

U.S. Chronic Disease Prevention Approaches and Recommendations

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Abstract

Chronic disease (CD) and disability account for nearly half of the U.S. burden of disease. CD-associated risk factors respond to behavior change interventions; yet, evidenced-based approaches in CD prevention are limited. This study describes perceived effective approaches and recommendations for CD prevention in the United States, focusing on seven risk factors: poor diet and adiposity, physical inactivity, tobacco use, mental illness, poor medication adherence, high alcohol consumption, and excess salt intake.

Utilizing a step-wise qualitative methodology consisting of one-on-one interviews (n=74) and a consensus-building workshop of CD experts (N=24), the following five CD prevention approaches were identified: increase of government policy and regulations, change in the built environment, installment and improvement in workplace wellness programs, higher-value in community-based health initiatives, and use of technology in behavior change adoption.

The most actionable and consensual strategies to prevent CDs in the United States were changes in the built environment and a higher-value in community-based health initiatives.

Keywords: Nutrition; Diet; Public Health.

Introduction

Noncommunicable chronic diseases (CDs) are slow progression and long duration diseases. The four core groups of CDs include diabetes, cancer, cardiovascular, and respiratory diseases, which together account for 82.0% of all CD fatalities [1].

Approximately 51.0% of U.S. adults have at least one chronic disease, with 26.0% living with two or more [2]. CDs account for 84.0% of U.S. healthcare costs and are responsible for seven of 10 deaths yearly [3].

CDs not only negatively affect individuals and their families at the micro-level-CDs have grave impacts at the macro-level, affecting the U.S. economy and healthcare system.

Economic costs of CDs take many shapes; lost productivity due to absenteeism, early retirement, time needed to care for ill family, and the soaring healthcare costs of potentially life-long treatments. The total impact of CDs on the U.S. economy is \$1.3 trillion USD annually, with lost productivity totals of \$1.1 trillion yearly and an additional \$277 billion USD spent on treatment [4].

The United States' failure to reduce the prevalence rate of CDs is pronounced further when viewed within an international perspective. Among similar developed countries, Americans have higher CD rates and poorer health [5,6].

By the year 2030, the World Economic Forum estimated that global economic impact of the five leading CDs—cancer, diabetes, mental

illness, and cardiovascular and respiratory diseases—may reach \$47 trillion USD [7]. Urgency to address CD causes is amplified by the projected rise in world population: A developing world undergoing a health transition with surges in overnutrition and obesity rates [8], and a sharp increase in those aged 60 and older [9].

Health is influenced by the socio-economic conditions of communities. Factors such as early childhood development, education, employment status, food security, healthcare access, and economic status play active roles in long-term health [10]. Social determinants of health are critical in achieving health equity at the local and national levels.

In addition to these contextual elements, individual health behaviors increase the risk of disease development and progression. These risk factors are susceptible to behavior change interventions; yet, action- and evidence-based interventions that have demonstrated sustainable success in targeting modifiable CD risks are limited.

The goal of this research was to describe CD prevention approaches and recommendations in the United States as perceived by diverse health experts.

Risk factors included were poor diet and adiposity, physical inactivity, tobacco use, mental illness, poor medication adherence, high alcohol consumption, and excess salt intake. These risk factors were selected because of their influence in development of type 2 diabetes, certain cancers, cardiovascular disease, and chronic respiratory diseases (Table 1).

Chronic Disease	Contribution	Risk Factor(s)
Type 2 Diabetes	Diabetes also is a major risk factor for cardiovascular disease, kidney disease, and blindness	Poor diet and adiposity, physical inactivity, poor medication adherence
Cancer	Breast, prostate, and colorectal	Poor diet and adiposity, physical inactivity, tobacco use, high alcohol consumption, mental illness
Cardiovascular Disease (CVD)	50.0% of all CD deaths globally are CVD-related	Poor diet, physical inactivity, excess salt intake, tobacco use, high alcohol consumption, poor medication adherence
Chronic Respiratory Diseases	Asthma, chronic obstructive pulmonary disease, respiratory allergies, occupational lung diseases, and pulmonary hypertension (together account for 7.0% of all morbidity worldwide)	Physical inactivity, tobacco use, poor medication adherence

Table 1: Major contributors to development of CDs in the United States [9-11].

Materials and Methods

A qualitative research methodology was employed to explore perceived CD prevention approaches and recommendations for U.S. adults (≥18). The objective of this research was to uncover emerging themes and insights from multidisciplinary U.S. CD experts [11]. By implementing a modified Delphi technique [12], a consensus of opinion was obtained. The methodology employed a stepwise process with two distinct data collection methods: expert consultation and consensus-building workshop. Data collection began in May 2014 and concluded in September 2014.

Expert consultation

The first data collection used qualitative, semi-structured, in-depth interviews with a population consisting of U.S. experts in CD prevention. The objectives of this methodology were to describe: the interventions commonly used for prevention of CDs in the United States; interventions that are not commonly used but could be applied to CD prevention; and perceived CD prevention solutions and their effectiveness in the United States.

Researchers used a modified snowball sample (N=100). Subjects were identified through peer recommendations and Internet searches. The sample was identified through a criterion-based frame of desirable interviewees that accounted for diverse demographic variables and area of expertise related to the CD modifiable common risk factors of poor diet and adiposity, physical inactivity, tobacco use, mental illness, poor medication adherence, high alcohol consumption, and excess salt intake.

The research team developed a 10-item interview guide that was reviewed by a panel of experts (N=4) and pilot-tested (N=9) to obtain content validity and suitability. Interviewers contacted the respondents initially via email with text content including the purpose of the interview, expected length of interview, statement of securing confidentiality, and next steps. Follow-up communication consisted of a combination of email and telephone modes with a maximum of three reminders to secure high response rate [13]. The interviews involved a lead interviewer and a note taker. All interviews were conducted via telephone, lasted approximately 30 to 45 minutes, and were recorded to ensure accurate transcription.

The expert consultation data analysis utilized grounded theory [14]. The lead interviewer and note taker summarized, reviewed, and coded data without the use of software. Using constant comparative analysis,

the data of each interview was compared to the responding sample's data to identify common patterns and themes. The expert consultation resulted in the identification of eight themes.

Consensus-building workshop

On September 12, 2014, The Sackler Institute for Nutrition Science, a program of the New York Academy of Sciences, hosted a consensus-building workshop to present findings from the interviews and gain further perceptions from an identified expert population (N=24) to build consensus on CD prevention approach frameworks using a modified Delphi technique. The samples from the expert consultation and workshop were partially dependent. Workshop participants had multidisciplinary and multisectoral backgrounds related to U.S. CD prevention. The workshop opened with presentations on outcomes of data collected to-date. The background information provided workshop participants the necessary information to generate discussion.

To build consensus, the workshop participants randomly were placed into five groups with the task of developing a framework to guide prevention recommendations. Participants were asked to identify the risk factors to which the group's recommendations best apply, to note how the recommendations address health equity issues, and to identify the best advocates to implement the recommendations. Workshop facilitators requested recommendations have a high potential for impact, be feasible, and cost-effective. After approximately 30 minutes of discussion, each group's spokesperson presented the framework. The workshop was audio-recorded for accurate transcription.

Results

The two data collection methodologies used a step-wise process, with each method's findings informing the next data collection. The expert consultation identified eight themes to reduce CD risk factors. The findings from the expert consultation informed the workshop participants' task to build a framework for the CD disease prevention approaches identified through earlier methodologies. Lastly, the five CD approaches were narrowed further by the researchers to two approaches that were perceived to be the most actionable, consensual strategies to prevent CDs in the United States utilizing the literature base and data from this research.

Expert consultation

Because no demographic differences were identified between pilot-test respondents and general respondents, the responses to the pilot test were incorporated to the population for an accepting response rate of 67.9% (N=109; n=74). Interviewees were 51.0% male and 49.0% female. Seventy-one percent were identified as general prevention experts, 11.0% physical activity, 5.0% tobacco use, 5.0% nutrition, 3.0% sleep, 2.0% technology experts, 1.0% each for diabetes, cancer, and sleep. The U.S. regions represented were widespread, but slightly

skewed to the South Region with 49.0% representation; this skew is likely because of the location of Washington, DC and its heavily populated health and policy organizations [15].

Expert interviews produced several reemerging strategies that were organized into eight themes to reduce CD risk factors: role of policy and government; increased regulation; focus on prevention and health; built environmental change; personalization of solutions; community healthcare; workplace wellness; and technology. Themes from the expert consultation with representative quotations are listed in Table 2.

Theme	Illustrative quotations
Role of policy and government	“The federal government has a key role to play in setting the health strategy for our nation and can serve as the convener of the various stakeholders that will ultimately work together to effect change. With this said, I do think that we might be underestimating the ability of decentralized governmental infrastructure to make effective change and should look to our state and local governments to implement policies and strategies at a local level.”
Increased regulation	“Remember the (beverage company) Super Bowl commercial that showed the diversity of Americans? People were outraged at the portrayal of our country as a nation of immigrants when they should have been outraged that soda was being marketed to minority communities hit hardest by food-related chronic diseases.”
Focus on prevention and health	“We’ve been thinking a lot, as an academic healthcare system, on how we can go beyond our walls. How can we relate to the communities in which our patients live? What can we do in those communities to extend our reach and impact?”
Built environmental change	“People are realizing that the things that are actually related to poor health are things that frankly the healthcare system doesn’t really pay attention to; things like poor education, unhealthy housing, and food deserts.”
Personalization of solutions	“Many of the current prevention solutions are taking a cookie-cutter approach that doesn’t work because it gives no attention or strategy to the local conditions or norms of the individual.”
Community healthcare	“We have to be where people are and where people have these issues and concerns; they’re not going to seek out doctors; they’re not going to seek out the knowledge all the time.”
Workplace wellness	“Workplace wellness is much like parenting—your kids really capture more of what you do than what you say. It’s the same in the employer environment—how leadership (behaves) has a strong and powerful influence.”
Technology	“There are a lot of questions about how we really use the technology as an effective means of intervention. We struggle a bit with the ‘toys vs. tools problem’—that is, how do we sort out what is a potential very effective tool for us to use for prevention versus what is flashy and cool but won’t affect behavior.”

Table 2: Expert consultation themes to reduce CD risk factors and illustrative quotations (n=74).

Theme 1: Role of policy and government

Interviewees described the government as having a central role in prevention through implementing policies and supporting efforts from the broader health and wellness ecosystem. Policy can be initiated at local, state, and federal levels. Although the role of the government was not defined for interviewees, the majority of experts described a regulatory role.

Theme 2: Increased regulation

Increased regulation was discussed specifically as an approach taken towards affecting diet and adiposity, and is reported separately from the first approach of policy and government. Interviewees agreed that nutrition and diet were important variables across CD risk factors. Many compared obesity to a low-hanging fruit—the gateway to other CDs that regulation can trigger positive outcomes. In particular, advertising, marketing, and displays of foods and ingredients that are correlated to obesity and overnutrition should be regulated. Interviewees stated advertising and marketing regulations worked well for tobacco cessation and lessons learned could be transferred to the food industry. However, other interviewees recognized that food and tobacco are inherently different—food is necessary for survival.

Theme 3: Focus on prevention and health

Interviewees remarked that the traditional approach to prevention is too narrowly modeled on the healthcare system’s current approach of disease treatment. Prevention should move beyond preventing medical occurrences to a lifestyle approach that focuses on encouraging optimal nutrition, physical activity, mental health and wellness, and sleep.

In order to effectuate a transition to a health-maintaining lifestyle approach, interviewees agreed that prevention payment systems would need to be altered to either 1) incentivize healthcare providers to transition from a treatment to a prevention system or 2) incentivize a new group of providers to focus on wellness as an industry. Several gaps in research also were discussed such as intervention cost-effectiveness studies, research on predictors of CDs, implementation evaluations, and research on behavior change.

Theme 4: Built environmental change

Interviewees suggested a significant need for change in the built (also referred to as physical) environment in several key areas including: housing, transportation, access to healthy foods, and access to safe and enjoyable exercise options. Environmental changes can facilitate and reinforce sustained healthy choices. While a need exists

for the individual to have motivation and desire to enact change, an important factor is to ensure his or her environment allows and supports this change.

Theme 5: Personalization of solutions

Interviewees commented that prevention strategies must not only be adapted to individual needs and the environment, but also develop an individual's health literacy to increase available resources. When programs are developed, feedback and input from the concerned individuals are necessary to ensure effective outcomes. Interviewees reported that understanding and adapting healthier options to an individual's current lifestyle may assist small, sustainable lifestyle changes in taking root.

Theme 6: Community healthcare

Interviewees commented that Americans need to learn and value health. By using a holistic approach, communities can play an active role in prevention and solutions. Therefore, community leaders must understand the prevention needs and influences of CDs and utilize community workers. Community workers are the links between the public health sector and the individual.

Communities are seen as the appropriate level to understand specific collective needs, design participatory prevention strategies, and implement activities in disadvantaged communities. Communities that utilize local health workers or coaches who experience life in similar ways as the individuals and are relatable, may increase intervention uptake and sustained behavior change. These professionals create a sense of ownership, accountability, and responsibility that come with a continued relationship. Programs can be integrated into existing channels where individuals are currently involved, including YMCAs, churches, and recreation centers.

From a population-level, community healthcare creates a more manageable population where solutions can be better tailored at an individual-level. Additional development is needed with community healthcare, especially in the innovation of business models and payment structures.

Theme 7: Workplace wellness

According to interviewees, workplace wellness programs are a useful tool to provide information to employees, create communities around wellness, and lower the barrier for entry into healthy lifestyle practices. Moreover, places of employment are regarded as missed opportunities for a captive audience. Organizational leadership, whom champion activities and create a culture around wellness, was viewed as ideal.

However, the interviewees observed that many programs rely on incentives that encourage short-term behavior change and lack the needed environmental changes to sustain long-term adoption. As such, many programs currently suffer from self-selection bias and provide incentives to employees who are already health conscious and engage in healthy lifestyles outside of the workplace. Currently, most workplace wellness programs focus on office-setting employees and do little for the most at-risk populations, which are most influenced by social determinants of health.

Theme 8: Technology

Experts agreed that technology will have a major impact on the way prevention solutions are designed and implemented, and many confirmed that tools already have made significant improvements in providing accessible information to individuals about his or her health. The exact mechanism behind the presentation of information, and how that presentation will translate into sustainable behavior change has not been identified. The majority of interviewees felt that technology will not be a remedy for sustainable behavior change.

Consensus-building workshop

The researchers consolidated the original eight themes that emerged from the expert consultation to five approaches for the consensus-building workshop. The role of government and policy and increased regulation were combined into one approach entitled increase government policy and regulation. Personalization, focus on prevention and health, and community healthcare themes were merged into the approach entitled higher-value in community-based health initiatives. This was performed to transform the themes identified in the expert consultation into five actionable approaches. (Table 3) presents the five approaches focused on during the consensus-building workshop.

U.S. CD Prevention Approach
Increase of government policy and regulations
Change in the built environment
Higher-value in community-based health initiatives
Installation and improvements in workplace wellness programs
Use of technology in behavior change adoption

Table 3: Aggregated CD prevention approaches for workshop consensus building (N=24).

The Increase of Government and Regulations Group presented four recommendations that are listed in order of favorability by group members. Firstly, the U.S. government needs to take an active role as the disseminator of best practices and assist in mapping best practices to geographical areas where the best practice would be most effective. Secondly, the U.S. government should incentivize local communities to implement these best practices and play a role in supporting communities in adoption of practices. Thirdly, the U.S. government requires an interagency assessment to eliminate outdated policies. Lastly, the U.S. government has an opportunity to play a leadership role in creating standards for data at the local, state, and federal levels. The data need to be shared and operable across locations. The Increase of Government and Regulations Group stated the best advocates would be local grassroots and professional organizations.

The Change in the Built Environment Group did not provide recommendations but rather important variables to consider that would influence a framework when making recommendations. This Group focused on changes such as housing, roads, and access to business. This Group believed that the built environment applies to all seven risk factors included in this study: poor diet and adiposity, physical inactivity, tobacco use, mental illness, poor medication adherence, high alcohol consumption, and excess salt intake. The influences of the local community affect behavior. By improving the

built environment, overall health equity may improve (for instance through increases and accessibility to community gardens and walking paths) or decline (for instance through increases in cost of living, eventually pricing out low income households). Advocates for improving the built must work with local government, urban planning agencies, businesses, educators, and religious leaders.

The Higher-Value in Community-Based Health Initiatives Group provided three recommendations. The first recommendation was to include prioritized community buy-in by involving local community members in the decision-making, planning processes, and the identification of local resources. The second recommendation was to build a local multisectoral coalition to work collectively on CD prevention interventions or programs targeted to that community's population. The third recommendation was to have an advocate—local champion—who has the opportunity to change social norms from within the community. The recommendations apply to all seven risk factors but may have the most impact with poor diet and adiposity, tobacco use, mental illness, and high alcohol consumption. The recommendations improve health equity because decision-making participation is open and all community members have an opportunity to be heard. The best advocates for these recommendations are the local champions embedded and respected throughout the community.

The Installment and Improvements in Workplace Wellness Programs Group recommended that programs be broader, with employers investing in not just the physical health of employees, but in the employees' emotional, social, financial, and spiritual well-being. Health improvement programs focus on productivity and performance. Health improvement initiatives should be separate from healthcare and delivery systems that focus on attraction, retention, and the overall value of the company. Therefore, workplace wellness programs should concentrate more on employee health enhancement instead of healthcare delivery. To increase health equity, programming should be applicable to all employees, regardless of seniority or pay grade—and be offered to the employee's family members. Strategies should improve and not impair health and involve a variety of employees in workplace wellness program design to avoid top-down approaches. The best advocates are workers within the organization and not leaders of the organization.

The Use of Technology in Behavior Change Adoption Group offered a five-pronged framework to combat all of the risk factors. The technology should be inspirational and motivational to continually engage users. The technology must use knowledge, attitudes, and behavior of its users to develop a shared value. The third component of the technology was to have a contextual aspect. The fourth aspect was the technology needs to be scalable and deployable for diverse populations. Lastly, the fifth element was the technology requires a means for evaluation, measurement, and reporting. In contrast to the recommendations made by other approach groups, this Group recommended insurance companies and industry as advocates.

Discussion

The findings presented in this research highlight perceived priorities to address the growing prevalence of CDs in the U.S. adult population. The five CD prevention approaches identified at the culmination of this project were 1) increase in government policy and regulation; 2) change in the built environment; 3) higher value in community-based health initiatives; 4) installment and improvements in workplace

wellness programs; and, 5) use of technology in behavior change adaptation.

The expert consultation identified significant barriers to implementation and effectiveness for three of these approaches. Competing interests from industry in regards to food advertising regulation and government bureaucracy restrict the scope of government regulation. Cost implications for employers and lack of visibility on returns on investment curtail the deployment of employee wellness programs. Finally, sustaining commitment and selection bias for low-income populations is an important limitation to technology adoption among individuals who are most at-risk of developing CDs. Therefore, the researchers concluded from the methodologies' aggregate data that changes in the built environment and higher value in community-based health initiatives to be the most actionable, consensual strategies to prevent CDs in the United States.

Changing the built environment is an attractive prospect from a public health perspective because no intervention uptake is required from the target population. Modifications to the environment directly influence health indicators for all (e.g., improved walkability leading to reduced vehicle usage and reduced air pollution), and also may influence adoption of healthier habits (e.g., increased daily physical activity). Additionally, changes to the built environment can be implemented by local government and be executed in consultation with local health advocates in a relatively short timeframe. However, the effect of environmental change in reducing exposure to a risk factor is complex to measure [16]. Randomized controlled trials are seldom used in environmental health research [17].

In a review of population-level approaches to reduce CD risk factors, the majority of studies were observational and found only mild evidence suggesting that diet was affected by the local environment, characterized by increased availability of a convenience store, grocery store, farmer's market, and supermarket, alongside increased availability of healthy food in these locations; and reduced availability of fast-food outlets near homes and schools [18]. Similarly, changes to the environment that only affected access to healthy foods in the retail market, the cornerstone of the United States' healthy food financing initiative, improved awareness but did not increase consumption of healthy food options [19]. Environmental changes must take place at multiple levels to have a lasting effect [20].

A framework to describe individual preference interactions with the food environment was recently proposed to assess food policies, highlighting the pivotal role of local and national government action [21]. Both top-down policy change and bottom-up, community-based action are required to institute changes to the obesogenic environment [22]. The research presented in this paper found that community-based health initiatives were perceived as the space where individuals could participate in decision-making, as well as receive information and education to support his or her health. Community-based initiatives not only complement changes designed to improve diet and physical activity—these initiatives are critical in driving strategies to address two frequently hidden health issues that contribute to CDs: poor medication adherence and mental illness. Community-based initiatives have the ability to deploy frontline healthcare workers as educators and organize a continuum of care with health providers [23].

However, evaluation of interventions driven by community-health workers in addressing poor medication adherence and mental illness is challenging. A Cochrane Review including 182 randomized controlled trials aimed at improving medication adherence found that

interventions were generally not effective, and interventions that showed significant impact led to only minor improvements with no common characteristics among the effective interventions identified [24]. A study of medication non-adherence among adult patients suffering from hypercholesterolemia suggested a need for complementary strategies such as peer- and home-based support, cell phone reminders, and improved medication pricing [25-27].

Current strategies to address mental, emotional, and behavioral disorders involve schools, families, and communities and rely on close collaboration with the social, educational, and judicial systems [28]. The current U.S. healthcare system is focused on detection and management of mental illness and not prevention. A systematic review and meta-analysis of mental health interventions found that the diversity of context and participant characteristics mediated the impact of preventive interventions, making identification of common elements in successful mental illness prevention strategies difficult [29].

CD prevention interventions present a complex web of variables and influences that are challenging to design, implement, and evaluate. This research built consensus that changes to the built environment and a high-value in community-based health interventions are feasible CD prevention approaches, which may have greater coverage and face fewer barriers than other approaches identified. The researchers propose that changes in the built environment serve as the first building block to initiate change, with community-based health initiatives as a complementary strategy geared toward supporting the translation of environmental changes into individual outcomes. Evaluations are needed to identify successful models.

Limitations existed within the study research methodologies. Although the expert consultation yielded a high response rate (67.9%) having a complete population of possible U.S. health expert interviewees would have allowed for a more scientific sampling method, such as simple random sample.

Conclusion

Through two qualitative data collections utilizing a stepwise process, a majority of agreement was achieved in developing five approaches perceived to improve U.S. CD prevention: increase of government policy and regulations, change in the built environment, installment and improvements in workplace wellness programs, higher value in community-based health initiatives, and use of technology in behavior change adoption. Overwhelming sentiment was that individual initiatives are not especially effective alone, but deploying several, simultaneously, compounds increase efficacy. A multisectorial framework utilizing local and state governments, community organizations, and the private sector is necessary to address participation barriers and obstacles in programs that decrease risk factors of CDs and focus on prevention rather than cures. This research reinforced the importance of institutional, behavioral, and environmental changes in minimizing risk factors for CDs. Different intervention models can coexist. Considering perceived opportunities and challenges, changes to the built environment in conjunction with community-based health initiative appear a promising step towards sustainable CD prevention.

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