Circulation: Cardiovascular Quality and Outcomes

AHA SCIENTIFIC STATEMENT

Rapid Diet Assessment Screening Tools for Cardiovascular Disease Risk Reduction Across Healthcare Settings

A Scientific Statement From the American Heart Association

ABSTRACT: It is critical that diet quality be assessed and discussed at the point of care with clinicians and other members of the healthcare team to reduce the incidence and improve the management of diet-related chronic disease, especially cardiovascular disease. Dietary screening or counseling is not usually a component of routine medical visits. Moreover, numerous barriers exist to the implementation of screening and counseling, including lack of training and knowledge, lack of time, sense of futility, lack of reimbursement, competing demands during the visit, and absence of validated rapid diet screener tools with coupled clinical decision support to identify actionable modifications for improvement. With more widespread use of electronic health records, there is an enormous unmet opportunity to provide evidence-based clinician-delivered dietary guidance using rapid diet screener tools that must be addressed. In this scientific statement from the American Heart Association, we provide rationale for the widespread adoption of rapid diet screener tools in primary care and relevant specialty care prevention settings, discuss the theory- and practice-based criteria of a rapid diet screener tool that supports valid and feasible diet assessment and counseling in clinical settings, review existing tools, and discuss opportunities and challenges for integrating a rapid diet screener tool into clinician workflows through the electronic health record.

Maya Vadiveloo, PhD, RD, FAHA, Chair
Alice H. Lichtenstein, DSc, FAHA, Vice Chair
Cheryl Anderson, PhD, MPH, FAHA
Karen Aspry, MD, MS, FAHA
Randi Foraker, PhD, FAHA
Skylar Griggs, MS, RD, LDN
Laura L. Hayman, PhD, MSN, FAHA
Emily Johnston, MPH, RDN, CDE
Neil J. Stone, MD, FAHA
Anne N. Thorndike, MD, MPH, FAHA
On behalf of the American Heart Association Council on Lifestyle and Cardiometabolic Health; Council on Arteriosclerosis, Thrombosis and Vascular Biology; Council on Cardiovascular and Stroke Nursing; Council on Clinical Cardiology; and Stroke Council

Key Words: AHA Scientific Statements ■ cardiovascular diseases ■ decision support systems, clinical ■ diet ■ electronic health records ■ point-of-care systems

https://www.ahajournals.org/journal/circoutcomes

Poor dietary quality has surpassed all other mortality risk factors, accounting for 11 million deaths and ≈50% of cardiovascular disease (CVD) deaths globally.[1] Paralleling this trend, US healthcare expenditures have grown steadily and now represent 17.9% of the gross domestic product in 2016,[2] nearly half of which was accounted for by obesity-related conditions ($1.42 trillion/y).[3] Dietary interventions focused on single nutrients (eg, vitamin D, omega-3 fatty acids) have not adequately reduced incident CVD.[4–7] Conversely, dietary patterns low in fruits, vegetables, and whole grains and high in red and processed meat, added sugars, sodium, and total energy are the leading determinants of CVD, Alzheimer disease, some cancers, and diabetes mellitus risks.[1,2] As a result, strategies that promote holistically healthier dietary patterns to reduce chronic disease risk are of contemporary importance.[8]

Despite the importance of diet quality, most clinicians and other members of the healthcare team do not currently assess or counsel patients about their food and beverage intake during routine clinical care[9,10] because of clinical constraints. Clinical practice barriers include lack of training and knowledge, lack of time, insufficient integration of nutrition services into many healthcare settings, lack of reimbursement, and competing demands during the visit.[10–13] Inadequate nutrition training among clinicians and other members of the healthcare team represents a structural contributor to diet-related disease.[13] However, these barriers can be overcome. Recent evidence suggests that even brief training can increase physician self-efficacy in dietary counseling.[14] In addition, a brief diet screener tool, particularly one that provides clinical decision support (CDS) and can be tracked through electronic health records (EHRs), is likely to reduce some of these barriers by providing an efficient and valid assessment of diet quality and identifying actionable modifications for improvement appropriate for practitioners without adequate training to intervene. Such assessment is a necessary first step to support dietary changes, which are ideally part of a more comprehensive plan.

Once diet is assessed, CDS can help clinicians and other members of the healthcare team engage patients in diet education and evidence-based behavior counseling. For instance, a systematic review conducted by the US Preventive Services Task Force found that in adults not at high risk for CVD, behavioral counseling for diet and physical activity resulted in modest benefits in blood pressure, low-density lipoprotein and total cholesterol levels, and body weight, resulting in a US Preventive Services Task Force C recommendation for a positive but small benefit.[15,16]

The usability and ultimately use of rapid diet screener tools in clinical settings will depend on their ability to deliver the right data to the right people at the right time.[17] The term *right data* implies that CDS tools provide not only accurate information but also, in the case of dietary screener data, actionable steps for improvement. In the context of a short clinical encounter, dietary data must be presented in a clear, easily digestible format to prompt shared decision-making between the right people: a patient and the clinician. Attention should be paid to the workflow of the encounter to ensure that EHR-based diet screeners and related CDS tools occur at the right time during the clinical encounter without interrupting the course of usual care.[18]

The objectives of this American Heart Association (AHA) scientific statement are to provide a rationale for adopting a rapid diet assessment tool in clinical settings, to discuss the emerging role of clinicians and other members of the healthcare team in diet screening and counseling, and to provide an evidence-based assessment of tools currently available and feasible for integration into the EHR. The statement specifically focuses on the rationale and feasibility for rapid diet assessment in clinical settings among adults 20 to 75 years of age, desired theory- and practice-based criteria for a rapid diet screener tool and review of existing tools, implementation and challenges of a diet screener tool, and considerations for integrating a rapid diet screener tool into the EHR. The target audience for this statement is clinicians and other members of the healthcare team who focus on preventing and treating chronic diseases in diverse clinical practice settings. The statement is not intended to comprehensively review tools needed for secondary prevention/therapeutic diets or specialized clinical, nonadult populations, nor does it focus on the applications of dietary screening data for population health monitoring or quality assessment improvement across practice settings.

RATIONALE FOR CLINICIAN-DELIVERED DIET ASSESSMENT AND COUNSELING

The massive health impacts of poor diet quality in the United States and globally[1] and the potential for large reductions in healthcare costs and enhanced quality of life from population-wide improvements in diet quality[19] provide a strong rationale to increase the delivery of diet assessment, education, and counseling by clinicians and other members of the healthcare team in diverse healthcare settings. Moreover, the consistent evidence that low nutrition knowledge negatively affects diet quality and clinician-delivered diet counseling improves diet behaviors and cardiometabolic risk factors[15,16,20,21] supports adoption of routine integration of diet assessment and counseling into diverse healthcare settings.

For instance, national data have shown that US adults 20 to 65 years of age have suboptimal diet quality, achieving 60% to 65% of ideal scores.[22] Although diet quality is positively correlated with socioeconomic indicators, low nutrition knowledge was associated with low diet quality regardless of education and income.[8]

Similarly, in the Italian Moi-sani cohort, higher nutrition knowledge was associated with better adherence to the Mediterranean diet and a lower prevalence of obesity.[23] These data underscore the importance of increasing nutrition knowledge to improve diet quality.[22]

In addition, increased delivery of diet assessment and counseling by clinicians and other members of the healthcare team aligns with the transformation of healthcare delivery in the United States to value-based accountable care and population health management. The national prevention strategy of the 2010 Affordable Care Act called for these efforts to extend to entire practice-based populations; to be focused on the behavioral determinants of health, including healthy eating; and to be better integrated with public health sector efforts.[24]

The evidence that clinician-delivered diet assessment, education, and counseling can improve diet-related behaviors and cardiometabolic risk factors has been summarized in recent reviews.[25–27] Even brief diet counseling led to a significant, albeit modest, improvement in diet quality,[25] as well as body weight, total cholesterol, low-density lipoprotein cholesterol and fasting glucose concentrations, systolic and diastolic blood pressures, and incident diabetes mellitus.[26,27] Limited evidence demonstrated that intensive counseling involving registered dietitians increased dietary quality by increasing the intake of fruits, vegetables, and nuts and decreasing the intake of commercial baked goods.[28] As a result, the Centers for Disease Control,[29] US Preventive Services Task Force,[27] AHA/American College of Cardiology Foundation guidelines for the secondary prevention of coronary artery disease,[30] and American College of Cardiology/AHA guideline for the primary prevention of CVD recommend dietary counseling by clinicians and other members of the healthcare team.[31] Recent evidence that diet quality may be suboptimal even after a diagnosis of coronary disease also supports outpatient diet counseling in primary and secondary prevention settings.[32,33] Last, limited evidence demonstrates the utility of dietary screeners in measuring dietary changes associated with behavioral interventions.[34] In summary, the efficacy of dietary counseling for improving diet quality and cardiometabolic risk factors both in the population at large and among those with established disease provides additional support for incorporating evidence-based dietary screening and counseling of patients into clinical practice.[25]

FEASIBILITY OF CLINICIAN-DELIVERED DIET ASSESSMENT AND COUNSELING

Population-wide dietary assessment and counseling by clinicians and other members of the healthcare team have become more feasible in the past decade as the reach of health systems has expanded. The percentage of US adults <65 years of age who have CVD risk factors and are covered by healthcare insurance has increased significantly since passage of the 2010 Affordable Care Act.[35] The percentage of adults who have contact with clinicians and other members of the healthcare team annually is 85%; the average is 3 to 4 times yearly.[36] Primary care clinicians, cardiologists, and endocrinologists treat the majority of adults with hypertension, hyperlipidemia, and diabetes mellitus, and evidence-based dietary interventions are included in the management guidelines for these conditions.[37–39]

Also in support of the feasibility and efficacy of dietary assessment and counseling by clinicians and other members of the healthcare team are data that show that most patients view clinicians as credible and trusted sources of dietary advice.[40,41] Many clinicians have indicated interest in discussing diet with their patients and view this activity as within the scope of their practice.[13,40,42] Low perceived knowledge, limited self-efficacy, and lack of time were cited as barriers.[43] Because the EHR provides CDS, documentation, and referral processes, it is more feasible to incorporate diet assessments into existing workflows with less clinical burden than previously. Even as medical nutrition training and competencies improve, a rapid diet screener can help standardize diet assessment in clinical practice and facilitate tracking, benchmarking, and the improvement of diet quality.

DESIRED THEORY-BASED FEATURES OF A RAPID DIET SCREENER TOOL

All self-reported dietary tools are subject to some measurement error and bias; therefore, diet assessment tools must undergo extensive reliability and validity testing. In this advisory, we a priori established theoretical and practice-based criteria for an optimal diet screener tool (Table 1) applicable for assessing diet quality in the US adult population 20 to 75 years of age.[45,46] In reviewing the literature, we emphasized diet screener tools developed or used in clinical practice within the past 10 years that evaluated the total diet rather than single food groups (eg, fruits and vegetables) or nutrients. Tools that evaluated total diet were emphasized to ensure that the tools evaluated reflected up-to-date dietary guidance and captured foods to limit and encourage in recognition that dietary patterns are complex and individual components may have synergistic effects. A detailed summary of brief diet screener tools is provided in Supplemental Tables 1 and 2. For each identified criterion, we allocated 0, 0.5, or 1 point if the dietary screening tool met those criteria and summed them to generate a total score; screeners ranged from meeting 2.5 to 9 of 10 established criteria.

Of the 15 tools reviewed for this statement, the 3 that met the greatest number of theoretical and practice-based validity criteria were the Mediterranean Diet Adherence Screener (MEDAS)[47–51] and its variations,[52] the modified, shortened Rapid Eating Assessment for Participants

Table 1. Proposed Theoretical and Practice-Based Criteria for a Rapid Diet Screener Tool in Healthcare Settings

Optimal Diet Screener Tool Characteristics	Definition
Theoretical factors	
Evaluates total diet quality	Assesses adherence to a dietary pattern or combination of foods and nutrients to encourage and foods and nutrients to discourage
Test-retest reliability assessed	Repeat testing over a short period will produce similar results
Validity assessed against another complete dietary assessment method such as an FFQ, food record, or 24-h recall	Diet assessed via the screener vs an established diet assessment method similarly evaluate the overall quality of the diet
Validity assessed within multiple populations of US adults 20–75 y of age, across diverse racial/socioeconomic and clinical/nonclinical populations	Tool developed is generalizable among adults of different backgrounds
Validity assessed by examination of association between scores on the diet screener tool and health biomarkers	Individuals with high vs low scores on the screener have observable differences in cardiometabolic risk factors
Practice-based factors	
Brief	Diet screener tool can be used in the time-sensitive clinical setting taking <10 min to complete (previously established as no more than 35 items)
Provides CDS	Provides immediate guidance on healthy dietary changes, identifies future goals, or allows clinicians and other members of the healthcare team to quickly identify patients who may need more intensive counseling. Diet screener tool is part of a customizable clinical protocol resulting in a plan of action (ie, guidelines for immediate clinician-initiated dietary counseling or referrals for more intensive nutrition or behavioral therapies).[12]
Sensitive to change over time	The screener will capture changes in a person's diet over time
Able to be completed at administration without special knowledge or software	Screener is easy to learn and use in the clinical setting with diverse populations. Patients, clinicians, and other members of the healthcare team should be able to administer it.
Able to be scored at administration without special knowledge or software	Scoring should be automatic if electronic or easy to calculate. Diet screener tool is accessible and universally implemented by primary care and specialty clinicians and other members of the healthcare team in an EHR to provide consistent delivery of nutritional advice across specialties and to enable dietary adherence monitoring.[44]
Useful for chronic disease management	Clinicians, other members of the healthcare team, and patients should be able to understand the score and ways to improve the score. The diet screener tool should be validated for various populations for both cardiometabolic risk factors and monitoring of dietary changes.

CDS indicates clinical decision support; FFQ, food frequency questionnaire; and EHR, electronic health record.

(REAP),[53–55] and the modified version of the previously validated Starting the Conversation tool (Table 2).[43,56]* Although the Starting the Conversation tool met 0.5 fewer criteria than the PrimeScreen tool, we chose to discuss it given its frequency of use in clinical practice.

Briefly, the original 14-item MEDAS[51] was developed and validated in the PREDIMED study (Prevención con Dieta Mediterránea) conducted in Spain from 2003 to 2009. In 2011, the screener was compared with a full-length, 135-item food frequency questionnaire in >7000 older adults at high risk for CVD. There was moderate agreement between the MEDAS and food frequency questionnaire results (r=0.52, P<0.001). Higher MEDAS scores were associated with higher high-density lipoprotein cholesterol (P<0.0001) and lower body mass index, waist circumference, triglyceride concentrations, triglyceride/high-density lipoprotein ratio, fasting glucose concentrations, total cholesterol/high-density lipoprotein ratio, and 10-year coronary artery disease risk.[51] The 14-item screener has subsequently been validated in smaller samples in Germany[48] and England.[47] More recently, the English version of the MEDAS was validated in a clinical sample of UK adults 55 to 80 years of age who were at high risk for CVD, although no significant associations between the MEDAS score and cardiometabolic risk factors were observed.[49]

To date, 2 studies have applied the MEDAS to US populations. The first study used forward and backward translation from Spanish to English to incorporate the MEDAS into an EHR within the EPIC system in a US neurology clinical practice.[50] A corresponding electronic flow sheet provided CDS (ie, auto-scoring and auto-interpretation) to allow responses to be reviewed with patients. It was recommended that patients with scores <10 be referred to a registered dietitian nutritionist. Notably, the system automatically incorporated results from the MEDAS into the progress note, capturing data relevant for diet quality improvement and practice-based research. Although the English-translated tool was not specifically validated, lower MEDAS scores were associated with higher body mass index and higher prevalence of hypertension. The second study[52] from the same research group developed the Mediterranean Eating Pattern for Americans, which added 2 questions and altered target intakes for some foods. The Mediterranean Eating Pattern for Americans was validated against a 156-item food frequency questionnaire, and although the concordance between the Mediterranean Eating Pattern for Americans and food frequency questionnaire was less than in the original validation study in Spain,[51] higher scores remained positively associated with higher diet quality and were marginally, but not significantly, associated with lower body mass index.

Overall, the MEDAS and Mediterranean Eating Pattern for Americans screeners met most of the theoreti-

*The tools listed here serve only to illustrate examples of these types of tools. This is not intended to be an endorsement of any commercial product, process, service, or enterprise by the AHA.

Table 2. Rapid Diet Screener Tool Options for Clinical Settings

Least time-intensive: expert opinion	Nutrition screening protocol	Powell and Greenberg Screening Tool[44]	
		1. How often per week do you eat ≥5 fruits and vegetables?	
		2. How often do you consume sugary food/drinks (juice, sweeteners in coffee or tea, sugary sodas)?	
	Starting the Conversation*	Ask about the frequency of these dietary intakes occurring over the previous few months[43,56]	
		1. Fast food meals or snacks per month	
		2. Servings of fruit per day	
		3. Servings of vegetables per day	
		4. Regular sodas, juices, or other sugary beverages per day	
		5. Servings of beans, nuts, chicken, or fish per week	
		6. Regular snack chips or crackers per week*	
		7. Desserts and other sweets per week*	
		8. Use of butter or meat fat*	
	REAP-S[54,55,57]	In an average week, how often do you:	
		1. Skip breakfast	9. Eat fried foods such as fried chicken, fried fish, French fries, fried plantains, tostones, or fried yuca?
		2. Eat ≥4 meals from sit-down or take-out restaurants?	10. Eat regular potato chips, nacho chips, corn chips, crackers, or regular popcorn instead of unsalted nuts, or air-popped popcorn?*
		3. Eat <2 servings of whole-grain products or high-fiber starches a day?	11. Add butter or margarine to bread, potatoes, rice, or vegetables at the table?*
		4. Eat <2 servings of fruit a day?	12. Eat sweets such as cake, cookies, pastries, donuts, muffins, chocolate, and candies >2 times per day?
		5. Eat <2 servings of vegetables a day?	13. Drink ≥16 oz of nondiet soda, fruit drink/ punch, or Kool-Aid a day?
		6. Eat or drink <2 servings of milk, yogurt, or cheese a day?	14. Usually shop and cook (you or a family member) rather than eating sit-down or take-out restaurant food?
		7. Eat >8 oz of meat, chicken, turkey, or fish per day?	15. Usually feel well enough to shop or cook?
		8. Eat regular processed meats (bologna, salami, corned beef, hot dogs, sausage, or bacon) instead of low-fat processed meats (roast beef, turkey, lean ham, low-fat cold cuts/hot dogs)?	How willing are you to make changes in your eating habits to be healthier?
	MEDAS[50,51]	1. Do you use olive oil as the principal source of fat for cooking?	
		2. How much olive oil do you consume per day (including that used in frying, meals eaten away from home, salads, etc)?	
		3. How many servings of vegetables do you consume per day?	
		4. How many pieces of fruit (including fresh-squeezed fruit juice) do you consume per day?	
		5. How many servings of red meat, hamburger, or meat products (ham, sausage, etc) do you consume per day?	
		6. How many servings of butter, margarine, or cream do you consume per day?	
		7. How many sugar-sweetened beverages do you drink per day?	
		8. How much wine do you drink per week?	
		9. How many servings of pulses do you consume per week?	
		10. How many servings of fish or shellfish/seafood do you consume per week?	
		11. How many times per week do you consume commercial sweets or pastries (not homemade) such as cakes, cookies, biscuits, or custard?	
		12. How many servings of nuts (including peanuts) do you consume per week?	
		13. Do you prefer to eat chicken, turkey, or rabbit meat instead of beef, pork, hamburgers, or sausages?	
Most time-intensive: validated short diet screeners		14. How many times per week do you consume cooked vegetables, pasta, rice, or other dishes prepared with a sauce of tomato, garlic, onions, or leeks sautéed in olive oil (sofrito)?	

MEDAS indicates Mediterranean Diet Adherence Screener; and REAP-S, Rapid Eating Assessment for Participants–Shortened.
*These questions were modified to reflect current nutrition recommendations for dietary fat. The modified questions have not been validated.

cal and clinical validity criteria (Table 1) for a rapid diet assessment screening tool for use in clinical settings. They assess total dietary quality, demonstrate criterion and predictive validity, are brief, and can be administered across diverse populations remotely or in person with a computer, mobile application, or paper form. Either can be used to provide CDS by numerous clinicians and other members of the healthcare team.

A second dietary screener tool that has been used frequently is the REAP and shorter REAP-S. The first version of the REAP was developed[53] with the intent of providing a tool to rapidly assess and discuss diet quality with patients, particularly in lower-income populations. The 27- to 31-item REAP questionnaire has been validated with the Healthy Eating Index[58] (r=0.49, P=0.0007), a diet-quality index used to evaluate concordance with US dietary guidance, and has been demonstrated to have good test-retest reliability (r=0.86). However, because the original tool emphasized limiting dietary fat, only updated modified versions reflect contemporary nutritional guidance.[54] A recent report that compared the unmodified REAP tool with a modified version found that older white adults with higher REAP scores had lower odds of executive dysfunction and that the results were similar between the 2 versions.[57] The shortened version (16-item REAP-S), which had less focus on dietary fat, was recently compared with the Healthy Eating Index–2010 in a group of healthy adult omnivores and vegetarians.[54] The REAP-S scores were moderately correlated with the Healthy Eating Index–2010 and with the nutrient density of the diet. Taken together, the REAP tools have some of the established criteria deemed important for an optimal brief diet assessment tool for use in diverse clinical settings, including a physician key to guide dietary advice.

Last, the modified Starting the Conversation tool[43] assesses dietary intake and provides CDS with only 8 questions. Although the tool was not validated against a complete dietary assessment method, it was sensitive to dietary changes over 2 years and able to be used by a range of clinicians and other members of the healthcare team.[56] It also has been used among patients with a diagnosis of heart failure, and among this clinical sample, better dietary habits moderated the association between heart failure and cognitive impairment.[59]

DESIRED PRACTICE-BASED FEATURES OF A DIET SCREENER TOOL

The adoption of evidence-based validated diet screener tools is necessary and desirable in clinical practice, yet their use must also be balanced against practical constraints: time and workflow. Thus, as it pertains to clinical utility, this section discusses existing tools ordered from the least to most time-consuming and includes both evidence-based data and expert opinion (summarized in Figure 1 and Table 2).

Almost 16 years ago, there was a call to action for clinicians and other members of the healthcare team to play a key role in combatting the twin epidemics of excess body weight and physical inactivity.[60] Yet, annual physician visits generally remain an overlooked opportunity to screen patients with regard to diet and physical activity. The challenges in assessing diet in clinical settings are practical and relate primarily to time available to assess diet quality, to provide actionable steps to patients, and to enter the information into the EHR.

To start a conversation about lifestyle related behaviors, the simplest tool available includes only 2 questions (Table 2). These questions can be asked by the clinician, medical staff, web-based educational site, or a community resource person.[44] Because of the brevity of the tool, it may be advantageous for clinicians to administer the questions, given the high level of respect for their advice and their ability to motivate patients to change behaviors.[60–65] Similar to other screening questions administered in primary care settings, patients who score higher than a certain threshold (indicating greater dietary risk) would be prompted for additional counseling or a more detailed dietary assessment.[44]

Many clinicians have developed their own tools to start a discussion about diet quality and CVD prevention. Some of these tools share elements with validated rapid diet screener tools (Table 2).[44,46,49–51,56,66–68] For example, clinicians have asked patients to rate their diet from 1 to 10 (poor to optimal) and then asked patients to indicate why they gave the score they did and to further indicate what food changes would be needed to be an 8 or 9 of 10. Some patients quickly identify eating out and having too much salt or carbohydrates. If the score is ≤6, the patient is referred for more formal counseling. In 2004, during his AHA presidential address, Dr Robert Eckel endorsed the use of a 3-minute diet and lifestyle patient interview[12] that was easy to implement and provided actionable goals for the patient to work on for a follow-up visit. Since that time, EHRs have become ubiquitous, making it easier to capture information elicited from a short interview and have it available for future discussions. Such discussion may encourage patients to reduce their intake of added sugar and substitute fish or chicken for red and processed meat.[14,69,70] Although many of these tools reflect prudent dietary advice, greater adoption of validated tools in clinical settings can assist in standardizing evidence-based approaches going forward.[12] Table 2 summarizes some of the available tools, emphasizing the degree to which they have been validated and their approximate length. Although many of the longer, validated tools provide greater ability to monitor changes in a patient's diet over time and to correlate them with diet-related cardiometabolic risk markers, the tool that clinicians and other members of the healthcare team select will be determined largely by time constraints in their existing workflows.

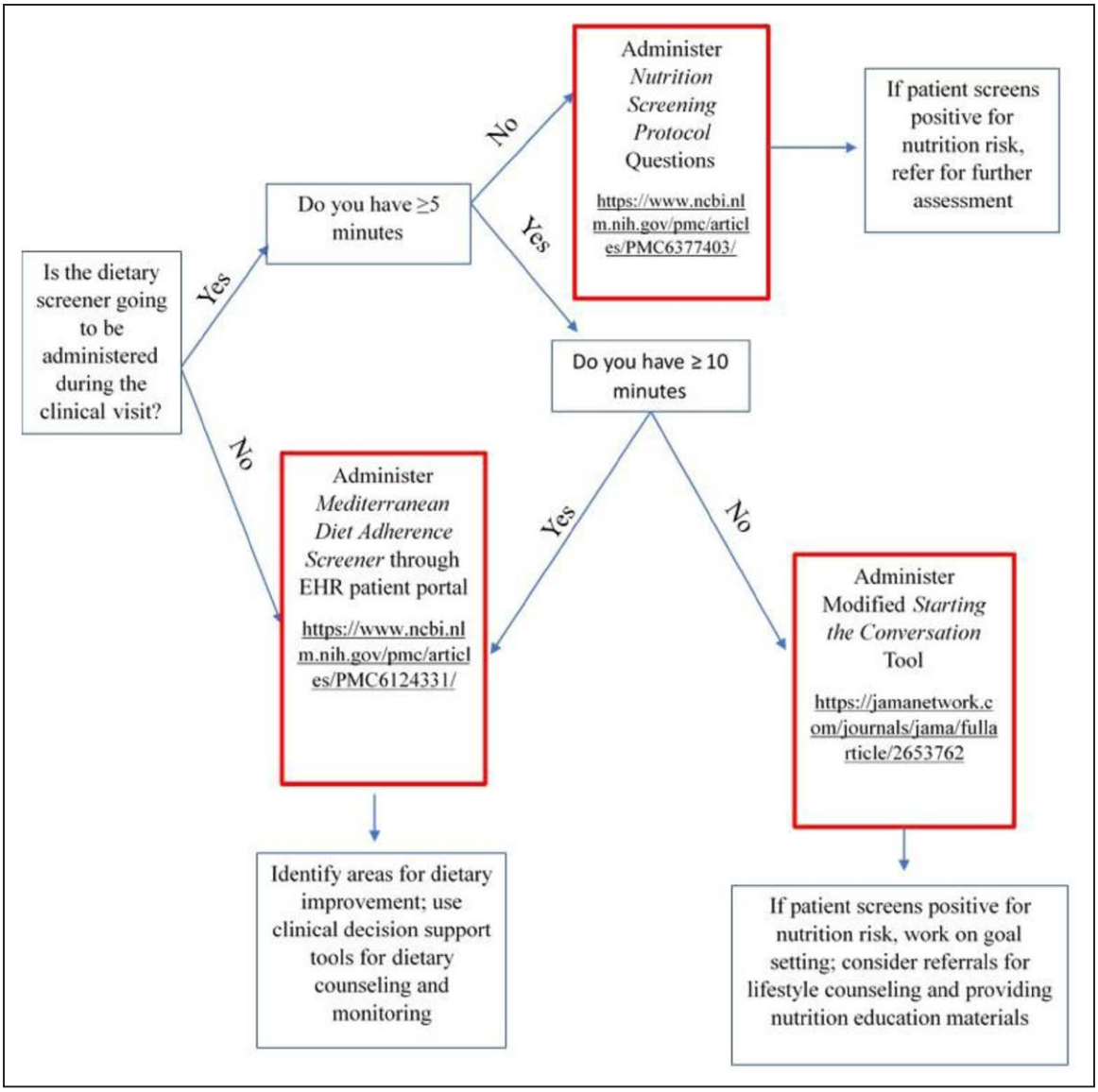

Figure 1. Clinical decision support chart for rapid diet screener tool selection.
This provides clinicians with scaffolding to help choose the most appropriate diet screener tool given the constraints they may experience within their specific clinical settings. EHR indicates electronic health record.

In the future, if nutrition researchers and clinicians use consensus group methods[71] when developing new rapid diet screener tools, it can help ensure that tool development reflects theoretical and practice-based expertise. Adding any time to existing clinician workflows is challenging, and partnerships between clinicians and other members of the healthcare team and nutrition providers and researchers are essential for consistent implementation of a rapid diet screener that measures and reflects current dietary guidance.

IMPLEMENTATION AND CHALLENGES OF A DIET SCREENER TOOL

Broad integration of diet screener tool into clinical settings represents a major change to current standards of practice and thus requires evidence of effectiveness to encourage adoption. The use of a brief diet screener tool has been documented to validly measure patients' dietary quality in ambulatory settings.[46,53,56] As noted, there is growing recognition that behavioral lifestyle counseling can modestly benefit cardiometabolic health[15,16] and that more intensive counseling can lead to further improvement.[28] Although several rapid validated diet screener tools are now available (Supplemental Tables 1 and 2), few studies have evaluated the effectiveness of these tools in promoting improved diet quality.

A study evaluating a 27-question REAP tool surveyed medical students and primary care clinicians to determine the feasibility of implementation.[53] Overall, the clinicians rated the tool moderately high for ease of use, practicality, usefulness, and length. The 8-question

Table 3. 5As Framework for Behavior Change

Assess: Assess risk, current behavior, and readiness to change
Advise: Advise change in specific behaviors
Agree: Agree to and collaboratively set goals
Assist: Assist in addressing barriers and securing support
Arrange: Arrange for follow-up, including referrals if needed

Starting the Conversation tool was evaluated among adults with type 2 diabetes mellitus participating in a self-management intervention. The results indicated that the tool was feasible for use in a primary care setting and was sensitive to treatment-related changes in dietary intake.[56] Although this tool, like the REAP, does not reflect current guidance on dietary fat, an adapted version of the Starting the Conversation tool has been developed that reflects contemporary dietary recommendations.[43] The 14-item MEDAS questionnaire for adherence to the Mediterranean diet was evaluated within the context of a structured clinical documentation support tool built into the EHR.[50] This study demonstrated the feasibility of using the EHR to capture and document in clinic notes the level of adherence and to provide immediate and specific dietary feedback with a numeric score to discuss with patients.

In an era when deficiencies in medical nutrition education and training persist, diet screener tools with CDS, including guidance on when to refer to another clinician, can bridge gaps in knowledge and competencies. Taken together, evidence suggests that some clinicians and other members of the healthcare team may be able to implement rapid diet screener tools into their clinical practice and workflows. Tools of a length similar to the MEDAS, when incorporated into the EHR, have been shown to be feasible in clinical workflows in some settings,[50] and knowledge about how best to implement these tools to promote behavior change and to improve health is progressing. Ultimately, information gleaned from a diet screener tool should enable clinicians and other members of the healthcare team to apply the 5As framework for dietary behavior change (Table 3), which operationalizes a clinical process for guiding patients through the process of improving their diet. Assessment is an integral first step to providing dietary advice and securing additional support to adopt dietary changes.[72] It should also eventually facilitate practice-level and system-level improvements in diet quality through tracking of diet-quality data in the clinical information system, reporting of diet outcomes, and engaging patients in efforts that will ultimately result in improved management of dietary risk and CVD at a population level. Given the lessons learned from implementing depression screening into clinical settings,[73] it is prudent to consider advocating for integration of dietary screening into the EHR and making it a standard billable practice to incentivize adoption by clinicians. In addition, if accountable care organizations add routine dietary screening as a core quality measure, it may more readily be adopted as a standard-of-care measure in primary care settings.

Table 4. Strengths and Limitations of 2 Approaches to EHR Data Collection

	Strengths	Limitations
Rapid diet screener tools completed by patients via EHR portal	Lower perceived risk of judgment by clinicians and other members of the healthcare team for responses	Limited reach into underserved populations
	Completed at patients' convenience	Potentially less reliable than clinician-administered diet screener tools
	Perceived as important if request to complete comes from clinician	Ineffective if dietary data are not reviewed by clinicians and other members of the healthcare team
Rapid diet screener tools completed by clinicians and other members of the healthcare team in the EHR template	Collected in real time and used in shared decision-making during encounter	Lack of ownership of task by clinicians and other members of the healthcare team
	Perceived as more reliable by clinicians because completed by a professional	Healthcare system referral resources may not exist to address diet
	Framed as a vital sign for clinicians	Low prioritization by clinician during short clinical encounter

EHR indicates electronic health record.

CONSIDERATIONS FOR INTEGRATING A RAPID DIET SCREENER TOOL INTO THE EHR

Clinicians, from primary care to specialist clinicians, often cite difficulty with completing clinical tasks, including documentation of the healthcare visit, during the allotted time frame.[74] The EHR is the ideal platform to prompt clinicians and other members of the healthcare team to capture dietary data and deliver dietary advice to patients[75] because it not only allows secure storage of data but also enables access to these data when needed at the point of care and for documentation purposes. There are 2 primary mechanisms for collecting such data via the EHR: a rapid diet screener tool completed by the patient using an EHR portal[76] or manual entry of data by clinicians and other members of the healthcare team into a dietary tool EHR template (Table 4).[77] For either approach, structured data elements are preferred not only for their ease of completion (yes/no versus fill-in-the-blank responses) but also to avoid the complicated downstream interpretation of unstructured (ie, narrative) data elements.

The feasibility of conducting wellness assessments via patient-facing EHR portals has been demonstrated.[76,78]

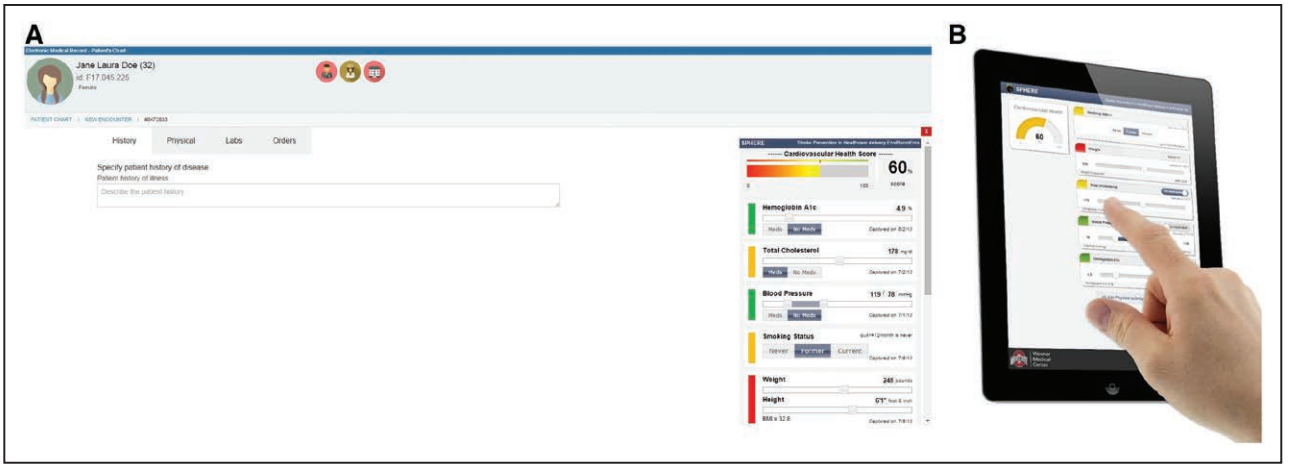

Figure 2. Prototypes of electronic health record (EHR) diet screener tools.
Complementary EHR–embedded (**A**) and mobile health (**B**) applications[80] to assist in the visualization of EHR-based screeners in clinical settings across platforms.

A current limitation to collecting data from patients via EHR portals is their reach. Although nearly 9 in 10 office-based physicians have adopted some form of an EHR, 50% do not take advantage of more advanced features.[79] In addition, underserved populations, for example, racial minorities or those from rural areas, are less likely to have access to and to be regular users of patient portals.[78] Healthcare systems with opt-out strategies for patient portal access (ie, enrolling all patients by default and requiring them to actively unenroll) may have fewer disparities in use among underserved populations than those with opt-in strategies, which require potential users to register to use the system. Complex or multistep patient portal registration processes could also serve as a barrier to the use of EHR portals.

Manual entry of dietary data into an EHR data template by clinicians and other members of the healthcare team is preferable to using a separate platform in which to enter relevant data. Data entered on an external website are not stored in the EHR, and although that information is available for use to counsel the patient during the session, the external website does not provide a record of the patient-clinician dietary discussion. Conversely, dietary data via the EHR are available for use during a clinical encounter and are permanently recorded in the patient's health record. To deliver the data from rapid dietary screeners to the point of care, the EHR must be programmed to make the data available.[80] Feedback from rapid diet screener tools can be presented to clinicians within the EHR in the form of a best-practice alert. A pop-up message can remind clinicians to perform a task. Best-practice alerts can also prompt referrals to dietitians and other resources within the healthcare system. In addition, key messages to improve diet quality can be added to after-visit summaries with the use of keyboard shortcuts. More sophisticated EHR-embedded web applications can be delivered to the point of care to give clinicians options for providing next steps to patients and to prompt clinicians to engage in shared decision-making for health behaviors.

Most common EHR platforms have extant functionality for displaying a web application within the EHR viewing screen so that clinicians and other members of the healthcare team do not have to navigate to an external website (Figure 2A). Such web applications can be programmed to automatically populate with EHR data and to be interactive to enhance shared decision-making at the point of care.[81] Mobile health applications can be designed to mimic EHR-embedded applications and may serve to extend the impact of the intervention beyond the point of care (Figure 2B).[80]

Historically, the use of myriad EHR platforms and versions of platforms has presented technical challenges to scalability that have been difficult to surmount.[82] Specifically, the differences between EHR platforms and versions therein required programming web applications and other EHR-embedded solutions that were specific to each platform and version of the platform. Recently, standardized approaches have emerged for transmitting health data that will more seamlessly allow rapid diet screeners to be implemented in the EHR.[83,84] These approaches also enhance the scalability of such tools across institutions. Although technically it has become easier to disseminate EHR-based tools widely across platforms and versions of platforms, institutional approval processes for such tools need to be integrated into the EHR if they are not part of the scheduled EHR software update.

Once rapid diet screeners tools are implemented in the EHR, it is critical to quantify usability, workflow integration, and level of patient-clinician communication with the use of such tools to ensure their continued impact on health. Before EHR implementation, prototypes of rapid diet screeners can be tested by end users using a think-aloud protocol.[85] Assessing usability of the assessment before implementation can determine whether changes need to be made before implemen-

tation for use within certain clinics or among certain clinicians and other members of the healthcare team. Gathering these data ahead of time can improve the uptake of the application in the real world.[86]

NEW CALLS TO ACTION AND CURRENT GAPS IN CLINICIAN-DELIVERED DIET ASSESSMENT, EDUCATION, AND COUNSELING

Despite the evidence supporting the value of diet assessment, education, and counseling by clinicians, data have shown sizable gaps in the percentage of patients who report receiving clinician-delivered dietary counseling. According to data from National Health Interview Surveys, the prevalence of dietary counseling by physicians in 2000 was 24%, increasing to 33% in 2011.[10] Disparities in diet counseling related to access to health care and differences based on ethnicity and sex were found. Men and the uninsured were significantly less likely to receive diet counseling; paradoxically, those with higher socioeconomic status were more likely to report more diet counseling despite generally having higher diet quality.[10]

Recent evidence suggests that nutrition education for clinicians, combined with the creation of a culture that values dietary counseling, increased clinician engagement.[87] However, survey data have consistently demonstrated that physicians cite insufficient nutrition training and knowledge as a major barrier to engaging patients in diet counseling, even during their peak learning years.[9,88,89] These data align with ongoing gaps in medical nutrition education and training,[90,91] underscoring an imminent need to better integrate nutrition education and competencies into medical school curricula.[92] Recently, both the American College of Lifestyle Medicine[69] and the American Association of Medical Colleges have called for greater incorporation of behavioral and social sciences into medical school and training curricula and for competencies related to behavior counseling.[93] Similarly, the AHA and American College of Lifestyle Medicine have called for renewed efforts to improve medical nutrition education, training, and professional competencies across healthcare professionals.[11,69] Although the largest body of evidence emphasizes the need for nutrition training in medical schools and residencies, training for physician assistants, nurses, pharmacists, and others is also limited and important.[94,95] In the absence of such training, a valid rapid diet screener tool with CDS can help bridge the gap in conducting diet assessment and providing feedback in clinical settings.

Table 5. Future Research Needs

Validate existing modified diet screener tools used in clinical practice
Test utility within diverse populations
Evaluate longitudinal associations with cardiometabolic risk factors
Develop novel diet screener tools using applications of machine learning
Develop and validate diet screener tools for special populations (eg, pediatric, secondary prevention, geriatric)
Evaluate the feasibility of implementing diet screener tools in clinical settings
Process evaluation
Focus groups or in-depth interviews with clinicians and other members of the healthcare team and patients

FUTURE RESEARCH OPPORTUNITIES TO IMPROVE EXISTING DIET SCREENER TOOLS

Although some groups have altered available diet screener tools to conform to current dietary guidance,[43,57] thorough validation of these modified tools is needed, particularly in diverse populations. Included in these validation studies should be the predictive validity in relation to cardiometabolic risk factors in both primary and secondary prevention settings. Relevance for secondary prevention of chronic disease (eg, specialist visit for hyperlipidemia, diabetes mellitus, hypertension, and coronary heart disease)[46] may require more focused assessment of specific aspects of dietary intake, including eating frequency and timing. Of contemporary interest is the use of machine learning to develop and validate diet screener tools. One example of these efforts was conducted in a group of French-speaking adults in Quebec for whom a supervised learning approach was used to identify food patterns most predictive of health outcomes that included a maximum of 6 questions.[96] Subsequently, the algorithm classified individuals into mutually exclusive subgroups optimized to identify individuals at risk of having low diet quality. Although supervised learning within diet assessment may enhance tool development for specialized populations, the primary advantage of supervised learning versus static approaches is that it allows a highly specific assessment in only a few minutes. A summary of key areas to direct future research endeavors is provided in Table 5.

SUMMARY

This AHA scientific statement provides compelling rationale for adopting a rapid diet screener tool for use in clinical settings. This call to action is made after an assessment of the feasibility for clinicians and other members of the healthcare team to screen diet quality and to provide feedback in clinical settings, an evalua-

tion of existing rapid diet screener tools against optimal theory and practice-based features, and consideration of the necessity and practicality of integrating a rapid diet screener tool into the EHR.

It is evident that clinicians generally view dietary counseling as within their scope of practice, and clinician-delivered dietary counseling modestly improves diet quality and diet-related cardiometabolic risk factors. However, clinicians are constrained by lack of nutrition knowledge and time for patient counseling. Several existing rapid diet screener tools have been identified that meet theory- and practice-based validity criteria, some of which take <5 minutes to complete, have been integrated into EHRs, and provide immediate actionable dietary feedback. The process of integrating rapid diet screener tools into a health system is a complex but critical facet of improving primary and secondary prevention that ultimately involves concomitant consideration of the structural barriers (ie, time, reimbursement) that impede clinical care. This AHA scientific statement is designed to accelerate efforts to make diet quality assessment an integral part of office-based care delivery by encouraging critical conversations among clinicians, individuals with diet/lifestyle expertise, and specialists in information technology. In the future, providing regular diet assessment and recommendations based on validated clinical tools will help patients address the lifestyle changes they need for healthier lives and reduce the public health and economic burdens from CVD and other chronic diseases linked to poor diet quality.

Disclosures

Writing Group Disclosures

Writing Group Member	Employment	Research Grant	Other Research Support	Speakers' Bureau/ Honoraria	Expert Witness	Ownership Interest	Consultant/ Advisory Board	Other
Maya Vadiveloo	University of Rhode Island	None	None	None	None	None	None	None
Alice H. Lichtenstein	Jean Mayer USDA Human Nutrition Research Center on Aging at Tufts University	None	None	None	None	None	None	None
Cheryl Anderson	University of California, San Diego	None	None	None	None	None	None	None
Karen Aspry	Brown University, Lifespan Cardiovascular Institute	None	None	None	None	None	None	None
Randi Foraker	Washington University in St. Louis, School of Medicine	NIH (cardiovascular disease risk algorithm in the EHR)*	None	None	None	None	None	None
Skylar Griggs	Boston Children's Hospital	None	None	None	None	None	None	None
Laura L. Hayman	UMass Boston College of Nursing and Health Sciences	None	None	None	None	None	None	None
Emily Johnston	Penn State	American Heart Association (predoctoral fellowship 2019)†	None	None	None	None	None	None
Neil J. Stone	Northwestern University	None	None	None	None	None	None	None
Anne N. Thorndike	Massachusetts General Hospital	None	None	None	None	None	None	None

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.

ARTICLE INFORMATION

The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

This statement was approved by the American Heart Association Science Advisory and Coordinating Committee on May 15, 2020, and the American Heart Association Executive Committee on June 22, 2020. A copy of the document is available at https://professional.heart.org/statements by using either "Search for Guidelines & Statements" or the "Browse by Topic" area. To purchase additional reprints, call 215-356-2721 or email Meredith.Edelman@wolterskluwer.com.

Supplemental materials are available with this article at https://www.ahajournals.org/doi/suppl/10.1161/HCQ.0000000000000094.

The American Heart Association requests that this document be cited as follows: Vadiveloo M, Lichtenstein AH, Anderson C, Aspry K, Foraker R, Griggs S, Hayman LL, Johnston E, Stone NJ, Thorndike AN; on behalf of the American Heart Association Council on Lifestyle and Cardiometabolic Health; Council on Arteriosclerosis, Thrombosis and Vascular Biology; Council on Cardiovascular and Stroke Nursing; Council on Clinical Cardiology; and Stroke Council. Rapid diet assessment screening tools for cardiovascular disease risk reduction across healthcare settings: a scientific statement from the American Heart Association. *Circ Cardiovasc Qual Outcomes.* 2020;13:e000094. doi: 10.1161/HCQ.0000000000000094

The expert peer review of AHA-commissioned documents (eg, scientific statements, clinical practice guidelines, systematic reviews) is conducted by the AHA Office of Science Operations. For more on AHA statements and guidelines development, visit https://professional.heart.org/statements. Select the "Guidelines & Statements" drop-down menu, then click "Publication Development."

Reviewer Disclosures

Reviewer	Employment	Research Grant	Other Research Support	Speakers' Bureau/ Honoraria	Expert Witness	Ownership Interest	Consultant/ Advisory Board	Other
Stephen P. Juraschek	Beth Israel Deaconess Medical Center/Harvard Medical School	None	None	None	None	None	None	None
Aurelia Macabasco-O'Connell	Azusa Pacific University	None	None	None	None	None	None	None
Angela Odoms-Young	University of Illinois at Chicago	None	None	None	None	None	None	None
Allison R. Webel	Case Western Reserve University	Gilead Sciences (university received a research grant)†	None	Association of Nurses in AIDS Care*	None	None	None	None
Jean A. Welsh	Emory University	None	None	None	None	None	None	None

This table represents the relationships of reviewers that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all reviewers 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.

REFERENCES

1. GBD 2017 Diet Collaborators. Health effects of dietary risks in 195 countries, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2019;393:1958–1972.
2. National Center for Health Statistics. Health, United States, 2017: with special feature on mortality. 2017. https://www.cdc.gov/nchs/data/hus/hus17.pdf. Accessed July 1, 2020.
3. Waters H, DeVol R. Weighing down America: the health and economic impact of obesity. 2019. https://webcache.googleusercontent.com/search?q=cache:9Lh1hH57uDUJ:https://assets1b.milkeninstitute.org/assets/Publication/ResearchReport/PDF/Weighing-Down-America-WEB.pdf+&cd=2&hl=en&ct=clnk&gl=us&client=firefox-b-1-d. Accessed July 1, 2020.
4. Angellotti E, D'Alessio D, Dawson-Hughes B, Chu Y, Nelson J, Hu P, Cohen RM, Pittas AG. Effect of vitamin D supplementation on cardiovascular risk in type 2 diabetes. *Clin Nutr.* 2019;38:2449–2453. doi: 10.1016/j.clnu.2018.10.003
5. Manson JE, Cook NR, Lee IM, Christen W, Bassuk SS, Mora S, Gibson H, Albert CM, Gordon D, Copeland T, et al; VITAL Research Group. Marine n-3 fatty acids and prevention of cardiovascular disease and cancer. *N Engl J Med.* 2019;380:23–32. doi: 10.1056/NEJMoa1811403
6. Manson JE, Cook NR, Lee IM, Christen W, Bassuk SS, Mora S, Gibson H, Gordon D, Copeland T, D'Agostino D, et al; VITAL Research Group. Vitamin D supplements and prevention of cancer and cardiovascular disease. *N Engl J Med.* 2019;380:33–44. doi: 10.1056/NEJMoa1809944
7. Pittas AG, Dawson-Hughes B, Sheehan P, Ware JH, Knowler WC, Aroda VR, Brodsky I, Ceglia L, Chadha C, Chatterjee R, et al; D2d Research Group. Vitamin D supplementation and prevention of type 2 diabetes. *N Engl J Med.* 2019;381:520–530. doi: 10.1056/NEJMoa1900906
8. Liese AD, Krebs-Smith SM, Subar AF, George SM, Harmon BE, Neuhouser ML, Boushey CJ, Schap TE, Reedy J. The Dietary Patterns Methods Project: synthesis of findings across cohorts and relevance to dietary guidance. *J Nutr.* 2015;145:393–402. doi: 10.3945/jn.114.205336
9. Kolasa KM, Rickett K. Barriers to providing nutrition counseling cited by physicians: a survey of primary care practitioners. *Nutr Clin Pract.* 2010;25:502–509. doi: 10.1177/0884533610380057
10. Ahmed NU, Delgado M, Saxena A. Trends and disparities in the prevalence of physicians' counseling on diet and nutrition among the U.S. adult population, 2000-2011. *Prev Med.* 2016;89:70–75. doi: 10.1016/j.ypmed.2016.05.014
11. Aspry KE, Van Horn L, Carson JAS, Wylie-Rosett J, Kushner RF, Lichtenstein AH, Devries S, Freeman AM, Crawford A, Kris-Etherton P; on behalf of the American Heart Association Nutrition Committee of the Council on Lifestyle and Cardiometabolic Health; Council on Cardiovascular and Stroke Nursing; Council on Cardiovascular Radiology and Intervention; and Stroke Council. Medical nutrition education, training, and competencies to advance guideline-based diet counseling by physicians: a science advisory from the American Heart Association. *Circulation.* 2018;137:e821–e841. doi: 10.1161/CIR.0000000000000563
12. Eckel RH. Preventive cardiology by lifestyle intervention: opportunity and/or challenge? Presidential address at the 2005 American Heart Association Scientific Sessions. *Circulation.* 2006;113:2657–2661. doi: 10.1161/CIRCULATIONAHA.106.175744
13. Crowley J, Ball L, Hiddink GJ. Nutrition in medical education: a systematic review. *Lancet Planet Health.* 2019;3:e379–e389. doi: 10.1016/S2542-5196(19)30171-8
14. Harkin N, Johnston E, Mathews T, Guo Y, Schwartzbard A, Berger J, Gianos E. Physicians' dietary knowledge, attitudes, and counseling practices: the experience of a single health care center at changing the landscape for dietary education. *Am J Lifestyle Med.* 2019;13:292–300. doi: 10.1177/1559827618809934
15. US Preventive Services Task Force; Grossman DC, Bibbins-Domingo K, Curry SJ, Barry MJ, Davidson KW, Doubeni CA, Epling JW Jr, Kemper AR, Krist AH, Kurth AE, et al. Behavioral counseling to promote a healthful diet and physical activity for cardiovascular disease prevention in adults without cardiovascular risk factors: US Preventive Services Task Force recommendation statement. *JAMA*. 2017;318:167–174. doi: 10.1001/jama.2017.7171
16. Patnode CD, Evans CV, Senger CA, Redmond N, Lin JS. Behavioral counseling to promote a healthful diet and physical activity for cardiovascular disease prevention in adults without known cardiovascular disease risk factors: updated evidence report and systematic review for the US Preventive Services Task Force. *JAMA.* 2017;318:175–193. doi: 10.1001/jama.2017.3303
17. Payne PR, Lussier Y, Foraker RE, Embi PJ. Rethinking the role and impact of health information technology: informatics as an interventional discipline. *BMC Med Inform Decis Mak.* 2016;16:40. doi: 10.1186/s12911-016-0278-3
18. Middleton B, Sittig DF, Wright A. Clinical decision support: a 25 year retrospective and a 25 year vision. *Yearb Med Inform.* 2016;suppl 1:S103–S116. doi: 10.15265/IYS-2016-s034
19. Scrafford CG, Bi X, Multani JK, Murphy MM, Schmier JK, Barraj LM. Health economic evaluation modeling shows potential health care cost savings with increased conformance with healthy dietary patterns among adults in the United States. *J Acad Nutr Diet.* 2019;119:599–616. doi: 10.1016/j.jand.2018.10.002
20. Lv N, Azar KMJ, Rosas LG, Wulfovich S, Xiao L, Ma J. Behavioral lifestyle interventions for moderate and severe obesity: a systematic review. *Prev Med.* 2017;100:180–193. doi: 10.1016/j.ypmed.2017.04.022
21. Patnode CD, Evans CV, Senger CA, Redmond N, Lin JS; U.S. Preventive Services Task Force Evidence Syntheses, formerly Systematic Evidence Reviews. *Behavioral Counseling to Promote a Healthful Diet and Physical Activity for Cardiovascular Disease Prevention in Adults Without Known*

Cardiovascular Disease Risk Factors: Updated Systematic Review for the US Preventive Services Task Force. Rockville, MD: Agency for Healthcare Research and Quality; 2017.
22. Beydoun MA, Wang Y. Do nutrition knowledge and beliefs modify the association of socio-economic factors and diet quality among US adults? *Prev Med*. 2008;46:145–153. doi: 10.1016/j.ypmed.2007.06.016
23. Bonaccio M, Di Castelnuovo A, Costanzo S, De Lucia F, Olivieri M, Donati MB, de Gaetano G, Iacoviello L, Bonanni A; Moli-sani Project Investigators. Nutrition knowledge is associated with higher adherence to Mediterranean diet and lower prevalence of obesity: results from the Moli-sani study. *Appetite*. 2013;68:139–146. doi: 10.1016/j.appet.2013.04.026
24. Shaw FE, Asomugha CN, Conway PH, Rein AS. The Patient Protection and Affordable Care Act: opportunities for prevention and public health. *Lancet*. 2014;384:75–82. doi: 10.1016/S0140-6736(14)60259-2
25. Ockene IS, Hebert JR, Ockene JK, Saperia GM, Stanek E, Nicolosi R, Merriam PA, Hurley TG. Effect of physician-delivered nutrition counseling training and an office-support program on saturated fat intake, weight, and serum lipid measurements in a hyperlipidemic population: Worcester Area Trial for Counseling in Hyperlipidemia (WATCH). *Arch Intern Med*. 1999;159:725–731. doi: 10.1001/archinte.159.7.725
26. US Preventive Services Task Force. Behavioral counseling in primary care to promote a healthy diet: recommendations and rationale. *Am J Prev Med*. 2003;24:93–100. doi: 10.1016/s0749-3797(02)00581-0
27. Lin JS, O'Connor E, Evans CV, Senger CA, Rowland MG, Groom HC. Behavioral counseling to promote a healthy lifestyle in persons with cardiovascular risk factors: a systematic review for the U.S. Preventive Services Task Force. *Ann Intern Med*. 2014;161:568–578. doi: 10.7326/M14-0130
28. Brauer P, Royall D, Li A, Rogrigues A, Green J, Macklin S, Craig A, Pasamem J, Brunelle L, Maitland S, et al. Nutrient intake and dietary quality changes within a personalized lifestyle intervention program for metabolic syndrome in primary care. *Applied Physiology, Nutrition, and Metabolism*. 2019;161:1297–1304. doi: 10.1139/apnm-2019-0070
29. US Department of Health and Human Services and Office of Disease Prevention and Health Promotion. Healthy People 2020. https://www.healthypeople.gov/. Accessed July 1, 2020.
30. Smith SC Jr, Benjamin EJ, Bonow RO, Braun LT, Creager MA, Franklin BA, Gibbons RJ, Grundy SM, Hiratzka LF, Jones DW, et al. AHA/ACCF secondary prevention and risk reduction therapy for patients with coronary and other atherosclerotic vascular disease: 2011 update: a guideline from the American Heart Association and American College of Cardiology Foundation [published correction appears in *Circulation*. 2015;131:e408]. *Circulation*. 2011;124:2458–2473. doi: 10.1161/CIR.0b013e318235eb4d
31. Arnett DK, Blumenthal RS, Albert MA, Buroker AB, Goldberger ZD, Hahn EJ, Himmelfarb CD, Khera A, Lloyd-Jones D, McEvoy JW, et al. 2019 ACC/AHA guideline on the primary prevention of cardiovascular disease: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines [published correction appears in *Circulation*. 2019;140:e647–e648]. *Circulation*. 2019;140:e563–e595. DOI: 10.1161/CIR.0000000000000677.
32. Li S, Chiuve SE, Flint A, Pai JK, Forman JP, Hu FB, Willett WC, Mukamal KJ, Rimm EB. Better diet quality and decreased mortality among myocardial infarction survivors. *JAMA Intern Med*. 2013;173:1808–1818. doi: 10.1001/jamainternmed.2013.9768
33. Teo K, Lear S, Islam S, Mony P, Dehghan M, Li W, Rosengren A, Lopez-Jaramillo P, Diaz R, Oliveira G, et al; PURE Investigators. Prevalence of a healthy lifestyle among individuals with cardiovascular disease in high-, middle- and low-income countries: the Prospective Urban Rural Epidemiology (PURE) study. *JAMA*. 2013;309:1613–1621. doi: 10.1001/jama.2013.3519
34. Peterson KE, Hebert JR, Hurley TG, Resnicow K, Thompson FE, Greene GW, Shaikh AR, Yaroch AL, Williams GC, Salkeld J, et al. Accuracy and precision of two short screeners to assess change in fruit and vegetable consumption among diverse populations participating in health promotion intervention trials. *J Nutr*. 2008;138:218S–225S. doi: 10.1093/jn/138.1.218S
35. Barghi A, Torres H, Kressin NR, McCormick D. Coverage and access for Americans with cardiovascular disease or risk factors after the ACA: a quasi-experimental study. *J Gen Intern Med*. 2019;34:1797–1805. doi: 10.1007/s11606-019-05108-1
36. Riu P, Okeyode T. National Ambulatory Medical Care Survey: 2016 national summary tables. 2016. https://www.cdc.gov/nchs/data/ahcd/namcs_summary/2016_namcs_web_tables.pdf. Accessed July 1, 2020.
37. Whelton PK, Carey RM, Aronow WS, Casey DE Jr, Collins KJ, Dennison Himmelfarb C, DePalma SM, Gidding S, Jamerson KA, Jones DW, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation*. 2018;138:e484–e594. DOI: 10.1161/CIR.0000000000000596.
38. American Diabetes Association. Standards of medical care in diabetes—2019: abridged for primary care providers. *Clin Diabetes*. 2019;37:11–34. doi: 10.2337/cd18-0105
39. Grundy SM, Stone NJ. 2018 American Heart Association/American College of cardiology multisociety guideline on the management of blood cholesterol: primary prevention. *JAMA Cardiol*. 2019;4:488–489. doi: 10.1001/jamacardio.2019.0777
40. Mullen PD, Evans D, Forster J, Gottlieb NH, Kreuter M, Moon R, O'Rourke T, Strecher VJ. Settings as an important dimension in health education/promotion policy, programs, and research. *Health Educ Q*. 1995;22:329–345. doi: 10.1177/109019819402200306
41. American Dietetic Association. Where did you hear that? American Dietetic Association Survey reveals popular and credible sources of nutrition information. *Nutrition and You: Trends 2008*. http://www.eatrightpro.org/~/media/eatrightpro%20files/media/trends%20and%20reviews/nutrition%20and%20you/trends_2008_where_did_you_hear_that.ashx. Accessed July 1, 2020.
42. Soltesz KS, Price JH, Johnson LW, Tellijohann SK. Family physicians' views of the Preventive Services Task Force recommendations regarding nutritional counseling. *Arch Fam Med*. 1995;4:589–593. doi: 10.1001/archfami.4.7.589
43. Kahan S, Manson JE. Nutrition counseling in clinical practice: how clinicians can do better. *JAMA*. 2017;318:1101–1102. doi: 10.1001/jama.2017.10434
44. Powell HS, Greenberg DL. Screening for unhealthy diet and exercise habits: the electronic health record and a healthier population. *Prev Med Rep*. 2019;14:100816. doi: 10.1016/j.pmedr.2019.01.020
45. Thompson FE, Kirkpatrick SI, Subar AF, Reedy J, Schap TE, Wilson MM, Krebs-Smith SM. The National Cancer Institute's Dietary Assessment Primer: a resource for diet research. *J Acad Nutr Diet*. 2015;115:1986–1995. doi: 10.1016/j.jand.2015.08.016
46. England CY, Andrews RC, Jago R, Thompson JL. A systematic review of brief dietary questionnaires suitable for clinical use in the prevention and management of obesity, cardiovascular disease and type 2 diabetes. *Eur J Clin Nutr*. 2015;69:977–1003. doi: 10.1038/ejcn.2015.6
47. Miura K, Entwistle TR, Fildes JE, Green AC. Relative validity of short questionnaires to assess Mediterranean diet or low-fat diet adherence. *J Aging Res Clin Pract*. 2017;6:23–27.
48. Hebestreit K, Yahiaoui-Doktor M, Engel C, Vetter W, Siniatchkin M, Erickson N, Halle M, Kiechle M, Bischoff SC. Validation of the German version of the Mediterranean Diet Adherence Screener (MEDAS) questionnaire. *BMC Cancer*. 2017;17:341. doi: 10.1186/s12885-017-3337-y
49. Papadaki A, Johnson L, Toumpakari Z, England C, Rai M, Toms S, Penfold C, Zazpe I, Martínez-González MA, Feder G. Validation of the English version of the 14-item Mediterranean Diet Adherence Screener of the PREDIMED Study, in people at high cardiovascular risk in the UK. *Nutrients*. 2018;10:138. doi: 10.3390/nu10020138
50. Rasmussen E, Fosnacht Morgan AM, Munson R, Ong A, Patel S, Yucus C, Pham A, Patel V, Frigerio R, Lai R, et al. Use of an electronic medical record to track adherence to the Mediterranean diet in a US neurology clinical practice. *Mayo Clin Proc Innov Qual Outcomes*. 2018;2:49–59. doi: 10.1016/j.mayocpiqo.2017.12.003
51. Schröder H, Fitó M, Estruch R, Martínez-González MA, Corella D, Salas-Salvadó J, Lamuela-Raventós R, Ros E, Salaverría I, Fiol M, et al. A short screener is valid for assessing Mediterranean diet adherence among older Spanish men and women. *J Nutr*. 2011;141:1140–1145. doi: 10.3945/jn.110.135566
52. Cerwinske LA, Rasmussen HE, Lipson S, Volgman AS, Tangney CC. Evaluation of a dietary screener: the Mediterranean Eating Pattern for Americans tool. *J Hum Nutr Diet*. 2017;30:596–603. doi: 10.1111/jhn.12451
53. Gans KM, Risica PM, Wylie-Rosett J, Ross EM, Strolla LO, McMurray J, Eaton CB. Development and evaluation of the nutrition component of the Rapid Eating and Activity Assessment for Patients (REAP): a new tool for primary care providers. *J Nutr Educ Behav*. 2006;38:286–292. doi: 10.1016/j.jneb.2005.12.002
54. Johnston CS, Bliss C, Knurick JR, Scholtz C. Rapid Eating Assessment for Participants [shortened version] scores are associated with Healthy Eating Index-2010 scores and other indices of diet quality in healthy adult omnivores and vegetarians. *Nutr J*. 2018;17:89. doi: 10.1186/s12937-018-0399-x

55. Segal-Isaacson CJ, Wylie-Rosett J, Gans KM. Validation of a short dietary assessment questionnaire: the Rapid Eating and Activity Assessment for Participants short version (REAP-S). *Diabetes Educ.* 2004;30:774, 776, 778 passim. doi: 10.1177/014572170403000512
56. Paxton AE, Strycker LA, Toobert DJ, Ammerman AS, Glasgow RE. Starting the conversation performance of a brief dietary assessment and intervention tool for health professionals. *Am J Prev Med.* 2011;40:67–71. doi: 10.1016/j.amepre.2010.10.009
57. Sundermann EE, Katz MJ, Lipton RB, Lichtenstein AH, Derby CA. A brief dietary assessment predicts executive dysfunction in an elderly cohort: results from the Einstein Aging Study. *J Am Geriatr Soc.* 2016;64:e131–e136. doi: 10.1111/jgs.14381
58. Kennedy ET, Ohls J, Carlson S, Fleming K. The Healthy Eating Index: design and applications. *J Am Diet Assoc.* 1995;95:1103–1108. doi: 10.1016/S0002-8223(95)00300-2
59. Alosco ML, Spitznagel MB, Raz N, Cohen R, Sweet LH, Colbert LH, Josephson R, van Dulmen M, Hughes J, Rosneck J, et al. Dietary habits moderate the association between heart failure and cognitive impairment. *J Nutr Gerontol Geriatr.* 2013;32:106–121. doi: 10.1080/21551197.2013.781408
60. Manson JE, Skerrett PJ, Greenland P, VanItallie TB. The escalating pandemics of obesity and sedentary lifestyle: a call to action for clinicians. *Arch Intern Med.* 2004;164:249–258. doi: 10.1001/archinte.164.3.249
61. Bull FC, Jamrozik K. Advice on exercise from a family physician can help sedentary patients to become active. *Am J Prev Med.* 1998;15:85–94. doi: 10.1016/s0749-3797(98)00040-3
62. Kreuter MW, Chheda SG, Bull FC. How does physician advice influence patient behavior? Evidence for a priming effect. *Arch Fam Med.* 2000;9:426–433. doi: 10.1001/archfami.9.5.426
63. Lewis BS, Lynch WD. The effect of physician advice on exercise behavior. *Prev Med.* 1993;22:110–121. doi: 10.1006/pmed.1993.1008
64. Lin PH, Yancy WS Jr, Pollak KI, Dolor RJ, Marcello J, Samsa GP, Batch BC, Svetkey LP. The influence of a physician and patient intervention program on dietary intake. *J Acad Nutr Diet.* 2013;113:1465–1475. doi: 10.1016/j.jand.2013.06.343
65. Stead LF, Buitrago D, Preciado N, Sanchez G, Hartmann-Boyce J, Lancaster T. Physician advice for smoking cessation. *Cochrane Database Syst Rev.* 2013;2013:CD000165. doi: 10.1002/14651858.CD000165.pub4
66. Gans KM, Ross E, Barner CW, Wylie-Rosett J, McMurray J, Eaton C. REAP and WAVE: new tools to rapidly assess/discuss nutrition with patients. *J Nutr.* 2003;133:556S–562S. doi: 10.1093/jn/133.2.556S
67. Greenwood JL, Lin J, Arguello D, Ball T, Shaw JM. Healthy Eating Vital Sign: a new assessment tool for eating behaviors. *ISRN Obes.* 2012;2012:734682. doi: 10.5402/2012/734682
68. Martínez-González MA, García-Arellano A, Toledo E, Salas-Salvadó J, Buil-Cosiales P, Corella D, Covas MI, Schröder H, Arós F, Gómez-Gracia E, et al; PREDIMED Study Investigators. A 14-item Mediterranean diet assessment tool and obesity indexes among high-risk subjects: the PREDIMED trial. *PLoS One.* 2012;7:e43134. doi: 10.1371/journal.pone.0043134
69. Mondala MM, Sannidhi D. Catalysts for change: accelerating the lifestyle medicine movement through professionals in training. *Am J Lifestyle Med.* 2019;13:487–494. doi: 10.1177/1559827619844505
70. Devries S, Freeman AM. Nutrition education for cardiologists: the time has come. *Curr Cardiol Rep.* 2017;19:77. doi: 10.1007/s11886-017-0890-6
71. Humphrey-Murto S, Varpio L, Wood TJ, Gonsalves C, Ufholz LA, Mascioli K, Wang C, Foth T. The use of the Delphi and other consensus group methods in medical education research: a review. *Acad Med.* 2017;92:1491–1498. doi: 10.1097/ACM.0000000000001812
72. Eaton CB, McBride PE, Gans KA, Underbakke GL. Teaching nutrition skills to primary care practitioners. *J Nutr.* 2003;133:563S–566S. doi: 10.1093/jn/133.2.563S
73. Akincigil A, Matthews EB. National rates and patterns of depression screening in primary care: results from 2012 and 2013. *Psychiatr Serv*. 2017;68:660–666. doi: 10.1176/appi.ps.201600096
74. Prater L, Sanchez A, Modan G, Burgess J, Frier K, Richards N, Bose-Brill S. Electronic health record documentation patterns of recorded primary care visits focused on complex communication: a qualitative study. *Appl Clin Inform.* 2019;10:247–253. doi: 10.1055/s-0039-1683986
75. Romano MJ, Stafford RS. Electronic health records and clinical decision support systems: impact on national ambulatory care quality. *Arch Intern Med.* 2011;171:897–903. doi: 10.1001/archinternmed.2010.527
76. Sorondo B, Allen A, Bayleran J, Doore S, Fathima S, Sabbagh I, Newcomb L. Using a patient portal to transmit patient reported health information into the electronic record: workflow implications and user experience. *EGEMS (Wash DC).* 2016;4:1237. doi: 10.13063/2327-9214.1237
77. Cifuentes M, Davis M, Fernald D, Gunn R, Dickinson P, Cohen DJ. Electronic health record challenges, workarounds, and solutions observed in practices integrating behavioral health and primary care. *J Am Board Fam Med.* 2015;28(suppl 1):S63–S72. doi: 10.3122/jabfm.2015.S1.150133
78. Bower JK, Bollinger CE, Foraker RE, Hood DB, Shoben AB, Lai AM. Active use of electronic health records (EHRs) and personal health records (PHRs) for epidemiologic research: sample representativeness and nonresponse bias in a study of women during pregnancy. *EGEMS (Wash DC).* 2017;5:1263. doi: 10.13063/2327-9214.1263
79. Office of the National Coordinator for Health Information Technology. Office-based physician electronic health record adoption. 2017. https://dashboard.healthit.gov/quickstats/pages/physician-ehr-adoption-trends.php. Accessed July 1, 2020.
80. Foraker RE, Shoben AB, Kelley MM, Lai AM, Lopetegui MA, Jackson RD, Langan MA, Payne PR. Electronic health record-based assessment of cardiovascular health: the Stroke Prevention in Healthcare Delivery Environments (SPHERE) study. *Prev Med Rep.* 2016;4:303–308. doi: 10.1016/j.pmedr.2016.07.006
81. Foraker RE, Kite B, Kelley MM, Lai AM, Roth C, Lopetegui MA, Shoben AB, Langan M, Rutledge NL, Payne PR. EHR-based visualization tool: adoption rates, satisfaction, and patient outcomes. *EGEMS (Wash DC).* 2015;3:1159. doi: 10.13063/2327-9214.1159
82. Evans RS. Electronic health records: then, now, and in the future. *Yearb Med Inform.* 2016;suppl 1:S48–S61. doi: 10.15265/IYS-2016-s006
83. Saripalle R, Runyan C, Russell M. Using HL7 FHIR to achieve interoperability in patient health record. *J Biomed Inform.* 2019;94:103188. doi: 10.1016/j.jbi.2019.103188
84. Bloomfield RA Jr, Polo-Wood F, Mandel JC, Mandl KD. Opening the Duke electronic health record to apps: implementing SMART on FHIR. *Int J Med Inform.* 2017;99:1–10. doi: 10.1016/j.ijmedinf.2016.12.005
85. Chrimes D, Kitos NR, Kushniruk A, Mann DM. Usability testing of Avoiding Diabetes Thru Action Plan Targeting (ADAPT) decision support for integrating care-based counseling of pre-diabetes in an electronic health record. *Int J Med Inform.* 2014;83:636–647. doi: 10.1016/j.ijmedinf.2014.05.002
86. Porat T, Delaney B, Kostopoulou O. The impact of a diagnostic decision support system on the consultation: perceptions of GPs and patients. *BMC Med Inform Decis Mak.* 2017;17:79. doi: 10.1186/s12911-017-0477-6
87. Khandelwal S, Zemore SE, Hemmerling A. Nutrition education in internal medicine residency programs and predictors of residents' dietary counseling practices. *J Med Educ Curric Dev.* 2018;5:2382120518763360. doi: 10.1177/2382120518763360
88. Kushner RF. Barriers to providing nutrition counseling by physicians: a survey of primary care practitioners. *Prev Med.* 1995;24:546–552. doi: 10.1006/pmed.1995.1087
89. Vetter ML, Herring SJ, Sood M, Shah NR, Kalet AL. What do resident physicians know about nutrition? An evaluation of attitudes, self-perceived proficiency and knowledge. *J Am Coll Nutr.* 2008;27:287–298. doi: 10.1080/07315724.2008.10719702
90. Adams KM, Butsch WS, Kohlmeier M. The state of nutrition education at US medical schools. *J Biomed Educ*. 2015;2015:7.
91. Briggs Early K, Adams KM, Kohlmeier M. Analysis of nutrition education in osteopathic medical schools. *J Biomed Educ*. 2015;2015:6.
92. Cassidy-Vu L, Kirk J. Assessing the need for a structured nutrition curriculum in a primary care residency program. *J Am Coll Nutr*. 2020;39:243–248. doi: 10.1080/07315724.2019.1644251
93. Association of American Medical Colleges. Behavioral and social science foundations for future physicians. 2011. https://www.aamc.org/system/files/d/1/271020-behavioralandsocialsciencefoundationsforfuturephysicians.pdf. Accessed July 1, 2020.
94. Wetherill MS, Davis GC, Carter V, Wells E, Williams MB, Ijams SD, Monlezun D, Harlan T, Whelan LJ. Development and evaluation of a nutrition-centered lifestyle medicine curriculum for physician assistant students. *Med Sci Educ*. 2019;29:163–172. doi: https://doi.org/10.1007/s40670-018-00655-4
95. DiMaria-Ghalili RA, Mirtallo JM, Tobin BW, Hark L, Van Horn L, Palmer CA. Challenges and opportunities for nutrition education and training in the health care professions: intraprofessional and interprofessional call to action. *Am J Clin Nutr.* 2014;99(suppl):1184S–1193S. doi: 10.3945/ajcn.113.073536
96. Lafrenière J, Harrison S, Laurin D, Brisson C, Talbot D, Couture P, Lemieux S, Lamarche B. Development and validation of a Brief Diet Quality Assessment Tool in the French-speaking adults from Quebec. *Int J Behav Nutr Phys Act.* 2019;16:61. doi: 10.1186/s12966-019-0821-6