and personality (Brey, 2008).

In order to apply HET's to the body to obtain the desired enhancement, techniques of application must be used. There are three general techniques – prosthetic, chemical and genetic. Prosthetic enhancement is defined as the application of an artificial device that replaces a missing limb (American Heritage Medical Dictionary, 2007). As previously mentioned, the focus here is not on the replacement of a limb to *return* to normal body function but on the replacement of a limb to *exceed* normal body function. It has been determined that some prosthetics, especially those designed for athletic performance, provide an unfair advantage over typical body parts.

A recent example of this was seen at the 2012 London Olympics, where Oscar Pistorius, a double below-knee amputee, competed in the 400 m and 4 x 400 m relay races. Pistorius, often referred to as “Blade Runner” or “The fastest man on no legs” runs with J-shaped carbon-fiber prosthetics that some believe give him an advantage over runners with ankles and feet. In a report published in *The Journal of Applied Physiology*, it was determined that Pistorius's prosthetics allowed for more energy efficient movement and less force generation (Weyand et al., 2009). Though he did not place at the 2012 Olympics, he has gone on to win silver medals in other able-bodied sporting

events and run a 400 m dash in a time that ranked him 15th fastest in the world. These facts, among others, call in to question if Oscar Pistorius's prosthetics really give him an advantage over his competitors and if so, how much?

There has also been consideration of replacing healthy body parts with mechanics to improve function. The creation of powered exoskeletons from biotechnology and robotics was made possible and are even commercially available in Japan. While some are used to aide injured or disabled individuals in every day life, others are being raced in "exoskeleton races" or as military equipment, aiding soldiers to carry loads bearing weights far beyond their normal capabilities, and at increasing costs (Pons, 2008). The increased size, speed and strength these machines provide their wearer are clear illustrations of physical enhancement. Other examples of prosthesis include the implantation of pacemakers, organ donation and breast and other implants (though it can be argued that pacemakers and organ donation are exclusively therapeutic examples).

Chemical enhancements include the modifications of biological processes yielding superior functioning through the use of chemicals. One very obvious example is the abuse of steroids in athletics. Other examples include the use of Nootropics³ and pharmaceuticals such as Adderall to boost memory, creativity and overall cognitive abilities, the use of beta-blockers to slow down the heart rate to increase performance during stressful tasks and the use of Viagra and other hormones in normally functioning individuals to increase sexual performance.

Genetic enhancement techniques involve the modification of DNA within a person's cells.

³Nootropics defined as drugs, supplements, nutraceuticals and foods that improve mental functions such as cognition memory, intelligence, motivation attention and concentration (Dorland's Medical Dictionary, 2008).

At this time, genetic enhancements are still the most rudimentary, though it is unsure for how long. A current example is the use of embryonic screening to determine the sex of a fetus (sex determination). Though the tests involved are able to screen for hundreds of diseases and conditions, they are also available to screen characteristics that are not considered birth defects or potentially harmful. This technology is leading to the rise of “designer babies” - babies whose genetic makeup have been artificially selected by genetic engineering combined with in vitro fertilization to ensure the presence or absence of particular genes or characteristics (Agar, 2006).

Scientists have also been able to connect the gene responsible for the control of color in the striped zebra fish to the human gene that determines skin color. This knowledge leads to the possibility of the alteration of human skin tone, hair and eye color, facial shape and quality of teeth in terms of enamel (Green, 2007).

Even more recently, it has become possible to scan every chromosome in a single embryonic cell with the use of a microchip, allowing for the rapid testing of genes involved in hundreds of conditions. Some of these conditions are life-threatening, some are potentially dangerous and others including weight, athletic ability, height, hair and eye color and intelligence are clearly not (Abraham, 2012). Other emerging technologies include gene implantation through viral injection, the combination of animal and human DNA, homologous recombination, human artificial chromosomes (HACs) and the possible addition of HAC's to our set of 46 chromosomes.

As research and emerging technologies surrounding human enhancement continue to increase, so do the number of different outlooks, opinions and suggestions. These ideas range from uncontrolled creation and use of enhancements as part of an extremist view

from the likes of the bio-liberals, technophiles and transhumanists to the other extreme of no progression or use of human enhancements from the bio-conservative point of view. There are also numerous groups who claim to occupy the middle ground, one being the “technoproggressives⁴.”

The push towards the use of human enhancement comes most strongly from the Transhumanists and Technophiles. Transhumanists strongly support the possibility and desirability of fundamentally transforming the human condition by developing and making widely available technologies to eliminate aging and greatly enhance human intellectual, physical and psychological capacities (Bostrom, 2005). Technophiles, generally speaking, show a strong enthusiasm for all technology and see it as a way to improve life and solve problems (American Heritage Dictionary of the English Language, 2000).

One of the arguments for the use of HETs is the defense of autonomy and the individual’s right to “maintain or modify their own minds and bodies; so as to guarantee them the freedom of choice and informed consent of using human enhancement technologies on themselves and their children” (Ford, 2005). The regulation or restriction of these enhancements could infringe on one’s natural and political right to improve their life as they see fit. Regulations could also hinder the possible improvements these enhancements have the potential to make, such as eradicating certain diseases.

Transhumanists fear that the withholding of medical advancements from the public could have much larger repercussions than dispersing them.

⁴Technoproggressives operate as a group who believes technological developments are empowering when they are regulated by legitimate democratic authorities to ensure that their costs, risks and benefits are fairly shared by the stakeholders in the developments (Carrico and Mundi, 2006).

When answering the question if individuals and families have the right to alter their own minds and bodies, or if that power should be held by the state, one study claimed, “In a democratic society, it’s every man and woman who should determine such things, not the state...Governments are instituted to secure individual rights, not to restrict them” (Naam, 2005).

However, it is here that the question if a person’s right to freedom is more important than their overall safety comes into play, as well as how informed their “informed” consent is. The study performed for the U.S. National Science Foundation discusses these concerns when stating:

Even if such technologies prove to be so dangerous or risky that we strongly believe we need to protect individuals from their own decisions to use those technologies (through paternalistic regulations), the well-informed individual might circumvent this issue by freely and knowingly consenting to those risks, thereby removing this reason to restrict use (Allhoff, Lin, Moor, Weckert, 2009).

This illustrates that fact Transhumanists believe that even if regulations were placed on enhancements, they may not be effective. The study even stretches so far as to compare possible regulations on human enhancement to regulations placed on narcotics and how successful or not these laws have been.

Another argument supporting HETs is the possibility of their use to improve the overall quality of life. If there is medical technology available that allows for the eradication of certain diseases, relief from suffering, pain and unhappiness and the ability to live longer, healthier, more fulfilling lives shouldn’t it be readily pursued, developed

and put to use? Transhumanists would say yes. They believe that enhancing an otherwise healthy individual only improves their quality of life when it is done safely and effectively. Becoming faster, stronger, smarter and more attractive is part of the human species' innate desire to improve, survive and increase our well-being and happiness.

In a statement regarding designer babies one advocate for enhancements stated, “We should select a healthy child for the same reason as we would act to prevent harm to an existing child—in order to minimize the amount of unnecessary suffering in the world (Sparrow, 2011)... but to what extent?”

The possibilities of improvement in almost all walks of life seem to be the strongest argument for the implementation of enhancements, a fact that brings up another argument in support of HET's. This argument encompasses the very familiar “the ends justify the means” logic. Supporters of human enhancement do not deny the risks and dangers of some enhancement procedures. They do however feel the risks are worth the rewards. This does become difficult to assess because the justification process varies from person to person, enhancement to enhancement.

Another argument in support of HETs is perhaps less subjective. Some scientists, medical professionals and ethicists believe that to predict and prepare for the future we must look to the past. This means that looking at past methods of human enhancement would reveal what future ones hold. They also believe that when these previous enhancements were evaluated, they proved to be very successful.

For example, prosthetics has largely changed the way people with extreme injuries and disabilities interact and live on a day-to-day basis. Organ transplants and pacemakers have saved countless lives and cosmetic surgeries have improved a number

of people's self-perception, esteem and quality of life. It can easily be argued here that these forms of enhancements are being used as therapy and invalidate the argument due to the fact that their application is not one of "enhancing." However, if one were to consider vaccinations, this case study might prove to have some merit.

Before we examine the success (or not) of vaccinations, they need to be recognized an enhancement, as there is some disagreement here. One perspective is that:

A vaccination seems to be an enhancement in that there is no existing pathology it is attempting to cure, merely a possible or likely pathology we wish to avoid. We are drawn to perceive vaccines as some form of therapy— perhaps preventative therapy—given its close association with medicine" (Allhoff, Lin, Moor, Weckert, 2009).

Vaccinations have been improving immune function to better ward off disease for years. Their benefits include cost effective prevention of disease, personal immunity, decreased likelihood that a disease will be contagious and passed to another individual and overall decreased mortality rates from diseases that can be prevented through vaccination (National Institute of Allergy and Infectious Disease, 2010). This illustrates one example where human enhancement has saved countless lives and improved entire societies (see Appendix A, Table 1).

Another application of vaccines as an example of enhancement goes back to the question of regulation. One study thought:

If enhancements in general are ultimately found to be socially or ethically problematic, then counting vaccinations as enhancement opens the possibility that they should be regulated or restricted, which would create

a serious public health disaster, as well as a counter-example to the claim that enhancements are problematic. (Allhoff, Lin, Moor, Weckert, 2009).

The last argument of support is a philosophical one. It surrounds a question that may not have a clear answer in any application, a question that may be more personal than objective. The question is if fear is a strong enough reason not to pursue human enhancements. Does fear provide a “go-with-your-gut” argument⁵ that we should follow or is it perhaps irrational and almost always an uneducated jump to conclusions? Supporters of human enhancement would say the latter. Across each study, one constant that remained was that more education surrounding human enhancement is needed. One such study states:

In foresight and technology assessment as in any other reflection on the future of HET, one has to be aware of the fine line between taking a broad look at the future and feeding the hype...Such a strategy of “hype and hope” always appears to be precarious. This strategy can have both positive effects...and adverse effects. Among the latter...is the popularization of the reverse of the optimistic futurism – a pessimistic futurism involving apocalyptic fears and visions of horror, which itself is being increasingly used to raise attention for nascent fields (Coenen et al., 2009).

Those that would agree with the statement that fear is a good enough motivator to steer clear of progressing human enhancements are groups such as the bio-conservatives, as well as many ethicists, scientists and medical professionals.

⁵Intuitionism describes a philosophy that resolves moral dilemmas by appealing to ones intuition.

They feel that the ends may not satisfy the means and that rapid progression of technology and augmentation of ourselves can have huge repercussions.

The first argument discussed here against the use of HET's is also a philosophical one. It touches on personal, moral and religious ground. It deals with the idea that altering our minds, bodies and genes is an act of manipulating nature, of playing god. That enhancing ourselves questions the meaning of life and what it means to be human. The concern of HET's effects on human dignity and what it means to be human was even deemed the fiercest point of resistance (Sandel, 2007).

The difficulty here is the definition of what it means to be human. Does enhancing a part of ourselves make us no longer human, posthuman⁶? There is also the argument that there may be nothing wrong with modifying nature. Where does it state that modifying nature is wrong in the bible or other religious and moral works?

In response, bioconservatives express that their objection involves an immediate, non-linguistic, gut-feeling reaction to the prospect of enhancement, rather than the outcome of a process of reasoned evaluation. This reaction is a form of intuition (Roache, Clarke, 2004). It is thought that one can simply feel and understand that augmenting themselves beyond a state of naturalness is wrong. One knows that there is something that makes them human though they may have difficulty expressing what that is. An attempt at defining what the quality that makes us human is as follows:

The deepest fear that people express about technology is...a fear that, in the end, biotechnology will cause us in some way to lose our humanity –

⁶Defined as a hypothetical future being whose basic capacities so radically exceed those of present humans as to be no longer unambiguously human by our current standards (Bostrom, 2003).

that is, some essential quality that has always underpinned our sense of who we are and where we are going, despite all of the evident changes that have taken place in the human condition through the course of history (Fukuyama, 2002).

The next argument against the enhancing of humans is more practical. It focuses on the obligation of medical professionals to treat and cure unhealthy persons before “improving” healthy ones and the obligations of scientists to research the countless number of existing diseases before researching HET’s.

Concerns have been raised regarding the use of precious resources towards making healthy individuals more than healthy when so many unhealthy individuals are dying from Alzheimer’s, HIV/Aids, spinal cord injuries, cancer, etc. Is it fair to be pouring resources into enhancement when so many individuals lack basic healthcare? Many have expressed that it is unjust for society to fund research into human enhancement technologies when millions of people around the world are suffering and dying prematurely (Irish Council for Bioethics, 2009). Supporters of human enhancement claim that funding research for cybernetics, genetic engineering, nanotechnology, etc. will eliminate diseases and save money and lives in the long run.

The next argument against human enhancement focuses on a socio-political context. Some believe that human enhancement will not only affect the science and medical field and those who are enhanced or performing the enhancing but also affect those that remain unenhanced.

The first way HETs are thought to create social and political controversy is the fact that they may not be readily available. Some of the procedures or medicines may be

very expensive and as a result, only the wealthy could afford them, eventually leading to only the wealthy becoming enhanced. This could mean that the wealthy would not only have better resources but also be smarter, stronger, faster, healthier, more attractive and have better genes. If this were true, human enhancement would largely contribute to an even greater divide between the already existing “haves” and “have-nots.”

Some believe this divide will become so exaggerated that classism will continue to increase and even possibly create two separate species, humans (unenhanced) and posthumans (enhanced) (Irish Council for Bioethics, 2009). This could have dramatic effects on human rights and dignity and possibly create a world as depicted in the film *GATTACA*.

There is also the argument that enhancements could propose a national threat. Supporters of human enhancement believe that the United States needs to research and develop HET's for the military and general public in order to stay on track with other countries and increase national security. It could pose a huge potential problem if countries like China were using enhancements to build stronger, superior militaries and citizens, while the United States opted out of such technologies, eventually leading to the inability to protect ourselves against possible threats.

Bioconservatives and other groups against the use of HET's feel that global restrictions need to be implemented. They believe that these possibilities prove the danger of such enhancements and that something must be done. They are aware that it is impossible to implement global restrictions on human enhancement simultaneously but do believe that there needs to be a move in that direction. It is possible that enhancement

seekers would leave their own homes to visit countries with no or little restrictions on enhancements to receive a procedure (Allhoff, Lin, 2008).

Another social and political concern is that human enhancements are a form of eugenics. Eugenics is defined as the “applied science or the bio-social movement which advocates the use of practices aimed at improving the genetic composition of a population, usually referring to the manipulation of human populations” (National Library of Medicine, 2010). A comparison was made that human enhancement seeks to improve humans to a universally accepted norm, closely resembling eugenics (Irish Council for Bioethics, 2009).

The problem of human enhancements and eugenics is the possibility of a Nazi-like approach to the use of HET's. Technologies could be used to eradicate the less intelligent, less attractive, and less desirable traits, as well as whole populations. It is believed that eugenics and HET's are insensitive and even intolerable to people with disabilities. Concerns have been raised that HET's might be used to stamp out diversity or to eradicate people with disability. It is also feared that human enhancement would be used to shape people to fit the demands of society by standardizing the types of personalities, skills and physiques individuals have (Irish Council of Bioethics, 2009).

While supporters of HET's claim human enhancement is a “new eugenics,” one that seeks to do no harm but only to benefit society, refuters claim eugenics is simply eugenics. They also fear that the eugenic point of view may put pressure on individuals to undergo enhancements that they never would have otherwise and that they feel uncomfortable with, bringing the issue of choice under scrutiny.

Another criticism of human enhancement that regards choice is germ-line

modifications. In germ-line gene transfer, the parents' egg and sperm cells are changed with the goal of passing on the changes to their offspring (Hanna, 2006). This means that if parents choose to enhance themselves, in some cases they can also be choosing to irreversibly change their children's future. Opponents of HET's argue that:

Genetic engineering may cause psychological harm to future people because they will not have given their consent to be enhanced. They also raise concerns that genetic engineering narrows the range of life choices available to a modified individual. For instance, if parents choose the genetic make up of their child, the child may feel enormous pressure to live up to the expectations of his/her parents. There are also concerns that genetic modification violates an individual's right to an open future i.e. a future they can choose for themselves (Irish Council of Bioethics, 2009).

It however, can be argued that no one gives consent to be born with the genetic make-up that they are given and that genetically-engineered children would feel no different about this than any other children.

One last argument to be presented is an issue of safety. One of the largest concerns surrounding human enhancement is that it will be pursued and practiced with a reckless short-term perspective. In opposition to bio-liberals, who as stated previously, believe restriction and regulation of enhancement technologies could have disastrous side effects, bio-conservatives believe regulation is absolutely necessary to maintain the safety of the individual and the entire community. There is fear that without regulations, a regard for humanity will be lost and people will be held on the same level as the common-tested laboratory rat.

As these contrasting views have demonstrated the ethics of human enhancement technologies are nowhere near black and white. There are groups in support of and groups strongly against and as will be discussed now, there are groups in the middle, the grey area.

It seems to us that the most realistic outcome of a debate about human enhancement will be neither unrestricted freedom nor total prohibition: the issue is likely much more complex than hinging on the single issue of personal autonomy or human dignity. Rather, like many other political and social debates, we may find some commonsense somewhere in the middle (Allhoff and Lin, 2008).

There are many ethicists, scientists and professionals that occupy a sort of middle ground. These groups of people have a more difficult time attaching a name or label to themselves and differ in ideals perhaps even more so than the afore mentioned groups.

The first common ground some groups have been able to share is that human enhancements can be beneficial, when regulated with rigorous testing. This differs from the bio-conservative view previously mentioned because bio-conservatives do not believe HETs should be used, even if they were regularly monitored. They simply are expressing that if it came down to enhancements being “legalized” and/or “regularized” they must be monitored. The opinion focused on here is that regulation will not only remove some of the negatives that bio-conservatives fear but also create some positives. Paul R. Billings, a medical geneticist claims that:

Limiting science and, when appropriate, only allowing its conduct under clear and enforceable regulatory conditions will not suppress the creativity

of cell biologists and geneticists trying to understand human development, the etiology of disease, and possible treatments. In fact, if such understanding encourages irresponsible scientists who seek to “improve” humans through basic genomic changes (eugenics), caution and societal governance will safeguard scientific pursuits and provide hope, not extinguish it (Billings, 2002).

This group believes that it is not the enhancements themselves that are dangerous but the possibility that these enhancements would be part of a “free market,” available to all and without regards to safety.

A second compromising movement is generally only concerned with alleviating the risk of creating a large gap between the rich and the poor. Their concern is a social one that regards that it is also not the enhancements that are at fault but it is their selective availability that raises problems. This group advocates for affordable and universal access to all technologies. Nick Bostrom, a well-known philosopher and director of Oxford’s Future of Humanity Institute, makes this statement outright when he said, “A related concern is that genetic selection might aggravate inequality... There are many ways in which this concern could be assuaged: the technology could be made available to all” (Bostrom, 2008).

A third group of thought focuses on the idea that some enhancements should be permitted, while others should not. The distinction between which of the techniques are appropriate for use and which are not is a difficult one that did appear to differ across certain groups. One distinction that was made repeatedly was that enhancements that only effected the individual being enhanced were generally okay, while the enhancements that

may affect the enhanced's children or others were not permitted (Allhoff, Lin, Moor, Weckert, 2009). This would rule out germ-line modifications and any prenatal selection processes. However, determining what does and doesn't affect others and in terms of how much proves difficult.

One view that appeared to be accepted by all bio-liberals, bio-moderates and even some bio-conservatives was the use of human enhancements for therapeutic endeavors. Only the most conservative thought that human enhancement technologies should not be used for therapy (Institute for Ethics and Emerging Technologies, 2012). This would simply mean that human enhancement technologies would be regularly used but that they would not be doing any enhancing and would only be working to bring individuals back to their normal range of function.

From these arguments presented, one can see that the ethics of the development, use and distribution of human enhancement technologies are very complex. It appears that these emerging technologies are challenging ethics in ways they have never been challenged before – and at incredible speeds. There is talk amongst that field that new ethical principles may need to be put in place. Fritz Allhoff, in his study for the United States National Science Foundation stated:

Technologies, particularly new converging technologies for human enhancement, generate many ethical problems. Sometimes the problems can be treated easily under existing ethical policies. But because new technology allows us to perform activities in new ways, situations may arise in which we do not have adequate policies in place to guide us... We need to formulate and justify new policies (laws, rules, and customs) for

acting in these new kinds of situations (Allhoff et al., 2008).

Allhoff also stated that ethical theories are often too simplistic and do not give guidance in specific situations. Others agree, stating a multi-disciplinary approach is the most appropriate (Brey, 2000).

Another problem with current ethical principles is that they rely too often on a technological assessment of cost vs. benefit, which too easily invites an evaluation in terms of money instead of moral values. It is thought that, “We need to be more proactive and less reactive in doing ethics” (Moor and Weckert, 2004).

This conversation about the shortcomings of current ethical policies, along with the clearly divided debate on the use of human enhancement technologies provides the foundation of the original research presented here. In an attempt to determine if the medical and scientific communities significantly side with one of the afore-mentioned views toward human enhancements, professionals from each field were surveyed. It was hypothesized that participants would be generally in favor of using human enhancement technologies as therapeutic tools but would be against their use as enhancers. It was also hypothesized that participants would feel less strongly about cosmetic enhancements, such as plastic surgery and orthodontia, due to their somewhat regular occurrence in the United States

Methods

Participants

Participants in this survey were selected based on two criteria; their profession and location. Only individuals within the scientific and medical community were asked to participate. Contributors included doctors, surgeons, nurses, medical assistants, physical

therapists, geneticists, chiropractors, biological researchers, dentists and naturopathic physicians. The choice behind this criterion was to ensure that the persons being surveyed had some background knowledge of human enhancement technologies and medical ethics.

Selection was also loosely based on proximity. All participants surveyed were either from or living in Oregon or Washington at the time the research was conducted. This factor was simply due to accessibility. All participants had completed some form of educational training, most with a bachelor's degree or higher. Gender, age and other personal information were not asked upon surveying. 106 total individuals were surveyed. All contributors were asked to assist in the research but any participation was voluntary.

Materials

The survey opened with an informed consent form including a paragraph discussing the purpose of the study and any pertinent background information. The amount of time the participant would invest, statements attesting to confidentiality and the benefits and risks of the survey were also included. Furthermore, the cover page included contact information for the primary researcher, the overseeing academic advisor and the review board and counseling center affiliated with the university behind the research.

The survey itself consisted of eighteen multiple-choice questions, included as Appendix B. Seventeen of the eighteen questions were yes, no or unsure answers. An

optional comment box was available at the end of each question to allow participants the opportunity to clarify their answers or provide more information.

The content of the questions covered ethical issues that can potentially arise from the use of human enhancement technologies, as well as how human enhancements should be administered. All questions were formed in such a way that answers would be based on personal opinion. No questions had right or wrong answers.

Procedure

This study was both non-experimental and cross-sectional. It was designed to gather data on how medical and scientific professionals feel about human enhancement. Collected data was compiled and analyzed for the appearance of trends.

All participants were individually asked over email, telephone or in person to participate in the survey. Once the individual agreed, a link to the survey was provided and all data collection occurred online. Once the individual accessed the link to the survey, they were directed to the aforementioned informed consent page. Participants were informed that they could stop the survey at any time and that it was by no means required of them to complete or submit the survey. By clicking the “next” button, the participant gave informed consent and agreed to participate in the survey. The actual survey was then revealed, with all eighteen questions on one page. The survey did not allow for participants to skip any questions but a response of unsure was an acceptable answer for all questions. Once all questions were answered, the participants selected the “next” button once more and were brought to a screen that thanked them for their time and contribution.

The purpose of the survey was to attempt to determine how the medical and scientific community, as a whole, perceives the research, use and regulation of human enhancement technologies. The purpose was stated clearly before the participant began responding to questions. Therefore, there was no need for debriefing or an explanation of possible deceit or ulterior motives with survey instrument results after the completion of the survey.

All survey responses were subjected to statistical analyses in order to determine if the results were significant. A Chi-square test was performed for each of the eighteen survey questions, resulting in a p-value for each one. If the p-value was determined to be less than 0.05, the response to the question was considered significant.

Results

The results of the given survey supported the hypothesis that scientific and medical professionals are in favor of the use of human enhancement technologies as therapeutic tools. The overall attitude towards HET's as enhancers still remains unclear. Participants responded to questions both in support of and against the use of human enhancement technologies.

Overall, positive responses towards human enhancements can be seen with the following examples. When asked, in general, if it was ethical to pursue human enhancements 69.81% of participants said it was, compared to 8.49% that said it was not. The remaining participants responded as unsure ($\chi^2 (2, N=106) = 66.31, p<0.001$). For further explanation please refer to Figure 1. Participants also felt that pursuing human enhancements was a worthwhile endeavor. As reported, 58.49% of responders felt that

human enhancements deserve the attention of medical professionals, the development and use of technology and the allocation of research, time and money (χ^2 (2, N=106)=31.63, $p<0.001$, see Fig. 2).

Participants also felt that the United States would be at a disadvantage if they did not pursue human enhancements when compared to countries that did. It was observed that 56.60% of respondents thought that disregarding human enhancements was not advantageous for the U.S. (χ^2 (2, N=106) = 26.08, $p<0.001$, see Fig. 5).

Participants felt overwhelmingly that the fear of the unknown was not a strong enough reason for human enhancements to be restricted, with 87.74% of participants responding that it was not (χ^2 (2, N=106) = 141.32, $p<0.001$, see Fig. 8).

There were also numerous responses to questions that were not in favor of enhancements. For example, 49.06% of participants felt that the feasibility of an enhancement was not reason enough to pursue that enhancement (χ^2 (2, N=106) = 22.91, $p<0.001$, see Fig. 3). It was felt that the possibility of improving the quality of a life was necessary before investigating a certain procedure or method of enhancement.

Participants also showed a strong feeling toward the possibility of the selective use of enhancements causing divides between specific groups. A large percentage of participants (87.74%) felt that enhancements could cause an even greater divide between the Have's and Have not's, assuming that they will be costly and therefore primarily available to the wealthy (χ^2 (2, N=106) = 141.44, $p<0.001$, see Fig. 10). Also observed, 80.19% of participants thought that the selective use of HET's could ultimately cause a divide between the "enhanced" and the "unenhanced" (χ^2 (2, N=106) = 105.97, $p<0.001$,

see Fig. 11). It was assumed that this divide would be unfavorable because one group would have a greater advantage over the other. For example, the enhanced could ultimately become more intelligent, physically superior and more attractive than the unenhanced.

In terms of specific circumstances many respondents were again not in favor of the use of enhancements. For example, 66.04% of participants did not feel that parents should have the right to genetically modify their children for any reason beyond genetic diseases (χ^2 (2, N=106) = 51.97, $p < 0.001$, see Fig. 13). It was also felt that technology should not be used to dramatically extend people's lifespans, with 51.89% of participants providing this response (χ^2 (2, N=106) = 16.56, $p < 0.001$, see Fig. 15).

Participants were also asked if they would be willing to enhance an entirely healthy patient, upon their request. In response, 61.32% of contributors said that they would not perform an enhancement (χ^2 (2, N=106) = 38.09, $p < 0.001$, see Fig.16).

Results also provided some ambiguous responses in regards to whether they were in favor or against the use of enhancements. One specific question asked if altering our minds, bodies and genes is manipulating nature. 73.58% of participants felt that these types of interference were manipulating nature (χ^2 (2, N=106) = 80.13, $p < 0.001$, see Fig. 9). It was also asked if the use of HET's is somehow different from other methods of improvement humans have and are currently using to better their quality of life. In response, 66.98% of contributors felt that HETs are somehow different (χ^2 (2, N=106) = 57.24, $p < 0.001$, see Fig. 17). The major reason provided was the newly developed ability to manipulate genes. Participants were also asked if human enhancements were a form of

eugenics. Yes was a response for 32.08% of participants. No was a response for 33.02% and 34.91% were unsure ($\chi^2 (2, N=106) = 0.08, p=0.95$). This was the only response that did not prove to be significant (see Fig. 12).

In terms of restricting human enhancements, participants felt that the government should not hold this power, with 53.77% stating that this was a government issue ($\chi^2 (2, N=106) = 26.85, p<0.001$, see Fig. 7). It was proposed that the medical and science/research fields should have oversight or that the decision should be state by state. Also in terms of restriction, participants did not feel that an individual's right to autonomy was violated if they were not allowed to pursue enhancements. It was observed that 47.17% did not think autonomy was a factor in the restriction of enhancements ($\chi^2 (2, N=106) = 13.73, p<0.002$, see Fig. 6).

Participants were also asked how they felt human enhancements technologies should be used in general. The majority (66.98%) of contributors felt that human enhancements should only be used in terms of healing and medicine ($\chi^2 (5, N=106) = 163.60, p<0.001$, see Fig. 14). They did not feel that enhancement technologies should be used to alter healthy individuals.

When asked if it was more worthwhile to pursue some forms of human enhancements over others, an overwhelming 89.62% of participants said yes ($\chi^2 (2, N=106) = 162.04, p<0.001$, see Fig. 4). This response supported the previously stated hypothesis that participants would feel more comfortable with some enhancements over others due to the fact that some enhancements are already a regular fixture of life.

The last question of the survey asked participants if they thought that a new, separate Hippocratic oath should be created for human enhancements. In majority, 71.70% of respondents felt that a new code of ethics should be created ($\chi^2 (2, N=106) = 73.27, p < 0.001$, see Fig. 18). The major reason provided was that circumstances are different when dealing with a healthy patient.

Discussion

The present study proposed that medical and scientific professionals would respond positively to the notion of using HET's as therapeutic tools but would respond negatively to their use as enhancers. Overall, these hypotheses were supported in that participants generally did respond positively to HET's when used for therapy and negatively when used for enhancing. However, some discrepancies arose when data revealed that medical and scientific professionals also responded positively toward HET's as enhancers in some instances.

In order to determine how HET's should be approached, it was first necessary to determine if pursuing them was even ethical from a medicinal and research standpoint. The majority response was a "yes." However, numerous open-ended responses stated that the ethics varied from enhancement to enhancement and that some are not ethical at all. Overall, it was felt that the specific enhancement, the intent of the enhancement and the outcome needed to be taken into consideration before it could be considered ethical to pursue it. Examples of enhancements that were thought to be ethical in pursuit included any that restored normal functions of life, aided in therapy, increased the quality of life, or only affected the single individual receiving (and paying for) the enhancement. This

list of “ethical enhancements” sports a common theme in that almost all suggested are used as forms of treatment. Results from this question, therefore supported the hypothesis that members of the medical and scientific communities feel HET’s are worth pursuing if they are used in a therapeutic manner.

Additional evidence supporting this hypothesis was illustrated most obviously by one specific question that simply asked how HET’s should be used. The majority of participants stated that human enhancement technologies should be used only in circumstances of healing and medicine and not for enhancing. They felt that these tools were absolutely necessary to restore an individual’s health and only one participant responded that these technologies should be completely prohibited.

However, a considerable number of participants responded to this question with an answer of “other.” These individuals felt that HET’s should always be used in terms of therapy but should also be used for enhancing on a case-by-case basis. One participant stated that, “the approval of an enhancement would depend on the ethics, the future impact on others beyond the person seeking the enhancement and the type of enhancement.” A second participant stated that, “a combination of research medicine and enhancements should be used. I think most types should be researched – in terms of practice, I think limiting to healing and medicine is key, but that definition is tricky.” These results illustrate what was previously discussed in the literature mentioned above – that the regulation and practice of HET’s as enhancers is complicated, unclear and highly debated in difference of opinion and perceptions on what and when HET's are acceptable.

The responses received when asked if human enhancements are a worthwhile use of resources including money, research, time, technology and the attention of healthcare specialists also supported the proposed hypothesis. While most contributors replied with a “yes,” those that provided a more detailed response again stated that this factor depended on the situation and the enhancement itself. An overwhelming number of responders again felt that HET’s used for healing and therapy are a worthwhile use of all resources. A percentage of responders felt that HET’s used for *enhancing* purposes are a worthwhile use of private resources but should not be consuming public or government funding. Another factor participants felt affected the worthiness of an enhancement was the age of the person receiving it. Of those that mentioned age as a variable, all stated that it would not be worthwhile to perform enhancements on the elderly or extend their lifespans (will be discussed in further detail). Others felt that certain enhancements were worthwhile, while others were not (also will be discussed in further detail). The most common enhancements that were considered to be unworthy of resources included plastic surgery for improved aesthetics and steroids for improved athletic performance.

As a separate question, it was then asked if some forms of human enhancement were worth pursuing over others. An overwhelming majority answered with a “yes,” stating that those aimed at improving human function, reconstructing and curing diseases and illnesses should be pursued more than cosmetic enhancements, age-reversals and other medically irrelevant procedures. This data, again, fits the pattern that HET’s used for therapy receive much more support than those used for enhancing.

Participants were also asked if the feasibility of an enhancement was reason enough to pursue it medically and technologically. Approximately half replied that the

possibility of a specific enhancement was not reason enough to pursue it. They felt that a benefit of the research or practice had to be known and that any enhancement considered unethical should not be pursued. However, multiple participants felt that possible enhancements should be pursued in the chance that the research could improve other medical technologies and therapies. These individuals felt that technology should not be limited because improvements can always be made in medicine, even when the benefits are not yet known. A specific enhancement that was provided as an example was gene manipulation and reproductive therapies. Though procedures in these categories are possible, respondents repeatedly mentioned that just because we can does not mean that we should.

Participants were also asked if parents have the right to genetically modify their children. A large majority said that parents do not have this right and almost all open-ended responses claimed that they only have this right when the child or embryo is affected by a debilitating disease or condition. These responses provide more evidence that genetic enhancements were perceived as the most ethically problematic for participants.

Contributors also felt similarly when asked if technology should be used to dramatically extend people's lifespans. A large proportion of participants felt that technology should not be used to extend lifespans beyond a reasonable means and that it should only do so if the quality of life can also be enhanced and extended. This illustrates another example of the therapy over enhancement hypothesis.

Evidence that did not seem to support the hypothesis that medical and scientific professionals believe HET's should be used only in terms of therapy can be seen in the responses to multiple questions. The first being, if the United States did not pursue human enhancements, would we be at a disadvantage when compared to countries that did pursue human enhancements. The majority of participants responded with a yes, indicating that the research and practice of HET's may be crucial to the U.S. remaining in its position as a world leader. Of the received open-ended responses, most were concerned with the possibility of other countries potentially routine use of cognitive enhancers and the U.S. losing its position as a front-runner in modern medicine.

The second question that received the majority of answers in favor of pursuing human enhancements asked if the fear of the unknown was a good enough reason not to pursue human enhancements. An overwhelming number of participants responded with a "no." Open-ended answers provided such clarifications as "scientific research and discovery is always a journey into the unknown" and "potential benefits would not be discovered due to unjustifiable restrictions." However, though a large number of contributors stated that fear should not hinder the research and practice of HET's, they also believed that proceeding with caution and constant evaluation was absolutely necessary. These factors illustrate that the survey participants understand that benefits and discoveries that could (and most likely would) come from the research and administration of HET's but that an element of caution should remain when working in such a "grey-area" of ethical consideration.

The third question that provided responses in support for the use HET's as enhancers asked if altering our minds, bodies and genes is manipulating nature. While,

roughly 75% of participants agreed that it was, most felt that this was not a bad thing. The open-ended responses expressed that the majority believed most of the activities we as humans take part in every day manipulates nature. Vitamins, antibiotics, surgery, vaccines, cars and computers, all inventions we view as beneficial, were named as examples of tools that manipulate nature. This reveals that the medical and scientific communities don't necessarily view human enhancements as ethically questionable due to their manipulation of our minds, bodies and genes but perhaps because of their lack of necessity when compared to methods of healing. Therefore, if HET's could be proven to be almost entirely beneficial and with minimal risk, it is likely that opinion towards them will change, even in instances of enhancing vs. treating.

When asked if HET's could potentially widen the gap between the Have's and Have not's due to the assumption that they will be costly, allowing the wealthy to gain privileged access to them, almost all participants agreed. This would appear to be an argument against the use of enhancements; however, the open-ended responses reflected a different opinion. While most agreed it was possible and an issue to consider, they also believed it was not reason enough to halt or lessen the pursuit of enhancements. Others provided examples where they believed this was already occurring, mostly with availability to plastic surgery and the possibility of priority in receiving an organ for transplant. It was also discussed that this gap already occurs in the medical field, with the wealthier being able to afford better health care in general.

When asked if a divide between the "enhanced" and "unenhanced" could also be caused almost all participants again agreed. It was also felt that this is already somewhat occurring in cases of plastic surgery and orthodontia. These results indicate that medical

and scientific professionals do not feel that socio-economic factors attributed to the widespread use of HET's are reason to abandon pursuit of them.

More evidence in support of medical and scientific communities responding somewhat positively to HET's as enhancers was seen in response to the question if HET's are somehow different than other ways of improvement that humans have used ever since their existence. The majority of participants responded that HET's are different from other methods of improvement. They felt that they are much more advanced, invasive, extreme and can accomplish much more than anything used in the past. However, most respondents did not state that these factors were negative. They felt that this was simply the progression that occurs in all fields when advances in technology are made. It was not expressed that HET's should not be pursued because they are more extensive. They were instead viewed as developments made in the field of medicine and though they differ technologically, it was thought that their overall goal of improving and extending well-being was the same. Some hesitation was expressed with the possible range of effects that could be caused by modifications and the cellular and genetic level.

Three questions were asked in terms of oversight and regulation of HET's. The first question asked if a person's right to autonomy was violated if they were not allowed to pursue human enhancements. Almost half of participants stated that this right was not violated if human enhancements were restricted. It was simply stated that some enhancements are illegal or restricted for the benefit of the individual, as well as the community and should not be considered as violating autonomy.

The second question asked if the government should hold the power of restricting HET's. Again, half of the participants felt that the government should not have this power. They felt that oversight and regulation was absolutely necessary but that it should come from a coalition of researchers, ethicists, physicians and other experts. Only as a last resort or in lack of another impartial authority should the government be the regulating official.

The last question asked regarding oversight of HET's asked if they should have their own code of medical and research ethics. A significant proportion of participants felt that they should. Reasoning behind this included HET's rapid rate of change, the notion that this form of medicine is no longer about healing and saving endangered lives, the fact that some procedures are not necessary and that one cannot always guarantee that they will "do no harm" when enhancing healthy patients. It was felt that this proposed new code would require input from religious leaders, medical professionals, psychologists, philosophers and ethicists. It was also felt that it should include "the whole of medicine and the human endeavor."

Two questions presented resulted in obscure results. The first question asked if human enhancement was a form of eugenics. Responses to this question were almost completely split between "yes," "no" and "unsure," resulting in insignificant data.

The second question asked if the participant would be willing to enhance a healthy patient on their request alone. Though the majority replied that they would not be willing to enhance a healthy patient solely on their request, multiple open-ended responses revealed conflicting results that participants would be willing under certain

circumstances. The cost vs. the benefit, as well as what the specific enhancement was would all have to be carefully considered. Plastic surgery, cognitive enhancing and orthodontia were the only enhancements that were specifically identified that surveyed professionals were willing to perform. It was hypothesized that the confusion with these two questions could be attributed to the questions themselves. Participants may have been uncertain on exactly what was being asked or may have needed more information to answer the questions properly.

Overall, it was concluded that medical and scientific professionals feel that the use of human enhancement technologies should primarily be used in terms of healing and therapy. They should also be researched and pursued because of the possibility of improving existing or developing new medical therapies. HET's used only for the purpose of enhancing should generally be prohibited due to their ethical implications and lack of necessity. Enhancements that only affected the individual being enhanced and that provided no financial burden on the community or extreme risk of danger should generally be permitted. Medical and scientific professionals also felt that HET's require their own code of medical ethics that must take into account their numerous implications. Lastly, it was determined that the medical and scientific communities were most comfortable with HET's as enhancers in the forms of cosmetic surgery and orthodontia and least comfortable with genetic enhancements.

This study was able to determine an overall feeling of the scientific and medical communities towards the use of human enhancement technologies. It appears that the surveyed individuals collectively occupy the afore-mentioned middle ground that lacks an attached title. Occupation of middle ground on the spectrum of bioethical theory can

be seen as a positive attribute of most healthcare and research professionals. The general public can be comforted in knowing that these communities support all efforts to bring the most advanced and efficient technologies to aid in their healing and healthcare, as well as disregard practices that challenge ethical principles and contain too many risk factors.

This study was not without limitations and suggestions for future research can be made. The first implication of this study was that all participants were located within two U.S. states. This makes it slightly more challenging to provide an overwhelming feeling of communities that are present in all fifty states. In the future, it is suggested that data collection occur for a longer period of time, include a larger sample size and cover a greater geographical range.

In terms of data collection and analysis, this study did not analyze any specific demographic factors of participants due to privacy issues. They were selected based on their location and general profession but neither was asked upon surveying. For future research, it may prove interesting to require participants to state their age and/or specific profession and make comparisons. In hindsight, this study could have benefited from determining how specific professionals responded to certain questions.

Difficulties also arose with the nature of specific survey questions. Because questions were often so subjective or general, participants may have had a more difficult time answering them than they would have if the questions were more direct. The subjective, opinion based questions and responses were to be desired, however, in the future a longer survey with more specific questions may prove to be useful.

Lastly, statistical analysis was not conducted between multiple choice questions and open-ended responses. Further research may benefit from this. Overall, further research is suggested to better determine the attitude of the scientific and medical communities toward human enhancement technologies and continue to ask the question this study sought insights to, “Just because we can, should we?”

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Appendix A

Disease	Baseline 20th Century Pre-Vaccine Annual Cases	2008 Cases*	Percent Decrease
Measles	503,282	55	99.9%
Diphtheria	175,885	0	100%
Mumps	152,209	454	95.7%
Pertussis	147,271	10,735	92.7%
Smallpox	48,164	0	100%
Rubella	47,745	11	99.9%
<i>Haemophilus influenzae</i> type b, invasive	20,000	30	99.9%
Polio	16,316	0	100%
Tetanus	1,314	19	98.6%

*Provisional. Widespread use of vaccines in the United States has eliminated or almost eliminated infectious diseases that were once terrifying household names. Credit: Morbidity and Mortality Weekly Report, Centers for Disease Control and Prevention, 4/2/99, 12/25/09, 3/12/10

Table 1: The Impact of Vaccines in the United States (Originally published by the U.S. Department of Health and Human Services)

Appendix B

Human Enhancement, Medical Manipulation and Ethics

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Purpose: The purpose of this study is to determine how the scientific and medical communities look at rapidly advancing technologies and the changes they bring to their respective fields. With the increase in technology and development, many procedures are now possible that were once thought to be science fiction. This study focuses on aspects of human enhancement technologies and procedures that are now available, readily being made available and/or in the research phase. Human enhancements are defined as “artificial enhancements referring to the development of technologies and techniques aimed at overcoming current limitations of human cognitive and physical abilities” (Brey, 2008). Medicinal practices aimed at bringing the body back into its normal range of function are not the focus of this study. This survey attempts to answer the question, “Just because it can be done, should it?” It takes an ethical approach when looking at if human enhancement should be stopped, should continue with restrictions or should be pursued wholeheartedly. Specific enhancements discussed are plastic surgery, performance enhancing drugs, cognitive function enhancing drugs, prosthetics, sex determination and gene manipulation. This study intends to provide some evidence if an overall feeling of the medical and scientific community towards human enhancements can be determined.

Methods: Your opinions on medical procedures and practices, as well as their outcomes and common ethical issues will be obtained through this short and anonymous survey. You do not have to answer every question and can withdraw from the survey at any time. The survey should take no more than 10 minutes. Some previous knowledge of human enhancement and medical and research ethics is required.

Confidentiality: Your participation in this study is entirely anonymous and confidential. While you have been targeted due to your profession and location, no other personal information is required. No one will know that you have participated and in no way will any information you give be traceable to you.

Benefits/Risks: While there is no monetary compensation for participating in this survey, you may benefit from knowing you contributed to valuable research within the scientific community. The information you provide may not benefit you directly but could potentially benefit others. There are no known risks for participating in this study.

Questions: If you have any questions or concerns please contact the principal researcher, Krista Harrington at above given email. If you have questions or concerns about your rights as a participant in this study please contact the Western Oregon University Institutional Review Board at 503-838-9200 or at irb@wou.edu. If you feel the need to speak to a professional due to the study's inquiry into your personal beliefs or any other reasons regarding your experience please contact the Western Oregon University Health and Counseling Center at 503-838-8313.

1. Is it ethical to pursue human enhancements?
Yes
No
Unsure
Space for explanation (optional)
2. Are human enhancements a worthwhile use of resources (money, research, time, technology, attention of medical professionals)?
Yes

No

Unsure

Space for explanation (optional)
3. Is the feasibility of an enhancement reason enough to pursue it technologically and medically (just because we can should we?)
Yes
No
Depends on the enhancement (optional)
Space for explanation
4. Are some forms of human enhancements worth pursuing over others (eg. cognitive enhancers over plastic surgery?)
Yes
No
Depends on the enhancements
Space for explanation (optional)
5. If the U.S. did not pursue human enhancements, would we be at a disadvantage when compared to countries that did pursue human enhancements?

Yes
No
Unsure
Space for explanation (optional)

6. Is a person's right to autonomy violated if they are not allowed to pursue human enhancements?

Yes
No
Unsure
Space for explanation (optional)

7. Should the government hold the power of restricting human enhancement technologies (HETs)?

Yes
No
Unsure
Explanation (optional)

8. Is fear of the unknown a good enough reason not to pursue human enhancements?

Yes
No
Unsure
Explanation (optional)

9. Is altering our minds, bodies and genes manipulating nature?

Yes
No
Unsure
Explanation (optional)

10. Assuming that HETs will be costly, could the possibility that the wealthy may only have access to them cause an even greater divide between the rich and the poor?

Yes
No
Unsure
Explanation (optional)

11. Could a divide between the enhanced and unenhanced also be caused?

Yes
No
Unsure

Explanation (optional)

12. Is human enhancement a form of eugenics?

Yes

No

Unsure

Explanation (optional)

13. Should parents have the right to genetically modify their children?

Yes

No

Unsure

Explanation (optional)

14. Should HETS...

Be completely prohibited

Be used freely without restriction

Be used only in terms of healing and medicine, not for enhancing

Be used only in the military

Be researched but never practiced

Other

15. Should technology be used to dramatically extend people's lifespans?

Yes

No

Unsure

Explanation (optional)

16. Would you be willing to enhance a healthy patient on their request alone?

Yes

No

Depends on the situation

Explanation (optional)

17. As humans, we have been enhancing and improving ourselves since we have existed. Are HETs today somehow different?

Yes – they go beyond what is considered improvement

No – they are just using the tools we have available to improve our quality of life

Unsure

Explanation (optional)

18. Do HETs require their own code of ethics?

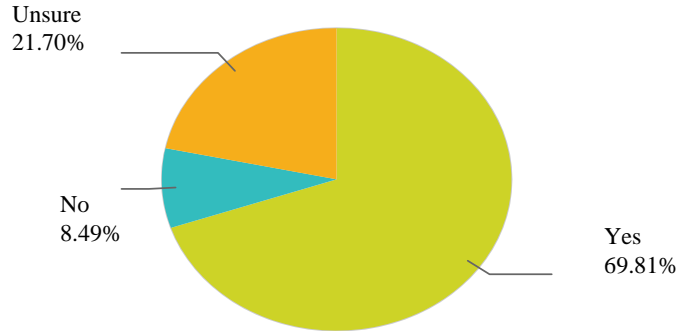
Yes

No

Unsure

Appendix C

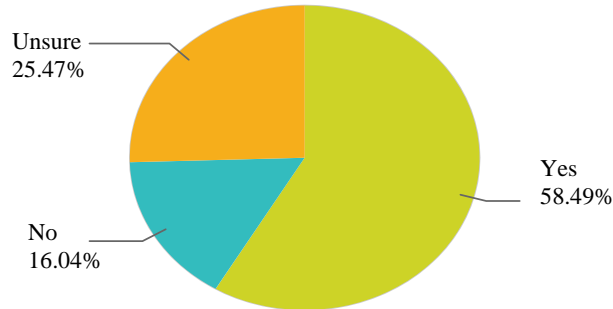
Q1 Is it ethical to pursue human enhancements?



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	69.81%	74	< 0.001	0.831
No	8.49%	9		
Unsure	21.70%	23		

Figure 1: Summary data for question 1 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.

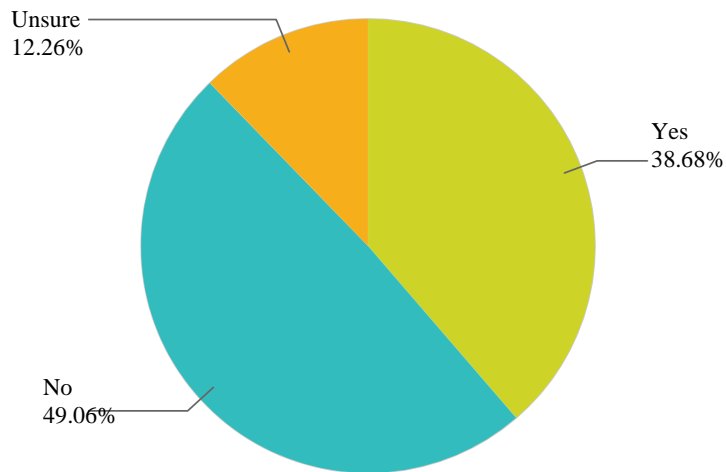
Q2 Are human enhancements a worthwhile use of resources (money, research, time, technology, attention of medical professionals)?



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	58.49%	62	< 0.001	0.859
No	16.04%	17		
Unsure	25.47%	27		

Figure 2: Summary data for question 2 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.

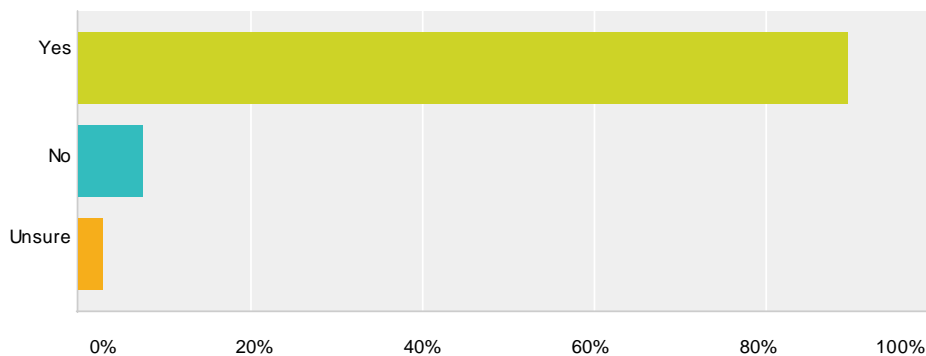
Q3 Is the feasibility of an enhancement reason enough to pursue it technologically and medically (just because we can, should we?)



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	38.68%	41	< 0.001	0.662
No	49.06%	52		
Unsure	12.26%	13		

Figure 3: Summary data for question 3 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.

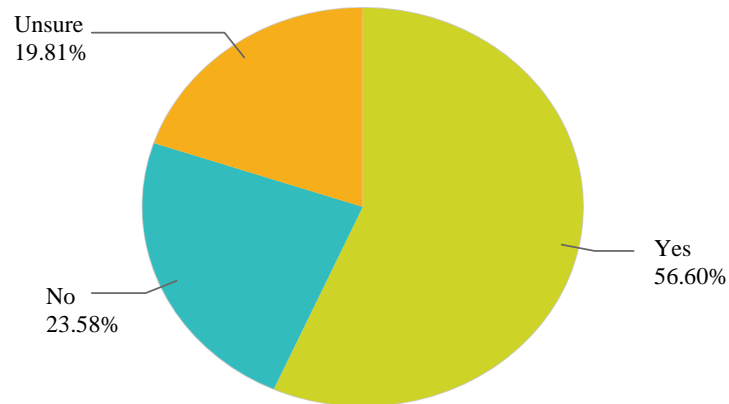
Q4 Are some forms of human enhancements worth pursuing over others (eg. cognitive enhancements over plastic surgery?)



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	89.62%	95	< 0.001	0.416
No	7.55%	8		
Unsure	2.83%	3		

Figure 4: Summary data for question 4 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.

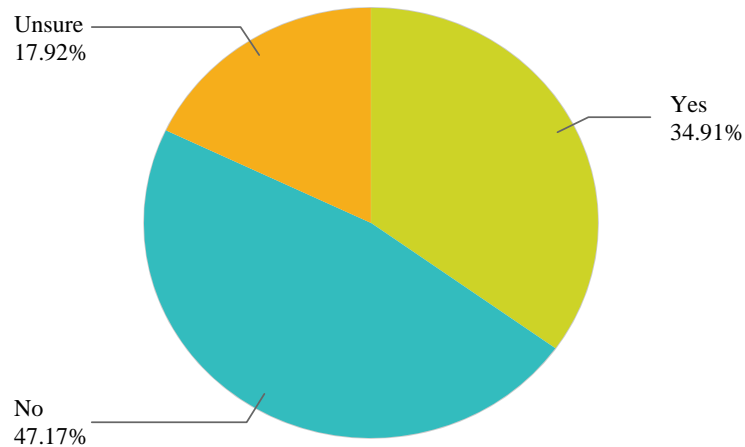
Q5 If the U.S. did not pursue human enhancements, would we be at a disadvantage when compared to countries that did pursue human enhancements?



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	56.60%	60	< 0.001	0.797
No	23.58%	25		
Unsure	19.81%	21		

Figure 5: Summary data for question 5 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software

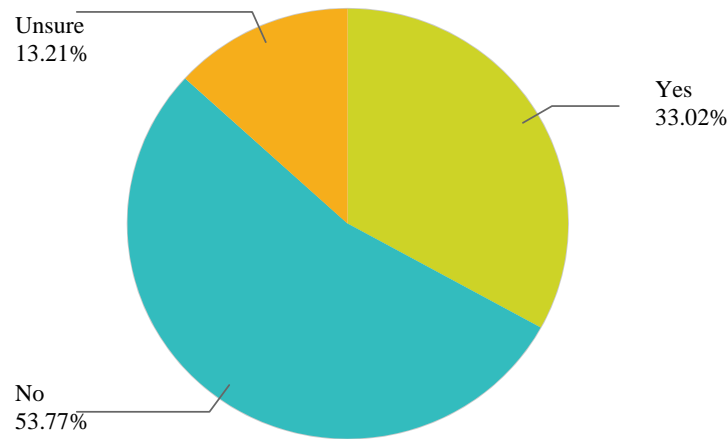
Q6 Is a person's right to autonomy violated if they are not allowed to pursue human enhancements?



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	34.91%	37	< 0.001	0.710
No	47.17%	50		
Unsure	17.92%	19		

Figure 6: Summary data for question 6 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.

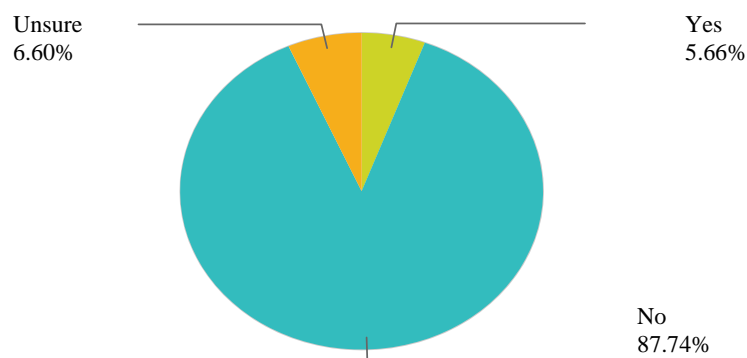
Q7 Should the government hold the power of restricting human enhancement technologies?



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	33.02%	35	< 0.001	0.653
No	53.77%	57		
Unsure	13.21%	14		

Figure 7: Summary data for question 7 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.

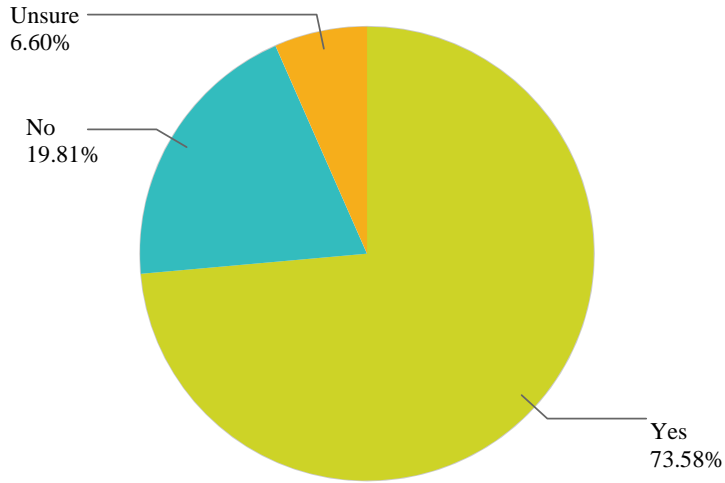
Q8 Is fear of the unknown a good enough reason not to pursue human enhancements?



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	5.66%	6	< 0.001	0.352
No	87.74%	93		
Unsure	6.60%	7		

Figure 8: Summary data for question 8 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.

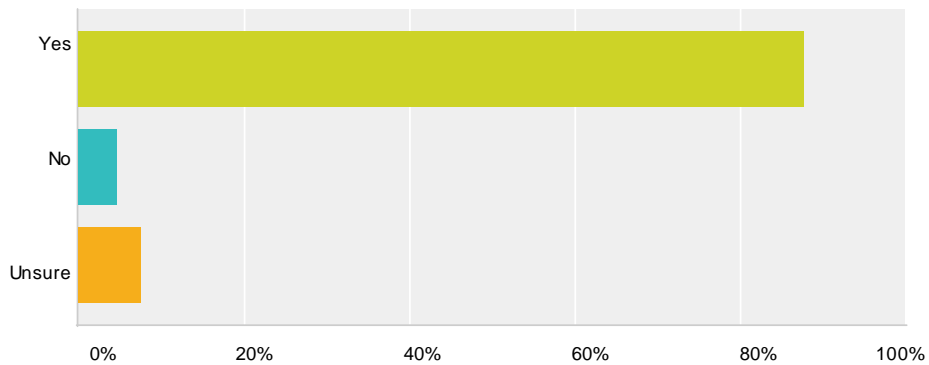
Q9 Is altering our minds, bodies and genes manipulating nature?



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	73.58%	78	< 0.001	0.597
No	19.81%	21		
Unsure	6.60%	7		

Figure 9: Summary data for question 9 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.

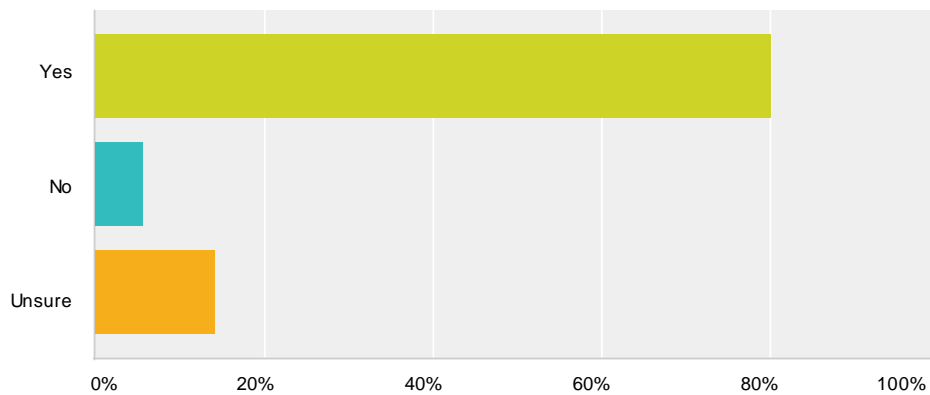
Q10 Assuming that human enhancement technologies will be costly, could it be possible that the wealthy may gain privileged access to them and cause an even greater divide between the Have's and Have not's?



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	87.74%	93	< 0.001	0.559
No	4.72%	5		
Unsure	7.55%	8		

Figure 10: Summary data for question 10 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.

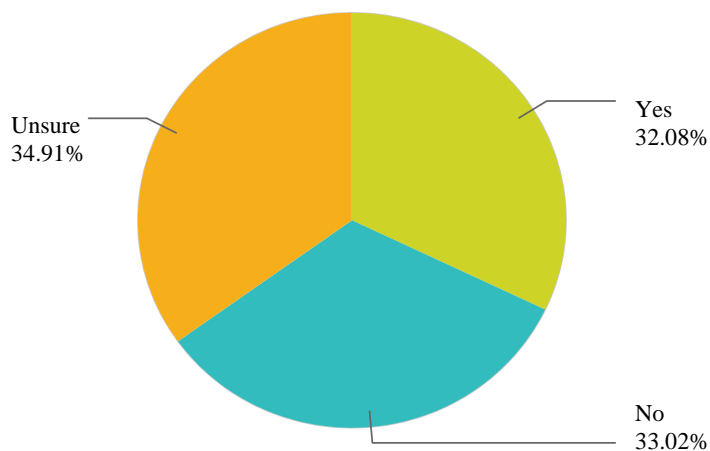
Q11 Could a divide between the enhanced and unenhanced also be caused?



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	80.19%	85	< 0.001	0.716
No	5.66%	6		
Unsure	14.15%	15		

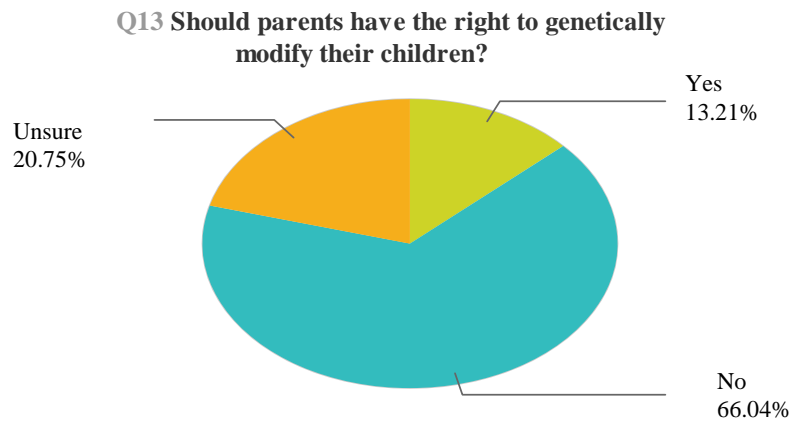
Figure 11: Summary data for question 11 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.

Q12 Is human enhancement a form of eugenics?



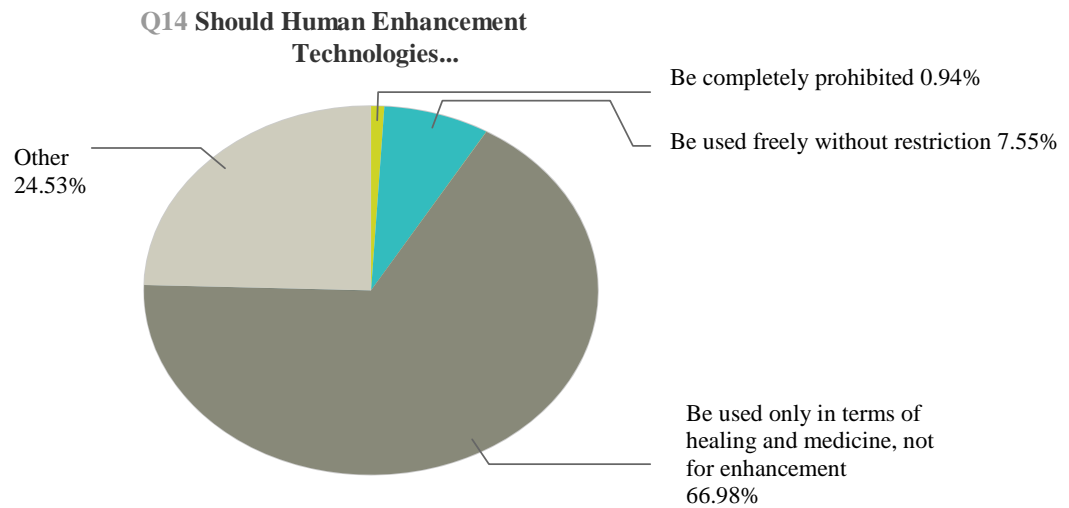
Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	32.08%	34	0.95	0.822
No	33.02%	35		
Unsure	34.91%	37		

Figure 12: Summary data for question 12 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	13.21%	14	< 0.001	0.580
No	66.04%	70		
Unsure	20.75%	22		

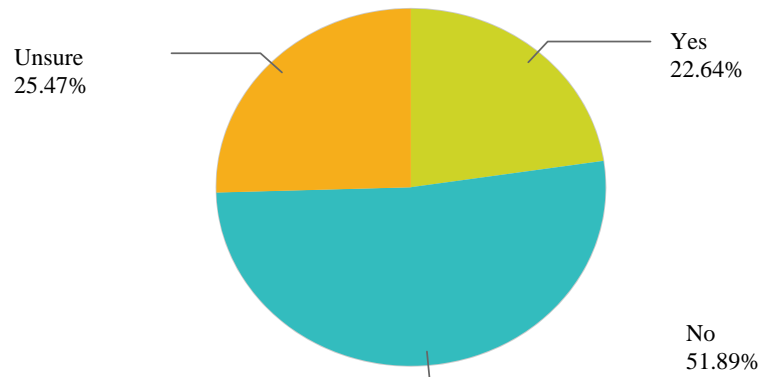
Figure 13: Summary data for question 13 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.



Answer	Response (%)	Response (#)	P - value	Standard deviation
Be Prohibited	0.94%	1	< 0.001	1.1327
Be used freely	7.55%	8		
Be used for healing	66.98%	71		
Other	24.53%	26		

Figure 14: Summary data for question 14 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.

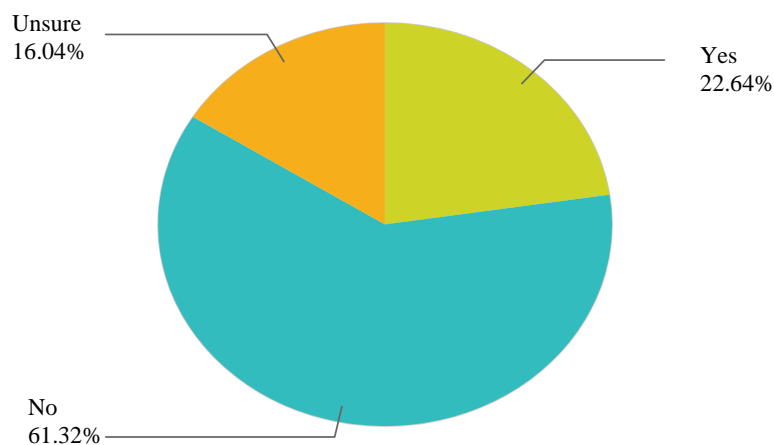
Q15 Should technology be used to dramatically extend people’s lifespans?



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	22.64%	24	< 0.001	0. 696
No	51.89%	55		
Unsure	25.47%	27		

Figure 15: Summary data for question 15 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.

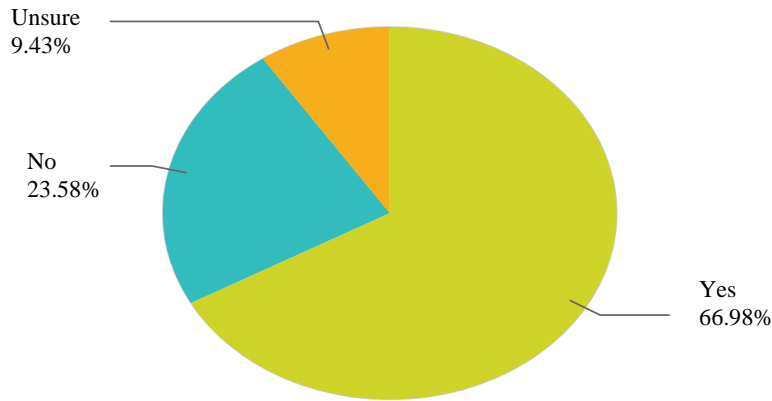
Q16 Would you be willing to enhance a healthy patient on their request alone?



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	22.64%	24	< 0.001	0. 621
No	61.32%	65		
Unsure	16.04%	17		

Figure 16: Summary data for question 16 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.

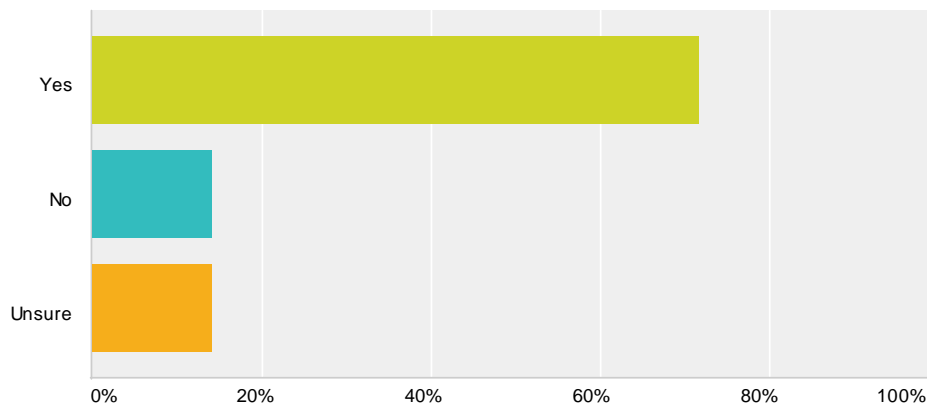
Q17 As humans, we have been enhancing and improving ourselves since we have existed. Are Human Enhancement Technologies today somehow different?



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	66.98%	71	< 0.001	0.661
No	23.58%	25		
Unsure	9.43%	10		

Figure 17: Summary data for question 17 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.

Q18 Should Human Enhancement Technologies have their own code of medical and research ethics?



Answer	Response (%)	Response (#)	P - value	Standard deviation
Yes	71.70%	76	< 0.001	0.730
No	14.15%	15		
Unsure	14.15%	15		

Figure 18: Summary data for question 18 of research survey. Results were tabulated by website that hosted survey. Statistics were calculated using Microsoft Excel software.