Perspectives on Plastic Surgery and Global Health

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Abstract: Of the many factors affecting the health of the human race, those amenable to correction by plastic surgical intervention comprise a significant number. The interface between the global health community and the plastic surgery community historically has been quite diminutive, but this is changing with globalization. This overview provides a primer of global health for the plastic surgeon, and a discussion of the global burden of disease as it relates to plastic surgery. The article then briefly discusses the disparity between the global plastic surgery needs and the supply of expertise, and the difficulties presented by policy, finances, and implied societal preferences for care.

Key Words: global health, global burden of disease, economic modeling, DALYs, international plastic surgery

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Historically, the term global health has not been associated with plastic surgical needs. In fact, surgical needs in general have not been given much attention in the global health arena. Arguably, the most thorough compendium of the global burden of disease, Disease Control Priorities in Developing Countries,[1] a 1400-page tome that gives the reader an excellent overview of global misery, devotes exactly 1 chapter, 16 pages long, to surgical problems. With this background, is it even appropriate to discuss health conditions amenable to correction through plastic surgical intervention? This question will be addressed throughout this article, but at this point let us postulate in the affirmative. So, if we are to discuss the role of plastic surgery in global health, exactly whose health are we discussing, what are we discussing, and why are we discussing it?

It is appropriate to start with the question of whose health we are contemplating. Current estimates indicate that there are 6.6 billion people in the world. Of these, 1.3 billion, or 22%, live in China, although that number is rapidly becoming outdated. India claims 1.1 billion, another number becoming obsolete as it is written.[2] For perspective, this is 3 to 4 times the population of the United States in roughly the same land area as the lower 48 states. Arguably more relevant than the population figures of today are those of the future. It is estimated that the human population reached its first billion in 1804, taking somewhere around 40,000 years (depending on the anthropological determination of when bipedal creatures could be termed human) to reach that milestone. The second billion was reached in 1927, and the third in 1960. Since then, we have added another billion every 12 to 14 years.[3] Depending on how population is managed as we speak, by 2050 there could be as few as 7.7 billion or as many as 11 billion.[4]

Almost all of this growth will occur in developing countries, as more developed countries are projected to maintain almost steady state population. The rate of growth is projected to decrease significantly, but a positive growth curve still results in an ever-growing population, albeit more slowly than what is at present.[3] As early as 1600 BC, Babylonian tablets indicated a concern that there were too many people on the earth. A bit more recently, the Reverend Thomas Malthus, in 1798, published his Essay on Population, in which he predicted the world was at its capacity in terms of human habitation, and that the next century would see massive starvation.[4] Although there certainly were hardships, the Industrial Revolution and other advances obviously prevented this from occurring. In the 1960s, Noble Laureate Paul Ehrlich wrote The Population Bomb, in which he predicted massive famine and starvation in the 1970s for the same reasons. Despite famines in Biafra and Bangladesh, technological improvements again prevented the disastrous predictions from coming true. Today, Malthusian projections, with very plausible scientific backing of the effects of climate change and concerns of food supply, are again being made.[5]

HISTORICAL BACKGROUND

So, as it applies to the population described, what is global health? Historically, global health concerns largely meant dealing with infectious diseases such as tuberculosis, polio, smallpox, malaria, and various worms and parasites that cause maladies such as blindness, chronic malnutrition, diarrhea and dehydration, and others. Then, issues of population management, vaccinations, and nutritional needs such as vitamin A supplementation achieved commensurate significance. Many of these problems were essentially solved through some remarkable advances. The Salk and Sabin polio vaccines almost eradicated that disease; the conceptual home runs and persistence of Foege et al did eradicate smallpox[6]; Nalin et al[6a–6d] developed the scalable use of oral rehydration therapy to save millions of children from dying of dehydration because of diarrheal diseases,[7] and better agricultural technology led to astonishing increases in food production.

The advent of the 1980s brought new challenges to the global health community in the form of HIV/AIDS and a re-emergence of tuberculosis. This time, tuberculosis came associated with the immunosuppression of HIV infection and in the form of a multidrug-resistant strain. Added to this was the persistence of malaria and the technological aspects that have prevented the development of a practical vaccine for that disease. Together, these entities comprised a large proportion of global health concerns from the medical perspective. However, developments since then have been far more successful than would have been predicted a mere 15 years ago. Antiretroviral drugs now make AIDS a chronic disease of very functioning people rather than a death sentence. The work of Jim Kim et al[7a] in the realm of drug availability probably saved us all from rampant multidrug-resistant tuberculosis. Malaria, although still characterized as a major problem, has been reduced significantly in some areas through measures such as indoor spraying for mosquito control, insecticide-treated bed nets, and targeted treatment and prophylaxis. People such as President Jimmy Carter and Bono lending their names and their efforts to global health initiatives have helped programs such as the WHO 3 by 5 program, the Global Initiative against AIDS, TB, and malaria, the US-initiated PEPFAR program for HIV, and others make inroads into these global health issues.

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None of these initiatives have addressed problems specifically related to surgical conditions. When the needs of a society or region are vitamin A and calories, dying from appendicitis or an incarcerated hernia, starving from the disability of a burn deformity or a hand injury, or lack of employment opportunities because of a cleft lip or a cleft palate are indeed of secondary concern. As globalization and general economic development have improved ever so slightly, the extent of health diminution because of lack of available surgical intervention has become more evident. This has given rise to a nascent literature on the topic.

THE SCOPE OF PLASTIC SURGICAL NEEDS GLOBALLY

Arguably, the best overview of the topic is the chapter mentioned earlier by Debas, et al.[7b] These authors used a reasonable definition of what constituted a surgical condition, then applied this to data from the Global Burden of Disease study.[8] They calculated that in terms of disability-adjusted life years (DALYs), 11% of the lost life and productivity in the world were because of surgical conditions. Of these, 66% were caused by injuries, malignancy, or congenital anomalies, which are the 3 categories most frequently involving plastic surgery.[1]

THE GLOBAL BURDEN OF DISEASE STUDY AND THE CONCEPT OF DALYS

The original Global Burden of Disease (GBD) study was undertaken to gain an objective idea of what disease and what health problems really were the cause of most of the world's misery.[9] From these data, the distribution of aid, research efforts, etc, could be directed more toward objectively determined needs rather than simply following high-profile problems or those simply favored by donors. The study is summarized by Murray CJL et al.[8] The study was revisited and expanded, and summarized by Lopez et al.[10]

In addition to attempting to gain a better understanding of disease burden from field studies, the GBD study attempted to define, in a quantitative way, the significance of over a 100 conditions to the affected individual. The mechanism of how this was measured is beyond the scope of this article, but the ultimate output was the DALY. Most previous estimates of population health used mortality statistics, which fail to capture the concept that there are states of health between death and normal, full, healthy life. The DALY was defined as the sum of the years of life lost because of earlier than expected death, plus the years of productive life lost due to the effects of the disability created by the health condition. To determine the latter, it was necessary to define how much a health condition detracted from a full life. For example, it was determined that congestive heart failure secondary to ischemic heart disease, when treated, decreased one's productiveness and enjoyment of life by 17.1%.[11] For each year of expected life after the onset of the condition, there would accumulate 0.171 DALYs. The calculations are actually a bit more complicated, as the concepts of age weighting and discounting were used[12,13] (these are slightly controversial).[14,15] Age weighting makes the assumption that some years, be age, are more valuable than others. Discounting is identical to that used by a bank, making the assumption that years lost in the future are not as valuable as the present. In the GBD study, it was estimated how many people in a population were affected by each condition, their ages, and from these data it was calculated how many DALYs could be attributable to each condition. The WHO lists estimates of DALYs and mortality data from each of its member countries from 2002 data.[16] There are other measures of health than the DALY that are widely used.[14,17]

Unfortunately, there are scant data on the actual extent of these problems. The 140 conditions addressed in the revision of the original GBD study could not include every possible condition that could be alleviated by surgical intervention.[10a] Similarly, although immense amounts of data are collected around the world by the WHO, Demographic Health Surveys,[18] and others, data that would indicate the extent of the unmet need for surgical intervention for many conditions do not exist.

However, there are estimates for some of these conditions that give us an idea of plastic surgery needs. According to WHO data, in the Southeast Asian Region alone, there are over 6.5 million DALYs per year lost to burn injuries. That is not to say that an infinite supply of plastic surgeons, physical therapists, and hospital facilities could restore every single one of these productive years of life, but a reasonable supply of plastic surgeons, physical therapists, and hospital facilities could certainly make a colossal dent in that figure. This example also demonstrates the complex nature of such problems, and how integrated plastic surgical needs are with all of human needs. Better assessment of the scope of the problem would give us an indication of how much of this particular problem is because of established contractures and other postburn complications and how much because of loss of life. The problem also involves the issue of ongoing lack of acute burn management in many places, resulting in easily preventable contractures that cause lifelong disability. One step further back in the cascade is the issue of prevention, which brings up issues of cooking methods, electrical safety, and other precipitating factors. Eventually, this cascade leads back to problems that are more sociologic in nature, of which the most glaring is poverty.

Continuing with the example of burns in South Asia, the economic loss secondary to this unmet plastic surgical need is astonishing. A very rudimentary way to estimate economic loss is simply to multiply DALYs by the Gross National Income (GNI) per capita. This method is perhaps the most conservative way of looking at this issue. It ignores the externalities of the loss sustained by the caregivers of the injured individual, or the costs of medical care and supplies, or the value of human aspects of the loss. The WHO Commission on Macroeconomics and Health in 2002 suggested that 3× the GNI per capita might be a more appropriate estimate.[19] This report observed that economic loss because of health problems comprises 3 components: direct loss of income, loss of longevity, and loss of psychologic well being even in the absence of loss of longevity or direct financial loss. Value of a Statistical Life literature, even from developing countries, yields colossal estimates of these losses.[20] Simple use of GNI per capita, though, indicate that the loss of economic productivity secondary to burns in South Asia is about 5 billion dollars per year. If the GNI were estimated in terms of purchasing power parity (PPP) rather than simple dollar value (Atlas method), this figure rises to 23 billion dollars.

GNI, GROSS DOMESTIC PRODUCT, PURCHASING POWER PARITY, AND THE ATLAS METHOD

The World Bank and other institutions use several measures to evaluate and compare economies. The most widely known of these are Gross Domestic Product (GDP) and GNI, which are somewhat similar. The GDP considers the value of all domestic production of goods and services. The GNI includes this value as well as net flow of income from abroad such as profits realized from abroad, and similar income sources. The Atlas method is a means of calculation of the GNI that removes some of the acute effects of the volatility of the currency market by averaging exchange rates over a 3-year period. Purchasing Power Parity (PPP) considers price differentials between countries in its calculation of income. By doing so, it enables comparison of GNI with "equal" value of the dollar, so that there are no differences in relative prices for similar goods or services between countries.[21]

The same data for the continent of Africa indicate that almost 2 million DALYs are lost per year because of burns there. Again, the most conservative economic estimate indicates that about 2.6 billion dollars are lost per year because of this problem. Until the institution of the PEPFAR program, this was greater than the annual US aid provided to the entire continent.

These examples suggest the real difficulty in assessing the extent of unmet plastic surgical needs around the globe. The actual gathering of data can involve massive efforts in terms of field work followed by modeling to obtain what will be best guesses of the scope of the problem.[22] For some conditions, this modeling can be done based on already known (or estimated) numbers. A prime example of this is cleft lip and palate. The incidence is reasonably known in the human population, and can be combined with population data and birth rate data to develop an estimate of the number of affected infants who will be born every year.

For a gross global estimate, taking the global population to be 6.6 billion, the crude birth rate to be 20.09,[23] and the incidence of cleft lip and palate to be 1:700 (an arbitrarily chosen number for this example based on the widely varying estimates of incidence for different ethnic groups[24]), we learn that there are approximately 189,000 affected infants born each year. Obviously, this estimate can be refined considerably with existing data for each country, as birth rates, population figures, and estimates of cleft incidence based on racial characteristics are available. These also represent a range of pathologic states. Some may have incomplete cleft lips that lend themselves to cure with a single operation, but many others are born with complete cleft palates that will need multiple services for years-surgery, speech, often more surgery with extensive diagnostics, orthodontics, audiology, etc. Although the number of clefts and the DALYs concomitant with this number may not be the millions attributable to burns, it nevertheless represents a substantial number of people whose lives can be restored essentially to normal with good plastic surgical care.

Cleft lip and palate also lend themselves to further economic modeling, as these are 2 conditions examined by the global burden of disease study. Both the treated and untreated conditions were assigned weighting factors to estimate the degree of disability each state conferred on the affected individual. Using these weighting factors, economic modeling done on clefts repaired over a 3-year period in one of the programs of Interplast indicated that the most conservative estimate of economic gain rendered by the repairs was $13,000 for each individual for lip repairs and $30,000 per individual for palate repairs. Other methods (Value of a Statistical Life) of estimate yielded the stunning numbers of $236,000 for cleft lip and $620,000 for cleft palate, as estimates of what repair added to the lives of the individuals.[25]

The scope of other plastic surgical needs are much more difficult to estimate with the data available today. Hand problems are particularly difficult in terms of enumerating their incidence and prevalence. Congenital problems such as syndactyly can be estimated just as was done earlier for the incidence of clefts. However, for upper extremity trauma there are essentially no statistics. These injuries range from entities such as single joint contractures to untreated flexor tendon injuries to the mutilations of the wars in Sierra Leone. When the initial global burden of disease study assigned weighting factors to afflictions of humanity, the only upper extremity entities addressed were fractures of the radius, ulna, bones of the hand, and amputation of a finger, of a thumb, and of an arm, with the term arm not otherwise defined.[25a]

The plastic surgical ramifications of trauma are likewise difficult to enumerate. In the demographic of ages 5 through 34, which comprise most people in the developing world, road traffic accidents are among the top 4 causes globally.[26] Many of the injuries from these accidents undoubtedly are amenable to plastic surgical intervention, but this number is unknown. The incidence of workplace hand trauma around the world also is unknown, as is the incidence of extremity amputation because of a lack of plastic surgical skills for extremity salvage.

MEETING PLASTIC SURGICAL NEEDS

The other part of the equation regarding unmet plastic surgical needs is the number of plastic surgeons available to handle the burden of disease. Compounding the difficulty in assessing this is the problem of defining what constitutes a plastic surgeon, or what problems are dealt with by whom in various regions. This is even inconsistent in the United States, where the overlap among specialties is quite significant. One example in the global arena occurs in many parts of Asia, in which cleft problems are handled by stomatologists, who are trained through a dental background without other medical training.

The number of plastic surgeons, then, is difficult to define, and similarly difficult to enumerate. In the United States, there are about 6600 members of the American Society of Plastic Surgeons,[27] indicating a floor for the estimate of actual plastic surgeons. The International Confederation of Plastic, Reconstructive, and Esthetic Surgery claims 22,000 plastic and esthetic surgeons; 30,000 residents; and 25,000 hand surgeons as members.[28] The Indian Society for Surgery of the Hand has just over 750 members,[29] and the Association of Plastic Surgeons in India has about 1200 (Personal communication, Dr. Subodh Singh, Organizing Secretary, Association of Plastic Surgeons of India, August 16, 2008). Medindia lists 250 on its website.[30] In contrast, there are 3 members in Uganda[31] and 1 in Zambia.[32] Regardless of these numbers, or those that could be garnered from elsewhere in the world, this does not represent the number of plastic surgeons currently involved in addressing any of the problems construed as comprising the burden of plastic surgical disease. Many of these surgeons have practices limited to, or dominated by, cosmetic surgery. Needless to say, this is purely a reflection of economics and the implicit preferences of societies globally to reward cosmetics over the care of those in need because of disease or injury. Because of the differential in financial reward, the phenomenon seen in the United States, where even family practice physicians and obstetricians advertise widely for cosmetic interventions,[33] is not unique. Although many in the developing (and developed) world go without basic care, many others have disposable income.[34]

So, it is reasonable to make the statement that there is a disconnect between the plastic surgical global burden of disease and the supply of practitioners able and willing to address that burden. This disconnect is one of geography, of training, of finances and financial incentives, and of public policy and implicit societal preferences. The needs are several. Field study of the true extent of burn injuries, preventable extremity loss and disability, cancer reconstruction needs, congenital deformities including clefts, and other problems that reflect global plastic surgical need, is required to gain a better perspective on the depth of the problem. Preliminary work in this regard has been done, largely addressing surgical needs in general.[35–37] Second is the issue of distribution of human resources and expertise. This problem has been addressed in various forms for years by numerous volunteer groups. Needless to say, it is likely that some of these programs have implemented strategy that has been more helpful in terms of building capacity and assisting with care in the developing world than others. The difficulties inherent in exporting plastic surgical expertise have been examined in depth by Semer.[38] More recently, the value and importance of meeting surgical needs have been recognized more

broadly,[39] and the implementation of programs to meet these needs has expanded more broadly.[40,41]

SUMMARY

In the interest of improving global health, it is important to recognize that regardless of the importance of prevention of malaria, TB, HIV, and other such problems, the significance of those health conditions that have already afflicted large numbers of people and that lend themselves to the finite solutions of plastic surgical intervention must also be acknowledged. The measurement of the magnitude of those problems is in its infancy, and is limited by the many practical obstacles of logistics, funding, and human resources. What is known about the extent of these problems indicate a massive need in the developing world that contributes significantly to poverty and the more apparent lack of physical well being. Answering this need will require not only continued efforts from the plastic surgery community but also greater recognition of the problems such that they can be addressed at the policy level. Societal preferences manifested by the free market are not likely to yield solutions for the poor, injured, or disabled.

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