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Self-Care for the Prevention and Management of Cardiovascular Disease and Stroke: A Scientific Statement for Healthcare Professionals from the American Heart Association

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Abstract
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Keywords
prevention, self-care, cardiovascular disease, AHA Scientific Statements, stroke

Disciplines
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American Heart Association | American Stroke Association

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A Scientific Statement for Healthcare Professionals From the American Heart Association

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***Abstract*—**Self-care is defined as a naturalistic decision-making process addressing both the prevention and management of chronic illness, with core elements of self-care maintenance, self-care monitoring, and self-care management. In this scientific statement, we describe the importance of self-care in the American Heart Association mission and vision of building healthier lives, free of cardiovascular diseases and stroke. The evidence supporting specific self-care behaviors such as diet and exercise, barriers to self-care, and the effectiveness of self-care in improving outcomes is reviewed, as is the evidence supporting various individual, family-based, and community-based approaches to improving self-care. Although there are many nuances to the relationships between self-care and outcomes, there is strong evidence that self-care is effective in achieving the goals of the treatment plan and cannot be ignored. As such, greater emphasis should be placed on self-care in evidence-based guidelines. **(*J Am Heart Assoc*. 2017;6:e006997. DOI: 10.1161/JAHA.117.006997.)**

Key Words: AHA Scientific Statements • cardiovascular disease • prevention • self-care • stroke

Imagine a world in which cardiovascular disease (CVD) is not the No. 1 cause of death decade after decade because self-care is pushed to the top of the hierarchy of best practices to managing health. Now, imagine the more probable scenario in which a "perfect storm" of an aging population,[1] increased numbers of individuals with multiple CVD risk factors,[2] and increased prevalence of people with multiple chronic conditions[3,4] converge to create a healthcare crisis[5] because self-care has been ignored. The latter scenario is the reality we are facing as fragmented, episodic, acute care remains a major focus of the healthcare system, whereas primordial and primary disease prevention fostered by optimal self-care receive far less attention. The purpose of this scientific statement is to synthesize the evidence for the effectiveness of self-care in preventing, delaying, and managing CVD and stroke. We delineate the self-care skills and

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knowledge required to achieve these goals, discuss barriers to engagement in good self-care, and present optimal strategies whereby healthcare providers and systems can support individuals and families as they engage in self-care. Although our focus is on adults, we set the stage by describing the need for self-care at all life stages.

Self-Care Defined

Self-care is fundamental to maintenance of health, and prevention and management of chronic illnesses.[6,7] The World Health Organization definition of self-care[7] and other recent definitions focus primarily on healthy people.[8] In this article, we use a definition of self-care from the Theory of Self-care of Chronic Illness that addresses both the prevention and management of chronic illness, with core elements of self-care maintenance, self-care monitoring, and self-care management.[9] In this definition, self-care is a process whereby individuals and their families maintain health through health-promoting practices and managing illness. People who engage in self-care maintenance adhere to those behaviors needed to maintain physical and emotional stability. Self-care monitoring involves a process of observing oneself for changes in signs and symptoms—body listening. Self-care management is used by people as they respond to signs and symptoms when they occur.

Similar self-care activities are important whether one is concentrating on the prevention or management of CVD or stroke. With the onset of CVD or stroke, there are several additional elements of self-care that need to be incorporated into the health regimen. Categorically, these self-care behaviors can be mapped with key elements of the Theory of Self-care of Chronic Illness.[9] Based on current evidence-based guidelines and complementary reviews, self-care maintenance, monitoring, and management of the common CVDs of hypertension,[10–13] heart failure (HF),[6,14–16] stroke,[17–19] atrial fibrillation (AF),[20–22] coronary artery disease,[23,24] and peripheral artery disease[25] are presented in Table 1.

Of 8760 hours in a year, patients spend only around 10 hours or 0.001% of their time with healthcare providers, meaning all other health maintenance, monitoring, and management activities are done by individuals or patients and their families as self-care activities outside of the clinical or hospital setting. The basic self-care activities important in CVD and stroke prevention and management are captured in the American Heart Association (AHA) "Life's Simple 7" (ie, smoking cessation, maintenance of body mass index [BMI], physical activity, healthy diet, maintaining low cholesterol, maintaining normal blood pressure [BP], and maintaining normal fasting plasma glucose).[8] These behaviors have been shown to reduce incident stroke,[26] HF,[27] venous thromboembolism,[28] and chronic kidney disease,[29] and even incident cognitive impairment[30] and non-CVD.[31]

Self-Care as a Decision-Making Process

Self-care is most commonly understood as a naturalistic decision-making process in which persons engage for the purpose of maintaining health and managing acute and chronic illness.[9,32–35] Self-care decision making is a complicated process. Better understanding of the nature of self-care decision making will help clinicians understand how to better teach self-care to their patients and to understand how self-care fails and how to improve it. Naturalistic decision making has been used to explain the process of self-care in individuals with CVD, most commonly HF, as well as other chronic illnesses.[35–38]

The naturalistic decision-making framework explains that, in real-world settings, people make decisions that are meaningful and familiar to them.[39] These real-world decisions are complex; they involve uncertainty, ambiguity, dynamically evolving conditions, missing information, time stress, and high stakes. These decisions may also have ill-defined, shifting, or competing goals and involve multiple individuals. The naturalistic decision-making process explains how individuals make decisions given this complexity and how they develop the skills necessary to succeed when faced with similar situations.[40] Naturalistic decision making emphasizes how individuals use their experience and personal values in decision making.[39] Experience emerges from situational awareness,[41] or perception of the situation, as well as comprehension of the significance of a specific situation. One's experience with the situation, each option, and past response create a set of patterns that include relevant actions and expected outcomes associated with each possible response.[36] In this way, past experience and personal values lead to the actions taken in specific situations.[42]

Section Summary

- Self-care is defined as a naturalistic decision-making process addressing both the prevention and management of chronic illness, with core elements of self-care maintenance, self-care monitoring, and self-care management.

The Coming Chronic Disease Healthcare Crisis

Worldwide, we are experiencing an unprecedented increase in the age of the population attributed to decreased fertility, particularly in developed countries, and increased life expectancy.[43] Life expectancy increased globally by 20 years

Table 1. Self-Care of Common Cardiovascular Disorders Using the Middle-Range Theory of Self-Care Nomenclature

	Hypertension	Heart Failure	Stroke	Atrial Fibrillation	Coronary Heart Disease	Peripheral Artery Disease
Self-care maintenance						
Continued cardiovascular health behaviors						
Smoking cessation	X	X	X	X	X	X
Maintain normal body mass index	X	X	X	X	X	X
Routine physical activity	X	X	X	X	X	X
Maintain healthy diet	X	X	X	X	X	X
Maintain low cholesterol	X	X	X	X	X	X
Maintain normal blood pressure	X	X	X	X	X	X
Maintain normal fasting plasma glucose	X	X	X	X	X	X
Reduce dietary sodium intake	X	X	X	X	X	X
Decrease alcohol use	X	X	X	X	X	X
Gaining knowledge						
Seek information about the condition	X	X	X	X	X	X
Determine where to get more information	X	X	X	X	X	X
Understand self-care requirements	X	X	X	X	X	X
Adherence to condition-specific treatments						
Take medications as prescribed	X	X	X	X	X	X
Know normal and side effects of treatments	X	X	X	X	X	X
Understand why treatment is prescribed	X	X	X	X	X	X
Learn how to adjust to specific dietary recommendations						
Attend cardiac/other rehabilitation		X	X		X	
Keep schedule appointments and contact providers as needed	X	X	X	X	X	X
Self-care monitoring						
Know common signs and symptoms		X	X	X	X	X
Know signs and symptoms of worsening disease (eg, stroke or heart failure)	X	X	X	X	X	X
Know signs and symptoms of complications (eg, bleeding from anticoagulation)		X	X	X	X	X
Routine (daily) blood pressure measurement	X			X	X	
Routine (daily) weight measurement	X	X			X	
Establish routine for monitoring signs and symptoms	X	X	X	X	X	X
Self-care management						
Distinguish among cardiovascular symptoms and non–life-threatening conditions	X	X	X	X	X	X
Have a plan of what to do when signs and/or symptoms occur	X	X	X	X	X	X
Further reduce dietary sodium	X	X				
Increase diuretic		X				
Take nitroglycerin					X	
Adjust anticoagulation				X		
Evaluate the effectiveness of treatment	X	X	X	X	X	X
Know when and which provider to call when signs and/or symptoms occur	X	X	X	X	X	X

from 1950 to 2000 and is expected to increase by another 10 years by 2050.[43] By 2050, the population aged ≥60 years will double; 25% of the population will be >60 years of age; 20% >65 years of age; and close to 5% will be >85 years of age.[2] By most projections, an increase in morbidity affected years will accompany the increase in life expectancy. Aging is a major risk factor for noncommunicable chronic conditions, particularly CVD and stroke, so this "silver tsunami"[44] will result in huge numbers of elderly individuals with multiple chronic conditions.[4] By 2050, the number of people with chronic conditions will escalate by 40%, and the number of older people with disabilities from chronic conditions will double.[44] Currently, at least 66% of all deaths worldwide are attributable to noncommunicable diseases, the most common of which is CVD, and this percentage is projected to increase in coming years.

CVD is the primary cause of death in men and women in the United States and worldwide.[45,46] Multiple lines of research convincingly demonstrate that preventing CVD is economically, socially, and humanly superior to even the best medical treatment of manifest CVD.[47–49] Using sophisticated modeling, 1 group compared CVD prevention versus treatment for a population aged 30 to 84 years with risk-factor levels, event rates, current behavior patterns, levels of treatment, and mortality rates resembling those of the US population. In the target population, 44% of all deaths were attributable to heart disease. Management of CVD risk factors before an event would have prevented or postponed 33% of these deaths. This compared with prevention of only 8% of deaths if "perfect care" was used during an acute event. These data provide strong support for the importance of self-care in preventing CVD and further events.[47]

Section Summary

- A globally aging population will result in huge numbers of elderly individuals with multiple chronic conditions, including CVD and stroke, by 2050.

A Life Course Approach to CVD

By the time CVD is manifest, it usually has been a silent condition for years.[50] Thus, it is essential that self-care of CVD risk factors is addressed as early as possible, not waiting for the emergence of overt CVD. Many advocate taking a "life course" approach to the prevention of chronic illnesses beginning with primordial prevention, because it is clear that the seeds of most noncommunicable diseases are planted very early in the life course.[44,51,52]

Epidemiological data suggest that events in the perinatal period, and possibly even in the periconception period, are associated with an increased risk of chronic diseases in later life.[53] This "fetal programming," also known as "developmental origins of health and disease," describes the process whereby a nutritional or endocrine event during a critical period of development results in an increased later risk of chronic disease.[54,55] Low-birth-weight (LBW) infants have a higher risk for coronary heart disease, cerebrovascular disease, metabolic syndrome, type 2 diabetes mellitus, and hypertension as adults than normal-birth-weight infants[56–58] that is not explained by lifestyle factors such as smoking, diet, employment, alcohol, or exercise.[57,59] LBW may be caused by fetal, placental, or maternal factors, but, in many cases, the cause is not identified.

A number of potentially modifiable maternal risk factors have been associated with LBW, including young or old age (<17 years or >35 years), low BMI (<20 kg/m^2), alcohol or drug use, smoking, and poor nutrition. Preeclampsia is associated with LBW and a higher risk of stroke, hypertension, and obesity as well as evidence of widespread vascular dysfunction in the offspring.[60–63] Maternal obesity also predicts childhood obesity in the offspring.[53] Even maternal exercise during gestation may influence cardiometabolic status in the fetus and infant.[64] An intriguing study from the Helsinki Birth Cohort 1934–1944 reported that offspring of women who were preeclamptic compared with those of women with normotensive pregnancies have an increased risk for adulthood abnormalities in adaptive functioning, mental well-being, and later depressive symptoms, all of which might affect self-care in adulthood.[65,66]

Other periods during the life course are receiving increased attention for the appearance of risk factors that must be addressed early. For example, pregnancy is considered a "natural stress test" that uncovers risk for future CVD among mothers.[67] Women with hypertension or preeclampsia during pregnancy have more than double the risk for a future CVD or cerebrovascular disease death or diagnosis than women who do not have these conditions during pregnancy.[68] LBW among offspring or delivery of a preterm baby place the mother at increased risk for CVD.[52] Early self-care during this window of opportunity could stave off the development of CVD.

Maternal risk factors place infants and adolescents at higher than normal risk for early development of CVD risk factors and higher risk of early disease.[69] Thus, self-care must address maternal risk factors for LBW, primordial prevention (eg, not starting smoking, avoiding overweight, being active, eating a heart healthy and low-sodium diet), and the early appearance of cardiometabolic risk factors in LBW offspring. For example, childhood obesity is rising as are other risk factors, such as sedentary lifestyle, and early self-care intervention to prevent or manage these risk factors is needed. Primordial prevention of CVD risk factors is best addressed with multifaceted, population-based strategies

involving increased education beginning in elementary schools or earlier, improvements in environmental infrastructure (eg, more sidewalks, parks, recreation centers, and easier access to healthful food choices), and regulatory initiatives (eg, tighter control of tobacco products, reduction in use of simple sugars and *trans* fats in foods). Such strategies are particularly important because, as this review highlights, it may be that only through primordial prevention will we achieve a marked reduction in the incidence and prevalence of CVD.

Failure of Routine Care to Promote Self-Care

Teaching and supporting self-care should be a major activity in our healthcare system. Yet, complexities in its conceptualization and practice result in underappreciation of self-care by clinicians and healthcare systems. As a consequence, clinicians have not emphasized self-care, and the vast majority of people do not perform self-care behaviors well.[16,70,71]

Self-care research and clinical efforts have been hindered by the perceptions of both patients and providers that pharmacological interventions are more effective than lifestyle change.[72,73] Widespread failure of clinicians to follow, or give more than token attention to, CVD prevention guidelines has resulted in little change or worsening in CVD risk factors over time in many countries and points to a compelling need for a greater emphasis on self-care.[74] Further evidence of this failure is evident in practice-based approaches to CVD risk reduction.[75,76] Some reasons for the lack of effectiveness of clinical efforts to influence CVD risk include the limited training of providers about patient education and use of effective behavior change strategies, lack of time for patient encounters, lack of support in the clinic environment for a self-care–based approach, growth of healthcare systems focusing on care of acute events with little appreciation of the chronicity of most conditions, and better reimbursement for treatment than for prevention.[77]

Our clinical and societal focus on an illness- or disease-driven model of episodic care has resulted in what Goldman et al call "investing in sickness rather than health."[49] This investment and our changing demography have resulted in people living longer with multiple chronic conditions that are not well controlled because self-care is at the heart of control of chronic illnesses.

Section Summary

- The seeds of most noncommunicable diseases such as CVD are planted very early in the life course, requiring a massive shift in the focus on treatment of acute events to an early emphasis on self-care.

Self-Care Behaviors

In this section, we address self-care behaviors at the individual, family, and community levels. The roots of health lie in behavior, genetics, social circumstances, health care, and environmental exposures.[78] Inadequate or unavailable medical therapy is thought to contribute little (around 10%) to illness and disease, whereas the predominant force is behavior, contributing ≈40% to overall health.[78] Other determinants of health include genetics and stress. Social circumstances and environment contribute another ≈20% to health.[78] Thus, it is clear that improving self-care at the individual, family, and community levels could produce a major impact in health.

Individual-Level Self-Care Behaviors

Autonomy, understanding self-care, and self-responsibility

Our healthcare system is built on the assumption that individuals seeking care will comply with healthcare providers' recommendations. Accountability is fostered in the context of keeping appointments and taking prescribed medications while following provider advice. The complex tasks of preventing chronic illnesses such as CVD and stroke commonly are addressed with provision of advice to "lose weight, get more activity, stop smoking" without provision of the knowledge, skills, and long-term support needed for people to be successful with these self-care behaviors. Training in self-care is not common in the current healthcare system (for either providers or patients), and there is little time for development of strong and respectful patient-provider partnerships.

Given the lack of emphasis on self-care in the healthcare system today, most patients expect that healthcare providers hold the responsibility for patients' health.[79] Thus, both healthcare providers and patients will need a major change in expectations about their respective roles in the prevention and management of CVD and stroke. Recently, the National Academy of Medicine (formerly the Institute of Medicine) wrote a white paper, "Vital Directions for Health and Health Care," which addresses the major problems with healthcare systems today and changes that need to be made. One of their major focuses was "Empower People—Democratize Action for Health."[78] With this focus comes the charge to develop a healthcare system in which patients and families are informed, empowered, and engaged in their own health care and that they are promoted as partners in making healthcare decisions and in ensuring that these decisions are commensurate with their goals for health and life.[78]

Knowledge of health status

Knowledge of health status and awareness of risk is an essential first step in self-care of CVD. Individuals need to

understand their current health status and their risk for future conditions in order to engage in adequate self-care. Such knowledge requires development of a partnership with all healthcare providers who are willing to promote self-care by keeping patients informed about their health status, thoroughly explaining all risk factors, and providing patients with access to appropriate sources of further information (eg, reputable web sources, books, and media outlets).

The "Know Your Numbers" campaign was designed to encourage people to determine their risk for CVD.[80] Five risk factors are targeted: BP, total cholesterol, high-density lipoprotein cholesterol, blood glucose, and BMI. The goal is for people to determine whether any of these factors are abnormal, allowing them to take appropriate action to reduce their risk for CVD. A similar campaign is used for people with pre–diabetes mellitus or type 2 diabetes mellitus.[81] There have been no studies to determine the effectiveness of these specific campaigns; however, the "Know Your Numbers" program in Australia to increase BP awareness resulted in a majority of people with hypertension seeking medical follow-up.[82]

Diet

Self-care related to diet differs from some other preventative lifestyle behaviors in that a new behavior is not required, such as exercise, but rather existing behaviors are modified. This can make dietary self-care challenging because it involves changing habitual behaviors that are embedded in culture and may have social consequences. Equally challenging are what can appear to be frequent changes to dietary recommendations, which may be frustrating to those attempting to follow guidelines. This may be particularly true in respect to changes in long-standing recommendations. One example is the change in current guidelines that no longer specify a maximum daily intake of dietary cholesterol, which people have spent the past 45 years struggling to limit.[83] Thus, it is important that people have confidence that the recommendations they are given are worth the effort to follow. The recent switch in focus away from restriction of specific nutrients to promoting heart-healthy dietary patterns[84] may increase stability in recommendations and reduce future frustration. It is important to note, however, that the recommended dietary patterns are still intended to restrict intake of specific nutrients, namely added sugars, *trans* fats, saturated fats, and sodium, indicating that these nutrients continue to be implicated in development of CVD.

Key components of current dietary recommendations[84] center around eating a varied, nutrient-dense diet that includes all vegetable subgroups: dark green, red and orange, legumes, and starchy. Also recommended are fruits, especially whole fruits, grains, particularly whole grains, fat-free or low-fat dairy, and protein from seafood, poultry, lean meats, eggs, nuts, seeds, and soy products. Unsaturated fat oils, such as soybean, corn, olive, canola, and safflower, are recommended.[85] The 2 most commonly recommended diets that achieve these recommendations are the Dietary Approaches to Stop Hypertension (DASH) and Mediterranean-style diets.[85] The recommendations can also easily be achieved with vegan or vegetarian diets as long as attention is paid to obtaining all essential amino acids and minerals.[84,85]

Although adherence to dietary recommendations has improved over the past 10 years, it still remains low at ≤60% of the population.[84] Although considerable research has been conducted testing the effect of various diets on cardiovascular health, studies to promote dietary adherence are limited. In a recent review of dietary advice interventions for healthy adults to improve CVD risk factors, most interventions focused on nutrient reductions, such as fats or sodium, or nutrient increases, such as fruits, vegetables, or fiber.[86] None focused on the currently recommended "whole diet" approach. Higher-intensity interventions with more personal contact were more effective than low-intensity interventions. Dietary advice appeared to be more effective for people with known or perceived risk for CVD who are more likely to be receptive to advice. Effectiveness of specific strategies was not identified in the review. In another recent review, strategies to change dietary behavior for prevention and management of chronic illness identified feedback, telephone follow-up after education sessions, provision of nutritional tools such as menus, and contracting as the most promising interventions.[87] However, none of the interventions was clearly superior, primarily because of the low quality of the studies.

Published examples of how to apply current dietary guidelines are based on Western foods.[84,85] Cultural considerations are important when planning self-care strategies for everyone given the multiplicity of cultures and the effect of culture on diet.[88] For example, in many cases, the diets of first-generation immigrants are more heart-healthy than the typical Western diet on arrival in the United States, but gradually change to a more Western-style diet over time.[89] In this case, strategies are needed to promote adoption of healthy components of the Western diet, rather than the large portion sizes or commercially prepared and convenience foods. For immigrants who maintain a diet from their home culture, the underlying principles of the guidelines can be applied by focusing on the selection of comparable foods.

Weight control

Maintaining a healthy body weight is an important self-care behavior and current dietary guidelines emphasize the

importance of weight control.[84] This is achieved by consuming appropriate serving sizes of recommended foods to meet estimated caloric demand. Estimating and tracking caloric intake is difficult over the course of a typical day and therefore not a successful strategy for weight control. Fortunately, serving sizes for specific food categories are provided in the guidelines for each level of caloric intake. Estimating serving sizes can be quickly mastered after a brief period of measuring out portion sizes. Individual caloric need is based on activity level, indicating that self-care strategies for increasing activity carry equal importance with diet in body weight maintenance.

Weight loss for people who are obese has been a long-standing recommendation for cardiovascular health.[90] It should be noted that with the exception of bariatric surgery, no interventions have been associated with substantial weight loss sustained over time. So, setting initial weight loss targets of 5% to 10% can have a clinically significant impact on CVD risk.[91] Self-care for weight loss is rarely achieved alone. Most successful lifestyle interventions for weight loss require participation in a program, either individually or in a group, for ≥6 months.[91] Long-term weight maintenance may require an ongoing support system. Computer-based interventions are an attractive alternative to in-person programs for convenience and cost. However, the evidence suggests that, whereas these programs are better than passive interventions such as pamphlets or a manual, they are not equal in effectiveness to in-person programs.[92] However, the majority of these studies were not highly interactive, so it is possible that interventions that provide greater interaction may be equally effective to in-person programs.

Physical activity and exercise

Aerobic exercise is a self-care behavior with incontrovertible health benefit, including systemic improvement in oxygen consumption, endothelial function, inflammation, BP, and insulin resistance as well as improvement in functional status, sleep quality, and quality of life.[93] The importance of physical activity on mortality risk was highlighted in the Oslo II study.[94] Elderly men who engaged in 30 minutes of physical activity 6 d/w had a 40% mortality risk reduction at 12-year follow-up —a benefit comparable to that observed with smoking cessation.

There is increasing evidence that inactivity or sedentary behavior is independently associated with negative outcomes independent of overall exercise or physical activity levels. In patients with symptomatic chronic HF, physical inactivity and high levels of daily television screen time are associated with greater risk of all-cause and cardiac mortality whereas modest exercise is associated with reduced all-cause and cardiac mortality.[95] In patients with diabetes mellitus, every 60 min/d increase in objectively measured sedentary behavior resulted in a 13% increase in mortality, independent of physical activity.[96] However, in adults without past CVD, higher physical activity levels and not sedentary behavior were related to lower CVD mortality.[97]

Cardiac rehabilitation teaches and encourages self-care and is recommended in clinical practice guidelines for patients with acute myocardial infarction or coronary revascularization,[98] other cardiac surgical procedures, chronic HF,[15] stroke,[99] and peripheral artery disease.[100] Traditional models of cardiac rehabilitation and structured exercise therapy have required a supervised setting in a healthcare environment to achieve the greatest benefit. However, there is increasing evidence that structured programs that take place in a home- or community-based environment may be as effective and more accessible to patients with CVD, who are often older and more debilitated.[101–103] The efficacy of these programs is augmented by incorporation of strategies such as health coaching and activity tracking. Despite the demonstrated benefits of cardiac rehabilitation, only 20% to 30% of eligible patients participate and referral is significantly lower in women than men.[104] Ades et al[105] estimate that if participation in cardiac rehabilitation increased to 70% of eligible patients, 12 000 lives and 87 000 hospitalizations could be saved in the first year alone.

Smoking cessation

Never smoking and smoking cessation are essential self-care behaviors with significant benefit to smokers and those exposed to tobacco smoke. Smokers who quit after a CVD event have better outcomes than those who continue to smoke, with health benefits that begin almost immediately. In those who quit, the risk of a recurrent event is the same as a nonsmoker within 3 years, and the risk of death from CVD is decreased by two thirds in former smokers versus those who continue to smoke.[106,107] Smoking reduction rather than cessation has little effect on clinical or biological markers, confirming that even minor exposure to tobacco smoke is harmful and illustrating the importance of complete cessation.[108–110]

Smoking cessation is an extremely challenging self-care behavior because of the addiction to tobacco, but medication can facilitate quitting,[111] even in those who are not yet ready to quit. In one trial, patients who were not willing to quit in the next month, but were willing to reduce the number of cigarettes smoked, were randomized to varenicline or placebo and instructed to reduce the number of cigarettes smoked by 50%, 75%, and 100% over 12 weeks. At weeks 21 to 24, those randomized to the varenicline group had a 38% abstinence rate compared with 13% in the placebo group.[112] Psychosocial interventions, behavioral interventions, telephone

counseling, and self-help materials are also effective in promoting smoking cessation, with the best results achieved with more intense interventions.[113] Group therapy is as effective as individual therapy, especially when augmented by physician advice or nicotine replacement therapy.[114] Healthcare providers who give brief advice to quit at every interaction with a smoker increase the odds of quitting by 34%,[115] which is further enhanced with brief counselling.[116] A combined approach to smoking cessation significantly increases the likelihood that a smoker will be able to quit.[117] Patients who quit after an acute CVD event may be more successful at maintaining this self-care behavior over time than patients with a slowly progressing chronic disease.[118,119] More research is needed to understand how best to help smokers quit.

Alcohol use

The data on alcohol use are confusing and the public is unsure what constitutes good self-care. Alcohol contributes to the development of hypertension and is associated with cardiomyopathy. Light-to-moderate alcohol consumption is protective in patients with stable ischemic heart disease. Current guidelines state that 1 or 2 drinks/d is reasonable for patients with stable ischemic heart disease.[98] Similarly, current stroke guidelines suggest that stroke patients who drink heavily should reduce their alcohol consumption, but it may be reasonable for them to consume light-to-moderate amounts of alcohol.[99] An inverse relationship was found between alcohol intake and acute coronary syndrome.[120] Moderate drinking was associated with a lower mortality rate than abstaining or heavy drinking.[120] Similar confusing results were found in diabetes mellitus,[120,121] incident HF,[122] and ischemic and hemorrhagic stroke.[123,124] Given the potential negative health and societal consequences of alcohol dependence or abuse, people who do not currently drink alcohol should not be encouraged to begin drinking. Those who do consume alcohol should be informed of the potential risks and encouraged to consume alcohol in moderation.

Medication adherence

Self-care includes taking medicines as prescribed and responsible selection and use of nonprescription medicines. Medication adherence is most likely when patients are well informed about medications, including potential side effects, the potential for drug interactions, and when to contact their clinician to discuss discontinuing or changing medications. Responsible use also includes understanding the pros and cons of using nonprescription or over-the-counter medicines, following the label recommendations, and an ongoing evaluation of the benefits and effectiveness of the drug. Responsible use also involves informing healthcare providers of the use of both prescription and nonprescription drugs.

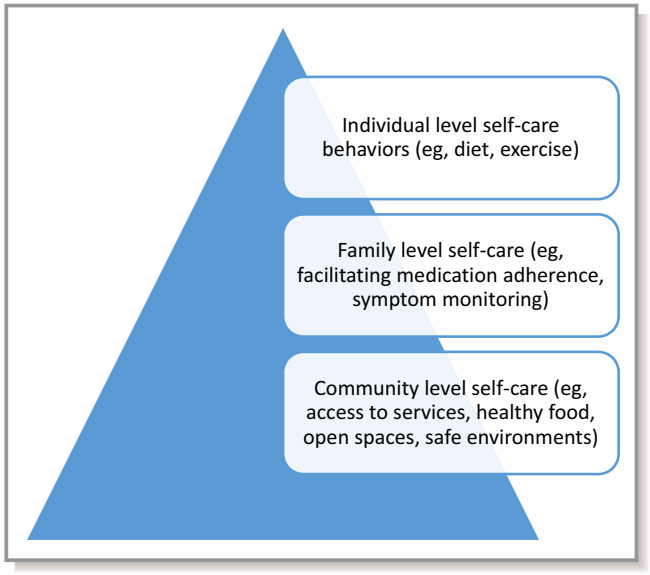

Figure. Self-care is often thought of as solely an individual-level behavior, but, in reality, self-care occurs at the individual, family, and community level.

Poor adherence to the medication regimen is a major factor in the inadequate achievement of CVD treatment goals.[125–127] Nonadherence to cardiovascular medicine is associated with greater risk of adverse effects and inappropriate therapeutic drug escalations.[126–128] Unfortunately, no clearly effective method of promoting medication adherence has been identified. Two recent systematic reviews found significant improvement in medication adherence through the use of text messages.[129–131] Patel et al[131] found that a mobile phone–based automated medication reminder system showed promise in improving medication adherence and BP control in individuals at high risk for CVD.

Family-Level Self-Care

Informal caregivers, typically family members, exert a significant influence on self-care,[132,133] with lack of support identified as an important barrier to self-care (Figure).[134–136] The most supportive contributions from caregivers are positive responses to a perceived need in a specific situation.[137] Family caregivers positively influence self-care by facilitating adherence to medications and diet as well as vigilance in monitoring.[138,139] In HF, significant family-level factors associated with patient self-care include sex, quality of life, relationship type and quality, social support, and factors associated with aging or disease progression such as number of chronic conditions, impaired activities of daily living, cognition, number of hospitalizations, and duration of

experience with the illness.[140] However, even when caregivers are invested and involved in promoting self-care, they are limited by their own lack of knowledge or skill.[138]

Recent studies have focused on couples or dyadic influences on self-efficacy,[133,141] self-care,[140] and dyadic patterns in collaborating on self-care.[142] In HF, dyadic patterns of self-care have been identified as novice and complementary, inconsistent and compensatory, or expert and collaborative.[142] Self-care self-efficacy, or task-specific confidence, is generally higher in informal caregivers than in patients.[141] Caregivers who rate the quality of the relationship higher are more likely to score the best in self-care self-efficacy.[133] Other investigators have found that when dyads disagree on self-care, this disagreement causes distress and dysfunction in the couple.[143–145] However, significant heterogeneity exists across dyads.[141] In a recent joint scientific statement from the AHA, American College of Cardiology, and American Geriatrics Society, models of care that integrate caregivers into decision making was identified as a significant practice gap across guidelines.[146]

Community-Level Self-Care

The range of environmental factors that impact health and the ability of people to perform self-care is remarkably broad. The World Health Organization European Healthy Cities program identified 12 key health determinants, including access to services, healthy food, open spaces, safe environments, healthy air, physical activity, and social cohesion.[147]

A number of studies have attempted to correlate walkability in the built environment with body weight, generally using BMI calculations. A 2008 review found that neighborhoods with barriers to physical activity were associated with higher BMI.[148] However, a more-recent systematic review failed to find that the multicomponent, community-wide interventions studied effectively increased physical activity for the population, although some studies with environmental components observed more people walking.[149]

Community-level dietary self-care strategies should include considerations for the food environment (shops, supermarkets, cafes, takeaways, restaurants, and vending machines).[150] Food deserts, defined as areas with limited availability of nearby food markets, are present in both urban and rural areas.[151] These food deserts are believed to limit access to heart healthy foods and be associated with higher food costs. Recent evidence, however, does not support the hypothesis that food deserts in urban neighborhoods significantly affect eating or shopping habits of people living in those neighborhoods.[152,153] People in rural areas may be more affected; transportation may be a greater barrier in rural areas than transportation to stores nearby in urban neighborhoods.[151,153] Food-cost disparities exist in rural areas, with the cost of healthier foods higher in areas with greater poverty and less population density than in more-wealthy, high-density counties.[154] Similarly, counties with the poorest population health ratings had the highest-cost foods compared with counties with the best population health ratings. Regardless of urban or rural location, individual food affordability and accessibility need to be considered. In these cases, careful assessment of access barriers and identification of community resources may be needed for individual success. The food environment in different countries can be vastly different. In England, the availability of fast-food outlets around schools is thought to be an obstacle to establishing healthy eating habits.[155] A link has been demonstrated between fast-food availability and obesity in older children.[156]

Section Summary

- The evidence supporting individual- (eg, exercise), family- (eg, social support), and community-level (eg, accessibility of healthy food) self-care approaches is described.

CVD Outcomes of Self-Care

In this section, we summarize the data supporting self-care for hypertension, coronary heart disease, peripheral artery disease, stroke, AF, and HF. There are so many studies focused on individual self-care behaviors that we summarize only meta-analyses. A brief summary of mechanisms of effectiveness concludes this important section.

Hypertension

Self-measurement and monitoring of BP is a major emphasis in the self-care of hypertension. In a recent meta-analysis, there was evidence that self-measurement of BP was superior to usual care (24 trials) in reducing systolic (−3.1 mm Hg) and diastolic (−2.0 mm Hg) BP at 6 months.[157] In the meta-analysis, additional support beyond self-measurement (24 trials) resulted in even greater reductions in systolic (−3.4 to −8.9 mm Hg) and diastolic (−1.9 to −4.4 mm Hg) BP compared with usual care up to 12 months.[157] Another meta-analysis of 11 trials of self-measurement of BP interventions versus usual care demonstrated a significant reduction in diastolic (weighted mean difference, −2.02; 95% confidence interval [CI], −2.93 to −1.11), but not systolic, BP.[158] The researchers also provided evidence that self-measurement of BP interventions compared with usual care (13 trials) improved antihypertensive medication adherence (standardized mean difference, 0.21; 95% CI, 0.08–0.34). A third meta-analysis[159] provided evidence that digital

interventions designed to improve hypertension self-care were superior to usual care in reducing systolic (weighted mean difference being −3.74 mm Hg [95% CI, −2.19 to −2.58]) and diastolic BP (−2.37 mm Hg [95% CI, 0.40 to −4.35]). Hence, there is evidence across multiple trials favoring self-care in general, and self-measurement of BP in particular, as efficacious means of reducing BP and improving medication adherence in hypertension. Another Cochrane review on self-monitoring for improving control of BP in patients with hypertension is currently underway.[160]

Coronary Heart Disease

Cardiac rehabilitation is a commonly prescribed element of care in coronary heart disease. Karmali et al[161] conducted a systematic review of interventions to improve uptake of cardiac rehabilitation in coronary heart disease. Eight of 10 studies included in this review increased the uptake of cardiac rehabilitation, 3 of 8 studies included improved adherence to cardiac rehabilitation, and no studies found a difference in quality of life.[161] More recently, Janssen et al[162] completed a meta-analysis of lifestyle modification programs for patients with coronary heart disease versus usual care (23 trials). In this analysis, usual care was associated with worse outcomes compared to lifestyle modification programs, including all-cause mortality (odds ratio, 1.34 [95% CI, 1.10–1.64]), cardiac mortality (odds ratio, 1.48 [95% CI, 1.17–1.88]), and the composite of cardiac readmissions and subsequent nonfatal infarctions (odds ratio, 1.35 [95% CI, 1.17–1.55]); improvements in dietary and exercise behavior were greater for programs that incorporated goal setting, self-monitoring, planning, and feedback techniques.[162] In summary, there is evidence across multiple trials to support self-care interventions that are focused on lifestyle modifications as a means to improve clinical outcomes in coronary heart disease. In contrast, interventions focused solely on improving adherence to cardiac rehabilitation only seem to influence uptake, but not adherence behavior or quality of life.

Peripheral Artery Disease

Li et al[141] recently reviewed the efficacy of structured home-based exercise programs in patients with peripheral artery disease. Across 5 trials, structured home-based exercise programs improved walking time (668 seconds [95% CI, 5.2–128.4]) and pain-free walking time (57.8 seconds [95% CI, 20.4–95.1]), as well as mean difference in Walking Impairment Questionnaire distance (8.7; 95% CI, 3.9–13.5) and speed scores (8.1; 95% CI, 4.5–11.6). Hence, there is evidence across multiple trials that home-based exercise programs improve walking ability in patients with peripheral artery disease. Moreover, there is an additional Cochrane review on disease management interventions for improving self-care in lower-limb peripheral artery disease currently underway.[163]

Stroke

A recent systematic meta-review of 13 systematic reviews representing 101 individual trials of self-care support interventions with stroke survivors provide high-quality evidence to support self-care.[164] The researchers concluded that support for self-care in the context of therapy rehabilitation delivered soon after a stroke resulted in short-term (<1 year) improvement in activities of daily living and reductions in the risk of dependence and death poststroke.[164] More recently, Fryer et al[165] completed a meta-analysis of 6 trials of stroke self-care programs and provided evidence that such interventions improve quality of life (standardized mean difference, 0.34 [95% CI, 0.05–0.62]) and improve self-efficacy (0.33 [95% CI, 0.04–0.61]) compared with usual care. Hence, there is evidence across multiple systematic reviews and multiple trials to support self-care as a means of improving activities of daily living, quality of life, and self-efficacy, as well as reducing dependency and premature death in stroke.

Atrial Fibrillation

Heneghan et al[166] completed a meta-analysis of self-testing and self-care of oral anticoagulation in AF. Across 11 trials, there was a significant reduction in thromboembolic events associated with self-monitoring versus usual care (hazard ratio [HR], 0.51 [95% CI, 0.31–0.85]), but no difference for major hemorrhagic events (HR, 0.88 [95% CI, 0.74–1.06]) or death (HR, 0.82 [95% CI, 0.62–1.09]); younger patients (aged <55 years) and those with mechanical heart valves had the greatest reductions in thromboembolic events in response to self-testing and self-care of oral anticoagulation.[166] Clarke-Smith et al[167] subsequently completed a meta-analysis of 8 trials focused on the efficacy of educational or behavioral intervention versus usual care in AF on time in therapeutic range of oral anticoagulation therapy. In this meta-analysis, self-monitoring did not improve time in therapeutic range compared with usual care (mean difference of 6.31 [95% CI, −5.63 to 18.25]).[167] The researchers suggested that they may not have found benefit because 4 of the trials included mixed indication cohorts and 10 further trials were excluded because they did not provide AF-specific data. They also suggest some patient-specific factors that could have impacted intervention effectiveness (eg, older age and inaccurate beliefs). Although there is evidence across multiple trials that self-testing and self-care of oral anticoagulation reduces the risk of thromboembolic events at large, more research is needed into mechanisms other than time in therapeutic range by which self-care interventions are successful in AF.

Heart Failure

For more than a decade, there has been evidence from meta-analyses of randomized, controlled trials that interventions focused on enhancing self-care in HF are efficacious versus usual care in improving outcomes. McAlister et al[168] first provided evidence across 4 trials that interventions focused on enhancing HF self-care reduced all-cause hospitalizations and HF hospitalizations. A subsequent meta-analysis of trials focused on HF self-care provided evidence that interventions focused on improving self-care (5 trials) reduced all-cause readmission and HF readmissions (3 trials).[169] Grady[170] reviewed trials focused on self-care interventions and quality of life in HF. Nine of the 17 trials included in her review showed an improvement in quality of life compared to usual care; but, methodological heterogeneity across the trials reviewed interfered considerably with the ability to draw any strong conclusions.[170] Ditewig et al[171] completed a systematic review without a meta-analysis on effectiveness of self-management programs in HF and concluded that self-care interventions generally had a positive effect on all-cause readmission, mortality, and quality of life. These researchers also highlighted significant methodological heterogeneity across studies that interfered with any strong summative conclusions. Another meta-analysis focused on structured telephone support interventions to improve HF self-care.[172] In this meta-analysis, self-care focused structured telephone support interventions reduced all-cause mortality (22 trials; HR, 0.87 [95% CI, 0.77–0.98]) and HF hospitalizations (16 trials; HR, 0.85 [95% CI, 0.77–0.93]). Recently, Jonkman et al[173] completed an individual patient data meta-analysis of HF self-management interventions. Self-management interventions (20 trials) reduced the composite risk of HF hospitalization or all-cause death (HR, 0.80 [95% CI, 0.71–0.89]), the risk of HF hospitalization (HR, 0.80 [95% CI, 0.69–0.92]), and improved 12-month HF-related quality of life (standardized mean difference, 0.15 [95% CI, 0.00–0.30]).[173] In subsequent analyses, it was concluded that no specific intervention characteristics other than longer intervention duration were associated with better self-management intervention efficacy.[174] In summary, there is sufficient information across many trials that interventions targeting HF self-care are associated with better clinical outcomes and improvements in quality of life, suggesting readiness for implementation studies.

Mechanisms of Effectiveness

Healthy self-care behaviors lower the risk of incident disease, and the mechanisms underlying these effects can be broadly summarized as cardioprotection.[175] This is particularly true of the self-care maintenance behaviors of smoking cessation, maintaining normal BMI, routine physical activity, reducing dietary sodium intake, decreasing alcohol use, and maintaining a healthy diet, a low cholesterol, a normal BP, and a normal fasting plasma glucose. Other self-care maintenance behaviors help reduce inflammation attributed to infection in CVD such as routine preventive dental care and annual influenza vaccination.[176,177] Medication adherence is perhaps the most obvious cardioprotective self-care behavior. For example, it has been proposed that HF patients who are adherent to prescribed therapies may avoid the escalation of loop diuretics,[178–180] avoid the need for inotropic therapy,[181,182] and potentially avoid having efficacious therapies discontinued during hospitalization,[183] all of which are associated with worse outcomes. When the emphasis of self-care changes from preventing to managing CVD and secondary prevention, these health behaviors become no less important because they address common cardiovascular pathophysiological mechanisms such as inflammation.[184]

Section Summary

- In hypertension, there is evidence across multiple trials demonstrating that self-care monitoring of BP is an efficacious means of reducing BP and improving medication adherence.
- In coronary heart disease, self-care interventions that focus on lifestyle modifications improve clinical outcomes.
- In peripheral artery disease, there is evidence across multiple trials that home-based exercise programs improve walking ability.
- In stroke, there is evidence across multiple systematic reviews and multiple trials to support self-care as a means of improving activities of daily living, quality of life, and self-efficacy, as well as reducing dependency and premature death.
- In AF, self-care monitoring of oral anticoagulation reduces the risk of thromboembolic events, but more research is needed into mechanisms of self-care for AF other than time in therapeutic range.
- In HF, there is sufficient information across many trials that interventions targeting HF self-care are associated with better clinical outcomes and improved quality of life, suggesting the need for implementation studies.
- Further research is needed to fully understand the mechanisms by which self-care exerts benefit.

Factors Influencing Self-Care

To effectively perform the self-care behaviors needed to prevent or manage CVD requires self-care knowledge, skills, confidence, and motivation to engage in these activities routinely, while contending with multiple individual

barriers.[185–187] These individual barriers can be compounded by family and community influences. Some of these major barriers are described below.

Individual Factors Influencing Self-Care

Depression

Depression and depressive symptoms are substantially more common in people with CVD that in the general population. The highest rates are observed in patients with HF (20%–30% depending on assessment used),[188] but rates with other cardiac conditions do not lag far behind.[189] Depression and depressive symptoms are independently and strongly associated with death, recurrent major cardiac events, and cardiac and all-cause hospitalizations in the short and long term.[188,190–192]

Depression and depressive symptoms are associated with poor self-care in those with CVD or risk factors for CVD.[193–197] Self-care areas negatively affected include diet and medication adherence, exercise adherence, self-monitoring, and appropriate response to symptoms.[198–203]

Poor self-efficacy

Self-efficacy, or confidence in one's ability to perform a particular behavior, is a powerful and consistent influence on performance of self-care across patient populations, various self-care behaviors, and developmental levels.[204–206] The effect of self-efficacy on self-care behaviors has been demonstrated for both self-care maintenance and management behaviors in multiple chronic CVD populations.

A systematic review of evidence to identify intrapersonal, social, and physical environmental determinants of moderate-to-vigorous intensity physical activity among working-age women found that enhanced self-efficacy was a consistent positive influence on activity.[207] Among patients with coronary artery disease, self-efficacy is a significant predictor of physical activity, especially in the early phase of initiating physical activity behavior.[208] Increased levels of self-efficacy promote greater antihypertensive and HF medication adherence[209,210] and dietary adherence.[211] Smoking cessation is clearly linked with confidence to quit and confidence to quit in the face of obstacles.[212] When examining self-efficacy in persons with HF categorized on their level of self-care performance, higher self-care confidence increased the odds of being an expert in self-care.[213,214]

Self-efficacy is a key influencer of enhanced self-care in populations with cardiac and comorbid conditions[215] and specifically complex self-care in those with concomitant HF and diabetes melliitus.[216] In a secondary analysis of data from symptomatic older HF patients, level of comorbidity moderated the relationship between self-efficacy and self–care maintenance, but not self-care management.[217] Specifically, in patients with less comorbidity, the relationship between self-efficacy and self-care was significantly stronger than in patients with more comorbidity. It appears that the additional conditions make it difficult for patients to identify the self-care needed in specific situations, thereby decreasing self-efficacy. Self-care confidence appears to be an important factor influencing HF self-care even in patients with impaired cognition, and interventions addressing confidence were suggested as a way to improve self-care in this population.[218]

Self-efficacy is reinforced by the actual performance of the self-care behavior; with successful performance, self-efficacy is enhanced, whereas failure undermines self-efficacy.[219] Self-efficacy enhancement empowerment early in a lifestyle intervention program improves self-efficacy and adherence to healthy lifestyle behaviors.[220] A study testing an intervention to improve HF symptom monitoring and response found greater improvements in self-care confidence in the intervention group compared with a control group.[221] A study of behavioral factors influencing physical activity in patients with stable coronary artery disease found that perceived social support explained 12% of the variance in physical activity, with self-efficacy partially mediating the relationship between perceived social support and physical activity.[222]

Cognitive decline

CVD is a major and increasingly recognized cause of dementia.[223] The incidence of cognitive decline increases with increasing age because of pathological changes in the cardiovascular and cerebrovascular systems commonly observed in those who have not maintained cardioprotective lifestyle habits through the life course.[52,223] CVD in many of its manifestations (eg, coronary artery disease, AF, hypertension, and myocardial infarction) and most CVD risk factors (eg, smoking, obesity, sedentary lifestyle) are independently associated with cognitive dysfunction along the continuum from mild cognitive impairment to dementia.[224] For example, cognitive impairment is common among those with HF,[225,226] with a prevalence ranging from 25% to 50%.[227–229]

In the cardiac population, cognitive decline commonly includes deterioration in memory and learning, attention, executive function, psychomotor speed, and visuospatial recall.[226,230–233] Such impairment can have a profoundly negative effect on an individual's ability to engage in effective self-care.[234] Interestingly, engagement in intensive CVD risk reduction self-care activities can improve cognitive impairment. For example, in older adults with HF, increased daily physical activity was associated with better cognition.[235] Optimal medical management,[236,237] cardiac rehabilitation,[238] and computer-based cognitive training programs[239,240] can

improve cognitive function. Improvement in self-care behaviors was observed when patients used a computerized board game that stimulated daily activities.[239]

Multimorbidity

The rise in prevalence of multimorbidity is a function of the aging of the population.[241] By 2030, ≥170 million people in the United States are expected to be performing self-care for ≥1 chronic condition.[242] Self-care is crucial for complex patients with multimorbidity, yet the presence of more than 1 condition is a significant barrier to self-care and is associated with poor outcomes such as mortality and increased healthcare use.[243,244] Currently, the most commonly co-occurring conditions are arthritis, hypertension, and diabetes mellitus.[245] When only CVD index populations are considered, the top 5 conditions are hypertension, hyperlipidemia, diabetes mellitus, arthritis, and anemia.[246]

Multimorbidity creates a web of co-occurring, interacting conditions, each of which require self-care. A recent review and analysis of multiple CVD data sets identified a complex network of 10 conditions (musculoskeletal disorders, thyroid disease, anemia, renal impairment, arrhythmias, cognitive impairment, depression/anxiety, respiratory disease, sleep disorders, and diabetes mellitus/metabolic disorders) that complicate self-care and increase mortality.[247] The higher the number of chronic illnesses, the lower the adequacy of self-care.[215] The complexity of multimorbidity has a direct effect on individual self-care decisions, particularly in the higher-level decision-making tasks of symptom recognition and management.[215] For example, someone with dyspnea must detect a change in the subjective perception of shortness of breath, interpret its meaning, label it correctly as associated with a particular condition, and then respond appropriately with the correct symptom management protocol.[35] Complicating this task is the overlap in symptom patterns coupled with distinct and sometimes conflicting self-care requirements of each individual chronic condition.[248] Symptom monitoring and differentiating the cause of a particular symptom are the most challenging skills when more than 1 chronic illness is present.[215] Key barriers to patient self-care arises from the confusing or contradictory information provided by multiple healthcare providers.[249] Management strategies must take into account the multiple and complex issues created by the web of multimorbidity in order to develop efficacious and efficient self-care support programs.

Multimorbidity is significantly higher in non-Hispanic white and black women than in any other demographic groups.[245] Because these populations have been historically understudied, little is known about outcomes of patients who are older, female, or racially diverse. These issues have a direct impact on the development of clinical practice guidelines and guideline-directed care.[246] Prevalence, poor outcomes, and understudied populations all point to a critical need for research to delineate the impact of multimorbidity on self-care.

Family-Level Factors Influencing Self-Care

A growing body of research points to a significant impact of social relationships on all-cause and disease-specific morbidity and mortality.[250–252] Both the size and diversity of one's social network or capital (informal connections available for support, help, and information) are strongly and prospectively linked with CVD morbidity and mortality. In particular, epidemiological data suggest that people who have larger, more integrated social networks are at reduced risk for mortality and ischemic heart disease[253] and stroke[254] and have a better prognosis after myocardial infarction,[255] compared with more socially isolated individuals.

Community-Level Factors Influencing Self-Care

Social networks simultaneously reflect both the individual's social capital and the community's social structures. People who are connected to a network or community rich in support, social trust, information, and healthy norms may have more access to resources that can help them achieve health goals.[256,257] Studies of urban versus rural communities suggest that rural residents have a higher burden of risk factors and encounter more challenges with self-care than their urban counterparts because of inequalities related to socioeconomic resources and access to care.[258–261] However, other studies in lower- and upper-middle-income countries report a greater prevalence of CVD risk factors attributed to urbanization,[262–265] so this issue remains unclear. It is not yet sufficiently clear what factors at the community level are proportionately more important to CVD risk management. Several study protocols have been designed to identify these critical elements, but results are not yet available.[187,266,267]

Section Summary

- Knowledge, skills, confidence, and motivation are required to effectively perform self-care.
- Common individual barriers that impede self-care include depression, poor self-efficacy, cognitive decline, and multimorbidity.
- Lack of social support is the most important family-level factor influencing self-care.

- Lack of social capital at the community-level limits access and affordability of care.

Interventions to Enhance Self-Care

Literally hundreds of studies have been conducted testing approaches to promoting self-care in CVD populations. Interventions based on self-care decision making[268,269] focus on the importance of building experiential skill in specific behaviors, sociocultural resources (ie, social support), and personal values. Innovative CVD self-care decision aids support complex decision making by assisting those with CVD and stroke to recognize decision situations (ie, those occasions with an opportunity to choose between courses of action) and by providing aids to facilitate effective responses based on evidence[270] and promote adherence to effective prevention strategies.[271] One particular complex decision that has captured the attention of investigators is the response to symptoms. Numerous studies have demonstrated that the time from initial symptom onset to seeking urgent treatment is prolonged in individuals with acute coronary syndrome and stroke.[272,273] Even in patients with extant CVD, the delay in onset of worsening symptoms to urgent healthcare utilization is often measured in days.[274]

Individual-Level Self-Care Interventions

A consistent theme among successful studies addressing symptom response and a variety of other self-care behaviors is the use of motivational approaches to promote self-care. For example, a systematic review and meta-analysis of interventions to improve medication adherence in adults with hypertension included 112 eligible treatment-versus-control group outcome comparisons of 34 272 subjects.[275] The most promising intervention components were those linking adherence behavior with habits, giving adherence feedback to patients, self-monitoring of BP, using pill boxes and other special packaging, and motivational interviewing. The most effective interventions used multiple components and were delivered over many days.

Knowledge and skill

Interventions to improve self-care in persons with CVD have generally included an educational component intended to improve knowledge and understanding about CVD and associated self-care practices.[276,277] Strategies to increase patient knowledge include didactic sessions, use of written materials and/or technology (eg, DVDs, iPADs), mHealth applications, and telemonitoring.[278] The effects of such strategies are mixed. Although some investigators report increased knowledge, results have been inconclusive as to the improvement in self-care behaviors.[279–282] A recent systematic review of 33 HF interventions examined the main mechanism of program effectiveness on clinical outcomes and reported that when interventions focused on improving knowledge alone, the effects were diminished.[283] The general consensus is that knowledge is necessary for effective self-care, but not sufficient to improve behavior or influence outcomes.[186,284,285]

In addition to knowledge, adequate self-care requires skill in performing routine preventive behaviors and skill in making decisions about signs and symptoms of a worsening condition.[286] Skill refers to the ability to use information and apply it in a specific context,[277] that is, carry out a task with a predetermined result. Much of what we know about how to improve skill in self-care comes from the HF self-care literature.[213,221,287,288] Patients report needing tactical self-care skills ("how to"; eg, preparing meals, monitoring weight) as well as situational skill ("what to do when").[286,289] Skill development has been studied in numerous populations with HF and shown to be important in improving self-care in ethnically diverse samples[268] as well as persons with both HF and diabetes mellitus.[290]

There is a growing body of literature examining the effects of interventions to improve self-care in persons with other CVDs, including hypertension,[291,292] AF,[167] coronary heart disease,[293,294] and stroke,[165] with a shift in focus to skill development as essential to improving self-care and related outcomes. For example, the "Keep Moving toward Healthy Heart and Healthy Brain" trial compared the effects of an exercise intervention that incorporated skills training to promote physical activity on clinical outcomes of BP, heart attack, and stroke.[295] Participants in the intervention group compared with those in the usual care group had reduced incidence of heart attack and stroke and a moderate reduction in BP (−3.72 mm Hg in systolic BP and −2.92 mm Hg in diastolic BP) 6 months after the intervention. The intervention group also demonstrated significant increases in physical activity at 3 and 6 months postintervention. Another example of the emerging emphasis across CVD self-care trials on skill development is the ACT (Achieving Blood Pressure Control Together) study,[292] a planned trial testing the effects of an intervention that includes skills training to enhance performance of hypertension self-care behaviors to improve BP in black adults with uncontrolled hypertension.

Technology to Support Self-Care Maintenance, Monitoring, and Management

Rapidly evolving personal technologies offer the promise of support for many aspects of self-care. The widespread

availability of mobile phones has generated intense interest in mHealth (mobile health)—the use of mobile phones to receive information and coaching to support self-care. mHealth provides the prospect of increasing our reach to deliver efficient, affordable healthcare services to widespread populations in need of primary and secondary prevention for diverse goals such as smoking cessation, weight loss, and physical activity.[296–299]

Mobile phone text messaging ("mHealth 1.0"[300]) has been shown to be effective in promoting a wide variety of self-care behaviors such as physical activity[299,301–304] and adherence to multiple lifestyle behaviors,[305] including BP control, weight control, and smoking cessation.[306] The content of successful text messages has included advice, motivational reminders, and support to change lifestyle behaviors. Notably, although the results are promising, they are still limited to a small number of trials, inconsistent outcome measures, and ineffective reporting of intervention characteristics.[307] The duration of effects remains to be determined.

A recent systematic review found that 79% of studies of text messaging, mobile applications, and telemonitoring by mobile phones were effective in improving CVD outcomes.[130] Some key factors associated with improved outcomes included personalized messages with tailored advice, greater engagement (2-way text messaging, higher frequency of messages), and use of multiple modalities. Not every mHealth intervention has been effective, however; the recent BEAT-HF (Better Effectiveness After Transition—Heart Failure) trial failed to reduce readmissions at 6 months in HF patients receiving telemonitoring and health coaching by telephone.[308] Large-scale, longitudinal studies are warranted to gain a clear understanding of the effects of mHealth on behavior change, CVD risk factors, and clinical outcomes and better identify who will benefit most from these interventions.[309]

"mHealth 2.0"[300] involves more-complex approaches than messaging, such as smartphone software applications (apps) and the use of sensors or monitors for self-care monitoring. Thousands of apps have been created since they first appeared in 2008, with health a particular focus. Systematic reviews on the effectiveness of mobile phone and tablet apps in self-care of long-term conditions support their potential for improving management and health outcomes through self-care. They also note, however, that health apps are largely unregulated and few are evidence based.[310–312]

Wearable devices such as pedometers measure exercise parameters, heart rate, and sleep. Self-care monitoring helps people become more aware of how their bodies work and what is normal, and enables them to track their progress in real time and stay motivated while making lifestyle changes. Wearable monitoring devices may alert a patient earlier to a change in health that needs medical attention. Even "low-tech" home-based equipment such as weight scales and BP monitors remain useful. Monitoring of BP,[313] glucose,[314] perceived exertion,[315] body weight,[316,317] international normalized ratio values,[318–321] calorie intake and energy expenditure,[322,323] postprandial glycemia,[323] and HF symptoms[221,324–326] has been shown to be comparable to provider management to improve outcomes.

In the future, "mHealth 3.0" may involve smartphone machine-learning algorithms and body sensors that make accurate patient-specific assessments and recommendations.[300] An example would be an app that recognizes that BP is elevated or detects an alarming arrhythmia through electrocardiograph signal analysis.[327,328] New self-care behaviors will emerge such as adherence to wearing these sensors and making decisions in response to such alerts.

There is potential for people with mobile devices to use apps with sensors and machine-learning algorithms to self-diagnose and treat. Use of these apps may shift the focus of patients away from CVD prevention to CVD treatment. Of equal concern is that they will also allow people to bypass healthcare providers. Consequently, it is essential that providers play an active role in the development of mHealth technology that supports active patient and healthcare provider engagement in self-care. In the AHA scientific statement on the use of mHealth-based strategies for CVD prevention, the authors called for testing of mHealth approaches that provide interaction between patients and healthcare providers using real-time data for joint decision making.[329] This use of mHealth technology has the potential to revolutionize self-care by allowing patients, family members, and providers to engage in active, real-time partnerships regarding self-care.

Family-Level Self-Care Interventions

Recognition of the positive influence of family engagement on self-care has supported the design and testing of family-focused self-care interventions for CVD patients and their family members. Although some clinical trials testing family- or dyad-level interventions for CVD self-care hold promise, they are limited in number, tend to have small sample sizes with short evaluation time frames, are based on varying theoretical frameworks, and have yielded conflicting results. The majority of studies have been with HF patients. Promising approaches focus on communication, decision making, reciprocity,[330] caregiver self-care, coping and communication, problem solving, and dealing with stress and negative emotions.[331] Factors that may interfere with a family-focused approach include high levels of anxiety and lack of perceived control among the family members,[332,333] disease severity, and caregiver burden.[331]

Multiple intervening and complex factors affect family-level self-care. The timing in the trajectory of care, pre-existing and evolving comorbidities, psychosocial status at baseline, family context and relational variables, as well as health literacy and dyadic interdependence converge to influence self-care. Family-focused self-care approaches needs to incorporate these factors when designing interventions for dyads or families. Furthermore, given that the physical and mental health of caregivers may be affected by the demands of caregiving, family-focused interventions need to offer support without increasing burden to the family caregiver.

Community-Level Self-Care Interventions

Community settings such as social or community centers provide an additional option to the local medical facility or the home in helping to build self-care skills.[334] Participants in community-based self-care training initiatives showed significant improvement in self-care maintenance and self-care management[268,335,336] and in CVD risk reduction.[337] There is, however, a paucity of studies on the direct links between community activities and CVD. One exception is a new and encouraging report from the World Health Organization, which found that 6 in 10 people globally are currently protected by at least 1 tobacco control measure—4 times more than in 2007. These community-level approaches reflect policies, warnings, advertising bans, and taxes for example.[338]

Theoretically, community neighborhoods may encourage self-care through activities and events that raise awareness and knowledge about healthy lifestyles, encourage collective activity and engagement, and alleviate social isolation. Examples include organized walks and runs, health fairs, farmers' markets, and support groups in the local community. Some evidence from the United States suggests that adults with access to a community garden consume more fruit and vegetables,[339] and community gardens have been used to improve the diet of poor communities, particularly in the developing world. Farmers' markets and community gardens may promote active lifestyles and mental well-being,[340] but few well-designed studies have been completed to confirm this assumption.

Support in the community may come from lay community health workers such as health trainers or coaches.[187] Dye et al[341] reported a successful initiative designed to improve hypertension self-care among older rural residents through education and support offered by trained volunteers. Participants received baseline and follow-up health risk appraisals with blood work, educational materials, and items such as BP monitors and pedometers. These participants demonstrated significant increases in hypertension-related knowledge that persisted at 16 weeks, as well as significant improvements in stage of readiness to change behaviors and in actual behaviors. Furthermore, clinically significant decreases in all outcome measures were observed, with statistically significant changes in systolic BP, weight, and glucose.

Section Summary

- Educational strategies focused on increasing knowledge have been inconclusive as to the improvement in self-care behaviors. Skill development approaches to improve self-care are more promising than purely educational approaches.
- Technology is promising as an approach to improving self-care behaviors in an efficient and affordable manner. The duration of effect needs further study. Future devices may use sensors and machine-learning algorithms that allow self-diagnosis and treatment. It is essential that healthcare providers play an active role in the development of mHealth technology that supports active patient and healthcare provider engagement in self-care.
- Promising family-focused intervention approaches have focused on communication, decision making, reciprocity, caregiver self-care, coping and communication, problem solving, and dealing with stress and negative emotions. Factors that interfere with family-focused approaches include high levels of anxiety and lack of perceived control among the family members, disease severity, and caregiver burden.
- Community-based interventions encourage self-care through activities and events that raise awareness and knowledge about healthy lifestyles (eg, AHA Heart Walk), encourage collective activity and engagement, and alleviate social isolation. There are few studies on the direct links between community activities and self-care outcomes.

Conclusions and Implications

In this scientific statement, we have argued the importance of self-care in the AHA mission and vision of building healthier lives, free of CVD and stroke. The evidence supporting specific self-care behaviors, the effectiveness of self-care in improving outcomes, and barriers to self-care were discussed. Although there are many nuances to relationships between self-care and outcomes, there are numerous instances of Level A (multiple populations evaluated, data derived from multiple trials or meta-analyses) and Class I to IIa evidence (benefit $\gg$ risk with sufficient evidence from multiple trials or meta-analyses)

regarding interventions that promote cardiovascular self-care. As such, greater emphasis should be placed on self-care in evidence-based guidelines.

Many self-care behaviors are consistent across cardiovascular conditions, and most CVD risk reduction self-care activities prevent other diseases as well. Ultimately, promoting wide uptake of the self-care behaviors outlined in this document is essential to reducing the incidence and prevalence of chronic CVD and other noncommunicable diseases.

To be maximally effective, self-care to optimize healthy lifestyle and prevent chronic CVD must become part of the culture of society.[342] A theme in the research summarized in this scientific statement is that interventions are more effective for people with known CVD than those without perceived risk. We can build on this knowledge with the design of interventions that focus the attention of individuals with CVD or perceived risk of CVD on self-care (Table 2). However, to truly control CVD, self-care must be practiced by all individuals at all ages and should not be relegated to only those who already have CVD. Further research is required to understand the factors that enable and motivate people to make healthy self-care choices.

Table 2. A World View of CVD Risk

Area	Issues and Comorbid Conditions That Increase CVD Risk	Within Border Ethnic, Racial, and Socioeconomic Disparities	Between Border Ethnic, Racial, and Socioeconomic Disparities
Worldwide	Worldwide, 15.5% of all births (20 million) are LBW. LBW infants are more than twice as common in developing countries (16.5%) as in developed countries (7%)[343]		
United States, 300 million people	Changing demographics with increase in diabetes mellitus, obesity, hypertension Age-adjusted death rates higher for males and strikingly higher for blacks compared with whites[344] Risk factors more prevalent in minorities with resultant increase in CVD[344] Racial disparity[345,346] LBW infant rate of blacks twice that of whites[347] CVD death rates highest in the most rural counties[348]	Yes	NA
Europe, 53 member states of the WHO European region and >740 million people	Alcohol and tobacco highest in the world[46,349] Large imbalance between nations related to economics and race/ethnicity[46,349]	Yes	Yes
Asia, >40 countries and >3 billion people	Increase in obesity and cholesterol on top of high tobacco and hypertension Increasing conversion of cerebral vascular disease to CVD as primary cause of death[350,351]	Yes	Yes
Australia/New Zealand, 29 million people	Large disparity in CVD, disproportionate risk factors in indigenous population[352] Racial disparity[353,354] In Australia, compared with non-indigenous people, Aboriginal and Torres Strait Islander peoples were 3 times more likely to have a heart attack and nearly twice as likely to die of heart disease[354] The indigenous Maori of New Zealand have higher rates of CVD mortality and morbidity than that for non-Maori non-Pacific New Zealanders[353]	Yes	NA
Africa, 1.2 billion people	Westernization of diet Increase in industrialization[355,356]	Yes	Yes
Latin America/Caribbean, 643 million people	Poorer diets, increased smoking, increased obesity (high end of obesity figures for Organization for Economic Cooperation and Development countries), less exercise, limited access to effective health care and medications[357,358]	Yes	Yes

CVD indicates cardiovascular disease; LBW, low birthweight; NA, not applicable; WHO, World Health Organization.

Disclosures

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This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit. A relationship is considered to be "significant" if (a) the person receives $10 000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns $10 000 or more of the fair market value of the entity. A relationship is considered to be "modest" if it is less than "significant" under the preceding definition.
*Modest.
†Significant.

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*Modest.

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