Promoting culturally targeted chronic disease prevention research through an adapted participatory research approach: The Qassim-Stanford Universities project

Sandra J Winter, PhD, Abby C King, PhD, Randall S Stafford, MD, PhD, Marilyn A Winkleby, PhD, William L Haskell, PhD, John W Farquhar, MD

¹Stanford Prevention Research Center, Stanford University School of Medicine, Medical School Office Building, 251 Campus Drive, Stanford, CA 94305-5411, USA
Correspondence to: S J Winter
sjwinter@stanford.edu

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ABSTRACT

The Kingdom of Saudi Arabia (KSA), similar to other countries in the Eastern Mediterranean, has been experiencing a recent rapid increase in the prevalence of chronic diseases and associated risk factors. To begin to take advantage of the chronic disease prevention and health promotion (CDPHP) knowledge available from other nations, researchers at a newly established University in the Qassim Province of the KSA have partnered with Stanford University in the United States of America. To ensure that CDPHP research and interventions are culturally relevant and appropriate, a participatory research approach has been adopted where local researchers are the target “community.” Contextual challenges of conducting CDPHP research in the KSA, at the individual, social/cultural, organizational and environmental/policy levels, are identified, as well as examples of CDPHP intervention strategies that may be culturally appropriate at each level.

KEYWORDS

Saudi Arabia, Chronic diseases, Community-based participatory approach

INTRODUCTION

According to the World Health Organization, chronic diseases now account for 59% of all deaths and 46% of the global burden of disease [1]. Key health behaviors associated with these chronic diseases include unhealthful diet, physical inactivity, and tobacco use [2]. There has been increasing appreciation that individual-level health behaviors occur in an environmental context that includes economic development (e.g., improved access to a greater variety and quality of food, transition away from manual labor), the globalization of food culture (e.g., an increase in “fast food” and changes in the relative pricing of high-fat, high-sugar foods), and a change in living patterns from rural or nomadic to urbanized [3]. Improving health behaviors thus requires strategies that target and integrate

Implications

Practice: Identifying region-specific contextual challenges of conducting chronic disease prevention and health promotion research and interventions should include a multi-level approach that incorporates individual, social, organizational and environmental factors.

Policy: Researchers in the Kingdom of Saudi Arabia should work closely with policymakers at the Ministry of Health to ensure that policy decisions are evidence-based and data driven.

Research: Using a community based participatory research approach in which local researchers are the target ‘community’ helps ensure that chronic disease prevention and health promotion research and interventions are culturally relevant and appropriate.

culturally appropriate behavioral, environmental, and social change programs and policies.

In the Kingdom of Saudi Arabia (KSA), concerns about increasing national chronic disease trends have prompted researchers and clinicians to seek out collaborations with experts abroad. This, in turn, has provided a unique opportunity to explore methods for exchanging chronic disease prevention and health promotion (CDPHP) research-based knowledge, scientific methods, and interventions with one of the most insular societies in the world.

The goals of this paper are to: (1) provide background information about the KSA, with specific reference to the current high and increasing prevalence of chronic diseases and their risk factors, (2) present a conceptual framework that promotes the exchange of CDPHP knowledge and research methods between one university in the KSA—Qassim University College of Medicine (QUCOM) in Qassim Province—and scientists from the Stanford Prevention Research Center (SPRC), Stanford University School of Medicine, California, United States of America (USA), and (3) provide examples of potential CDPHP interventions that can be targeted

at multiple levels and accommodate the particular social and cultural conditions that prevail in the KSA.

BACKGROUND

Saudi Arabia represents a society in transition with respect to its current emerging health challenges (a sudden shift from communicable to non-communicable diseases [4]) and geographic patterns (rapid increase in urbanization [5]). The Kingdom of Saudi Arabia (KSA) is the largest Arab country in the Middle East, and it also has the world's largest oil reserves, making it a wealthy country [5] (Fig. 1). The government is an Islamic monarchy, the constitution is the Holy Qu'ran, and the legal system is based on Shariah law [5]. There is no separation of religion and state. The country is the site of Mecca and Medina, the two holiest places in Islam [5]. The population is just over 29 million, of whom approximately 5.5 million are foreigners [6]. Many of the demographic statistics that are available focus specifically on Saudi, as opposed to non-Saudi, nationals. Saudi Arabia has a young population, with 38% of the population less than 14 years of age and only 2.5% of the population over 65 years of age [6]. The median age is

21.6 years [6]. Approximately 82% of the KSA population lives in urban areas [6]. The overall literacy rate is 78.8%, with somewhat higher rates for men (84.7%) than women (70.8%) [6]. There are 36 million cell phones in the KSA and approximately 7.7 million Internet users [6].

Regional differences in the KSA reflect variations in geography, wealth distribution, tribal affiliations, and cultural links to neighboring regions and countries [7]. The country has 13 provinces, of which Qassim, which is centrally located in the country, is the seventh most populated with 1.1 million people [8]. The area is renowned for its agricultural produce, particularly dates. The capital of Qassim province is Buraydah, which is inhabited by approximately half of the province's total population.

THE PROVISION OF HEALTHCARE IN THE KINGDOM OF SAUDI ARABIA

The Ministry of Health provides free healthcare to all Saudis and to non-Saudis who possess valid residence documentation. Care is provided through a network of 1,986 primary healthcare centers (PHCs) located throughout the nation [8]. If needed, patients requiring more advanced care are referred to one of 231 hospitals offering either general or specialized care. Table 1 provides details of the

Fig. 1 | Map of Saudi Arabia

Table 1 | Healthcare workers in the Kingdom of Saudi Arabia and in Qassim Province, 2008

Healthcare workers in Qassim Province, 2008					
	Physicians	Nurses	Pharmacists	Allied Health Workers	Administrative Workers
	N=1,849	N=3,957	N=78	N=2,414	N=1,292
	(%)	(%)	(%)	(%)	(%)
Male Saudis	5	24	63	75	82
Female Saudis	3	17	6	3	5
Male non-Saudis	73	2	19	7	2
Female non-Saudis	19	57	12	15	11
Total	100	100	100	100	100
Healthcare workers in the Kingdom of Saudi Arabia, 2008					
	N=24,802	N=55,429	N=1,529	N=28,752	N=20,329
	(%)	(%)	(%)	(%)	(%)
Male Saudis	11	23	46	66	84
Female Saudis	8	22	24	12	14
Male non-Saudis	66	4	16	10	1
Female non-Saudis	15	51	14	12	1
Total	100	100	100	100	100

gender and nationality of healthcare workers in Qassim Province and in the Kingdom [8].

In Qassim province, the physicians are predominantly male non-Saudis (73%), and the nurses are predominantly female non-Saudis (58%). Many of the physicians are from Pakistan, Egypt, and India, and many of the nurses are Filipina. In contrast, allied health (75%), administrative personnel (82%), and pharmacists (63%) are predominantly male Saudis. Nationally, the average number of patients cared for by each primary healthcare center per year is 12,500 and in Qassim province is 7,500 [8].

To gain an initial understanding regarding chronic disease prevalence and risk factors, a review of the relevant articles published over the past 10 years in the *Saudi Medical Journal* (SMJ)—one of the major Saudi Arabian medical journals published in English—was compiled. The information summarized below pertains primarily to Saudi nationals and indicates some common as well as distinctive behavioral entry points in the chronic disease prevention/health promotion area.

THE PREVALENCE OF CHRONIC DISEASES AND RISK FACTORS

Childhood through young adults

In children and adolescents in the KSA, the prevalence of obesity (defined as being over the 95th percentile of age and gender-specific body mass index) has been reported as being between 15.6% and 24.5%, and the prevalence of overweight (defined as being between the 85th and 95th percentile of age and gender-specific body mass index) has been reported as being between 13.7% and 14.9% [9, 10]. Comparable data in the USA from the National Health and Nutrition Examination Survey indicate that among children and

adolescents, the prevalence of overweight has been reported as being 17% (2003–2004) [11] and the prevalence of obesity, 16.9% (2007–2008) [12]. In one article in the SMJ, weight trends over time were compared from two cross-sectional studies of male elementary school students, one of which was conducted in 1988 and the other in 2005. The mean age of students in 2008 was 9.83 ± 1.97 and in 2005 was 9.92 ± 1.95 . During this 17-year period, mean body mass index increased from 16.5 kg/m^2 to 18.0 kg/m^2 , mean fat percentage increased from 13.2% to 19.7%, and obesity increased from 3.4% to 24.5% [13]. Reported child and adolescent nutrition-related health behaviors include diets rich in carbohydrates but deficient in fiber [14], increasing intakes of fast foods and soft drinks [15, 16], snacking after lunch [16], the consumption of *ghee* [16] (clarified butter), adding salt to food [16], and not eating breakfast [14, 16] or vegetables [16]. Other non-diet reported health behaviors potentially contributing to obesity rates in this age group have included large amounts of television viewing [15–17] and lack of physical activity [10, 16–18].

Significant gender differences have been reported in smoking rates among school students, with more boys than girls reporting daily and current smoking [19]. Similarly, gender differences have been reported with respect to source of cigarettes, usual place of smoking, intensity of smoking, knowledge of addiction of tobacco, and exposure to education on tobacco [19]. Reported reasons for smoking include the influence of friends [20] [21–23] and having a family member who smoked [20, 21]. Studies have also indicated that students are aware that smoking is harmful to their own health [20, 21, 23] and to the health of others [20, 21]. The media were noted as the major reported sources of information regarding the health consequences of smoking [23]. Some cities in the KSA, including the capital of Qassim Province, Buraydah, have implemented bans on the sale of cigarettes within city limits.

Adults

Between 1995 and 2000, a national household epidemiological health survey of over 17,000 Saudi men and women ages 30–70 years was conducted in the KSA (the Coronary Artery Disease in Saudis Study (CADISS)). CADISS data have been used to determine prevalence rates of coronary artery disease, type 2 diabetes, metabolic syndrome, hypertension, hyperlipidemia, obesity, and physical inactivity, as shown in Table 2.

The CADISS data highlight a number of potential health promotion targets, namely the low rates of physical activity (defined as 30 min or more of at least moderate-intensity activity conducted three or more times per week) and the high rates of overweight (defined as having a BMI between 25 and 29.9 kg/m²), obesity (having a BMI greater than or equal to 30 kg/m²), and diabetes (defined using the 1997 American Diabetes Association guidelines of fasting plasma glucose equal to or greater than 7.0 mmol/l or 126 mg/dl) [24]. The classification of overweight and obesity is non-overlapping, which suggests that 69% of men and 76% of women are either overweight or obese. In addition, the CADISS data show that with regard to coronary artery disease, type II diabetes mellitus, metabolic syndrome, and hypertension, people living in urban settings in KSA (which is about 82% of the population) have a higher prevalence of chronic disease and risk factors than those in rural areas.

Annual statistics produced by the Ministry of Health indicate that in 2008, of all visits to Primary Healthcare Centers (PHCs) in the KSA, 6% were due to diabetes mellitus (up from 4% in 2002) and 4% were due to hypertension (up from 2.7% in 2002) [8, 25]. The Ministry of Health statistics also indicate that emergency care visits to hospitals for these two chronic conditions have increased slightly between 2002 and 2008, rising from 2.3% to 2.6% for diabetes mellitus and from 2.3% to 2.8% for hypertensive diseases.

Comparing World Health Organization Global Infobase data on non-communicable disease indicators for the KSA and the USA for the period 2000 to 2006, the KSA has a higher prevalence of hypertension, diabetes, and physical inactivity than the USA [26]. In contrast, it currently has lower prevalence of overweight and obesity, as well as tobacco use than the USA. As noted in the earlier section describing Saudi youth, the range of smoking prevalence rates among youth and young adults may portend increasing smoking rates among Saudi adults down the road (see Table 3).

The relative newness of the chronic disease and risk factor trends and the nascent state of scientific research in this field in the KSA provide both opportunities and challenges.

A CONCEPTUAL FRAMEWORK FOR KNOWLEDGE EXCHANGE AND ACTION

A conceptual framework has been applied to facilitate the current knowledge exchange that adapts principles from community-based participatory research; that is, research begins with a topic of importance to the particular community, is collaborative in nature, involves all partners equitably in the research process, recognizes the unique strengths of research partners, and aims to combine knowledge with action to improve health outcomes [27]. The distinct aspects of this model include the principal target at which it is aimed, i.e., the scientists themselves, as opposed to members of the community who have traditionally been the target of participatory research efforts; and the setting (i.e., the KSA).

Initiation of chronic disease prevention and health promotion research by QUCOM faculty

Researchers from QUCOM initiated contact with researchers at the Stanford Prevention Research Center (SPRC), which led to the formalization of a

Table 2 | Prevalence of chronic conditions and risk factors using Coronary Artery Disease in Saudis Study (CADISS) data, 1995–2000

N=17,395 ^a	Population prevalence (%)	Men (%)	Women (%)	Urban (%)	Rural (%)
Coronary artery disease [35]	5.5	6.6	4.4	6.4	4.0
Diabetes [36]	23.7	26.2	21.5	25.5	19.5
Metabolic syndrome [37]	39.3	37.2	42	44.1	35.6
Hypertension [38]	26.1	28.6	23.9	27.9	22.4
Overweight [39]	36.9	42.4	31.8	–	–
Obesity [39]	35.5	26.4	44.0	–	–
Hypercholesterolemia (total cholesterol ≥5.2 mmol/l) [40]	54	54.9	53.2	53.4	55.3
Hypertriglyceremia (total triglycerides ≥1.69 mmol/l) [40]	40.3	47.6	33.7	–	–
Physical inactivity [41]	96.1	93.9	98.1	–	–

^a Sample sizes vary slightly by chronic condition and risk factor

Table 3 | Prevalence of non-communicable disease indicators, Kingdom of Saudi Arabia and United States of America

Non-communicable disease indicators	Men		Women	
	KSA (%)	USA (%)	KSA (%)	USA (%)
Overweight (BMI ≥ 25 kg/m ²)	66.2	77.4	71.4	74.5
Obesity (BMI ≥ 30 kg/m ²)	28.3	30.4	43.8	42.6
High blood pressure ($\geq$ SBP 140 and/or DBP 90 mmHg)	28.6	18.4	23.9	21.8
Current tobacco use	14.1	24.6	4.9	18.9
Type II diabetes ^a , both genders	23.7 (KSA) 6.8 (USA)			
Physical inactivity ^a , both genders	71.5 (KSA) 15.5 (USA)			

^a Separate data for men and women are unavailable

contract between the two academic institutions, the purpose of which is to exchange CDPHP knowledge. QUCOM researchers have identified diabetes and obesity as the focus of initial collaborative efforts. With the support of researchers at the SPRC, researchers at the QUCOM have initiated the process of designing appropriate studies to better ascertain the distribution and determinants of chronic disease risk factors and behaviors. A subsequent goal is to test which interventions could work best with which population segments under which social and environmental circumstances.

The conceptual framework uses a “train-the-trainer” approach based on the exchange of knowledge, skills, and experience from SPRC researchers who have been working extensively in this area to researchers at QUCOM who, because of the rapid onset of chronic diseases and conditions in their country, have less experience in this health area. As part of this information exchange, Qassim researchers have provided a wealth of knowledge and experience regarding the unique cultural, social, and environmental context in which CDPHP research will be conducted. Types of communication that have occurred between SPRC and QUCOM researchers, as well as the benefits and disadvantages of each, are described in Table 4.

Research aimed at combining knowledge with action to improve health outcomes

The Primary Healthcare Centers (PHCs) have been identified as venues to (1) implement descriptive epidemiologic studies to identify high and low risk groups, (2) conduct CDPHP intervention research and, (3) implement appropriate CDPHP interventions in the future. Potential advantages and disadvantages to using the PHCs are summarized in Table 5.

Factors that have been reported to encourage utilization of primary health care centers by patients in the KSA are the provision of free services, the location of primary health care centers near patients’ homes, and being attended to by an experienced physician, a Muslim physician, and by an Arabic-speaking health team [28].

The providers at the PHCs will play an important role in conducting research and also in encouraging improvements to modifiable lifestyle behaviors [29–

31]. Physicians’ attitudes and knowledge regarding their own blood pressure patterns and sedentary lifestyles may present barriers to the provision of preventive care [32]. Updating the chronic disease prevention knowledge of primary care providers may be useful, as at least one study suggested that knowledge levels and health education skills of primary care providers may not be optimal [33]. One way that this is happening in the current initiative is by training the university community in worksite wellness-based activities, including the use of health risk appraisals and personalized health behavior change counseling. Counseling channels include individual, small group, telephone, and online approaches. Training PHC workers in data collection, health education techniques, and behavior change strategies will be required. As mentioned earlier, the majority of the doctors and nurses in the KSA are non-Saudis whose services are contracted annually. If these providers are transitory and intend to leave the KSA, they may be less willing to undertake long-term research projects or CDPHP interventions. A comprehensive review of articles examining the quality of care provided at PHCs in the KSA suggests that although good access and effective care are generally provided for immunizations, maternal health care, and the control of epidemic diseases, this is generally not the case for chronic disease management programs, prescribing patterns, health education, and referral patterns [34].

For all parts of the conceptual framework, feedback loops are needed to: (1) formally evaluate CDPHP trainings and research development to ensure the adequacy of contextualization and the success of the training in seeding the small-scale pilot studies that can set the stage for intervention-oriented research; and (2) ensure that knowledge that is gained is incorporated into future research activities.

CHALLENGES IN CONDUCTING APPLIED RESEARCH IN THE KINGDOM OF SAUDI ARABIA

As for most locales and health problem areas, application of social ecological approaches that take account of the multi-level “web of causality” surrounding health and disease processes are critical. In the KSA, the contextual background is different to that found in many Western countries, so the CDPHP

Table 4 | Types of communication used to exchange Chronic Disease Prevention and Health Promotion knowledge

Type of communication	Benefits	Disadvantages
In-person meetings occurring in the KSA	Provides rich contextual background for the researchers in the USA	Expensive
	Facilitates the development of relationships between researchers from both Universities and individuals from the KSA Ministry of Health	Time-consuming and time-limited Limited number of SPRC faculty involved
In-person meetings occurring at Stanford	Increases visibility for this partnership throughout Qassim University, and particularly with top-level University leadership	Expensive Time-consuming and time-limited
	Provides opportunities for specific research project development and intensive mentoring of individual KSA faculty	Limited number of KSA faculty involved
Video conferencing	Expands the network of connections to include individuals who may not be able to travel	May be difficult to coordinate meetings with busy faculty schedules
	Allows people located in different locations to interact in real time	
	Helps address specific issues and promote problem-based learning	Time differences cause scheduling difficulties
	Less expensive than traveling for face-to-face meetings	
Telephone calls	Easy to conduct	Limited nonverbal cues to provide nuanced contextualization of conversations
Asynchronous communication: e-mails	Allows individuals in different time zones to respond at their convenience	No nonverbal cues to provide nuanced contextualization of conversations
	Forms a written record of proceedings	
	Quick and easy to send	
On-demand evidence-based learning materials that will be hosted on the learning management system of QUCOM: webinars, video conferences, customized web-based content, and narrated PowerPoint slides	Transfers general knowledge to a broader audience (faculty, staff, and medical students)	Time-consuming to prepare
	Minimizes the challenge of working in different time zones	May become outdated as research offers new findings
	Uses pre-recorded material that can be subtitled in different languages	

research strategies and interventions that have been developed over the last few decades in the West will need to be adapted at multiple levels. CDPHP programs that have been successfully implemented

in other Middle Eastern countries that share elements of the contextual background can potentially be adapted for use in the KSA. Challenges that may be associated with conducting applied research in this

Table 5 | Advantages and disadvantages of using primary healthcare centers as research venues

Using the primary healthcare settings as research venues	
Advantages	Disadvantages
PHCs reach almost everyone in the population, providing high quality care in a venue that is trusted by patients	Electronic health records at PHCs are limited making manual abstraction of data necessary
Conducting research in the PHCs ensures it is rooted in a “real world” context that is familiar to patients, providers, and policy makers	Oversight of the PHCs lies with the Ministry of Health (MOH) so it is necessary to develop effective working relationships with MOH officials at various levels.
Local knowledge and expertise can be used to design/evaluate interventions that are culturally appropriate	Not all families and individuals living in the catchment area of a PHC use the services offered. [42]
PHCs are already well-established organizational structures and procedures	Regional variations exist in the utilization of PHC services.

Table 6 | Contextual challenges and examples of intervention strategies in conducting Chronic Disease Prevention and Health Promotion research in the Kingdom of Saudi Arabia

Individual-level: knowledge, attitude, skills, values, aptitude
<i>Contextual challenges:</i>
Women have limited legal capacity to make healthcare-related decisions for themselves or their children
There are limited opportunities to be physically active, particularly for women, who are not allowed to drive or leave their homes without a male escort (<i>mahram</i>)
Long traditional clothing is worn by men and women, limiting physical activity and contributing to Vitamin D deficiency and related illness [43] [44–47]
Patients and providers lack CDPHP knowledge [33, 48–50] [51]
Use of alternative herbal medicines by some patients [52] which may compromise choices for more evidence-based medicines and treatment
Lower educational levels have been associated with poorer health outcomes among Saudis [41, 50, 53, 54]
<i>Examples of intervention strategies:</i>
Involve husbands in CDPHP decision making
Target women using home-based interventions, for example:
<ul style="list-style-type: none"> ◦Promote the use of home exercise equipment such as treadmills (which anecdotally appear to be reasonably common) ◦Encourage exercise and healthful nutrition in the home via videotapes and/or group-based exercise or food preparation activities in the home using video conferencing ◦Use “virtual providers” or health promotion advisors to provide culturally adapted CDPHP advice to women in their homes using telephones or computers
Use ubiquitous communication technologies such as newspapers, the internet, e-mail, mobile phones, radio, and television to spread CDPHP information
Target children to limit the amount of sedentary time spent watching television or playing computer games
Promote increased consumption of vegetables and fruits and decreased consumption of high calorie food and beverages in the home by educating the person in the house who is responsible for purchasing, planning, and preparing the family meals
Promote the use of existing fresh vegetable and fruit markets by the person responsible for food purchasing and preparation
Social/cultural: family, friends, social networks
<i>Contextual challenges:</i>
Privacy is greatly valued in the KSA which can impede participation in CDPHP activities
Some traditional foods are high in calories, for example, <i>kabsa</i> (a rice-based dish), dates, and <i>ghee</i> (clarified butter)
Few public spaces for individual or group activities; little sense of the Western concept of neighborhood [7]
<i>Examples of intervention strategies:</i>
Provide training in the use of social support from family to initiate and maintain CDPHP activities
Use mass media campaigns to spread CDPHP messages via prevalent media channels (e.g., television, radio, billboards)
Promote the formation of women’s groups and clubs for sharing health promotion ideas and activities
Use the Internet to access community-based, regional, national, or, potentially, global peer-to-peer support programs for individuals with or at risk for chronic diseases, e.g., the global Peers for Progress initiative (http://www.peersforprogress.org/about_us.php)
Organizational: schools, colleges, worksites
<i>Contextual challenges:</i>
Separation of the sexes in most public settings, including at educational and healthcare facilities
Fast-food restaurants selling high sodium, high saturated fat, calorie-dense, nutrient-scarce foods are ubiquitous and offer home delivery
Lack of population-based health information
Availability of resources for the care of patients with chronic conditions at PHCs in the Aseer region, south western Saudi Arabia varies, which may compromise care [55, 56]
Many of the healthcare providers are foreign born non-Saudis on renewable annual contracts that may limit opportunities for long-term partnerships
QUCOM is newly established and has not yet built an extensive research capacity nor is currently delivering health promotion information
<i>Examples of intervention strategies:</i>
Within the schools:
<ul style="list-style-type: none"> ◦Incorporate physical activity into the educational curriculum for both boys and girls at all grade levels ◦Provide CDPHP education at schools and colleges ◦Provide access to healthier food options at schools and colleges ◦Provide gender-specific tobacco cessation programs to accommodate observed gender differences in tobacco use [19]

Table 6 | (continued)

Use the primary health care center (PHCs) to:
○Provide CDPHP education
○Promote preventive screenings and follow-up
○Provide gender-based group activities, such as weight loss programs and physical activity training programs
○Conduct pilot/feasibility studies
○Recruit and train “health champions” to assist in a sponsored regional health promotion campaign
In worksites:
○Develop and implement worksite wellness programs in areas related to nutrition, physical activity, obesity, and smoking if appropriate
○Develop and train “health champions” to assist in the worksite’s health promotion programs
○Limit use of tobacco products and implement and enforce no smoking policies
○Provide access to healthier food options
Within QUCOM:
○Establish a research support center to improve research infrastructure and provide administrative, laboratory, and research assistance for CDPHP projects
○Develop regular scientific writing group and journal club activities in CDPHP
Within the general community:
○Construct gender-specific facilities where people can be physically active
○Construct test kitchens to educate about healthy food preparation
Environmental/policy: laws, policies, societal norms
<i>Contextual challenges:</i>
Overarching effect of Islamic laws and religious requirements may make it difficult to implement programs that have been successful in other cultures
Separation of men and women in public can create difficulties building social support network and may require duplication of facilities and programs
Little public transport available which is restricted to men; women are not allowed to drive
Societal norms have not previously included physical activity [29]
High temperatures make outdoor physical activity uncomfortable, and there are few indoor facilities, and even fewer that are available to women
Regional differences exist in prevalences of diseases [57], health risk factors [41], and utilization of healthcare services [58], creating potential health inequalities
<i>Examples of intervention strategies:</i>
Develop and strengthen relationships with decision and policy makers at the Ministry of Health
Collaborate with other local and regional Universities that share an interest in CDPHP research
Promote national, regional, and local population-based health improvement policies by targeting the major drivers of preventable morbidity and mortality: tobacco use, physical inactivity, and unhealthy eating
Organize competitions among regions on reaching particular health promotion goals
Anecdotal evidence indicates that “soap opera” style television programs are accessible in the KSA, and could potentially be used for health promotion messages
Promote initiation and enforcement of policies that restrict density of fast-food restaurants and home delivery, or that require healthier food and beverage options
Organize a sodium reduction campaign throughout all regions encompassed by Qassim’s reach, beginning with a pilot program in one area
Expand smoking bans that exist for some public places (e.g., airports) to other public places and enforce smoking policies
Work with the national Health Ministry on promoting a taxation plan on tobacco
Provide subsidies for the purchase of home treadmills and compare relative success among regions

setting have been identified in the literature as well as during the site visit by SPRC researchers to QUCOM and in ongoing discussions with QUCOM researchers. These challenges, as well as some potential interventions that could be deployed, are displayed in Table 6.

Despite the challenges to conducting applied research in the KSA that have been noted above, there are a number of opportunities. The KSA is a wealthy country, and this wealth has largely been shared across the Saudi population, which has increased the average household income [5].

Healthcare is provided free to all Saudis and to non-Saudis with valid residence documentation. There is awareness at the national, regional, and local levels of the importance of preventing chronic disease and promoting health behavior. The centralized and powerful bureaucratic system could aid in the rapid implementation of evidence-based CDPHP programs and policies using a top-down approach. The potential exists to adapt CDPHP interventions that have been successful in countries with similar cultural and social backgrounds.

CONCLUSIONS

Well-designed research that identifies important contextual factors for subgroups at risk and informs culturally relevant interventions can help ensure that resources are allocated for CDPHP interventions which are both cost-effective and which may eventually reach all population segments. The Kingdom of Saudi Arabia provides opportunities for researchers and healthcare providers to tackle the important issue of chronic disease prevention and management at an early stage of its population progression, thereby putting into practice the primary prevention tenets that are at the heart of this cultural exchange. In addition, the lessons learned from the current research exchange may be helpful in informing research development in other countries in the region and around the world that are facing similar “sea changes” in the health conditions facing their populations.

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- World Health Organization (2010) Facts related to chronic diseases. <http://www.who.int/dietphysicalactivity/publications/facts/chronic/en/>. Accessed 14 Aug 2010.
- IOM (Institute of Medicine). (2010). *Promoting Cardiovascular Health in the Developing World: A Critical Challenge to Achieve Global Health*. Washington DC: The National Academies Press.
- Nugent, R. (2008). Chronic diseases in developing countries. *Annals of the New York Academy of Sciences*, 1136(1), 70–79.
- Ng, S. W., Zaghoul, S., Ali, H. I., Harrison, G., & Popkin, B. M. (2011). The prevalence and trends of overweight, obesity and nutrition-related non-communicable diseases in the Arabian Gulf States. *Obesity Reviews*, 12(1), 1–13.
- Bureau of Public Affairs. Background note: Saudi Arabia. *Countries & regions* 2010; <http://www.state.gov/r/pa/ei/bgn/3584.htm>. Accessed 29 Jan 2011.
- Central Intelligence Agency (2010) The world factbook <https://www.cia.gov/library/publications/the-world-factbook/geos/sa.html#top>. Accessed 14 Aug 2010.
- Buchele, N. (2008). *Culture smart! Saudi Arabia* (3rd ed.). London: Kuperard.
- Ministry of Health. (2008). *Statistics Department, Ministry of Health (Saudi Arabia). Health Statistical Yearbook 2008*. Riyadh, Saudi Arabia: Statistics Department, Ministry of Health (Saudi Arabia).
- Al-Almaie, S. (2005). Prevalence of obesity and overweight among Saudi adolescents in Eastern Saudi Arabia. *Saudi Medical Journal*, 26(4), 607–611.
- Al-Rukban, M. (2003). Obesity among Saudi male adolescents in Riyadh, Saudi Arabia. *Saudi Medical Journal*, 24(1), 27–33.
- Centers for Disease Control and Prevention. (2005). MMWR weekly: QuickStats: Prevalence of Overweight Among Children and Teenagers, by Age Group and Selected Period — United States, 1963–2002. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5408a6.htm>. Accessed 30 January 2011.
- Ogden, C., Carroll, M. (2010). Prevalence of Overweight, Obesity and Extreme Obesity Among Adults: United States, Trends 1976–1980 Through 2007–2008. CDC National Center for Health Statistics, Division of Health and Nutrition Examination Surveys. http://www.cdc.gov/NCHS/data/hestat/obesity_adult_07_08/obesity_adult_07_08.pdf. Accessed 30 January 2011.
- Al-Hazzaa, H. (2007). Prevalence and trends in obesity among school boys in Central Saudi Arabia between 1988 and 2005. *Saudi Medical Journal*, 28(10), 1569–1574.
- Farghaly, N., Ghazali, B., Al-Wabel, H., Sadek, A., & Abbag, F. (2007). Life style and nutrition and their impact on health of

- Saudi school students in Abha, Southwestern region of Saudi Arabia. *Saudi Medical Journal*, 28(3), 415–421.
- Alam, A. (2008). Obesity among female school children in North West Riyadh in relation to affluent lifestyle. *Saudi Medical Journal*, 29(8), 1139–1144.
- Al-Gelban, K. (2008). Dietary habits and exercise practices among the students of a Saudi Teachers' Training College. *Saudi Medical Journal*, 29(5), 754–759.
- Al-Hazzaa, H., & Al-Rasheedi, A. (2007). Adiposity and physical activity levels among preschool children in Jeddah, Saudi Arabia. *Saudi Medical Journal*, 28(5), 766–773.
- Al-Hazzaa, H. (2002). Physical activity, fitness and fatness among Saudi children and adolescents: implications for cardiovascular health. *Saudi Medical Journal*, 23(2), 144–150.
- Abdalla, A., Al-Kaabba, A., Saeed, A., Abdulrahman, B., & Raat, H. (2007). Gender differences in smoking behavior among adolescents in Saudi Arabia. *Saudi Medical Journal*, 28(7), 1102–1108.
- Al-Damegh, S., Saleh, M., Al-Alfi, M., & Al-Hoqail, I. (2004). Cigarette smoking behavior among male secondary school students in the Central region of Saudi Arabia. *Saudi Medical Journal*, 25(2), 213–219.
- Al-Yousaf, M., & Karim, A. (2001). Prevalence of smoking among high school students. *Saudi Medical Journal*, 22(10), 872–874.
- Al-Turki, Y. (2006). Smoking habits among medical students in Central Saudi Arabia. *Saudi Medical Journal*, 27(5), 700–703.
- Hasim, T. (2000). Smoking habits of students in College of Applied Medical Science, Saudi Arabia. *Saudi Medical Journal*, 21(1), 76–80.
- Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care*. 1997; 20(7):1057–1058
- Ministry of Health. (2002). *Statistics Department, Ministry of Health (Saudi Arabia). Health Statistical Year Book 2002*. Riyadh, Saudi Arabia: Statistics Department, Ministry of Health (Saudi Arabia).
- Global Infobase (2011) Non communicable disease indicators. <https://apps.who.int/infobase/Indicators.aspx>. Accessed 01 Feb 2011.
- Israel, B., Schulz, A., Parker, E., & Becker, A. (1998). Review of community-based research: assessing partnership approaches to improve public health. *Annual Review of Public Health*, 19, 173–202.
- Saeed, A., & Mohamed, B. (2002). Patients' perspective on factors affecting utilization of primary health care centers in Riyadh, Saudi Arabia. *Saudi Medical Journal*, 23(10), 1237–1242.
- AboZaid, H., & Farahat, F. (2010). Physical activity profile among patients attending family medicine clinics in western Saudi Arabia. *Saudi Medical Journal*, 31(4), 428–433.
- Al-Rafae, S., & Al-Hazzaa, H. (2001). Physical activity profile of adult males in Riyadh City. *Saudi Medical Journal*, 22(9), 784–789.
- Siddiqui, S., & Ogbeide, D. (2001). Profile of smoking amongst health staff in a primary care unit at a general hospital in Riyadh, Saudi Arabia. *Saudi Medical Journal*, 22(12), 1101–1104.
- Al-Doghether, M., Al-Tuwijri, A., & Khan, A. (2007). Obstacles to preventive intervention. Do physicians' health habits and mindset towards preventive care play any role? *Saudi Medical Journal*, 28(8), 1269–1274.
- Al-Khashman, A. (2001). Screening for hypertension. Assessing the knowledge, attitudes and practice of primary health care physicians in Riyadh, Saudi Arabia. *Saudi Medical Journal*, 22(12), 1096–1100.
- Al-Ahmadi, H., & Roland, M. (2005). Quality of primary health care in Saudi Arabia: a comprehensive review. *International Journal for Quality in Health Care*, 17(4), 331–346.
- Al-Nozha, M., Arafah, M., Al-Mazrou, Y., et al. (2004). Coronary artery disease in Saudi Arabia. *Saudi Medical Journal*, 25(9), 1165–1171.
- Al-Nozha, M., Al-Maatouq, M., Al-Mazrou, Y., et al. (2005). Diabetes mellitus in Saudi Arabia. *Saudi Medical Journal*, 25(11), 1603–1610.
- Al-Nozha, M., Al-Khadra, A., Arafah, M., et al. (2005). Metabolic syndrome in Saudi Arabia. *Saudi Medical Journal*, 26(12), 1918–1925.
- Al-Nozha, M., Abdullah, M., Arafah, M., et al. (2007). Hypertension in Saudi Arabia. *Saudi Medical Journal*, 28(1), 77–84.
- Al-Nozha, M., Al-Mazrou, Y., Al-Maatouq, M., et al. (2005). Obesity in Saudi Arabia. *Saudi Medical Journal*, 26(5), 824–829.
- Al-Nozha, M., Arafah, M., Al-Maatouq, M., et al. (2008). Hyperlipidemia in Saudi Arabia. *Saudi Medical Journal*, 29(2), 282–287.
- Al-Nozha, M., Al-Hazzaa, H., Arafah, M., et al. (2007). Prevalence of physical activity and inactivity among Saudis aged 30–70 years. A population-based cross-sectional study. *Saudi Medical Journal*, 28(4), 559–568.
- Al-Mustafa, B., & Abulrahi, H. (2003). The role of primary health care centers in managing hypertension. How far are they involved? *Saudi Medical Journal*, 24(5), 460–465.

43. Fonseca, V., Tongia, R., el-Hazmi, M., & Abu-Aisha, H. (1984). Exposure to sunlight and vitamin D deficiency in Saudi Arabian women. *Postgrad Medical Journal*, 60(707), 589–591.
44. El-Desouki, M., & Sulimani, R. (2007). High prevalence of osteoporosis in Saudi men. *Saudi Medical Journal*, 28(5), 774–777.
45. Al-Maatouq, M., El-Desouki, M., Othman, S., Mattar, E., Babay, Z., & Addar, M. (2004). Prevalence of osteoporosis among postmenopausal females with diabetes mellitus. *Saudi Medical Journal*, 25(10), 1423–1427.
46. Garland, C., Garland, F., Gorham, E., et al. (2006). The role of vitamin D in cancer prevention. *American Journal of Public Health*, 96, 252–261.
47. Spina, C., Tangpricha, V., Uskokovic, M., Adorinic, L., Maehr, H., & Holick, M. (2006). Vitamin D and cancer. *Anticancer Research*, 26, 2515–2524.
48. Taha, A. (2000). Knowledge and practice of preventive measures in small industries in Al-Khobar. *Saudi Medical Journal*, 21(8), 740–745.
49. Al-Saeedi, M., Elzubier, A., Bahnassy, A., & Al-Dawood, K. (2002). Treatment-related misconceptions among diabetic patients in Western Saudi Arabia. *Saudi Medical Journal*, 23(10), 1243–1246.
50. Elzubier, A. (2001). Knowledge of hypoglycemia by primary health care centers registered diabetic patients. *Saudi Medical Journal*, 22(3), 219–222.
51. Abalkhail, B., Shawky, S., & Soliman, N. (2002). Validity of self-reported weight and height among Saudi school children and adolescents. *Saudi Medical Journal*, 23(7), 831–837.
52. Al-Rowais, N. (2002). Herbal medicine in the treatment of diabetes mellitus. *Saudi Medical Journal*, 23(11), 1327–1331.
53. Khalid, M. (2007). The prevalence of abdominal obesity and its associated risk factors in married, non-pregnant women born and living in high altitude, southwestern, Saudi Arabia. *Saudi Medical Journal*, 28(12), 1875–1880.
54. Ogbeide, D., Karim, A., Al-Khalifa, I., & Siddique, S. (2004). Population based study of serum lipid levels in Al-Kharj Health Center, Saudi Arabia. *Saudi Medical Journal*, 25(12), 1855–1857.
55. Al-Sharif, A., & Al-Khaldi, Y. (2003). Resource availability for care of hypertensives at primary health settings in Southwestern Saudi Arabia. *Saudi Medical Journal*, 24(5), 466–471.
56. Al-Khaldi, Y., & Al-Sharif, A. (2002). Availability of resources of diabetic care in primary health care settings in Aseer region, Saudi Arabia. *Saudi Medical Journal*, 23(12), 1509–1513.
57. El-Hazmi, M., & Warsy, A. (2001). Prevalence of hypertension in obese and non-obese Saudis. *Saudi Medical Journal*, 22(1), 44–48.
58. Al-Sharif, A., Al-Khaldi, Y., & Al-Shahrani, A. (2000). Utilization of primary health care during summer. *Saudi Medical Journal*, 21(4), 376–378.