

Factors Influencing Distribution of Prosthetic Devices in Iran:

An Economic Analysis

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Authors Note

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Abstract

An estimated 177,622 Iranians have suffered an injury resulting in amputation due to trauma from explosive devices, unsafe working conditions, and war collateral. Prosthetic devices in Iran are often scarce due to unequal distribution of wealth, involvement with wars, and lack of accessibility to vital resources. Amputees who are plagued by these issues are not able to fully participate in their society, creating a population that is unable to be independent. Without access to prosthetic devices, amputees face unemployment, homelessness, and a lower self-esteem. I examined external and internal economic factors that influence the distribution of prosthetic devices in order to overcome the financial barriers that hinder distributions. I also reviewed scholarly articles that focus on health care services and distribution of health care resources, economic sanctions and relationships between Iran and other countries, etiologic cause of amputation in Iran, and costs of prosthetic and assistive devices in order to find relationships that enable me to create a solution for the prosthetic distribution issues in Iran. I concluded that issues regarding prosthetic distribution resulted from high costs prosthetics that average \$14,000-\$62,000 in first world countries, coupled with unequal distributions of wealth and resources throughout Iranian provinces, unsafe conditions for Iranian citizens due to an estimated 16 million landmines laid by enemies throughout the country, and a deficit of trained physicians and materials to create properly working prosthetics. Sponsoring an organization, such as the Red Cross or Physicians for Peace, to supply Iran with three-dimensional printers would allow the creation of low-cost, high-functioning prosthetics and a more encompassing distribution throughout the country. This would permit a wider spectrum of amputees to have access to

affordable prosthetic devices, as well as create new jobs to aid economic growth within the country.

KEYWORDS: prosthetics, Iran, health care

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Introduction

Due to psychological helplessness, war collateral, economic sanctions, unequal distribution of wealth and healthcare resources, and government control in Iran, there is limited access to prosthetics for Iranian citizens. Because of this, the lifting of economic sanctions in combination with organizations allocating three-dimensional printers to produce low-cost prosthetics at heightened rates could alleviate issues regarding prosthetic accessibility.

An estimated 177,622 Iranians have suffered an injury resulting in amputation due to trauma from explosive devices, unsafe working conditions, and injuries incurred from collateral damage in wars. Prosthetic devices are difficult to acquire due to government control over the health care industry, lack of accessibility to properly trained physicians and necessary materials, as well as economic sanctions. Therefore, amputees create a population sector that cannot participate in society or take care of themselves.

Amputations in Iran are mostly caused by trauma; more specifically, landmines and explosive devices due to their involvement with the Iran-Iraq War, Iran-PJAK Conflict, Syrian Civil War, and Iranian intervention in Iraq. The millions of landmines that have been laid in Iran are a result of combined efforts from many countries that have been involved with wars with Iran, including the United States. Hundreds of thousands of civilians have been affected by these war efforts; a cooperation from international organizations such as the Red Cross and Physicians

for Peace would alleviate the burden that the population is facing. Furthermore, stabilizing their population by enabling all individuals to be equal participants in their society aids in quelling radical ideas that are fostered in unstable societies.

Deficits Caused by Amputation

Sefiddashti, Karyani, and Ghazanfar (2016) reported healthy individuals in a society contribute to the overall success of their country's population (p. 86). Sefiddashti, Karyani, and Ghazanfar (2016) noted that when individuals find themselves in a healthy state of body and mind, they are more likely to participate in a myriad of ways in their society, including, but not limited to: employment, philanthropy, entrepreneurship, and social events (p. 86). Therefore, the health of a population's individuals becomes crucial to the success of the overall population: without interaction and the ability to participate, individuals do not contribute to and grow within their society. The connection between public health and economic growth is furthered through the vitality of resource distribution to the progress of underdeveloped and developing countries—not only in the sense that it betters the individuals and enables them to be a better participant in their society, but it also has the potential to create new jobs and provide a more stable economy. By limiting the difference in resource distribution, health levels can be raised within the population, therefore promoting economic growth.

Sarvestani and Azam (2013) reported limb loss has shown to have a detrimental effect on an individual's economic, social, and psychological life (p. 126). Sarvestani and Azam (2013) noted that economically, most amputees cannot find stable jobs to support themselves financially (p. 128). Wyss, Lindsay, Cleghorn, and Andrysek (2013) explained socially, amputees are mostly ostracized because they are perceived as a non-functioning being, particularly when

considering that lower limb amputees require a functional prosthesis in order to facilitate mobility in physiological, recreational, and occupational activities (p. 102).

Wyss, Lindsay, Cleghorn, and Andrysek (2013) revealed from their study “Respondents complaining about the cosmesis of prosthetic feet indicated that manufacturers should provide a wider range of colours and sizes and smaller, more feminine looking feet. Appearance can have a profound effect on patient satisfaction with a particular prosthesis and is considered a strong motivator for the continued use of the prosthesis. (p. 106).” Stigmas placed on individuals with disabilities prevent them from many opportunities in their life, including stable employment, access to food and water, as well as friends and a support system, furthering the detrimental effects of amputation. By creating a wider range of available prosthetics, individuals with amputations will have a better chance of improving their quality of life as their disability will not be an obvious part of their appearance. If accessibility for materials to manufacture prosthetics was improved, the likelihood of a wider range of prosthetic designs would also be improved, therefore reaching a wider amputee population as individuals feel they would better identify with their device and the chance of prosthetic rejection would be reduced.

With the combined burdens resulting from the consequence of not being able to acquire prosthetic devices, the psychological impact becomes overwhelming, creating an atmosphere of helplessness as there are no solutions to their problems.

The inability to participate in occupational activity without a functional prosthesis supports Sarvestani and Azam (2013) claim about amputees being unable to find stable jobs to financially support themselves. Sarvestani and Azam (2013) declared that familial structure is interrupted as men, the leaders of Iranian households, have higher rates of amputation (p. 128). The effects of amputation given by Sarvestani and Azam (2013) contradict the parameters given

by Sefiddashti, Karyani, and Ghazanfar (2016) on what makes a successful individual in a population, contributing to the idea that amputees do not have a comfortable niche in society where they can continue to thrive in spite of their disability.

Sarvestani and Azam (2013) pointed out “In developed countries peripheral vascular disease is the major cause; whereas, trauma, infections, uncontrolled diabetes mellitus and malignancies are the leading causes for amputation in developing countries (11, 12). Most amputees in developed countries elderly patients with vascular problems (7, 13-15). However, in the developing countries, most patients with amputation are young and the major cause of limb amputation varies from one hospital to another.” The difference in etiology for amputation speaks volumes about the manner in which individuals are able to take care of themselves in the population they reside in. Although developing countries have amputations due to trauma, their lack of knowledge about treatable diseases demonstrates their lack of access to health care education and resources. As the younger stratification of a country’s population becomes more disabled due lack of health care and war-like conditions, the development of the country becomes stunted as many of them become dependent and unable to support themselves in a developing nation.

Wyss, Lindsay, Cleghorn, and Andrysek (2013) explained furthermore, social, economic, and psychological impacts stem into more dire consequences, such as homelessness, hunger, lack of equal opportunity, and a deficit of education (p. 102-103). Extreme situations such as these create a heightened probability of early death for amputees.

Landmine Epidemic: Collateral Damage from War

Soroush, Zargar, Soroush, Khateri, and Khaji (2008) and Chaloner and Mannion (1996) declared that the landmines located across Iranian provinces are an epidemic to the population.

Soroush, Zargar, Soroush, Khateri, and Khaji (2008) reinforced that 4,000 hectares of land in five western provinces of Iran contain approximately 16 million landmines and explosive ordinances, causing approximately 800 deaths and 1,200 other injuries per month due to landmine/explosive devices (p. 595).

Chaloner and Mannion (1996) reported that within those provinces, populations most at risk are those in rural areas who rely on subsistence farming; 75% of civilian landmine casualties in ten Red Cross Hospitals were individuals from peasant backgrounds who were injured while doing live-sustaining/job-sustaining chores, with women and children being a largely affected group (p. 2). Soroush, Zargar, Soroush, Khateri, and Khaji (2008) contradict Chaloner and Mannion's (1996) conclusion regarding the largest landmine-affected population group: Soroush, Zargar, Soroush, Khateri, and Khaji (2008) explained that 92% of victims were men (p. 596). In addition, Soroush, Zargar, Soroush, Khateri, and Khaji (2008) noted that 48.2% of the victims had no or little education; the mean age of victims was 23 (+/- 13 years), with 41.4% of amputees being 18 years old or less (p. 596).

Soroush, Zargar, Soroush, Khateri, and Khaji (2008) insisted that cause of detonation of landmines/other explosives by victims in rural areas engaged in the activities of: tending livestock, farming, attempting to manipulate a found mine out of curiosity, or playing; this could be due to the lack of education that characterize nearly half of the victims (p. 596-597). Chaloner and Mannion (1996) noted that these rural residents also tend to live furthest from medical facilities with no access to transport, increasing mortality rates and underreporting of casualty and landmine numbers (p. 2).

Demographic characteristics of Iranian society correlate with amputation rates. The demographics most commonly shared by amputees are the male gender, a lower socioeconomic

status, and a limited education level. The segregation of these demographic characteristics further divides the Iranian population as amputees tend to be from a certain region, with distinctive characteristics.

Economic Sanctions Preventing Resource Accessibility

Kozhanov (2011) reported that United States' companies and individuals have been banned from importing goods manufactured in Iran into the United States or through other countries, while exportation of United States' goods and services to Iran was also against economic regulations; this included giving Iranian firms information on medical engineering services or technological advances (p. 145). Kozhanov (2011) explained all financial activities (including lending money to Iranian banks and companies) between Iran and the United States has been prohibited, particularly regarding American investment in oil and gas industries that would develop Iran's economy (p. 146). There is a prevention of progress in internal developments within both countries due to the prohibition of a continuous exchange of supplies and communications between the United States, Iran, and their economic allies. While United States and its associated economic allies limited their oil and petroleum markets in an attempt to negatively impact Iran's economic market, such as through engineering and technological advancements, tensions are heightened. Even without full access to each other's markets, the countries may still experience stimulated internal growth as their own population attempts to match advancements occurring in their rival countries.

Kozhanov (2011) also reported "Trying to please the Khatami administration, the American government canceled its ban on the export of medical and agricultural products to Iran. U.S. authorities also allowed imports of Iranian dried fruits, carpets and caviar. These steps were considered a sign of the dilution of American sanctions. The actual failure of secret talks

between the two countries at the beginning of the 2000s did not lead to the immediate toughening of the sanctions. The George W. Bush administration, which took over in 2001, at first declared the intensification of dialogue between Iran and the United States as one of its goals. Moreover, after the events of September 11, 2001, certain progress was achieved in boosting cooperation between the United States and the IRI in efforts to combat terrorism and drug trafficking (p. 148-149).” The United States predictably changed sanctions and listed bans that had been based on political relationships with Iranian leaders. Revoking bans on medical and agricultural exports to Iran created a new cooperation that promoted Iranian access to health care services and materials. With the focus now on common goals, such as combating terrorism and drug trafficking, an amicable relationship can evolve that invites exploration of negotiation in regards to removing economic sanctions. Facilitating the relationship between countries allows the emergence of discussion for exchange of technological advances and medical information that will benefit Iranian amputees.

By lifting economic sanctions pertaining to medical supplies, device design, and proper materials, the amputee population and the Iranian economy would be stimulated. The overwhelmed Iranian medical system would have access to solutions for many of the problems that are plaguing their doctors and treatment centers.

Unequal Distributions in Wealth

Sefiddashti, Karyani, and Ghazanfar (2016) reported that there is an imbalance of resources, including health care services and supplies, between urbanized and rural regions in Iran (p. 87). Sefiddashti, Karyani, and Ghazanfar (2016) maintained that the imbalance of resources was partly caused by the unequal distribution of wealth: urbanized areas and political centers were better able to afford their needs, and therefore received first preference from supply

companies due to their financial stability (p. 87). The identification of provinces closest to policy-making centers receiving resources revealed a motivating economic influence. By allowing these resources to be allocated to a [presumably] richer area, it might be inferred that distributors want to please policy makers due to ulterior motives. The concept of this favoritism contributes to the imbalance of resource distribution, and as stated by Sefiddashti, Karyani, and Ghazanfar (2016), “results in a waste of resources” (p. 87).

Kiadaliri, Najafi, and Haghparast-Bidgoli (2011) reported that due to the imbalance of resources, the Iranian government committed to developing a larger primary health care basis through the establishment of primary care facilities in less populated regions, referred to as rural health houses (p. 1). Kiadaliri, Najafi, and Haghparast-Bidgoli (2011) explained that services offered at these facilities included maternal and child health care, family planning, vaccinations, and environmental health promotion; although the main job of the facilities are to refer patients to a higher level of care if appropriate (p. 1-2). Rural health houses account for a majority of health care interactions experienced by rural and lower-income populations and serve a greater population than most common hospitals do: they serve the main village they are located in, as well as villages that can be up to an hour away from health house. Only two physicians work at rural health houses, drastically increasing the standard ratio of patients per doctor (2,200 per 1 doctor, compared with the United States’ 390 per 1 doctor), and creating a higher demand for trained physicians. The rural population of Iran is approximately 32% of the country’s overall population, meaning that approximately one-third of the population does not have access to treatment above maternal and child health care, family planning, vaccinations, and health promotions. Individuals who have more than minor health care problems are not able to access

the treatment that they require. Amputees, who require continuous rehabilitation and access to trained physicians, are left as an unserved population.

Chaloner and Mannion (1996) noted that due to the lack of more advanced health centers in Iran, those that exist are overrun with patients, straining the public health system to its limits (p. 1). With the lacking influx of supplies and advancements due to outside economic sanctions, Iran's ability to recover is diminished.

Inefficient Materials and Physicians in Conjunction with Low Finances

Wyss, Lindsay, Cleghorn, and Andrysek (2013) declared that in developing countries, the most common complaints regarding prosthetics include high costs, lack of properly trained physicians, and lack of material and accessibility (p. 103). Wyss, Lindsay, Cleghorn, and Andrysek (2013) reported vital attributes of prosthetics include function, cost, and durability (p. 103); overlapping with the constraints of available prosthetics in developing countries.

Wyss, Lindsay, Cleghorn, and Andrysek (2013) demonstrated these issues by presenting the results of the survey they distributed to physicians in developing countries, "Poor prosthetic alignment has been widely reported in many LICs,4,8,18 which is largely attributed to deficiencies in the training of personnel.1 Recommendations made by a panel of experts included defining what 'acceptable alignment' is and developing a tool to help novice prosthetists identify and correct misaligned prostheses.8 These suggestions also relate to the Standardized Techniques, Technology Transfer and Tool/Equipment Availability codes, which were each rated higher by the lower income group and suggest that the problem of poor alignment in LICs is related to more than just poor training. (p. 106)." In addition to creating a health care environment with access to more materials and device designs, this could provide amputees access to properly trained practitioners and alleviate many issues faced in lower-income

countries. With the addition of properly trained practitioners, issues such as lack of materials or problematic device designs would be more readily addressed as these practitioners would be better equipped to handle such limitations within the prosthetic system. Properly trained practitioners also have a larger network of connectivity within the medical fields due to their education, creating the potential to draw in more funding or support for their practices.

Blough, Hubbard, McFarland, Smith, Gambel, and Reiber (2010) conducted research on projected lifetime costs (focusing on surgical costs and current prosthetic and assistive device costs) in the United States, and found that prosthetic and/or assistive device systems range from an average of \$14,187-\$49,208 for lower extremities, and \$18,703-\$62,271 for upper extremities (p. 390). Blough, Hubbard, McFarland, Smith, Gambel, and Reiber (2010) noted that these costs are completely covered by insurance systems within the United States (p. 398). Contrastingly, Sefiddashti, Karyani, and Ghazanfar (2016) explained “Up until 2005 the Ministry of Health and Medical Education (MoHME) was the sole purchaser and provider of primary care services in Iran’s health system (Takian et al., 2015). But since 2005 Iranian health system has experiences substantial change in both structural and organizational aspects in order to coordinate with government developmental programs. As a result of these reforms the MoHME remain the main policy maker and provider of health care services in Iran, but the Ministry of Co-operative, Labor and Social Welfare became the main financier of healthcare service in Iran. (p. 87)” Due to the Ministry of Health and Medical Education being the only provider in the country, creating an intense government control, the population has no alternatives to pursue access to other health care services. Having all health care services provided by the government provides conflicts of interest; strict limitations could be detrimental to the practice of professionals and could potentially provide more obstacles for individuals seeking help. Iran’s Ministry could easily

manipulate its population by threatening loss of accessible health care if one does not comply with their orders. With other sectors of the Ministry becoming involved with the financial aspect of health care, the power is diffused slightly, but is still held completely by the government.

“Our cost analysis included only the projected costs of prosthetic devices and assistive devices. The model estimates did not include costs for repair and increases in costs due to future technologies. Therefore, these cost estimates are conservative (Blough, Hubbard, McFarland, Smith, Gambel, and Reiber, 2010, p. 392).” This exclusion of key aspects, such as repair costs and technological development of the devices, gives an inaccurate measurement of the true extended costs that are associated with prosthetic and assistive devices. This provides misleading financial advice for individuals, which can be detrimental to one’s financial allocation for their health care and ongoing rehabilitation.

The United States has one of the most well-funded medical systems in the world. The information and technology that doctors and researchers have access to creates greater access to treatment within the country. Prosthetics, which are funded by Veteran Affairs, private practices, and Medicare, are accessible to much of the population who need them in the United States. The extraordinarily high prices are often made affordable by various health care providers and other means of funding (i.e. nonprofit organizations) in the United States. However, most developing countries, including Iran, have much higher prices, and our cost for prosthetics can be substantially less than theirs. On top of the higher cost, Iranians have limited access to prosthetics, as well as an unstable economy which creates cost fluctuations. This disproportion in health care provision between the United States and other developing and/or war-torn countries such as Iran are staggering; with new, high-cost technological advancements, the distribution gap will continue to grow.

Zare, Trujillo, Driessen, Ghasemi, and Gallego (2014) claimed that due to lack of health insurance and high rates of catastrophic injury among lower-income households, out-of-pocket costs for health care and health care resources is extraordinarily high (p. 1). Zare, Trujillo, Driessen, Ghasemi, and Gallego (2014) reported “It can be seen that inequality has persisted throughout the time period of analysis. From 1984 to 2010, inequality in health care expenditures (HE) was larger than the inequality for total expenditures; for example, mean GC in urban areas was 0.4448 for total expenditures and 0.7643 for total health expenditures (p. 5).” In urban areas within Iran, where economic conditions are significantly better compared to their rural counterparts, the total cost per household for health care expenditures was nearly double the total cost of other household needs (i.e. clothing, fuel, food). The exorbitant costs of health care are illustrated through this ratio, as it is shown that individuals have to pay double the combined cost of their everyday needs in order to keep themselves healthy and functioning. In a developing country, where a large mass of individuals struggle to maintain financial security, these costs become too expensive to continue, and healthcare becomes a luxury.

Zare, Trujillo, Driessen, Ghasemi, and Gallego (2014) reported that inflation rates within Iran are higher, and prices are likely to continue rising due to Iran’s economic instability (p. 1). While prosthetic and assistive devices may be anywhere from \$14,000-\$62,000 in the United States, the combination of limited health insurance, limited resources, and economic fluctuations, prosthetic and assistive device costs could be greatly heightened.

Although Kiadaliri, Najafi, and Haghparast-Bidgoli (2011) noted that although the Iranian government has committed to developing a larger primary health care basis (p. 1), the primary health services that are offered (i.e. maternal and infant care, vaccinations) do not benefit amputees or provide them with the resources needed to regain mobility and participate fully in

society, as Wyss, Lindsay, Cleghorn, and Andrysek (2013) stated that proper prosthetics and continuous rehabilitation is needed in order to reach these benchmarks (p. 102). In addition, Kiadaliri, Najafi, and Haghparast-Bidgoli (2011) reported “The geographic distribution of health facilities is considered as a major health policy issue in many countries, both developed and developing. It is believed that the utilization of, and access to, healthcare among individuals should not be affected by the geographical region in which they reside [7]. Although studies in Iran have examined the effectiveness of rural health houses in improvement of the population’s health status [8] and decreasing the disparities between rural and urban areas [9], little attention has been paid to the distribution of RHHs within rural areas in the country. (p. 2)” The distribution of health care resources is considered a major issue in countries that are still developing, without reference to the urbanization of an area. Although health houses have been crucial in improving the overall health status of the population, they are not effective in their placement within rural areas. Due to the unequal distribution of individuals throughout rural areas, equidistant placing of health houses end up becoming ineffective due to the lack of population surrounding certain health houses and overwhelming populations surrounding others.

Economic sanctions negate the idea that utilization and access to healthcare among individuals should not be affected by the geographical region in which they reside, which is the basis of supporting claims that most countries use in their health policies. By preventing the flow of medical and technological equipment (such as designs for innovative and low-cost prosthetics) to Iran (Kozhanov, 2011) the United States and its sanction-based allies contradict their very own policies.

Three-Dimensional Printers Providing Low-Cost Prosthetics at High Production Rates

Herbert, Simpson, Spence, and Ion (2005) claimed that of the three main components of lower limb prosthetic devices (socket, leg portion, and foot), the socket is the most important component due to its direct contact with the residual limb; if the socket is not properly made and formatted uniquely to the amputee, the prosthetic will most likely not be used due to discomfort (p. 141). Herbert, Simpson, Spence, and Ion (2005) and Rengier, Mehndiratta, von Tengg-Kobligk, Zechmann, Unterhunninghofen, Kauczor, and Giesel (2010) have concluded that with three-dimensional imaging of the residual limb, a three-dimensional printer can utilize the information to print a prosthetic socket and accompanying device parts.

Herbert, Simpson, Spence, and Ion (2005) have successfully created three-dimensional limbs using computer-aided design (CAD) and computer-aided manufacturing (CAM) through a technique known as rapid prototyping (p. 142-143). Herbert, Simpson, Spence, and Ion (2005) explained the components being 3D printed for prosthetic devices are created from powdered materials (i.e. starch), which has a printed binding solution repetitively cover the base component until a certain thickness is met; there are no special facilities that are required for these operations to occur (p. 144). The base component of the prosthetic device can be created for almost no cost due to the easy access to starch and other substitute materials such as gypsum. Since this process does not require specific facilities to be built or maintained to print devices, the overall costs for integrating this solution into the health systems would be affordable. The high volume of rural health houses that have been established could easily incorporate the devices needed to produce the prosthetics, helping reach the amputee population that is located in these rural populations.

Rengier, Mehndiratta, von Tengg-Kobligk, Zechmann, Unterhunninghofen, Kauczor, and Giesel (2010) pointed out that there are several types of rapid prototyping that have varying

strengths and weaknesses: (1) stereolithography, which has high accuracy, but not an abundance of strength, (2) selective laser sintering, which can be created from a multitude of materials, has good strength, but has a high cost and powdery surface, (3) fused deposition modeling, which has low cost and good strength, but lowered speeds during use, (4) laminated object manufacturing, produced at low costs, but requires specific materials, and (5) inkjet printing techniques, produced at low costs, having higher speeds, multimaterial capability, and is accompanied by lower strength (p. 337). Rengier, Mehndiratta, von Tengg-Kobligk, Zechmann, Unterhunninghofen, Kauczor, and Giesel (2010) reported that rapid prototyping is more beneficial than traditional manufacturing processes as it allows for a personalized approach to creating the device, aids in research, and is an efficient educational/training tool (p. 377).

Zuniga, Carson, Peck, Kalina, Srivastava, and Peck (2016) reported that they worked with CAD/CAM programs in order to create shoulder, arm, and hand prostheses for children (p. 1). Zuniga, Carson, Peck, Kalina, Srivastava, and Peck (2016) noted that the total cost for materials and other components was exactly \$200; a comparable price to other printed prosthetics made of similar or the same material (p. 4). Upper extremity prosthetics are generally more expensive than lower limb prosthetics due to their higher complexity level. Applying these techniques and processes to Iran's medical system would create a broader prosthetic market for amputees to acquire the devices they need.

Sponsoring a program, such as the Red Cross or Physicians for Peace to install and/or donate three-dimensional printers to the health industry in Iran would create new opportunities for affordable prosthetics. By utilizing the three-dimensional printers to print medical devices, jobs would also be created in order to facilitate the designing and manufacturing process, helping

to stimulate Iran's economy. Due to the specificity of the prosthetics that would be printed, there would also be less of a reliance on poorly trained physicians and overwhelmed medical centers.

Combating Etiology of Amputations

Moini, Rasouli, Khaji, Farshidfar, and Heidari (2009), Chaloner and Mannion (1996), Sarvestani and Azam (2013), and Mousavi, Saied, and Heidari (2012) all concluded that the largest leading cause of amputation in Iran is due to trauma. Moini, Rasouli, Khaji, Farshidfar, and Heidari (2009) explained that within the trauma experienced in Iran, occupational industrial accidents were a leading cause of traumatic occurrences (p. 78). Moini et al. (2009) noted "Our results showed amputation rate of about 1% in traumatic patients. Occupational injuries were the most common causes of these injuries. It has been shown that hand and fingers are the most frequent parts of body affected in these injuries and it is consistent with our results that showed high rate of finger amputation. Regarding the age and sex of victims, our results are consistent with previous reports which show most of the traumatic limb amputations occur in young males (p. 79)." This suggests that safer working conditions need to be implemented in industrial jobs; specifically concerning jobs that pose a risk to the upper extremities. Younger males are at a higher risk due to their concentration within industrial jobs. This high concentration of industrial workers is due to the economic state of the country; as Iran is still a developing country, it does not have as wide of a job market compared to developed countries. A multitude of the jobs that are available to individuals without higher education are dangerous and have higher rates of accidents within the workplace (such as with industrial jobs). Sarvestani and Azam (2013) reported that following trauma, other leading causes of amputation are infections and uncontrolled diseases in the youth population (p. 128).

Chaloner and Mannion (1996) insisted that amputations are most prevalent in rural areas (p. 2). Kiadaliri, Najafi, and Haghparast-Bidgoli (2011) maintained a majority of rural areas in Iran only have access to rural health houses: primitive health care facilities that cannot treat traumatic injuries (p. 11). Chaloner and Mannion (1996) reported that with the lack of health centers able to treat traumatic injuries, those that are able to treat such injuries are suffering from an overwhelming number of patients (p. 1). Chaloner and Mannion (1996) explained that this overabundance of patients is creating public health issues effecting economic recovery within Iran and placing more stress on the medical systems currently in place (p. 1).

Moini, Rasouli, Khaji, Farshidfar, and Heidari (2009), Chaloner and Mannion (1996), Sarvestani and Azam (2013), and Mousavi, Saied, and Heidari (2012) all concluded that in order to improve the functionality of the health care system in Iran, preventative measures should be implemented in order to lower trauma rates. Chaloner and Mannion (1996) stated “With so many landmines already deployed worldwide and the huge difficulties and cost involved in clearing them, a preventative approach is the only practical long-term solution. This can only be achieved by the application of effective international law. The epidemic of injuries described not only has a major global economic impact, but has produced a significant challenge to the provision of surgical and rehabilitation services in the countries which are least able to respond. The responsibility of surgeons to exert their influence for the prevention of landmine injuries is clear (p. 4).” The high number of amputations within Iran creates strain within the health care industry and presents a heightened ratio of patients to doctors in a system that is already overrun. This heightened load on physicians contributes to insufficient care given to patients as the pressure to see more individuals is weighted upon the professionals. By instituting preventative measures to

limit landmine injuries, the rate of amputations could be lowered and stress upon the restricted health care industry would be lifted.

Conclusion

As we've seen, many causes of the amputations in Iran are preventable or are a result of economic challenges that could be mitigated. Further, the potential for better communications between the United States and Iran could present many potential solutions for eliminating amputation. Despite financial challenges in Iran, technological advancements by the United States in combination with avoidance of amputation etiology and access to technology could eliminate prosthetic accessibility issues.

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