Nourish

Clinical Reference Guide and Tx Pathway: Heart Health

Introduction

Definition

A clinical pathway is a tool used to define, standardize, and sequence the interventions specific to conditions treated. Clinical pathways are followed to optimize outcomes, reduce risk, and ensure quality care.

Purpose

Cardiovascular disease (CVD) is the leading cause of death in Western countries, representing almost 30% of all deaths worldwide. Evidence shows the effectiveness of healthy dietary patterns and lifestyles for the prevention of CVD. Furthermore, the rising incidence of CVD over the last 25 years has become a public health priority, especially the prevention of CVD (or cardiovascular events) through lifestyle interventions (1).

A clinical pathway serves to standardize care, while allowing for clinical judgment and individuality of counseling style.

Background Treating CVD Risk

One in three deaths in the United States and one in four deaths in Europe are caused by CVD (1). In 2035, 45.1% (>130 million adults) of the US population are projected to have clinical expression of CVD (2).

CVD describes a range of disorders that affect the heart and blood vessels, such as hypertension, stroke, atherosclerosis, peripheral artery disease, and vein diseases. The probability of developing CVD is associated with unhealthy dietary patterns (i.e., excessive intake of sodium and processed foods; added sugars; unhealthy fats; low intake of fruit and vegetables, whole grains, fiber, legumes, fish, and nuts), together with a lack of exercise, overweight and obesity, stress, alcohol consumption, or a smoking habit (3).

Additionally, CVD often coincides with multiple comorbidities, such as obesity, diabetes, hypertension, or dyslipidemia, which represent four of the 10 greatest risk factors for all-cause mortality worldwide (4).

The rising incidence of CVD over the last 25 years has become a public health priority, especially the prevention of CVD (or CV events) through lifestyle interventions (5). A large body of scientific evidence has reported that nutrition might be the most preventive factor of CVD death (6). Diet plays an important role in the management of other risk factors, such as excess weight, hypertension, diabetes, or dyslipidemia (4). The identification and classification of nutrients, foods, or dietary patterns that can enhance CVD prevention is a priority and RDs have been at the forefront of CVD risk reduction in inpatient and outpatient settings.

CVD refers to a group of conditions that involve the heart or blood vessels, including coronary artery disease, heart failure, peripheral artery disease, and others. CVD is a broad term that encompasses any disorder of the heart and blood vessels.

Coronary artery disease (CAD) specifically involves the narrowing or blockage of the coronary arteries, which supply blood to the heart muscle. CAD is the most common type of heart disease and is a leading cause of myocardial infarction (MI), colloquially known as "heart attack."

Pathophysiology of CAD

Understanding the pathophysiology of CAD is crucial for developing effective prevention and treatment strategies, which often include lifestyle modifications, medications, and in some cases, surgical interventions.

The process of plaque buildup, known as atherosclerosis, is complex and can be influenced by various factors, including high cholesterol, high blood pressure, smoking, diabetes, and inflammation. High levels of low-density lipoprotein cholesterol (LDL-C), play a significant role in the development of atherosclerosis. LDL-C can penetrate the arterial wall and trigger an

inflammatory response, leading to the formation of plaque. There are additional biomarkers (e.g. inflammatory markers, lipoprotein subclasses, cytokines, etc.) that are thought to also be valuable to risk prediction (7).

Atherosclerosis and is a slow, progressive process involving several key steps (8):

Endothelial Dysfunction: Starts with damage to the inner lining of the coronary arteries (endothelium) caused by factors including high blood pressure, smoking, and/or high cholesterol. This damage allows LDL-Cl and other substances to accumulate in the arterial wall.

Formation of Plaque: LDL-C is taken up by macrophages in the arterial wall, leading to the formation of foam cells. Over time, smooth muscle cells migrate to the area and proliferate, forming a fibrous cap over the plaque.

Progression of Plaque: The plaque continues to grow, causing the arterial wall to thicken and the artery to narrow. This narrows the lumen (inner space) of the artery, reducing blood flow to the heart muscle. Stenosis refers to the narrowing of artery diameter, often as a result of plaque build up. It is thought to be responsible for stable and unstable angina.

Plaque Rupture: In some cases, the fibrous cap of the plaque can become thin and unstable, leading to rupture. When this happens, the contents of the plaque, including cholesterol and other substances, are exposed to the bloodstream. Several blood tests and imaging diagnostics (e.g. CT angiography) have been developed to try to predict rupture-prone plaque. The stability of plaque remains one of the most diagnostically elusive contributors to MACE in cardiology today.

Thrombosis: The exposure of plaque contents triggers the formation of a blood clot (thrombus) at the site of the plaque rupture. The blood clot can partially or completely block the artery, leading to a heart attack if it completely cuts off blood flow to a part of the heart muscle.

Ischemia and Infarction: The narrowing and blockage of the coronary arteries reduce blood flow to the heart muscle, causing ischemia (lack of

oxygen). If the ischemia is severe and prolonged, it can lead to myocardial infarction (heart attack), which is the death of heart muscle tissue.

Overview - CVD Risk Factors

Lipids

Decades ago Total Cholesterol (TC) was used to track CVD risk, in both primary and secondary prevention. Today, best practice favors incorporation of the entire lipid panel which provides the breakdown of cholesterol into its

components - high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), and triglycerides.

Low density lipoprotein (LDL-C) - Often referred to as "bad" cholesterol,* high levels of LDL-C are associated with an increased risk of CVD. Monitoring LDL-C levels and aiming for lower levels, especially in high-risk individuals, is a key part of managing CV health.

High Density Lipoprotein - Often referred to as “good” cholesterol,* high levels of HDL-C are associated with a decreased risk of CVD. HDL-particles are involved in the reverse cholesterol transport pathway, where they pick up excess cholesterol from cells and tissues and transport it back to the liver for excretion or re-utilization. In this process, HDL particles can acquire cholesterol esters from LDL particles or other sources.

LDL particles primarily transport cholesterol from the liver to peripheral tissues. If there is excess cholesterol in the bloodstream, LDL particles can transfer cholesterol esters to HDL particles through cholesterol ester transfer proteins.

This exchange of cholesterol esters between HDL and LDL particles plays a role in maintaining cholesterol homeostasis in the body. However, disruptions in this process, such as reduced HDL levels or dysfunctional HDL particles, can contribute to the development of atherosclerosis and CVD.

*The terms “bad” and “good” cholesterol, though often recognized by patients and therefore helpful in education, are erroneous. Cholesterol ester exchanges between HDL (high-density lipoprotein) and LDL (low-density lipoprotein) particles through a process called cholesterol ester transfer. This process involves the transfer of cholesterol esters, which are the storage form of cholesterol, between lipoprotein particles. Therefore “cholesterol”

can not be good or bad. If it is carried on a low density lipoprotein particle it can contribute to arterial plaque. If it is carried on a high density lipoprotein particle it will contribute to reverse cholesterol transport and the removal of arterial plaque.

Diabetes - [see Reference Guide and Tx Pathway - PreDM, T1DM, T2DM]

Diabetes is considered a risk equivalent for major adverse cardiovascular events (MACE). This means that having diabetes is associated with a significantly increased risk of developing CVD, to a level similar to that of someone who has already had a heart attack).

People with diabetes are more likely to develop CVD due to various factors, including insulin resistance, chronic inflammation, and abnormalities in lipid metabolism. Diabetes is also associated with other risk factors for CVD, such as high blood pressure and dyslipidemia.

Due to the elevated risk of CVD in individuals with diabetes, aggressive management of CV risk factors is recommended. This includes lifestyle modifications, blood glucose control, blood pressure management, and lipid-lowering medications to reduce the risk of heart attacks and other CV events (9 - 13).

Smoking/secondhand smoke exposure

Smoking has a significant impact on the risk of CVD. It is one of the most important modifiable risk factors and is associated with a higher risk of developing a range of CV conditions, including coronary heart disease, stroke, peripheral artery disease, and aortic aneurysm. Smoking affects CV health through the following (14):

Atherosclerosis: Smoking damages the lining of the arteries, leading to the buildup of fatty deposits (plaque) that narrows and hardens the arteries (atherosclerosis). This can restrict blood flow to the heart, brain, and other organs, increasing the risk of heart attack and stroke.

Blood Pressure: Smoking causes an immediate increase in blood pressure and heart rate. Over time, this can damage the arteries and lead to hypertension (high blood pressure), a major risk factor for CVD.

Cholesterol Levels: Smoking lowers HDL (good) cholesterol levels and increases LDL (bad) cholesterol levels, promoting the development of atherosclerosis.

Blood Clotting: Smoking increases the risk of blood clots forming in the arteries, which can block blood flow and lead to heart attack or stroke.

Inflammation: Smoking causes inflammation throughout the body, including in the arteries, which can contribute to the development of atherosclerosis and other CV conditions.

Carbon Monoxide: Smoking reduces the oxygen-carrying capacity of the blood by increasing carbon monoxide levels, which can strain the heart and blood vessels.

Quitting smoking can significantly reduce the risk of developing CVD. Within a few years of quitting, the risk of heart attack and stroke decreases and approaches that of non-smokers.

Registered Dietitians can be an important part of a patient's tobacco cessation goals. By reinforcing the synergy between other self-care behaviors, and using motivational interviewing, Nourish RDs can help support a patient's tobacco cessation goals through education on the following (15):

Nutritional Counseling: Provide guidance on maintaining a balanced diet to support overall health and minimize weight gain, which is common when quitting smoking.

Behavioral Strategies: Help develop coping strategies to manage stress, cravings, and triggers that may lead to smoking.

Lifestyle Modifications: Recommend lifestyle changes, such as regular physical activity, to help reduce cravings and improve mood.

Nutritional Supplements and NRT: Discuss the use of certain supplements, such as vitamin C or B-complex vitamins, which may help reduce cravings and support the body during the quitting process. As well RDs should be familiar with nicotine replacement products, both OTC and Rx.

Support Groups: Refer patients to smoking cessation programs or support groups where they can receive additional support and encouragement.

Monitoring Progress: Monitor the patient's progress and provide ongoing support and encouragement to help them stay motivated and committed to quitting.

Collaboration: Work collaboratively with other healthcare providers, such as physicians and counselors, to ensure a comprehensive approach to smoking cessation.

Obesity [see Reference Guide and Tx pathway - Overweight and Obesity]

Obesity contributes to coronary artery disease (CAD) through several mechanisms (16, 17):

Increased LDL Cholesterol and Triglycerides: Obesity is often associated with elevated levels of LDL cholesterol and triglycerides, which can lead to the formation of atherosclerotic plaques in the coronary arteries.

Decreased HDL Cholesterol: Obesity is also associated with lower levels of HDL cholesterol, which plays a protective role against CAD by removing cholesterol from the arteries.

Insulin Resistance and Diabetes: Obesity is a major risk factor for insulin resistance and type 2 diabetes, both of which are associated with an increased risk of CAD.

Hypertension: Obesity is closely linked to hypertension which is a major risk factor for CAD.

Inflammation: Obesity is associated with chronic low-grade inflammation, which can contribute to the development and progression of atherosclerosis.

Sleep Apnea: Obesity is a common cause of obstructive sleep apnea, a condition characterized by interruptions in breathing during sleep. Sleep apnea is associated with an increased risk of CAD.

Physical Inactivity: Obesity is often accompanied by a sedentary lifestyle, which is a risk factor for CAD.

Overall, obesity is a complex condition that can contribute to CAD through various mechanisms.

Physical Inactivity

Physical inactivity is a significant risk factor for CVD. Regular physical activity has numerous beneficial effects on the CV system, including:

- **Improving Heart Health**: Physical activity strengthens the heart muscle, improves its efficiency, and helps maintain healthy blood pressure levels.
- **Lowering Bad Cholesterol**: It can increase HDL (good) cholesterol levels and lower LDL (bad) cholesterol levels, reducing the risk of plaque buildup in the arteries.
- **Managing Weight**: Physical activity helps maintain a healthy weight or reduce excess weight, which is important for reducing the risk of CVD.
- **Improving Blood Sugar Control:** Regular exercise can help control blood sugar levels, reducing the risk of diabetes, a major risk factor for CVD.
- **Reducing Inflammation:** Physical activity can reduce inflammation in the body, which is associated with atherosclerosis (hardening and narrowing of the arteries).
- **Improving Mental Health:** Regular exercise can reduce stress, anxiety, and depression, which are all linked to an increased risk of

CVD.

Conversely, physical inactivity increases the risk of developing CVD. Sedentary behavior is associated with higher levels of obesity, high blood pressure, unhealthy cholesterol levels, and insulin resistance, all of which are risk factors for CVD (18, 19).

The American Heart Association recommends, for CVD risk reduction, at least 150 minutes per week of moderate-intensity aerobic activity or 75 minutes per week of vigorous-intensity aerobic activity, or a combination of both, along with muscle-strengthening activities on 2 or more days a week (20).

Nourish RDs can recommend guideline-driven activity for patients who would benefit.

- American Heart Association Recommendations for Physical Activity in Adults and Kids
- World Health Organization Physical Activity Recommendation

- Centers for Disease Control Activity Statement

Unhealthy Diet

Poor diet quality is strongly associated in multi-country cohort studies with elevated risk of CVD morbidity and mortality. The importance of dietary patterns beyond individual foods or nutrients, underscores the critical role of nutrition in CVD prevention (21).

Estimating CVD Risk

Determining CVD risk typically involves using a CVD risk calculator. These calculators estimate an individual's risk of developing a MACE, such as a heart attack or stroke, over a specific period, usually 5 to 10 years. The calculation is based on various factors known to influence CVD risk.

Risk Calculators

There are several risk calculators and equations (22). Some commonly used include:

Framingham Risk Score: The Framingham Risk Score estimates the 10-year risk of developing coronary heart disease based on age, gender, total cholesterol, HDL cholesterol, systolic blood pressure, smoking status, and diabetes status. It is widely used and has been validated in various populations.

ASCVD Risk Estimator: The ASCVD (Atherosclerotic Cardiovascular Disease) Risk Estimator calculates the 10-year risk of developing a first atherosclerotic CVD event, including heart attack or stroke. It uses similar risk factors as the Framingham Risk Score but also includes race/ethnicity and treatment for hypertension.

Reynolds Risk Score: The Reynolds Risk Score is a less well known tool that includes additional risk factors such as family history of premature heart disease, high-sensitivity C-reactive protein (a marker of inflammation), and presence of hemoglobin A1C (a marker of long-term blood sugar control) in addition to traditional risk factors.

Pooled Cohort Equations: These equations are used to estimate the 10-year risk of a first atherosclerotic CVD event in the United States. They are based on data from multiple cohort studies and include age, gender, race, TC, HDL-, systolic blood pressure, antihypertensive medication use, diabetes status, and smoking status.

Assessing Risk and Guiding Treatment

Calculated risk score(s) can guide treatment decisions. For example, individuals at high risk may benefit from more aggressive interventions to reduce their risk, such as lifestyle modifications (e.g., diet, exercise) and medications (e.g., statins).

Patient Education and Monitoring

Risk calculators can also be used to educate patients about their CV risk and motivate them to make lifestyle changes to reduce their risk.

Risk calculators can be used to monitor the impact of interventions over time. For example, if a patient makes lifestyle changes, their risk score may decrease, indicating a reduced risk of CVD.

Overall, CVD risk calculators are valuable tools for assessing and managing CV risk, helping to prevent heart attacks, strokes, and other CV events.

RDs should use CVD risk calculators as part of a comprehensive assessment to help guide their dietary recommendations for patients. These calculators provide valuable information about an individual's risk of developing CVD and can help dietitians tailor their advice to address specific risk factors.

- **Assessment**: Use CVD risk calculators to assess the patient's overall risk of developing CVD based on factors such as age, gender, blood pressure, cholesterol levels, smoking status, and diabetes status.
- **Education**: Educate patients about their calculated risk and the importance of lifestyle factors, in reducing their risk of CVD.
- **Tailored Recommendations:** Use the risk calculator results to tailor dietary recommendations to address specific risk factors. For example, patients at high risk may benefit from a diet that is low in saturated fat, cholesterol, and sodium, and high in fiber, fruits, vegetables, and whole grains.

- **Monitoring**: Monitor the patient's progress over time and adjust dietary recommendations as needed based on changes in risk factors and overall risk.
- **Collaboration**: Work collaboratively with external healthcare providers, such as physicians and nurses, to ensure a comprehensive approach to managing CVD risk.

Overall, CVD risk calculators can be a valuable tool for dietitians in assessing and managing the CV health of their patients. They can help identify

individuals at high risk who may benefit from more intensive dietary interventions and monitoring (22).

Interventions

Pharmacological, OTC and Supplements Tx

While RDs do not prescribe drugs, as part of treatment care teams they should be aware of the basic classes of medication used in primary and secondary prevention. RDs are able to assess a patient's supplement intake and make recommendations based on the research (23).

Cholesterol Lowering Agents

Rx Statins: Statins are the most commonly prescribed medications for lowering LDL cholesterol. They work by blocking an enzyme (HMG-CoA reductase) in the liver that is needed to produce cholesterol. Examples include atorvastatin, simvastatin, and rosuvastatin. Most statins are available in generic brands, with the exception of Livalo (pitavastatin).

Rx PCSK9 Inhibitors (Alirocumab/Praluent, Evolocumab/Repatha): A newer class of medications, administered to date by injection only, that help lower LDL-C levels by upregulating the LDL receptor to remove LDL-C from the bloodstream.

Rx Absorption inhibitors (ezetimibe/Zetia): Absorption Inhibition targets a protein called NPC1L1 (Niemann-Pick C1-Like 1) in the small intestine. This protein is responsible for transporting cholesterol from the diet into the bloodstream. By inhibiting NPC1L1, Zetia reduces the amount of cholesterol absorbed from both food as well as endogenous cholesterol made in the liver.

Bile Acid Sequestrants (BAS): Bile acid sequestrants work in the intestines by binding to bile acids, which are made from cholesterol, and preventing them from being reabsorbed into the bloodstream. This causes the liver to use more cholesterol to make bile acids, which lowers the level of cholesterol in the blood. Examples include cholestyramine and colesevelam.

Despite their effectiveness in lowering cholesterol, bile acid sequestrants are not used as frequently as other cholesterol-lowering medications due to their side effects, inconvenient administration, and drug interactions.

OTC Red Rice Yeast (Red Yeast Rice, RYR) - Structurally and mechanistically similar to Mevacor (a low intensity statin), Red Rice Yeast lowers LDL-C through disruption of HMG-CoA reductase in the liver (OTC).

OTC Plants Stanols - Plant stanols are structurally similar to cholesterol and compete with cholesterol for absorption in the intestines. When consumed as part of the diet, plant stanols can partially block the absorption of dietary cholesterol, leading to lower levels of cholesterol entering the bloodstream. This mechanism helps to reduce low-density lipoprotein (LDL) cholesterol. Plant stanols are often combined with plant sterols in OTC supplements (e.g. CholestOff). There is debate in the literature on whether plant sterols might be harmful to "high absorbers," meaning the primary mechanism by which they have hyperlipidemia is absorption in the small intestine (24).

Triglyceride Lowering Agents

Rx and OTC Omega-3 fatty acids - Typically used to lower very high triglyceride levels in people with severe hypertriglyceridemia. The two prescription omega-3 fatty acid medications approved by the FDA in the United States are:

- Lovaza (omega-3-acid ethyl esters): A prescription omega-3 fatty acid medication that contains a combination of ethyl esters of omega-3 fatty acids, including eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). It is approved for use in adults with very high triglyceride levels.
- Vascepa (icosapent ethyl): A prescription medication containing icosapent ethyl, a purified ethyl ester of eicosapentaenoic acid (EPA). It is approved for use in adults with very high triglyceride levels.
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- Omega-3 FAs are also available over-the-counter. The benefits of Rx (over OTC) are quality control and cost (for those patients that have Rx coverage benefits).

U.S. health agencies offer no guidelines for how much EPA and DHA a person should include in their daily diet. However, there are recommendations for daily consumption of ALA, based on age and gender. The National Academy of Medicine recommends men consume 1.6 grams of ALA daily and 1.1 grams per day for women. Individuals who are pregnant or breastfeeding need more.

Best practice suggests that people should ideally get their nutrients from food that delivers a host of nutrients, not just an isolated nutrient. However, if the diet is not adequate, dietary supplements, such as fish oil, are another way people can consume healthy fats. According to an AHA science advisory in 2017, omega-3 fish oil supplements may slightly lower the risk of dying after heart failure or a recent heart attack, but they do not prevent heart disease.

Rx Fibrates (Fenofibrate brand names: Tricor, Lofibra, Fenoglide; and Gemfibrozil brand name: Lopid): Can help lower triglyceride levels and increase HDL cholesterol levels. They are often used in combination with statins when triglyceride levels are high. Examples include fenofibrate and gemfibrozil.

Rx and OTC Niacin (Vitamin B3): Can help lower LDL cholesterol and triglyceride levels and increase HDL cholesterol levels. However, it is not commonly used due to side effects (severe skin flushing combined with dizziness, rapid heartbeat, Itching, nausea, vomiting and diarrhea, gout, liver damage, increased risk for diabetes) when pharmacological doses are used.

Additional supplements examined in CVD risk reduction research include:

Coenzyme Q10 (CoQ10): Often used to decrease the risk of statin-associated myalgia.

Magnesium: Magnesium plays a role in heart health and may help lower blood pressure and reduce the risk of heart disease.

Folic acid (vitamin B9): Folic acid may help lower homocysteine (HCY) levels. Elevated HCY is associated with an increased risk of heart disease.

Garlic: Garlic supplements may help lower cholesterol and blood pressure, which can reduce the risk of heart disease.

Green tea extract: Green tea contains catechins, which are antioxidants that may help improve heart health by reducing cholesterol levels and improving blood flow.

Berberine: This compound found in plants like goldenseal and barberry may help lower cholesterol and blood sugar levels, which can benefit heart health.

Antioxidant minerals and vitamins (e.g. Vitamins C, and E and selenium): Inflammation and enhanced oxidative stress have been shown to be fundamental risk factors in the onset and progression of CVD. Chronic inflammation attenuates blood levels of antioxidants because of the continuous generation of elevated levels of reactive oxygen species (ROS). A sufficient intake of antioxidants is suggested to beneficially interfere with CVD by quenching ROS. However, the conclusion of rigorous research on antioxidants and CVD is complex and not entirely definitive. While early observational studies suggested that antioxidants, such as vitamins C and E, beta-carotene, and selenium, might reduce the risk of CVD by neutralizing free radicals and reducing oxidative stress, more recent large-scale clinical trials have not consistently supported these findings (25).

Surgical Interventions

Common surgical interventions for coronary artery disease (CAD) include (26):

Coronary Artery Bypass Grafting (CABG): In CABG, a surgeon takes a healthy blood vessel, often from the leg or chest, and grafts it onto the coronary artery to bypass a blocked section. This allows blood to flow around the blockage, restoring blood flow to the heart muscle. In CABG, the number of artery grafts done can vary depending on the extent and location of the

blockages in the coronary arteries. Generally, CABG can involve grafting one, two, three, or more coronary arteries.

Percutaneous Coronary Intervention (PCI): Also known as angioplasty, PCI is a non-surgical procedure used to open blocked or narrowed coronary arteries. A catheter with a balloon on its tip is inserted into the blocked artery and inflated to widen the artery. In many cases, a stent (a small mesh tube) is then placed in the artery to keep it open.

Coronary Artery Stenting: Stents are small, expandable tubes placed in narrowed or blocked coronary arteries to help keep them open. They are often used during PCI procedures.

Atherectomy: This procedure involves removing plaque from the arteries using a special catheter with a rotating shaver or laser tip.

Enhanced External Counterpulsation (EECP): EECP is a non-invasive treatment for angina and heart failure. It involves using inflatable cuffs on the legs to compress the arteries and increase blood flow to the heart.

Transmyocardial Laser Revascularization (TMR): TMR is a surgical procedure used to treat severe angina in patients who are not candidates for other procedures. It involves using a laser to create channels in the heart muscle to improve blood flow.

Heart Transplant: In severe cases of CAD where the heart is significantly damaged, a heart transplant may be considered. This involves replacing the diseased heart with a healthy heart from a donor.

The choice of surgical intervention depends on the severity and location of the blockages, the patient's overall health, and other factors. The goal of these interventions is to improve blood flow to the heart muscle, relieve symptoms, and reduce the risk of heart attack and other complications.

Lifestyle

The link between diet and heart disease is one of the most well-established associations between chronic disease and lifestyle in the literature.

Landmark studies

The Seven Countries Study: Conducted by Ancel Keys and colleagues, this study examined the relationship between diet, lifestyle, and CVD risk in different populations around the world. It provided early evidence linking dietary factors, particularly saturated fat intake, to CVD risk. Not without criticism, detractors argue that Keys selectively chose countries and regions that supported his hypothesis, excluding data from countries where the traditional diet contradicted his theory. As well, the study (like many) relied on dietary surveys and food frequency questionnaires, which might not have accurately captured participants' actual dietary intake. Critics contend that Keys may have overstated the significance of dietary fat as a risk factor for heart disease, possibly as a result of his relationships to the food industry, while downplaying other important factors such as sugar consumption, processed food intake, and overall lifestyle habits. While often criticized, it is still considered a landmark study in the field of diet and disease.

The Framingham Heart Study: This long-term study, which began in 1948, has provided valuable insights into the risk factors for heart disease, including diet. The study has highlighted the importance of dietary factors such as high blood pressure, high cholesterol, smoking, obesity, and physical inactivity in increasing the risk of heart disease.

The Nurses' Health Study and the Health Professionals Follow-Up Study: These large cohort studies have provided extensive data on the relationship between diet and various health outcomes, including heart disease. They have helped identify specific dietary factors, such as trans fats, sugar-sweetened beverages, and processed meats, that are associated with an increased risk of heart disease.

The Lyon Diet Heart Study: This randomized controlled trial demonstrated that a Mediterranean diet rich in fruits, vegetables, whole grains, nuts, fish, and olive oil reduced the risk of recurrent heart attacks and death from heart disease compared to a standard Western diet.

The PREDIMED Study: This large randomized controlled trial showed that a Mediterranean diet supplemented with extra-virgin olive oil or nuts reduced the risk of heart attack, stroke, and CV death in high-risk individuals compared to a low-fat diet.

These studies, among others, have been instrumental in shaping our understanding of the role of diet in heart disease and have highlighted the importance of a healthy diet in reducing the risk of heart disease.

RD Scope

Studies exploring the relationship of RD delivered Medical Nutrition Therapy (MNT), including remote delivery, and CV risk reduction have been overwhelmingly positive. (27 - 33).

RDs provide personalized nutrition advice based on the patient's health status, dietary preferences, and lifestyle. Medical Nutrition therapy and nutrition education for heart health includes helping patients understand the dietary factors that affect heart health, such as managing cholesterol levels, controlling blood pressure, and maintaining a healthy weight.

Fundamentals of Heart Healthy Dietary Pattern

- Achieve:
    - Balanced macronutrients (within AMDR)
    - Nutrient Density
    - Adequate hydration
    - Adequate Omega 3 intake
    - Plentiful plant foods
    - Wide variety of healthy foods
    - Substitution of tropical oils and hydrogenated fats with liquid plant oils rather than tropical oils and partially hydrogenated fats
- Limit:
    - Sodium
    - Added sugars
    - Processed foods instead of ultra-processed foods
    - Reduction of alcohol consumption if excessive

- Adjust energy intake and expenditure to achieve and maintain a healthy body weight
- Evaluate supplements in the context of the dietary pattern

Additional Considerations

Intolerance of Weight Bias / Stigma

Weight bias is common among healthcare providers with accumulating evidence that individuals with obesity are perceived as lacking self-control, unmotivated to improve health, noncompliant with treatment, and personally

to blame for their weight. Those who perceive bias from their healthcare providers have less trust in them, experience more difficulty and avoid preventive health services and medical appointments. Weight bias in obesity care can interfere with effective obesity treatment (34).

In a systematic review paper, six out of eight studies reported weight stigma expressed by dietitians and nutritionists. Their believed causes of obesity indicated a defined preference for internal factors rather than genetics or biology (35).

Person-Centered Approach

Shared decision making and patient-driven goal setting are foundational to Nourish's Clinical Philosophy.

Patient-centered care focuses on the patient and the individual's particular healthcare needs. The goal of patient-centered healthcare is to empower patients to become active participants in their care. Evidence-supported principles guiding care at Nourish include:

- Establishing a positive dietitian-patient relationship
- Displaying humanistic behaviors
- Using effective communication skills
- Individualizing and adapting care
- Redistributing power to the patient
- Allowing adequate session duration to practice patient centered care

Patient-centered care is associated with significant improvements in patients' health outcomes, and has been studied in dietetics and MNT delivery (36).

Motivational Interviewing

While not required of every RD in every session, Motivational Interviewing is a foundational counseling technique employed by Nourish RDs.

Most RDs at Nourish have had extensive education and experience with the tools of MI including: Open-ended questions, Rolling with Resistance (or avoiding the righting reflex), expressing empathy, developing discrepancy (or exploring ambivalence), and supporting self-efficacy among others.

MI is a collaborative, goal-oriented style of communication with particular attention to the language of change. It is designed to strengthen personal motivation for and commitment to a specific goal by eliciting and exploring the person's own reasons for change within an atmosphere of acceptance and compassion. The fundamentals of MI are identifying what the patient would like to accomplish through exploring ambivalence (35).

MI is practiced with an underlying spirit or way of being with people, including:

- **Partnership**. MI is a collaborative process. The MI practitioner is an expert in helping people change; people are the experts of their own lives.

- **Evocation**. People have within themselves resources and skills needed for change. MI draws out the person's priorities, values, and wisdom to explore reasons for change and support success.
- **Acceptance**. The MI practitioner takes a nonjudgmental stance, seeks to understand the person's perspectives and experiences, expresses empathy, highlights strengths, and respects a person's right to make informed choices about changing or not changing.
- **Compassion**. The MI practitioner actively promotes and prioritizes clients' welfare and wellbeing in a selfless manner.

Evidence-Based Care

Evidence-based practice (EBP) in dietetics involves providing holistic, quality care based on the most up-to-date research and knowledge rather than traditional methods, advice from colleagues, or personal beliefs/bias (35).

EBP is an approach to health care wherein health practitioners use the best evidence possible, i.e., the most appropriate information available, to make decisions for individuals, groups and populations.

EBP values, enhances and builds on clinical expertise, knowledge of disease mechanisms, and pathophysiology. It involves complex and conscientious decision making based not only on the available evidence but also on client

characteristics, situations, and preferences. It recognizes that healthcare is individualized and ever changing and involves uncertainties and probabilities.

EBP incorporates successful strategies that improve client outcomes and is derived from various sources of evidence including research, national guidelines, policies, consensus statements, systematic analysis of clinical experience, quality improvement data, specialized knowledge and skills of experts. Evidence-based Medicine (EBM) has been built on the cornerstone of eliminating bias (39).

It is the expectation of Nourish RDs that they evaluate and utilize the latest research studies, systematic reviews, and meta-analyses related to nutrition and dietetics. This evidence forms the foundation for making informed decisions about dietary interventions for Nourish patients.

Social Determinants of Health

Social Determinants of Health (SDOH) significantly influence the prevalence, diagnosis, management, and outcomes of chronic disease.

Access to Healthcare: SDOH can impact access to healthcare services. Patients from lower socioeconomic backgrounds may face barriers such as lack of health insurance, transportation issues, and limited availability of healthcare facilities. This can result in delayed diagnosis and sub optimal health management.

Health Literacy: Socioeconomic factors such as education level and language proficiency can affect health literacy, which is crucial for understanding and managing diabetes. Individuals with lower health literacy may struggle to comprehend medical information, adhere to treatment plans, and adopt healthy lifestyle changes necessary for health promotion.

Environmental Factors: Socioeconomic status often correlates with environmental factors such as neighborhood safety, access to healthy food options, and opportunities for physical activity. Communities in low-income neighborhoods may have a higher prevalence of food deserts, limited recreational facilities, and exposure to environmental toxins, all of which contribute to the development and progression of chronic disease.

Stress and Mental Health: Socioeconomic stressors, and adverse childhood experiences disproportionately affect individuals from disadvantaged backgrounds. Chronic stress can lead to dysregulation of hormones like cortisol and insulin, contributing to insulin resistance and the development of Type 2 diabetes. Additionally, mental health conditions such as depression and anxiety, which are more prevalent in certain socioeconomic groups, can impact self-care behaviors and exacerbate health management challenges.

At Nourish, incorporating the impact of SDOH on the health of patients is essential. Care plans that address systemic inequalities and promote health equity, will help empower Nourish patients to make healthy lifestyle choices. Care delivery goals include improving access to healthcare services, promoting health literacy, addressing environmental and social determinants of health, and implementing culturally competent care.

Race and Healthcare

While SDOH, such as socioeconomic status, education level, and neighborhood environment, play a significant role in shaping access to healthcare, race can also influence access due to historical, systemic, and institutional factors.

Historical Context: Historical factors such as segregation, discriminatory policies, and institutionalized racism have led to disparities in healthcare access and quality for racial and ethnic minority groups. These disparities may persist over time, even when controlling for socioeconomic factors.

Implicit Bias and Discrimination: Implicit biases among healthcare providers can result in differential treatment based on race, leading to disparities in access to quality care. Studies have shown that racial and ethnic minority patients are more likely to experience discrimination within the healthcare system, which can manifest as delayed care, inadequate pain management, and limited access to specialty services.

Cultural Competence: Often, healthcare systems lack cultural competence, which refers to the ability of healthcare providers and institutions to understand and effectively respond to the cultural and linguistic needs of diverse patient populations. Racial and ethnic minority patients historically

encounter barriers to care due to a lack of culturally competent services, including language barriers, cultural misunderstandings, and insensitive care practices.

Geographic Disparities: Racial and ethnic minority communities may be disproportionately located in areas with limited access to healthcare facilities, healthcare professionals, and essential services. This can result in challenges accessing primary care, specialty care, and preventive services, leading to disparities in health outcomes. This is one of the reason's Nourish remains extremely committed to delivering remote care via telehealth.

Health System Factors: Structural factors within the healthcare system, such as reimbursement policies, provider networks, and healthcare financing mechanisms, can contribute to disparities in access to care. For example, racial and ethnic minority groups may be more likely to be uninsured or underinsured, limiting their ability to afford and access necessary healthcare services.

Addressing racial disparities in healthcare access requires comprehensive strategies that address both social determinants of health and systemic factors related to race. At Nourish we emphasize treating the individual

patient holistically, which includes cultural sensitivity and awareness to mitigate implicit bias, promote cultural competence, improve healthcare infrastructure in underserved communities, and ensure equitable access to healthcare services for all individuals, regardless of race or ethnicity.

Clinical Pathway

Clinical pathways are structured, evidence-based plans that guide healthcare professionals through the delivery of care for specific conditions or goals. Below is a clinical pathway to direct dietitian clinical practice for working with patients who have heart health goals. Keep in mind that this is a general guideline for reducing risk for CVD. Individual patient needs may vary.

This Clinical Pathway aims to provide a structured and comprehensive approach to supporting patients in achieving heart health goals while addressing individual needs and promoting long-term success.

The number of sessions presented represents a recommendation based on heart health and disease risk reduction literature. Individual patient preference, learning style, magnitude of behavior change, and insurance limitations must be considered.

pre	**Referral and Assessment** In advance of appt with the patient, review the information that the patient shared in their signup flow/intake form. Review referral from the healthcare provider indicating the patient's heart health goals or a patient self-referral, as well as any uploaded medical documentation and records.
1.0 Sessions 1 - 2	**Complete the assessment** During the initial session for a heart health patient, RD will complete the assessment. Documentation in the relevant sections of the Nourish chart note is required (Patient’s

	chief complaint, medical history, lifestyle, other patient reported information, patient update and diet recall, metrics, etc.). Components of the assessment include: • Medical Hx, including surgical hx as it relates to heart health • Dietary Hx • Adult weight Hx • Medication Hx • Anthropometric measurements • Biochemical measurements • Current intake (24-hour recall) / Current dietary habits • Nutrition related behaviors & Nutrition knowledge and beliefs • Physical Activity Levels • Cultural and social factors • ASCVD Risk Calculator (if labs available)
1.3	**Complete diagnosis (PES)** **Examples**: • Intake of types of fats inconsistent with needs related to insufficient knowledge regarding dietary modifications and lifestyle changes necessary for managing CAD, as evidenced by elevated cholesterol levels, sedentary lifestyle, and high blood pressure.
1.4	**Establish Patient Goals:** • Collaborate with the patient to set realistic goals (e.g. lower fasting triglycerides by 20% in 6 months)

Sessions 1 -2 (with regular revisitation)	• Collaborate with the patient to set realistic and achievable behavioral goals (e.g. decrease alcohol consumption or # servings of processed foods) • Follow S.M.A.R.T goal format • Consider individual factors such as age, medical conditions, and lifestyle

1.5
Sessions 1 -2
	Develop Intervention
	• Develop an individualized dietary plan/pattern/approach
	  ○ Calculate Energy needs - Resting Metabolic Rate (RMR) using the Mifflin-St Jeor equation based on age, actual weight, height, and gender (in Provider Portal).
	  ○ Determine Total Daily Energy Expenditure (TDEE) by multiplying RMR by Activity Factor (AF) to get TDEE (in Provider Portal).
	  ○ Adjust for desired weight gain or loss (see weight loss pathway)
	  ○ Balanced macronutrient distribution
	  ■ Carbohydrates: 45-65% of total daily calories
	  • limit added sugars to no more than 100-150 calories (25-38 grams) per day for women and 150-200 calories (38-50 grams) per day for men. This recommendation is based on a daily caloric intake of about 2000-2500 calories
	  ■ Protein: 10-35% of total daily calories
	  ■ Fat: 20-35% of total daily calories
	  • Limit saturated fat intake to no more than 5-6% of total daily calories.
	  ○ Prioritize nutrient Density (EN/Kcal)
	  ○ Consider cultural and personal food preferences.

1.6 Sessions 3 - 12+	**Share evidence-based tools for heart healthy eating, including:** ■ Portion awareness tools (visuals, cups, food scale) ■ Meal Plans or idea lists ■ Heart healthy recipes and food prep/cooking education

	■ Food prep skills & exercises ■ Food journaling/tracking ■ Activity journaling/tracking ■ Nutrition Label reading ■ Hydration ■ Strategies for dining out ■ Self-weighing (if weight gain or loss is desired) ■ Regular Activity ■ Stress management techniques (meditation, yoga, breathing exercises) ■ Mindful eating ■ Behavior Contracts ■ Stimulus control ■ Social Support ■ Visualization ■ Gratitude ■ Tobacco cessation (if appropriate) RDs are to use clinical and behavior change judgment to select from the available tools to support patients with heart health goals.
1.8 Sessions 3 - 12+	**Physical Activity Integration** ● Encourage physical activity for heart health ○ American Heart Association Recommendations for Physical Activity in Adults and Kids ○ World Health Organization Physical Activity Recommendation ○ Centers for Disease Control Activity Statement

	• Further provide tailored guidance based on NASM, ACSM or ACE Guidelines and the patient's fitness level and preferences • Refer patient to a fitness professional and/or qualified fitness programming source to incorporate a personalized exercise plan if appropriate
1.9 Sessions 1 - 12+	**Additional charting requirements** • With each session, complete all relevant outcomes in general health and heart health sections, including updated lab results and blood pressure readings.
2.0 Session 1-12+	**Regular Monitoring and Follow-Up** • Schedule regular follow-up appointments to monitor progress • Adjust the dietary plan and goals as needed for heart health • Address any challenges or concerns the patient may encounter • Provide ongoing behavioral support to help the patient overcome barriers. • Encourage self-monitoring. • Discuss strategies for managing social and environmental influences on eating behavior
2.1 Session 12+	**Transition to Maintenance** • Once a patient's goals have been met, provide guidance on maintaining a heart healthy eating. • Recommend ongoing support through periodic check-ins • Explore with the patient whether there are other nutrition interests / goals with which you might be able to help.
2.2	**Multidisciplinary Collaboration**

Session 1-12+	• Collaborate with other healthcare professionals as available, such as physicians, psychologists, and fitness experts, to ensure comprehensive and coordinated care • Communicate regularly with the healthcare team to address any concerns
2.3 Session 12 or completion of program	**Evaluation** • Evaluate the effectiveness of the intervention by reviewing outcome trend graphs. • Collect patient feedback for continuous quality improvement.

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