Cardiovascular Disease: A Troubling Public Health Trend in Developing Countries

By

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Abstract

Globally, there is a transition from physical, agriculturally based economies toward economies based on more sedentary industrial activities (Bauman et al, 2005). This change has lead to an overall reduction in daily physical activity and an increase in obesity and cardiovascular disease rates as well as other lifestyle changes. Communities with more sedentary based economies need alternative ways to increase their physical activity level, monitor dietary changes, and learn strategies to control rates of cardiovascular disease. Unfortunately, there are many roadblocks to a community’s ability to increase opportunities to reduce cardiovascular disease. This paper will include a detailed discussion of cardiovascular disease, its implications on society, cardiovascular disease in developing versus developed countries including a discussion of possible factors related to increasing rates of cardiovascular disease, and recommendations to reverse this troubling trend.
Cardiovascular Disease: A Troubling Public Health Trend in Developing Countries

Introduction

Historically, mortality and morbidity rates in underdeveloped countries have been higher than in developed countries due to communicable diseases such as HIV/AIDs, Tuberculosis, upper and lower respiratory infection, and gastrointestinal disease. Although many of these disease processes are still a public health concern in developing and underdeveloped countries, these concerns are being addressed through effective resource utilization and implementation of successful plans to control the communicable diseases. However, the burden of disease of developing countries is shifting toward chronic disease with increasing rates of cardiovascular disease (Saxena, 2012). Reddy and Yusuf (1998) described an Emerging Epidemic of Cardiovascular Disease in Developing Countries, and research shows that this epidemic is no longer emerging, but very nearly here. According to the World Health Organization (2011), in 2008, 63 percent of all deaths were due to non-communicable disease and 30 percent were due to communicable diseases, with nearly 80% of all non-communicable diseases occurring in low and middle income countries. Stated differently, during the year 1990, nine million people died of cardiovascular disease worldwide, increasing to 17.5 million in 2005 and projected to reach 23 million by the year 2030, representing a projected increase of 31 percent from 2005 to 2030 (Saxena, 2012). According to the United Nations (2010), the world population is projected to grow by 28 percent over the same period from 2005 to 2030. More recently, as low and middle income countries undergo development with improving access to health care, including primary prevention of communicable diseases and timely disease intervention, developing countries are experiencing decreasing rates of morbidity and mortality associated with communicable diseases with an increase in life expectancy (Pradeepa, Prabhakaran, & Mohan, 2012). As the health
systems of developing countries improve, they begin to face new challenges in the form of increased rates of mortality and morbidity associated with non-communicable disease, such as cardiovascular, diabetes, kidney, liver, and intestinal disease. Many of these diseases are treatable to some extent, but one disease process stands out as having modifiable risk factors: cardiovascular disease.

Cardiovascular disease is considered a lifestyle disease with modifiable risk factors, although some individuals may be genetically predisposed to have earlier onset or more severe disease progression (Ashvaid, Ponde, Shah, & Jawanjal, 2012). According to the World Health Organization (2011), cardiovascular disease, and its sequelae, is becoming one of the greatest challenges that the developing world will face, changing the mortality rate from the younger generations to older generations and changing the primary cause of death from communicable diseases to non-communicable diseases (Ashvaid, Ponde, Shah, & Jawanjal, 2012). In fact, the World Health Organization (2011) has identified cardiovascular disease prevention and treatment as a strategic priority, including:

- effectively reducing cardiovascular disease risk factors and their determinants,
- developing cost effective and equitable health care innovations for management of cardiovascular disease,

Cardiovascular disease is also diverting much needed resources for primary prevention and secondary treatment to tertiary care in already financially strained developing countries (Gersh, 2010). Cardiovascular disease is the leading cause of death worldwide and 80 percent of all cardiovascular disease related deaths occur in low and middle income countries and at a younger age than in developed countries (Gersh, 2012). Therefore, cardiovascular disease in
developing countries is a disease process especially well suited for public health intervention with a shortage of such intervention (Institute of medicine, 2010).

India is a prime example of a developing country that is facing a severe increase in cardiovascular disease and could benefit through public health interventions before the disease prevalence reaches epidemic proportions. Estimates show that cases of cardiovascular disease will increase from 38.1 million in 2005 to 64.1 million in 2015, representing a 68 percent increase (Ashvaid et al., 2012). The United Nations (2010) estimates that the population of India will increase by nearly 15 percent over the same period from 2005 to 2015. These are stunning numbers and reflect the changing health situation of India, but are also reflected in other developing countries. The changing health situation in India is reflected in negative changes to the average Indian lifestyle. These changes include alterations in typical diet, decreased activity, increased drug and alcohol addictions, and increased urbanization (Ashvaid et al., 2012).

**Cardiovascular Disease**

Cardiovascular disease is often a multi-factorial failure of the heart to adequately pump blood throughout the body. There many components of cardiovascular disease including failure of the cardiac muscle itself due to poor cardiac conduction or cardiac hypertrophy. Cardiovascular disease can also manifest as poor blood flow within the heart or vascular system due to obstruction or collapse of the vessels. Pulmonary dysfunction is another element of cardiovascular disease.

**Table 1.0 Types of Dysfunction**

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<th>Type of Dysfunction</th>
<th>Presentation</th>
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<td>Cardiac</td>
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<td>Misconduction</td>
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<td>Cardiac</td>
<td>Angina</td>
<td>Atherosclerosis, arteriosclerosis</td>
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<td>Pulmonary</td>
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In cardiac dysfunction, the heart fails to pump adequately. This may be due to excessive resistance within the system leading to cardiac hypertension and cardiac hypertrophy or poor electrical conduction within the cardiac muscle, which causes inefficient heart beats, also known as arrhythmias. In cardiac hypertrophy, the heart chambers, the atria and ventricles, can expand beyond the normal limits due to back pressure within the cardiovascular system leading to continuously decreasing pumping inefficiency. Arrhythmias can also lead to the formation of blood clots, which can ascend to the brain and cause a cerebrovascular accident, or stroke.

In vascular types of cardiovascular disease, the vascular system becomes blocked with plaques along the inner walls of the vessels related to hypercholesterolemia/hyperlipidemia or chronic inflammation due to continuous damage to the vessel walls. If the inner diameter of the vessel wall becomes too small, leading to systemic hypertension, then the heart has to increase its pumping force, leading to cardiac hypertrophy. Additionally, the cells of the heart must receive oxygen and nutrients, just like all other muscles. Therefore, the heart also has a vascular supply nourishing the tissue and removing wastes. If these vessels become blocked, the cardiac muscle fails to receive nutrients and wastes are not adequately removed. This situation first produces a state of angina, or chest pain, and eventually can lead to a heart attack, known as a myocardial infarct. This is a life threatening condition and often leads to severe disability or death (Cotran, Kumar, & Collins, 1999).

The pulmonary system can also be compromised due to cardiovascular disease through pulmonary hypertension. Pulmonary hypertension is described as increased pressure within the pulmonary vessels causing the heart to work harder to achieve adequate blood flow. Pulmonary hypertension can eventually cause cardiac hypertrophy and ineffective blood circulation, leading
to increased cardiac effort to achieve the minimal required cardiac output (Cotran, Kumar, & Collins, 1999).

Risk factors for cardiovascular disease in Developing Countries

The INTERHEART study demonstrated that greater than 90 percent of population attributed risk of acute myocardial infarction could be accounted for by nine modifiable risk factors: smoking, diabetes, hypertension, abdominal obesity, apolipoprotein B/apolipoprotein A1 ratio, psychological stress, decreased fruit and vegetable intake, physical inactivity, and alcohol consumption (Praeppepa et al., 2012). Industrialization, urbanization, and globalization have all been identified as related factors in the epidemic of increasing cardiovascular disease in developing countries.

Additionally, the social determinants of health can also be utilized to identify some of the factors influencing cardiovascular disease rates in developing countries, such as India (Jeemon & Reddy, 2010). Social determinants of health encompass socio-economic determinants including age, gender, race, ethnicity, (un)employment, and religion. Psychosocial risk factors include poor social networks, low self-esteem, chronic stress, and isolation. Community and societal characteristics include social networks and social support structures, poverty, crime rates, and domestic violence (Ansari, Carson, Ackland, Vaughan, & Serraglio, 2003). Social determinants that directly influence cardiovascular disease rates in India include low socio-economic status with the low socio-economic group suffering the highest mortality (Jeemon & Reddy, 2010). Age is also an influencing factor with cardiovascular disease occurring at a younger age in developing countries versus developed countries (Jeemon & Reddy, 2010). For example, approximately 52 percent of deaths related to cardiovascular disease in India occur before the age of 70 years. In contrast, only 23 percent of deaths related to cardiovascular disease occur
before the age of 70 years in developed countries (Jeemon & Reddy, 2010). Many of the risk factors associated with developing cardiovascular disease, such as increased tobacco use, obesity, and hypertension have also been associated with lower levels of income and education in India (Jeemon & Reddy, 2010). Although highly inter-related and difficult to untangle, education level seems to have the strongest influence on mortality and morbidity related to cardiovascular disease in India (Jeemon & Reddy, 2010).

As countries transition from agriculture-based economies to industry-based economies, the population suffers with increasing rates of cardiovascular disease. Studies have identified multiple causative effects for this change including alteration in diet to a “Western diet” (Pradeepa et al., 2012). Many developing countries tend to have traditional diets, including low fat, high fiber whole grain rich diets or seafood-based diets. As the country becomes increasingly more industrialized, the population tends to transition from the traditional diet to a more western based diet, moving away from whole grains and toward high fat, high calorie diets. This change in diet in turn manifests itself as increased abdominal obesity, an identified risk factor for cardiovascular disease. Populations of countries undergoing urbanization and industrialization also have more disposable income derived from working in manufacturing. This increased income allows the population to move away from home cooked meals based on locally grown products to prepared meals consisting of non-native products. As the population transitions toward industrialization, the pace of life also increases and the individual must rely on fast foods, and foods that are easily prepared, in order to maintain the hectic schedule that this lifestyle demands. The availability of low cost, low nutrition vegetable oils and fats has increased the consumption of fats in low-income countries. Worldwide food production and marketing has
also lead to increased consumption of energy-dense foods that are poor sources of dietary fiber and several micronutrients (Reddy & Yusuf, 1998).

Populations of countries moving toward industrialization also undergo dramatic lifestyle changes, including a more sedentary lifestyle (Oldridge, 2008). Traditionally, these populations rely on being physically active during long days of manual labor growing the food that sustains them throughout the non-growing season. This lifestyle not only is physically demanding in order to grow the food, but also demands substantial effort to prepare and store the food, as well as, preparing the ground for future crops. As the country undergoes industrialization, the population becomes increasing sedentary since they no longer need to complete physically demanding food growth, preparation, and storage tasks in order to survive. This population also tends to migrate from rural settings to more urban settings in order to take advantage of the easier work, and the perceived better lifestyle that urbanization affords them. These individuals may work long shifts in manufacturing plants on production lines where they move very little throughout the day and cannot leave their position on the production line for more than a few moments every hour in order to achieve demanding production quotas.

Along with changes in diet and physical activity demands, industrialization brings additional lifestyle changes, including increased use of tobacco products with the associated negative impact on health. In developing countries, it is estimated that 43 percent of adult males smoke and this rate is increasing by 3.4 percent per year versus an overall declining adult smoking rate of 23 percent in the United States (Levenson, Skerrett, & Gaziano, 2007). As individuals in developing countries become more successful (as measured by income), they have more disposable income to purchase tobacco products that others perceive as being signs of increased prosperity and success, even wealth. Tobacco production is also a source of income, as
a cash crop and as an employment opportunity, in developing countries (Levenson et al., 2007). Although many of the poorest sectors of these populations have higher than average rates of tobacco use, it is the transitioning middle class, including women, that is most at risk for increased tobacco use (Levenson et al., 2007).

Urbanization further reduces the individual’s ability to be active by providing increased ease of transportation including better road surfaces, requiring considerably less energy to navigate than rough rural paths. Urbanized individuals also have the opportunity to travel less distance for basic needs, such as medical care or education, since these services are more readily available in the urban setting, thus requiring less ambulation to obtain these services. Urbanized individuals also have many other options to increase their ease of mobility, including wheeled devices, such as bicycles, which require less energy to complete a trip than ambulation. Additionally, if the individual has been successful enough, they may be able to take advantage of mass transit opportunities. Such opportunities include bus service or trains, and allow travel from one area to another, further reducing the individual’s reliance on calorie expending, and heart healthy, activities. In the urban and semi-urban settings, more opportunities exist for individuals to take advantage of automobiles for transportation. Individuals may be able to “hitch” a ride or know someone who has a vehicle. The most successful individuals can purchase a vehicle to increase their mobility and decrease energy demands associated with mobility. The focus of many developing countries is to produce small, inexpensive automobiles for the masses, which will serve to further reduce the population’s reliance on foot mobility. The transition to higher physical mobility is often interpreted as a sign of success in developing countries, since much of these populations base their ideals of success on western, developed countries where automobiles are pervasive.
The long hours working in sedentary jobs also reduces the individual’s ability to take advantage of opportunities for increased physical activity. Factory workers may spend as much as 12-16 hours up to six days per week working in a factory, leaving little time to seek out, and participate in, exercise-related activities. When not at work, few individuals have the time or energy to exercise, or to participate in events requiring higher levels of activity, at the times that the events are available. According to the World Health Organization 2002 World Health Report, approximately 17 percent of the global population is considered inactive and that approximately 41 percent of the global population is insufficiently active, meaning that these individuals participate in less than 2.5 hours per week of moderate exercise. This lack of activity is associated with 1.9 million deaths, 19 million Disability Adjusted Life Years, and 22 percent of coronary heart disease globally (Oldridge, 2008).

Even if the newly urbanized individuals had the time or energy to be active, few of the newly industrialized cities have safe opportunities for their inhabitants to participate in exercise, or wellness based activities. Many of these cities lack the space or infrastructure necessary to support safe locations to allow their tremendous populations access to exercise (Bauman et al., 2009). Also, many of these programs have associated costs that newly industrialized individuals cannot afford. Individuals could take advantage of simple activities such as walking for exercise to improve cardiovascular health; however, creating new green spaces and safe areas for exercise is likely a low on development plans, due to other financial priorities. Additionally, active individuals may become targets for other unsavory individuals in the population as these activities may be interpreted as those of someone being wealthier than they actually are.

Air quality is another risk factor that has been identified in developed countries, but that has not been well characterized in developing countries. Developing countries may have
increased levels of hazardous airborne chemicals due to limited regulation, when compared to
developed countries. Countries, such as China, that have experienced industrial growth in recent
years have often done so with little regulation of industrial gases in order to maximize economic
growth. Many industrial waste gases and airborne particles place a strain on the pulmonary
system in the form of bronchial constriction, impaired gas exchange, and limited oxygen intake.
The strain on the pulmonary system also places a secondary strain on the cardiovascular system
since more blood needs to be circulated in order to provide adequate blood-gas exchange. High
rates of industrial gases and poor air quality have been associated with increased risk and rates of
cardiovascular disease (Feng, 2012).

**Rates of cardiovascular disease**

As low and middle income countries go through development, industrialization, and
urbanization, researchers have refocused their concentration from the communicable diseases
typically studied in developing countries to non-communicable diseases, including
cardiovascular disease (Pradeepa et al., 2012). In developing countries, in 1990, 23 percent of
deaths in developing countries were due to cardiovascular disease, and this number is expected
to increase to almost 34 percent by the year 2020 (Pradeepa et al., 2012). Deaths from
cardiovascular disease range from four percent in high income countries to 42 percent in low
income countries. The unequal distribution of deaths due to cardiovascular disease is widening.
Over the past two decades, reported deaths related to cardiovascular disease has declined in high
income countries and increased in low and middle income countries (World Health Organization,
2011). The age–standardized mortality rate also has a large disparity ranging from 400-800
deaths per 100,000 in low and middle income countries to 100-200 deaths per 100,000 in high
income countries (Institute of medicine, 2010).
Although not well studied in developing countries, research shows significant differences in cardiovascular disease rates between men and women in developed countries (Pilote et al., 2007). Not only are there different rates of disease, but also severity of disease and presentation of disease. Health care providers need to have specialized training in the recognition of subtle differences in the presentation of acute cardiovascular disease episodes in men and women. The treatment of disease is also gender specific and requires specialized training.

The Societal Burden of Cardiovascular Disease

A societal burden on the overall population of developing countries exists given the rate of disease in low and middle income countries. The most obvious burden is climbing healthcare costs. Healthcare systems need to have very specialized equipment to safely perform interventional procedures, complete the necessary tests, and generally care for this population. Health care professionals also need to have specialized training. Unfortunately, little capacity exists for community or lay health educators to help reduce the burden on trained health care providers once the cardiovascular disease has progressed to the point of needing intervention.

However, specialized healthcare resources are limited or inefficiently utilized in many developing countries (Saxena, 2012).

Not only does the treatment of cardiovascular disease place a large burden on the society, but populations with high cardiovascular disease rates also suffer losses in productivity. One way this burden manifests itself is in lost days of work and lost output. Lost cumulative economic output from 2011 to 2025 associated with cardiovascular disease is estimated to be USD 2.53 trillion in high income countries, USD 1.07 trillion in lower-middle income countries, and USD 0.17 trillion in low income countries. The amount of lost output is smaller in low income countries relative to high income countries, but represents a larger percentage of the lower income countries’ Gross Domestic Product (Pradeepa et al., 2012). Lack of physical ability related to cardiovascular disease also results in lower worker productivity. Individuals may feel more fatigued, have less stamina for task completion, and have generally lower rates of activity tolerance secondary to the ineffective gas and nutrient exchange that occurs in diseased cardiovascular systems. In order to complete a full day’s work, individuals may require specialized diets and longer rest periods to manage increased diuresis and fatigue related to cardiovascular disease.

Industrialized countries often have a skilled workforce specialized in the industrial tasks that they can perform. In low and middle income countries, the age of disease onset for cardiovascular disease tends to be at a younger age and with more severe presentation, leading to a shortened life expectancy. The more experienced and skilled workers leave the workforce at a younger age reducing the overall skill level, and leading to a slower rate of development with all the associated costs to society (World Health Organization, 2010). In 1990, 46.7 percent of cardiovascular disease related deaths in developing countries occurred below the age of 70 years.
In contrast, only 22.8 percent of deaths related to cardiovascular disease in high income countries occurred below the age of 70 years (Reddy, 2003). Even in cases with successful treatment, the individual may not be able to fully return to the level of production that they were at prior to an episode of acute cardiovascular disease.

In an effort to mitigate these costs, developed countries have very specialized cardiovascular disease event treatment programs and improved individual outcomes leading to overall improvement of health statistics. Many rehabilitative programs exist, often run by specialized health care providers such as physicians, nurse practitioners, physician’s assistants, registered nurses, physical and occupational therapists, nutritionists, speech language pathologists, and many others. The specialized nature of these professions is one factor which accounts for the substantial costs associated with rehabilitative services following an acute cardiovascular event. The cost of rehabilitation is often proportional to the type and severity of the event. Even with successful rehabilitation, individuals often still have residual impairments and rarely achieve their pre-morbid functional state. Inequity also exists within rehabilitative care. Individuals with lower socio-economic status, and those who are less socially and physically mobile, have difficulty accessing rehabilitative services (Reddy, 2002).

In developing countries, costly medications play an important role in the treatment of cardiovascular disease and acute cardiovascular events. Medications are also an important component in the prevention of a cardiovascular event. These medications are very expensive and vary widely, from 1.5 days wages in Sri Lanka to 18 days wages in Malawi for a one month supply (Joshi, Jan, Wu, & MacMahon, 2008). In developing countries, a socialized healthcare system may exist, but more likely individuals will have minimal access to very limited forms of
insurance to help with the high medication costs. More likely individuals in low and middle income countries will receive sub-optimal care due to the staggering costs of treatment.

Cardiovascular disease and its sequae have many unknown associated costs, including strain on future generations. Since individuals are living longer, they are able to have more children. These children may be left without a parent, or at least a fully functional parent, due to high rates of cardiovascular disease. These future generations will also need to carry the burden of paying for treatment as well as filling the industrial jobs that are left vacant by experienced individuals who are prematurely leaving the workforce. Developed countries often have an adequate supply of trained and highly skilled workers, but developing countries may already have an inadequate supply of experienced and skilled workers. As experienced workers leave the workforce, the shortage is only compounded.

Since cardiovascular disease is often considered a lifestyle disease with modifiable risk factors, prevention is a necessary part of treatment. Unfortunately, due to the other high costs associated with the disease burden of cardiovascular disease, fewer screening programs are available in developing countries. The situation is compounded by the lack of trained healthcare providers. For example, in 2006, India had only six physicians per 10,000 inhabitants versus 26 physicians per 10,000 inhabitants in the United States in the same year (Joshi et al., 2008).

Overall, based on the world’s population, approximately one cardiac surgical center exists for every 1.4 million inhabitants. The distribution and access to cardiac surgical centers is not equitable, with cardiac surgical centers tending to be clustered in the urban areas of developed countries (Saxena, 2012). Cardiac surgical centers are unevenly distributed as well, with 400 such centers worldwide serving a range of populations from one center for 120,000 inhabitants in North America to one center for 33 million inhabitants in Africa (Saxena, 2012). Education and
early identification of signs and symptoms of cardiovascular disease are critical aspects of the
treatment of cardiovascular disease. However, developing countries often lack these programs
making the age of first detection, severity and progression of disease process at first detection,
and age at initial intervention greater. Advanced age at detection of cardiovascular disease
correlates with poorer outcomes of treatment (Saxena 2012).

The populations of developing countries also experience a lack of education and
understanding of cardiovascular disease. With little education regarding cardiovascular disease
process, the population is placed at higher risk of disease state. Many of the lifestyle activities
that lead to cardiovascular disease are also seen as activities of a higher income society,
including changes in diet, transportation, and industrial jobs that may be sedentary and highly
stressful. Populations of developing countries are placed at an increased risk of worsening
cardiovascular disease, partially due to limited resources for population level education. Lay and
community educators may already be trained in the education of communicable disease
processes and may not have the time or resources available to also be trained in non-
communicable disease education, such as cardiovascular disease. Cardiovascular disease is also
highly complicated, and many lay and community educators may not have the necessary
capabilities to understand the disease process and teach others effectively.

Needs Assessment

Assessment can first be used to identify the extent of cardiovascular disease at the
population and subpopulation levels, but this requires high quality data. The World Health
Organization (2010) estimates that one-third of all countries do not yet have the necessary
programs in place to capture vital statistics, such as annual death rates. Data illustrating cause-
specific death rates is scarcer. Lack of reliable data is a major roadblock to developing programs
to address cardiovascular disease in developing countries. Capacity of each geographic area and community also needs to be measured to see what programs exist and what resources are available. Identification of stakeholders and geo-political support for program development and implementation also needs to be elucidated (Institute of medicine, 2010).

Given the severity of incidence and prevalence of cardiovascular disease in the populations of low and middle income developing countries, this disease requires attention and global implementation of intervention in order to minimize the impact on susceptible populations. Public health leaders, therefore, have an opportunity to develop and implement assessment programs that identify the specific needs of each population. These programs need to be culturally aware of nuances that can have an impact on the assessment and treatment of cardiovascular disease. Assessment programs will also help identify priorities. They will also help determine what policy changes are necessary and what programs need implementation or strengthening (Institute of medicine, 2010). As previously stated, and reinforced by Majumdar and Soumerai (2009), measurement cannot be performed in a vacuum but must be “relevant to the context in which it is implemented” (Institute of medicine, 2010).

Given the extent of global diversity, appropriate cardiovascular disease measurement tools are lacking, especially measurement tools that have been validated in developing countries (Institute of medicine, 2010). Public health leaders within developing countries need to work toward standardizing data collection and dissemination programs. A simplified example of such a program would include the North Carolina Community Health Assessment Process (Community Health Assessment Guidebook, 2012). Such a process is initiated by public health leadership who establishes a Community Health Assessment Team, comprised of highly skilled and trained public health practitioners. Once this team is identified, the team members are tasked
with collecting primary data related to cardiovascular disease within the specified communities. Once primary data is collected the team focuses on sources of secondary data. After collecting both primary and secondary data, public health leaders will identify the tools necessary to analyze the primary and secondary data with the intent of identifying public health priorities related to cardiovascular disease and its sequela. Leaders will develop public health reports that identify the health priorities for each community, outline a plan of action that is individualized to each community, and disseminate this information to the stakeholders. The public health leaders will work with the stakeholders to develop an action plan that meets the needs of the community and has sufficient resources to be successful (Community Health Assessment Guidebook, 2012).

As described above, primary and secondary health data associated with cardiovascular disease must not only be collected, but also be used by those working on reducing cardiovascular disease rates, including policy makers and those developing interventions (Institute of medicine, 2010). With proper implementation of measurement programs, such as health assessments to gather primary and secondary data related to the specific needs of each community, hopefully public health leaders in developing countries can learn from the mistakes of leaders in developed countries who initially tried to control cardiovascular disease through a “high risk approach” using pharmacological intervention instead of a “population approach” using education, behavioral change with risk factor modification, and primary prevention (Reddy, 2002). Public health leaders working in developing countries face a daunting task as resources continue to be shared between maximizing the prevention and treatment of communicable diseases and prevention and intervention of cardiovascular disease (Pradeepa et al., 2012).

Primary and secondary data collection does not end with the assessment of needs, but must continue on through the intervention phase of public health improvement programs
Interventions ranging from policy development and change to community education to improved health care delivery systems have been suggested as possible interventions for the global epidemic of rising cardiovascular disease rates, mortality, and morbidity (Institute of medicine, 2010; Reddy, 2002). Given the wide ranging interventions that will likely be necessary, ongoing surveillance of metrics related to cardiovascular risk and disease rates will be a constant challenge. Standardized assessments, tailored to the context in which the measurement occurs, are needed to increase effectiveness of interventions and to produce the most efficient program possible (Institute of medicine 2010). Standardization across multiple countries with differing languages, social hierarchies, cultural and religious beliefs, and forms of monetary payment will further complicate the implementation of measurement systems. Public health leaders have an opportunity to focus on developing consensus of measurement protocols and determine appropriate metrics to maximize the usefulness of the data collected. No consensus exists yet amongst public health authors, but metrics that have been suggested as being useful include measurement of policy, population, health systems, quality of care, intervention and program performance, and individual health status (Institute of medicine, 2010).

Discussion of Leadership Challenges

The populations of developing countries will rely on strong public health leadership at all levels within the public health field, including public health practitioners, supervisors, and executives, to build consensus and program development. Strong public health leaders will need to possess a myriad of leadership skills in order to build accomplish these tasks throughout the developing countries as they face the impending epidemic of cardiovascular disease. The Council on Linkages between Academia and Public Health Practice identifies seven essential skills necessary for public health leaders. Public health leaders in developing countries will need
To possess many of these essential skills in order to address the rising rates of cardiovascular disease.

As programs are developed, public health leaders should ensure that assessment and intervention programs are based on ethical standards and that no portion of the population is mistreated or otherwise taken advantage of for research, financial, or any other reason (The Council on Linkages between Academia and Public Health Practice, 2010). Public health leaders will be tasked with developing programs that are inclusive and that all dealings with organizations, communities, and individuals are legal and ethical. This may be a substantial roadblock to programs that cross geo-political and religious boundaries given the potential differences in legal and ethical perspectives across multiple countries.

In order to overcome roadblocks, public health leaders will need to develop relationships with colleagues with similar interests in order to share limited resources. These relationships can also be used to develop consensus among stakeholders and to build a shared vision that can be supported across geo-political boundaries. Once a shared vision is defined, the public health leaders will need to develop the standardized assessments and interventions that can be tailored to meet the needs of each individual country. In order to be successful, strong partnerships will need to be developed to allow clear channels of communication and pooling of resources. As with any group, challenges and problems will arise and public health leaders will be called upon to help resolve both internal and external threats to delivery of public health services. As problems arise, leaders will rely on the strength of the previously developed relationships to help resolve the problems using open clear lines of communication (The Council on Linkages between Academia and Public Health Practice, 2010).
Given the extent of cardiovascular disease in developing countries, public health leaders will also need to take a global systems level view of the problem (The Council on Linkages between Academia and Public Health Practice, 2010). Since cardiovascular disease does not have one cause, but rather nine identifiable risk factors, leaders need to view the problem at the systems level and look at all aspects of the problem. A clear understanding of the resources available, and a complete view of the geo-political and healthcare related challenges that each developing country faces, will be necessary for successful program implementation.

Regardless of the health assessments and interventions that public health leaders ultimately develop and implement, a skilled public health workforce will be needed (The Council on Linkages between Academia and Public Health Practice, 2010). Public health leaders will be tasked with ensuring that public health workers are properly educated to successfully refocus resources from communicable disease programs to non-communicable disease programs. Public health workers will also need ongoing education and professional development opportunities as program and community needs change. Public health leaders should also work to develop a professional environment that fosters exchange of information and promotes peer mentoring to develop junior professionals and ensure ongoing engagement and growth with more senior professionals.

Programs required to address the epidemic of cardiovascular disease will also afford public health leaders many opportunities to implement ongoing quality improvement programs. Leaders have a responsibility to ensure that assessment and intervention programs are effectively and efficiently utilizing all resources in a way that produces usable results through ongoing performance improvement and quality assurance programs (The Council on Linkages between Academia and Public Health Practice, 2010).
Summary of Findings

Currently 80% of deaths from cardiovascular disease occur in developing countries. The progression of cardiovascular disease in developing countries clearly needs to be a focus of public health resources in developing countries. Public health systems within developing countries need to continue to transition from being primarily focused on the management of communicable diseases to the prevention and treatment of non-communicable disease, such as cardiovascular disease. Public health leaders of developing countries continue to face the challenging task of managing the needs of domestic agrarian cultures as they evolve. Public health leaders also should be prepared to handle the implications of this evolution on the health of the public that they serve.

Several individual authors suggest that strategies for managing the impending epidemic of cardiovascular disease within developing countries should be immediately implemented using a “population approach” as opposed to a “high risk” approach (Reddy, 2002). Larger institutions, such as the Institute of Medicine (2010), suggest that health assessments with standardized measurement and analysis tools need to be developed before implementing interventions. The Institute of Medicine (2010) also suggests that measurement must be standardized, and yet individualized, to each country due to the diversity found within the developing world, a factor which further compounds the assessment process. The World Health Organization (2011) has identified key areas of work for public health leaders to address with respect to rising cardiovascular disease rates in developing countries, but controversy still exists on the best course of action to meet these goals. It is unclear if health assessment and analysis tools can be both standardized and sufficiently meet the needs of individual developing countries.
Conclusion

Although the developing world is facing a severe epidemic, strong public health leaders can take actions now to identify needs and determine interventions to minimize the impact of cardiovascular disease. Many lives can be saved and the severity of morbidity associated with cardiovascular disease can be minimized. Further research, and the need for standardization of health assessments, is also needed to identify the factors most strongly correlated with increasing rates of cardiovascular disease in the developing world. Factors influencing individuals in the developing world are different from those in the developed world. Since factors influencing cardiovascular disease differ, with diverse causative components, further research is needed in the developing world to identify what components of pre-existing programs can be successfully implemented in developing countries. Additional research is also needed to elucidate cardiovascular disease risk factors and presentation between men and women in developing countries. The developed world can serve as source of information and resources, including the identification of successful program components and interventions, and which programs and interventions have failed. The developed world already has many successful strategies in place to reduce and control cardiovascular disease morbidity and mortality. Public health leaders in the developing world will need to possess and utilize strong leadership skills to identify and implement the pre-existing components that will best meet each country’s specific needs. They will also need to implement best practice strategies based on their individual needs. Further research is also needed regarding the prevention and treatment of cardiovascular disease in developing countries in order to build consensus and determine if standardized health assessments and analysis tools can be individualized enough to meet the needs of each
developing country, or if limited resources would be better utilized through the immediate implementation of non-standardized assessments.
References


