The Economics, Politics, and Ethics of a Golden Drug for Cancer Treatment

Parwiz Abrahimi[†], Steven Asplund[†], Victor Tseng[†]
Department of Bioengineering
University of Washington

INTRODUCTION

A new anti-cancer drug, herein referred to as The Drug, has been developed in the United States that has been shown to have an 80% success rate over the entire cancer population. The only drawback, however, is that this drug is prohibitively expensive, allowing only the very affluent to be able to afford payment out of pocket. Patients in a lower income bracket must therefore rely on external resources such as pharmaceutical benefit plans, Medicare, or private charities. These resources can only offer limited coverage of treatment costs. In this situation of scarcity, it becomes incumbent on economists, ethicists, and public health administrators to formulate a policy that best accommodates the demographics at risk of foregoing treatment based on their socioeconomic situation. This paper will evaluate the immediate economic consequences, associated social and political issues, and the ethical arguments which rationalize possible changes in public health.

ECONOMICS

As a starting point, consider the economics of modern-day healthcare. What effect would a prohibitively expensive cure for cancer have on the current health care payment system? The economics of modern-day health care can be summed up in three words: confusing, expensive, and unequal. The U.S. does not have the all-encompassing social health care system found in many European states, and dabbling with free market economics in medicine failed at the end of 1997, with the fall of HMOs.[1] Instead, a confusing conglomeration of for-profit and non-profit providers has arisen, overlaid with insurance companies' health care plans, job benefits, and government assistance, both at the state and federal levels. Consumers are faced with a myriad of choices which will determine their level of coverage. Under Medicare in Washington State alone, there are over 30 different plans to choose from with even more options taking effect in 2006.[2] Ultimately, a patient's level of care is determined by two factors: what the insurance company will pay, and what the patient is willing to pay, and therein lays the inequality.

Consider the results of a study on the price of chemotherapy for colorectal cancer conducted in 2005 after the market release of the monoclonal antibody drugs bevacizumab and cetuximab, which are used in conjunction with various chemotherapy treatments. The cost of drugs alone for a traditional, baseline Mayo Clinic regimen with a monthly bolus of fluorouracil plus leucovorin is $63 USD. [3] This comes with an increased median duration of survival from 8 months (without treatment) to 12 months. A regimen with FOLFIRI and weekly cetuximab extends the median duration of survival beyond 21 months, but at the cost of $30,675. [3] The study speculated that many insurance plans would not cover the use of these prohibitively expensive drugs when other less expensive, but less effective, intermediaries existed. If any plans did cover the use of bevacizumab or cetuximab, the premiums would certainly increase to

[†] Corresponding authors.

offset the increased cost. The end result: even for the insured, well-to-do patient, the most effective drugs would require significant economic sacrifice. For the uninsured, bevacizumab and cetuximab represent the unattainable cure.

This would be the effect of a cure for cancer attainable only to the most privileged few. While in 2004 it was estimated that some 56,000 could benefit from the monoclonal antibody treatment of bevacizumab and cetuximab[3], millions would benefit from a cure for cancer. Unable to pay for the treatment of hundreds of thousands in the U.S., insurance companies would be forced to deny coverage or would raise premiums so high that very few could afford plans covering The Drug. Instead, expect companies to cite the cost-effective benefits of currently available chemotherapy and surgical treatments. Some of the very wealthy would be able to pay for the drug out of pocket, but most would be unable to afford the co-pays, let alone the treatment itself. The class disparity within the U.S. health care system, already evident[4], would be exacerbated by the discovery and subsequent financial selectivity.

As mentioned previously, insurance companies will cite the cost-effectiveness of the drug as one reason for denying treatment coverage to clients. Currently, while denial of coverage on a cost-effective basis is almost unheard of in the U.S. due to a well-founded fear of litigation, there exists precedent for rejection of specific drug coverage in the U.K. on a cost-effective or a prohibitively expensive basis through the National Institute for Health and Clinical Excellence (NICE).[5] The Australian Pharmaceutical Benefits Scheme (PBS) also has a history of refusing recommendations on the basis of cost versus available funding. [6] The PBS ensures that covered drugs are not only cost-effective in increasing the QALY (Quality Adjusted Life Year), but that the coverage is economically viable.[6] The U.S. currently does not have any form of national price advisory or guidance, and the political motivation for cost-reducing subsidies, while high, would be equally offset by the current fiscally conservative frustration in Washington.[7] With a lack of government assistance or at least negotiation, health care providers, benefit programs and the insurance industry would feel compelled deny coverage (or at least pass off losses to the individual in the form of higher premiums and co-pays) at the risk of litigation.

With insurance companies, managed care organizations, pharmacy benefit managers and the government either unwilling or fiscally unable to cover the tremendous costs for The Drug, the likelihood of a public and political backlash against the pharmaceutical producer of the drug increases. The U.S.'s pharmaceutical industry has always been viewed with suspicion in the media and by many individuals as ultimately responsible for the high costs of prescription drugs through patient monopolies, and not as the natural cause of free-market economics. The classical defense for high prescription drug prices centers on the need for pharmaceutical companies to

recoup research and development losses. While an incorrect argument from a rational loss standpoint, the drug industry does reinvest more than 18% of sales revenue back into R&D, roughly $45 billion per year.[8] Much like the petroleum industry, pharmaceuticals must think decades ahead and there is a proven proportionality between the current cost of drugs and future research. Therefore, drug prices are often pegged to the profit maximizing level to ensure future growth.[8] As a final consideration, pharmaceuticals must also ensure future growth within the drug patient's market lifespan, usually 12-13 years after completion of clinical trials and FDA approval, more so now then ever with recent anti-trust complaints and lawsuits forestalling companies from prolonging patient life through legal means.[8]

The problem for the producer of The Drug will be to justify the prohibitively high cost of treatment. As noted, the pricing should not be influenced by the need to generate a return on previous investments under rational loss theory: sunk costs of research have already had their fiscal effect on the company and are irrelevant with regards to pricing.[8] Instead, product pricing is governed on the elasticity of demand, production costs and what the market will bear. Therefore, the cancer cure is astronomically high for only two possible reasons. First, exotic or complex production costs dictate the pricing scheme (this may also include intermediary costs such as storage, and transportation to the consumer). Second, the producer has decided that a high price at low sales volume is favorable for maximizing profit.

If pricing is controlled by production factors, then the producer has every motivation to suppress those costs allowing for an increase in sales volume through lower pricing prior to patent expiration. Perceived "losses" due to the lower price are negated by savings in production while profits are increased through increased sales. In addition, a high sales volume would also allow for greater brand-name recognition and continuation of sales after the entry of generics. Pricing based on maximum profit from a high price to low volume ratio would most likely cause public and political backlash. Profit from The Drug will not go to defray previous costs, it will instead be reinvested in R&D (and thus increasing the overall value of the company since such an overall increase in R&D leads to increased growth) or directly into company coffers and shareholder dividends. In either case the company is enriched at the economic expense of society.

SOCIO-POLITICS

The economic situation will undoubtedly generate social and political issues. One immediate consequence in a nation with a privatized health care industry: the divide between the wealthy and the poor will increase as the financially less fortunate are unable to pay for The Drug. Discussing this divide in terms of class warfare only politicizes the reality of the situation, wherein it literally may be the choice of life

and death for consumers. Therefore, expect extreme responses from all parties. With this in mind we can look at the social consequences from two possible responses: the consumer and government's response to the situation.

As the product is initially released, the consumers fall into two categories, those able to pay the price of The Drug and those unable to afford it. This analysis takes into consideration the response of those unable to pay for The Drug, assuming that those able to pay for it out of pocket will do so regardless of the cost. With The Drug too expensive for the middle class or sub-middle class patient, one initial reaction of the consumer would be to seek an alternative medicine with equal effectiveness. Objectionably put, this "poor man's drug" may have more undesirable side effects arising from its use. Specifically in critical cases such as in the case of cancer, an alternative drug that has a lower clinical efficiency will undoubtedly result in lower patient survivability[1]. In addition, the monopolistic price controlling of the company producing The Drug will be viewed with suspicion by the consumers. In a democratic state such as the United States, a rationally expected reaction to this perception is that the consumers will contact their elected representatives to elicit government intervention. As noted in the economic analysis, the government is currently limited in its fiscal ability to respond. This ultimately will lead to drastic actions taken by the consumers. In the past, even now, we've witnessed Americans flocking in numbers to Canada, Mexico, and the internet to purchase their drugs at internationally competitive prices. In fact, such was the topic of conversation at several senate hearings[2]. The drug purchasing comes with caution as these drugs are often generic or come in forms other than the patient requires (non-time release, etc.). Thus, the patient's health may very well be compromised by taking such drugs that are not FDA approved for sale in the United States. As the demand of these drugs increase, the black-market supply will undoubtedly increase as generic drug-makers meet the supply, ignoring any patents on the drug that is being manufactured. The quality, too, may be questionable as there may not be any regulatory checks in their synthesis and quality.

Fiscally limited, the government response may embody itself in regulatory committees, such as the previously mentioned NICE and PBS in United Kingdom and Australia respectively, which can influence the pharmaceutical company's pricing on The Drug by not endorsing it. After intense pressure from consumers and Medicare beneficiaries, the United States which has known to be one of the least aggressive nations to impose price controlling on drugs[3], has recently has approved its flagship Medicare's inclusion of a prescription drug benefit plan, set to come out in 2006[4]. In this plan, both generic and brand-name drugs are covered, however it may not cover certain drugs in the plans available. "Plan D", as it is called offers drugs to Medicare beneficiaries in plans composed of three basic tiers[5]. The first tier is composed of generic drugs. These are

cost-efficient drugs that are legally made and approved by the FDA, and are thus less expensive. The second tier is approved brand-name drugs. The last tier is composed of drugs that are not approved by the plan. Each successive tier costs more than the previous tier. With this prescription benefit plan, companies will undoubtedly be pressured into lowering prices for drugs to get massive promotion of their drugs into the second tier, making the drug available to the huge consumer base of Medicare. This would maximize the price and volume ratio and could be the cause of the company to lower their pricing. However, such may not be a viable solution over all. In cases when a drug exists that is not approved by the plan – most probably because of pricing – exceptions can be made by a doctor's recommendation. With such a high demand for this drug, patent protection, and no competitive treatment regiments, the company has a total monopoly over pricing. The only pressures for decreasing price would be direct political backlash by members of the government, which may have some affects, but is not a case where the government directly negotiates pricing with the company. In other states, however, more drastic approaches can be taken. For example in July of 2005[6], the government of Brazil, threatened to break Abbot Laboratories' patent on a key HIV/Aids drug, by synthesizing a generic form of the drug KALETRA. This put immense pressure on the company, as such an action would bring down world-wide prices of the antiretroviral drug, and eventually the two organizations came to a compromise with the drug price considerably reduced.

ETHICS

With the possibility that the economic situation may spur social action, the ethics of the situation must be examined. Decisions in modern medical ethics are guided largely by four principles: patient rights, beneficence, non-maleficence, and justice[1]. The fourth principle is the most versatile guideline for creating a moral distribution of coverage for The Drug; there are many ways to qualify justice. Justified distribution is based on need, which may be naively defined as the acuity of immediate illness. However, this definition is ethically (and economically) faulty because it dictates that resources be allotted to a patient in the gravest health, even though the patient may not benefit at all. If the definition of need is changed to mean the amount of The Drug needed to deplete the capacity to benefit from it, a more ethical scheme is created[2] by providing the greatest subsidy for The Drug to patients with the greatest capacity to benefit. Capacity to benefit is not equivalent to need, since two patients may have the same capacity to benefit, but end at different states of health after the same treatment. This means it will require different dosages to deplete the capacity to benefit.

One limitation of need-based distribution is the fact that it is impossible to meet the needs of the entire cancer population. It would be absurd to simply dole out coverage in proportion to the need of each patient.

As mentioned before, there is a hypothesized 20% failure rate of The Drug. This failure rate would be expressed if every patient received treatment. The rate could be suppressed if treatment was given to patients with the highest capacity to benefit, thereby ensuring success. Furthermore, cancer treatment often takes many months, accruing enormous costs. Spreading coverage over too large of population would only provide a small fraction of a complete treatment course. There would be no net benefit from such a system. The only consolation would come from meeting the need of a limited number of patients rather than diluting resources until they are ineffectual. The ethical challenge is to isolate this limited number group of patients in a fair way.

One solution is to devise a lottery in which the treatment becomes a pot, and the probability of winning is proportional to the need of the patient. The pot must be large enough to meet the need of the least needy patient. This lottery would be repeated, and the pot refreshed, until resources are entirely consumed (CD). This method generates a Poisson distribution if we try to implement it in practice[i].

We can compare the need-based ethics to two other prominent ethical models, either of which may be used to rationalize or support social changes in response to the economic situation. The first model is utilitarianism. A distribution is moral, according to utilitarianism, if it produces the largest health gain across the entire population[3]. The units of utility, as mentioned earlier, are QALY. In contrast to a need-based ethics, which creates a distribution from scratch, utilitarianism modifies (redistributes) the current distribution in such a way as to maximize total QALY. First consider the cost-effectiveness of a treatment as the cost per QALY (CPQ). This quantity is used by NICE in the production-side sense, in which it is sage to shunt resources from a low high CPQ drug to a low CPQ drug[4]. However, since The Drug has no competitive substitutes, we will look at CPQ from the vantage of the patient. Utilitarians use CPQ to mean the cost (unique to each patient) for one QALY. The entire health resources of a patient is then the product of that patient's CPQ and his or her current QALY. It is moral to transfer health resources from Patient A to Patient B if the CPQ of A is greater than the CPQ of B. It may seem entirely unexpected, but the gain in QALY is maximized when the entire health resources of B is shifted to A. However, this is axiomatically equivalent to the death of B, which is an improper moral and political outcome. The solution is to draw resources from a pool, such as public finance, or employee benefits[5], and relax the stringency of pure utilitarianism and allowing it to be morally right to transfer only some fraction (arbitrarily large, yet far from unity) of B's health resources to A, perhaps in proportion to economic need (for we cannot apply the concept of need as previously formulated).

For utilitarianism to be a useful doctrine in the politics of health care, it must be applied not just to transfers between two patients, but to transfers across the entire patient population. At this larger scale,

complications arise[ii]. One obtrusive, and pertinent, complication emerges as an outcome of defining QALY as a pure quantity of health, with no attached weight given to the quality of health. Consider patient C, who has cancer, for whom treatment with The Drug will only grant one year of perfect health (+1.0 QALY) because his capacity to benefit is very low. Now consider patient D, for whom some superficial facial surgery at the same CPQ will secure a lifetime (75 years) of health with an increase of 0.05 QALY per year. Patient D's utility gain is $+75 \times 0.05 = 3.75\,\text{QALY}$, which trumps patient C's utility gain. It is sensible to transfer life-saving resources from C to the vanity of D just on the basis of this kind of analysis? Since utilitarianism cannot accommodate all of these possible transactions, it is clear that it can only be applied on a grand dimension, to broad policies. Such policies might include establishing an order in which patients would be awarded coverage, based on the order of severity of their respective health conditions.

To determine a utilitarian pricing of the drug, the manufacturer's money flow must be tightly checked. A price must be chosen to both maximize availability to patients, and maximize the success of R&D in improving this drug (leading to cheaper methods of synthesis). This requires that the manufacturer make no gratuitous profits. If the drug is being produced at maximum cost-effectiveness (lowest CPQ possible), any additional profits should be redirected towards lowering market prices. The Drug will increase the total QALY of patients, regardless of how it is priced. It is the maximization of this increase which is the stamp of utilitarianism. As mentioned, one social response would be the formation of a regulatory pricing mechanism, similar to NICE or PBS. Note that NICE simply recommends the government against subsidizing a cost-ineffective drug. A system of the sort previously described would be more austere, keeping a close eye on the company finances and penalizing the company for increasing the price without a comparable increase in gain of QALY.

The second other ethical model is egalitarianism. In this kind of ethics, it is morally right to reduce the amount of health disparity within a population. This is not to say that it is morally right to subsidize a random (perhaps mean) level of health. Egalitarian ethics equalizes the opportunity for health[1], given that this opportunity is reasonably high. Typically, this definition is forged out of respect for the autonomy of the patient. Such a stipulation requires us to look at The Drug as an instrument by which a recipient can actualize a healthier way of life. Thus, distribution of coverage for The Drug must be informed by the lifestyles of the patients that are candidates, as well as their willingness to modify these lifestyles to maximize health expectancy. We expect that an egalitarian distribution is strongly correlated with an age distribution. Namely, coverage will be tapered for the senior end of the population since these patients have a higher CPQ than younger patients. In a need-based distribution, coverage for The Drug is

provided to a patient until his or her need is met. In egalitarianism, coverage is provided until all patients have equal capacity to benefit, and thus equal opportunity for health.

CONCLUSIONS OF STUDY

This concludes the analysis of the effect of a prohibitively expensive cure for cancer on the economics of the American health care system, the predicted social and political responses to the economic situation and the ethical components of said responses. In summary, the current health care system would be unable to financially cope with the fiscal burden imposed by widespread utilization of The Drug, regardless of the reason for the pricing scheme. This would lead to two responses, from the consumer and the government. Consumer response will be to seek out alternatives (generic or otherwise) the absence of which will result in increased pressure for a political solution. Under public pressure, the Federal government will pursue regulatory pricing options. Given the current fiscal situation of the government, the prospect of wide Federal coverage is unlikely. Solutions for the distribution of limited resources must then be considered from a moral viewpoint.

The moral analysis surveyed the advantages and disadvantages of three different ethical systems: need-based ethics, utilitarianism, and egalitarianism, as they pertain to fair coverage for The Drug. Need-based ethics is economically appealing since it prioritizes patients with respect to their capacity to benefit, effectively avoiding instances where the coverage may be fruitlessly spent on a patient with no capacity to benefit, no mater how serious the cancer is. Utilitarian ethics takes a global view, and thus guide decisions that will lead to a higher health gain in totality. It is quite flexible since it can be applied to any current coverage distribution. However, it has many shortcomings, including ambiguity about quality of health versus quantity of health, and applicability to only far-reaching policy changes. Finally, egalitarianism provides each patient with enough drug coverage to realize some level of health. This is more accommodating for a human-rights argument; since under an egalitarian system, it would be morally right to withdraw coverage from a patient unwilling to achieve some set level of health.

REFERENCES

ECONOMIC ANALYSIS

1.Kuttner, R. The American Health Care System. *N. Engl. J. Med*. 1999; 340: 664-668

2. Medicare. Nov. 2005. Medicare. 26 Nov. 2005 <http://www.medicare.gov>.

3. Schrag, D. The Price Tag on Progress – Chemotherapy for Colorectal Cancer. *N. Engl. J. Med*. 2004; 351: 317-319

4. Garrett, Laurie. Betrayal of Trust. New York: Hyperion, 2000.

5. Pearson, S., Rawlins, M. Quality, Innovation, and the Value for Money. *JAMA*. 2005; 294: 2618-2622

6. Henry, D., Hill, S., Harris, A. Drug Prices and Value for Money. *JAMA*. 2005; 294: 2630-2632

7. Zeihan, P. America Unplugged. Stratgic Forecasting, 2005.

8. Scherer, F.M. The Pharmaceutical Industry – Prices and Progress. *N. Engl. J. Med*. 2004; 351: 927-932

SOCIO-POLITICS

1. Pearson, S., Rawlins, M. Quality, Innovation, and the Value for Money. *JAMA*. 2005; 294: 2618-2622

2. Senate Committee Hearing on Drug Purchasing (108th Congress), 10 March 2003, *U.S Government Printing Office*, 2005. <http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=108_house_hearings&docid=f:86053.wais>

3. Scherer, F.M. The Pharmaceutical Industry – Prices and Progress. *N. Engl. J. Med*. 2004; 351: 927-932

4. Facts about Medicare Drug Plans, Medicare, *Centers for Medicare and Medicaid Services*, 2005, <http://www.medicare.gov/Publications/Pubs/pdf/11065.pdf>

5. Medicare Drug Plan Coverage, Medicare, *Centers for Medicare and Medicaid Services*, 2005, <http://www.medicare.gov/Publications/Pubs/pdf/11136.pdf>

6. Brazil Reaches Drug Patent Deal, 9 July 2005, *British Broadcasting Corporation*, 2005, <http://news.bbc.co.uk/2/hi/americas/4662877.stm>

ETHICAL ANALYSIS

1. Cookson R, Dolan P. Principles of justice in health care rationing. *J. Med. Ethics*. 2000; 26: 323-329

4. Culyer, A. Economics and ethics of health care. *J. Med. Ethics.* 2001; 27: 217-222

2. Culyer, A. Equity – some theory and its policy implications. *J. Med. Ethics.* 2001; 27: 275-283

5. Hurley, J. Ethics, economics, and public financing of health care. *J. Med Ethics*. 2001; 27: 234-239

3. Reich M, Roberts M. Ethical analysis in public health. *Lancet.* 2002; 359: 1055-59.

ENDNOTES

i As mentioned, we want to construct γ so that it is proportional to the normalized need of the patient, or $\gamma_i = \alpha_i \frac{N_i}{N_{\max}}$ where N_i is the need for patient i, and $N_{\max}$ is the need of the patient in the direst health. It would be erroneous to use $\alpha_i = N_{\max}\left(\sum_{i=1}^{P} N_i\right)^{-1}$, where P is the population size, even though this guarantees $\sum_{i=1}^{P} p(1,\chi) = \gamma_1 + \cdots + \gamma_P = 1$. This is because a patient may need to win the lottery more than once to meet his or her need. If a patient needs τ treatments to meet the need, the probability of winning τ times in χ lotteries, where the probability of winning once is γ, is given by the distribution $p(\tau,\chi) = \frac{1}{\tau!}e^{-\chi\gamma}\chi^n\gamma^n$. If we choose $\ln(\gamma) = \left(\frac{1}{\tau - 1}\right)\ln\left(\frac{\tau\cdot\tau!}{\chi^{\tau-1}}\right)$, then $p(\tau,\chi) = \tau\, p(1,\chi)$ which is desirable since we want the probability of satisfying need to scale with the amount of need. That is, the probability of satisfying a need $\tau N_{\min}$ is large than the probability of satisfying $N_{\min}$ by a factor of τ.

ii Other complications involve the way in which the patients are networked to each other. Some patients will have strong and numerous connections, while others will be more obscure. Utilitarianism generally treats all individuals as equals, with no regard to families, friendships, dependents, or other biased relations (3, 5). This is strongly antithetical to human instinct, and a comprehensive computational utility theory has yet to be developed for this scale.