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Plastic surgery and global health: How plastic surgery impacts the global burden of surgical disease

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Summary The global burden of surgical disease is estimated as being 11% of the total global burden of disease. In this article we discuss the portion of this burden which could be ameliorated with plastic surgical expertise. Although not necessarily seen as a major player in issues related to global health, plastic surgeons are uniquely qualified to decrease the burden of surgical disease afflicting people in the developing world. Burns, traumatic injuries, and congenital anomalies are some of the areas where the presence of plastic surgical expertise can make a significant difference in patient outcomes and thereby decrease the years of life lost due to disability due to these highly treatable conditions. In light of the severe shortage of plastic surgeons throughout the developing world, it falls to those concentrated in the developed world to harness their skills and address the vast unmet needs of the developing world so as to enhance global health.

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When discussing global health, the emphasis is usually on acute medical conditions such as infectious diseases. However chronic diseases such as cardiovascular diseases, mental health disorders, and diabetes are now playing a prominent role in global disease burden.¹ As recognition

of this 'double burden' of infectious and chronic diseases becomes apparent, the contribution of surgical conditions to global disease burden must not be overlooked. In fact, an estimated 11% of worldwide disability adjusted life years (DALYs) are due to surgical diseases.²

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'The DALY combines in one measure the time lived with disability and the time lost due to premature mortality. One DALY can be thought of as one lost year of 'healthy' life and the burden of disease as a measurement of the

gap between current health status and an ideal situation where everyone lives into old age free of disease and disability'.³

As such, global health leaders are articulating the view that surgical services play an important role within the complete context of health.⁴ Consequently, surgeons must play a larger role in global health delivery programs.

When considering the major disease control priorities in developing countries, the paucity of plastic surgeons is often ignored as a significant concern for healthcare delivery. However, plastic surgical expertise addresses many conditions that cause significant morbidity in countries with a large surgical disease burden. Sixty-six per cent of estimated DALYs comprising the global burden of disease attributed to surgical conditions are due to injuries, malignancies, and congenital anomalies, three areas in which plastic surgical expertise are commonly required.² Our purpose is to discuss the importance of plastic surgery as it relates to global public health.

Burden of plastic surgical disease

Diseases amenable to surgical treatment account for an estimated 10%–15% of all admissions to hospitals in developing countries.⁵ The primary cause of death in 20% of young adults is due to an untreated surgical condition.⁶ These estimates are likely conservative as many surgically treatable conditions are not included in health status reviews.¹

Injuries create the greatest surgical burden, followed by cancer, congenital anomalies, and childbirth complications.⁷ Surgical infections (e.g., necrotising soft tissue infections, abscesses, osteomyelitis), acute abdominal processes, hernias, and many blunt/penetrating injuries amenable to surgical intervention are just some of the surgical diseases often not summarised and reported.

There are few reports about plastic surgical need in developing countries and most reports are related to individual surgeon experiences. One such experience by a surgeon from the United Kingdom operating in a 'large bush hospital' in an unspecified location, estimated that 16.9% of operations would have fallen under the care of a plastic surgeon in the United Kingdom.⁸ These operations were related to hand conditions, burn scar contractures, and large necrotising soft tissue infections in need of debridement and tissue coverage.

In a report from a rural hospital in Pakistan, 62% of operations over a five year period came under the auspices of plastic surgery (38% burn scar contractures, 24% traumatic injuries/wounds). Sixty-five percent of patients were under the age of 18 years.⁹ A surgeon operating at a missionary hospital in Togo stated, 'numerous are the daily clinical cases for a plastic surgeon to perform.' Examples included a near hand amputation from a machete as well as complex facial lacerations.¹⁰ These anecdotal reports begin to offer a glimmer into the extent of the problem.

Although it is difficult to estimate the contribution plastic surgeons could make in reducing the global burden of surgical disease, a significant number of DALYs are amenable to plastic surgical intervention. For example, the bulk of the measured surgical disease burden is due to

burns, trauma, and congenital anomalies, all of which could be lessened by plastic surgical intervention.¹¹

Burns

The long-term disability associated with severe burns is considerable. In sub-Saharan Africa, for example, children under the age 15 years, lose seven times the number of productive years from fires than from war.¹¹ In South Asia, the DALYs due to fire for those under the age of 29 years rank as high as or higher than DALYs due to TB, malaria, and HIV/AIDS. Distinct from other developing countries, women in South Asia are disproportionately more affected than men, accounting for 72% of these burn injuries.¹¹

Most general surgeons are trained in the acute resuscitation and initial care required for the patient with a significant burn. But often the more subtle issues relating to maintenance of function during the healing stages are not considered by providers without plastic surgical expertise. Without proper consideration of splinting requirements or early burn excision and skin grafting, the healing process can be sub-optimal and the ensuing burn scar contractures can result in significant life-long disability. And release of contractures generally requires plastic surgical expertise.

Trauma

In low and middle-income countries, road traffic injuries are among the leading causes of death in the 5–14 and 15–44 year age groups. By 2020, trauma is estimated to become the third leading cause of global disease burden.¹² For each person who dies from trauma, three to eight more become permanently disabled, many of whom could benefit from timely surgical intervention.¹³

Fractures and associated soft tissue trauma are problems in which plastic surgeons can provide expertise. In addition to training in fracture reduction and fixation, plastic surgeons can provide soft tissue coverage to protect the fracture site and allow proper healing. This intervention can make the difference between a functional and permanently disabled extremity because without soft tissue coverage, the chance for osteomyelitis (acute or chronic) or nonunion increases from 9% to 20%.¹⁴ Most importantly, the procedures do not require expensive or technologically advanced equipment, just available plastic surgical expertise. In Malawi, proper bone fracture management has been shown to be feasible with acceptable outcomes (80% functional recovery, 12% persistent disability or amputation, and 8% death). These encouraging results were in spite of only 72% of patients reaching the hospital within 24 h of injury, the window of time when it is best to start antibiotics and perform the initial washout and dressing application to the site.¹⁵ This simple treatment is critical as it reduces the incidence of subsequent complications and life-long disability.

Although often deemed to be of lesser importance in the medical community, hand injuries can also cause significant disability. Each year in the United States there are approximately 18 million finger injuries severe enough to

warrant emergency room or physician consultation.¹⁶ The burden of hand injuries in the developing world has not been quantified, and is likely significant.¹⁷

Hand injuries range from simple lacerations to complex injuries involving soft tissue loss, tendon injury, nerve injury, and fractures. Without proper care, even a simple laceration can lead to permanent disability. For many hand injuries, definitive care can be delayed if the initial treatment (e.g., thorough wound irrigation, fracture reduction, loose skin closure, splinting) is done properly. This initial treatment does not require special expertise and allows time to refer the patient to a plastic/hand surgeon for definitive treatment.

Congenital anomalies

Congenital anomalies are estimated to account for 9% of the burden of surgical disease.² Cleft lip/palate (CLP) are common congenital anomalies and likely constitute a fair proportion of this burden. The incidence of CLP varies among ethnic groups (per 1000 live births there are 3.6 cases among Native Americans (North and South America), 2.0 among Asians, 1.5 among Indians, 1.0 among people of European ancestry, and 0.3 among Africans).¹⁸ The non-governmental organisation Smile Train used statistical modelling based on CLP incidence and population size to estimate that there are over 2.8 million children/adults worldwide with untreated CLP. The vast majority (almost two million) live in China and India.¹⁹

Dramatic improvement in appearance and speech can be achieved in one or two operations. These initial operations can be challenging even for a fellowship trained plastic surgeon, and secondary operations require even more expertise. Children with cleft palate often require speech therapy and up to 20% require a secondary operation to obtain socially acceptable speech. Ear infections and hearing loss are also common.²⁰

Disability Adjusted Life Year (DALY) estimates and why the 'true' burden of disease amenable to plastic surgery may be even higher

As previously stated, DALYs are a way to quantify the years of life lost due to disability and premature death. Disability estimates are related to actual impact on health and not 'the goodness associated with health' or 'well-being', functional status or the ability to perform activities of daily living.²¹

As such, the disability weight given to burn injuries and hand injuries are quite low. For example, the long-term disability weights for a 20–60% total body surface area (TBSA) burn and a >60% TBSA burn are the same (0.255).¹¹ This is evidence of the difficult nature of determining these weighting factors. The larger burn is potentially more disabling not only because of the greater probability of contractures or other sequelae of burn scars, but also because of the greater chance for death or long-term or permanent disabling pain often seen with burns of this magnitude. The location of the burn also plays a major determinant of life-long ill effect which is not reflected in these very broad categories. A significant burn to the face

or hands (<20% TBSA, disability weight 0.001) can leave someone in a much more disabled condition than a larger burn affecting for example, the trunk.

For CLP the average disability weights are 0.049 and 0.101 respectively.¹¹ These are again low, especially given the fact that it is not unheard of for midwives to suffocate newborns with cleft deformities.²² Presumably these weightings are intended to consider that children with CLP are usually otherwise healthy, but neglects the fact that these infants often cannot breastfeed, resulting in subsequent death from dehydration or malnutrition. In addition, these factors do not consider the lifetime of social abandonment suffered by some children with untreated CLP. This can spill over into the family's interaction with the community as well.

Whether or not it is reflected in disability weights, it is evident how successful treatment of these above mentioned conditions can play a major role in improving the health of patients and the lives and livelihoods of their families.

Human resource needs

It is unfortunate that developing countries carry much of the global disease burden but have limited resources to address these problems. Africa, for example, carries 25% of the world's disease burden yet has only 3% of the world's health workers.²³ It is estimated that an additional four million healthcare workers are needed worldwide.²⁴ Although the shortage of primary care doctors, nurses, and midwives is severe, the shortage of surgeons and surgical specialists, such as plastic surgeons is even worse.

Further compounding the problem are the system incentives in place even in developed countries that result in the surgeons that are present either choosing or being forced to use their skills for cosmetic surgery or other interventions that enable them to make a living rather than decrease the burden of disease. This results in an internal brain drain within the discipline of surgery itself.

In the populous countries of China and India, there are many potential providers with plastic surgical expertise; these two countries combined have approximately 3000 qualified plastic surgeons.¹⁸ Although an average of approximately 1.5 plastic surgeons per one million people is quite small in comparison to approximately 1 per 57,000 in the United States and Canada combined, it is more than in other areas of the developing world.²⁵

In marked contrast, sub-Saharan Africa is faced with a different situation. Zambia has one plastic surgeon for its population of approximately 10 million; Ghana has six plastic surgeons for its population of 22 million; and Uganda has three plastic surgeons for its population of 27 million.^{19,26,27} A challenge shared by all of these countries is the maldistribution of resources with specialists concentrated in urban areas, far from the populous rural areas where much of the surgical burden lies.¹⁰

Conclusions

Communicable diseases continue to garner the most attention in discussions about global health and as such,

they receive the vast majority of funding. As attention broadens to include interventions for chronic disease management, the need for enhanced surgical services must not be ignored.

There are many competing priorities when planning public health programs and determining which programs warrant implementation is a complex process. When resources are limited, funding one program often implies the neglect of another. Cost effectiveness studies are one way to prioritise programs. One reason that surgical services have historically been neglected is the perception that surgical services are expensive and not cost effective when compared to medical care and infectious disease programs. This belief has been refuted by studies demonstrating that surgical services, at \$11–77/DALY averted, are comparable to other public health interventions such as vaccinations (\$5/DALY averted) and antiretroviral therapy for AIDS (\$300–500/DALY averted).^{2,6,28} Even so, 'there is no Global Fund for Surgery, and rare indeed are the foundations willing to support surgery as an important part of global public health'.⁴

The global health community must compile more concrete data so as to determine better estimates on the magnitude of the burden of disease amenable to surgical interventions. As the relative contribution of plastic surgical conditions to the global burden of surgical disease is considerable, plastic surgeons must play a greater role in global health programs.

Because of the paucity of plastic surgeons in the developing world, plastic surgeons in developed countries are looking to help. In the United States and Canada alone, there are approximately 5700 active plastic surgeons.²⁵ Many are involved in efforts to improve and deliver care in developing countries. Treatment of CLP is the target for many of these organisations, allowing many thousands of patients to receive the definitive care they need. However, care must be taken with this disease specific approach. As described in this paper, there are many conditions in need of practitioners with plastic surgical expertise. The speciality must work with our global health partners to assist in the development of comprehensive means for delivering surgical services and not merely concentrate on a specific disease entity. To take an example from our medical colleagues, a specific criticism of HIV/AIDS programs funded and implemented by donors outside of the developing world is that resources are being shifted to these programs to the detriment of other important services.²⁹ The plastic surgery community must keep this in mind as it works to improve the health of people throughout the world.

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Conflict of interest

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