Teaching lifestyle medicine competencies in undergraduate medical education: active collaborative intervention for students at multiple locations

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Pasarica M, Kay D. Teaching lifestyle medicine competencies in undergraduate medical education: active collaborative intervention for students at multiple locations. Adv Physiol Educ 44: 488–495, 2020; doi:10.1152/advan.00148.2019.—The aims of this study are to 1) design feasible active collaborative educational approaches to teach and assess three of the newly described lifestyle medicine (LM) competencies to students at multiple locations; and 2) determine whether a mixed, flexible instructional delivery approach impacts students’ learning and perception of confidence in LM. The educational interventions were part of the undergraduate clinical medical education curriculum and have two parts: 1) an asynchronous session [online self-learning module (SLM)], and 2) a synchronous session using case-based collaborative learning delivered either mostly face to face, as determined by the instructor (approach A) or mostly virtual, as determined by the student (approach B). Both approaches were delivered in the curriculum as planned to 27 students in approach A (26% attending virtually) and 31 students in approach B (90% attending virtually). Approach B required more planning time. Approach A students (26 of 27) agreed that the SLM was valuable as an educational tool. The performance in the summative assessment was similar (P = 0.49) in both approaches [means (SD): 33.2 points (SD 10.6) approach A vs. 33.2 points (SD 10.1) approach B]. Students reported a similar increase in confidence (P = 0.33) with setting lifestyle change goals. The two educational approaches presented here address three of the new LM competencies using active collaborative learning. Both approaches are feasible for synchronous delivery to students located at local and distant sites, either face to face or virtual. The increase in the proportion of students attending virtually did not decrease the measured outcomes of learning and perceptions of confidence.

active learning; lifestyle; multiple clinical sites; undergraduate medical education; virtual participation

INTRODUCTION

Physiology of behaviors (like nutrition, exercise, and sleep) influence multiple body processes and impact health and disease (23). These were traditionally taught in the preclinical years of medical education, with minimal focus on clinical integration (12). However, in a 2010 Journal of the American Medical Association article, Lianov and Johnson (17) highlighted the evidence-based data related to the influence of these behaviors, either normal (physiological) or abnormal (physiopathological), as essential in patient care and noted that they were not sufficiently addressed (and, we would add, integrated) in clinical medical education. Even further, the term of “lifestyle medicine” (LM) was coined to incorporate the evidence-based science of using behavior change for the prevention and management of chronic diseases (17). This presented a perfect opportunity for the integration of preclinical physiology and physiopathology concepts into clinical medical education (23). In 2013, the American Medical Association (AMA) published LM competencies organized into five domains: leadership, knowledge, assessment skills, management skills, and use of office and community support (8). These were readily endorsed by the American College of Lifestyle Medicine and other organizations. However, as per a recent report by the AMA, the current integration of LM teaching in medical education is less than recommended, and, therefore, the AMA is advocating again for the development of new and innovative interventions to integrate LM into undergraduate, graduate, and continuous medical education (32).

In response, we developed a new curriculum in clinical undergraduate medical education, utilizing active learning methodologies and innovative technologies, to address current LM competencies. Our clinical undergraduate medical education, similar to many other medical schools, needs to be delivered from multiple clinical sites at various distances, yet offer similar learning experiences. To overcome this challenge, we expanded our instructional delivery by adding an option for virtual synchronous participation for the teaching sessions. This introduced two concerns. What impact will replacing face-to-face peer collaboration with virtual peer collaboration have on collaborative learning? How will mixed delivery of a synchronous session (face to face and virtual based on learner’s preference) in the medical clinical curriculum impact learning and students’ perceived confidence in LM clinical skills?

Collaborative face-to-face learning has multiple learning benefits (14, 31). In virtual learning, we replace face-to-face collaboration with virtual collaborative learning, which may not be as effective. As per a recent meta-analysis from the U.S. Department of Education (18), virtual learning can be as effective as face-to-face instruction. However, there is a concern that learning in undergraduate clinical medical education may not follow that same pattern, as the existing literature is less robust in undergraduate medical education. O’Donovan and Maruthappu (20) showed that medical students in a clinical curriculum using a synchronous delivered, e-learning module on clinical skills gained self-confidence. Others studied the effects of asynchronous e-learning delivered to medical students in their clinical curriculum on family medicine topics (26), surgical topics (6), palliative care topics (28), radiology topics (1), and ophthalmology topics (22). These interventions

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resulted in increased self-reported confidence (20), increased learning (6), no change in learning (1, 28), or slightly higher, but significantly different, learning (22) compared with face-to-face delivery. These methods were well received by medical students, who reported satisfaction with the sessions (1, 6, 28, 29). All of these interventions (1, 6, 20, 22, 28, 29) were fully delivered virtually.

Flexible learning has also been shown to have multiple benefits as a contributor to intrinsic motivation, one of the most important influences on learning (25). Giving learners a choice of when, where, how often, for how long, and how to learn gives them a feeling of being in control of their own lives and satisfies the need for autonomy, an important intrinsic motivator for learning (21, 33). Fostering autonomy by allowing learners to personalize their approach to learning (including minimizing the stress of the learning environment, time management, etc.) creates deeper connections that result in long-term retention (11, 24).

The aims of this project were to 1) design feasible active collaborative educational approaches to teach three of the newly described LM competencies to students at multiple locations; and 2) determine whether a mixed, flexible, instructional delivery approach impacts students’ learning and perception of confidence in LM. Based on data available on undergraduate and graduate students, if clinical medical education follows the same trends, we would expect that the virtual delivery and collaboration will increase or, at least, not decrease learning and, therefore, could be a viable option, especially when equivalent clinical training needs to be provided across different sites.

METHODS

This study was approved by the Institutional Review Board at the University of Central Florida College of Medicine.

Setting

The educational interventions were part of the Internal/Family Medicine Clerkship curriculum for third-year medical students (in a 4-yr curriculum). The clerkship teaching sessions are delivered asynchronously online and synchronously (face to face or virtually) once a week for 12 wk, while student experience clinical training in 8–12 different locations (“local sites” defined as 0.25- to 1.5-h driving distance from the medical school, and “distant sites” defined as 1.5- to 4-h driving distance from the medical school).

Description of the Educational Interventions

We conducted an informal needs assessment by mapping the current curriculum with the LM competencies previously published and endorsed by AAMC (8). Subsequently, we selected three competencies that were identified as gaps in our curriculum and relevant to third-year medical students in the Internal/Family Medicine curriculum: competency 1, demonstrate knowledge of the evidence that specific lifestyle changes can have a positive effect on patients’ health outcomes; competency 2, use nationally recognized practice guidelines to assist patients in self-managing their health behaviors and lifestyles; and competency 3, collaborate with patients and their families to develop evidence-based, achievable, specific, written action plans.

The overall educational learning outcome was to apply LM principles for the management of a patient with a chronic disease. This outcome was derived from the targeted LM competencies. As a prerequisite, students were required to complete a self-learning module (SLM) that introduced the popular SMART (specific, measurable, achievable, realistic, timely) goal approach for setting lifestyle goals in the management and/or prevention of chronic disease. The SLM reinforced the importance of lifestyle goals being specific, measurable, achievable, realistic, timely, with adequate evaluation. The SLM was followed with a synchronous classroom session in which students practiced these skills through role play (16).

The educational intervention had two parts and was delivered using two approaches. Both approaches had the same content and objectives. Delivery of part 1 was the same for both approaches, whereas delivery of part 2 was different in regards to face-to-face or virtual participation and collaboration, as summarized in Table 1 and described below.

Part 1 was an asynchronous session delivered online as an SLM (APPENDIX A) in 30–60 min of curricular time. The SLM introduced an easy-to-apply approach for discussing evidence-based LM recommendations for the management of several common chronic diseases, iron-deficient anemia, celiac disease, type 2 diabetes mellitus, hyperlipidemia, and addressed targeted competencies 1 and 2. The module was designed to provide practical, clinically significant information and links to regularly updated resources for future independent providers. The disease processes were chosen from the required clinical conditions for the clerkship.

Part 2 was a synchronous session delivered in 2 h of curricular time. Students were presented with four clinical scenarios of patients with a chronic condition poorly controlled and in critical need of a lifestyle intervention (APPENDIX B), which addresses targeted competency 3. The cases were refined using input from national and international experts during professional workshop presentations and instructor observation during session delivery. The lifestyle history was the same for all of the patients. However, the chronic condition was different (anemia, celiac disease, hyperlipidemia, type 2 diabetes mellitus). Students were tasked to 1) apply LM principles to develop specific personalized recommendations for the management of the assigned patient scenario, and 2) provide feedback to their peers on their recommendations.

Participation for part 2 was face to face or virtual. In approach A, students were assigned to either face-to-face or virtual attendance

| Prerequisites | Approach A | Approach B |
|---------------|------------|------------|
| Part 1        | SLM and practice session to learn how to set lifestyle goals and/or management of several common chronic diseases | Asynchronous, online to discuss evidence-based recommendation for the use of lifestyle medicine in the prevention of and management of several common chronic diseases |
| Part 2        | Asynchronous, online to discuss evidence-based recommendation for the use of lifestyle medicine in the prevention of and management of several common chronic diseases | Synchronous |
| Delivery      | Determined by the instructor: local students (74%) face to face in groups; distant students (26%) virtually in groups | Determined by students: face to face (10%) or virtually (90%) from the location of their choice, independent of the distance to clinical site |
| Attendance location | Face-to-face | Virtual |
| Group work | Solve one assigned clinical case and give feedback to peers | Solve one assigned clinical case and give feedback to peers |
| Task | | |
based on the distance between the clinical site and the school. Students at the local clinical sites were required to attend face to face, and students at the distant clinical sites were required to attend virtually, which resulted in a majority of students (74%) attending face to face. In approach B, students had the option to attend, either face to face or virtually, independent of the distance to clinical site, which resulted in majority of students (90%) attending virtually.

Collaborative work for part 2 was either face to face or virtual. In approach A, students worked face to face in groups to solve the clinical cases. Each group posted its assigned deliverable as a chat response in the university’s learning management system (Webcourse). In approach B, students worked virtually in groups to solve the same clinical cases. Students first posted their individual responses on the Webcourse’s discussion board for their assigned case and then used the Webcourse “like” feature to identify the best response. Feedback related to each group’s product was given verbally in the large-group debrief for both approaches.

Assessment of the Outcomes

The curriculum was assessed based on the Kirkpatrick pyramid (16), for which higher levels are associated with higher impact.

Feasibility. The feasibility of the sessions was measured by the completion of the session as planned. Evaluation of the SLM module included student satisfaction with the activity (level 1 of reaction on Kirkpatrick’s pyramid). Subjective observations as lessons learned from the instructors were also included.

Learning. Transfer of learning (level 3 of behaviors on Kirkpatrick’s pyramid) was measured during a summative, observed structured clinical examination using a standardized patient presenting with a chronic condition that warranted a LM intervention. The examination was delivered at the end of the clerkship. Students were scored on the seven components of lifestyle change goals using a scale from 0 to 40 (0 for no correct goal component; 10 for less than 3 correct components; 20 for 4–6 correct components; 40 for all 7 correct components). This activity assessed the three targeted competencies.

Perception of clinical confidence. Before and after the clerkship curriculum, students ranked their own confidence (level 2 of reaction on Kirkpatrick’s pyramid) in assisting patients with setting lifestyle change goals. A 5-point Likert scale was used and converted to points as follows: not at all confident (1 point), slightly confident (2 points), moderately confident (3 points), quite confident (4 points), and extremely confident (5 points). Differences in the confidence score pre- to post-clerkship curriculum was considered a change in confidence.

Statistical Analysis

Descriptive statistics (mean and standard deviation) are used to present the data. When differences in learning and confidence of approaches A and B are studied, a t test is used. *P < 0.05* is considered statistically significant.

RESULTS

Feasibility

Both approaches were delivered in the curriculum successfully as planned. Approach A was synchronously delivered to 27 students, 7 at distant sites participating virtually (26%) and 21 at local sites participating face to face. Approach B was synchronously delivered to 31 students, 7 at distant sides, and 21 at local sites participating virtually (*n* = 28, 90%), with only 3 students from the local sites participating face to face. Both sessions were facilitated by two instructors. More instructor time was necessary to design approach B. Technical support was needed during both approaches to troubleshoot problems related to the microphones or connections for the students participating virtually. Most students (26 of 27) agreed and strongly agreed that the SLM was valuable as an educational tool to increase their ability to prescribe lifestyle advice to patients with common medical conditions.

Transfer of Learning

The performance of the students at the observed structured clinical examination using a standardized patient presenting with a chronic condition that warranted a LM intervention was similar, as showed by an average performance score of 33.2 points (SD 10.6) in approach A versus 33.2 points (SD 10.1) in approach B [means (SD); *P = 0.49*].

Perception of Clinical Confidence

Students reported a similar increase (*P = 0.33*) in confidence with setting lifestyle change goals for improving the outcomes of lifestyle interventions with approach A [1.1 points (SD 0.9)] versus approach B [0.9 points (SD 1.1)]. Students who were not at all confident before the sessions (two in approach A and one in approach B) reported being quite confident after the intervention. The specific distribution of confidence is described in Table 2.

DISCUSSION

The two educational approaches presented here address three of the new LM competencies using active collaborative learning in only 2–3 h of curricular time. Both approaches are feasible for synchronous delivery to students located at local and distant sites, either face to face or virtual. In approach B, offering students the choice to attend either face to face or virtually resulted in a higher proportion of students attending virtually with no decrease in the measured outcomes of learning and perception of confidence. However, approach B required more resources. Either approach could be adopted by educators interested in integrating LM into their clinical curriculum, with selection to be done based on the instructor or student preference, and/or technical and/or time resources. In addition, using our previously published findings, that virtual synchronous and asynchronous delivery would yield higher student engagement (attendance, assignment completion, the number and quality of interactions) compared with face-to-face synchronous delivery (15), we suggest that, if maximal student engagement is an aim, then approach B should be used.

Table 2. Student perception of confidence in improving the outcomes of lifestyle interventions with patients by setting lifestyle change goals

|                      | Extremely Confident | Quite Confident | Moderately Confident | Slightly Confident | Not at All Confident |
|----------------------|--------------------|-----------------|----------------------|-------------------|---------------------|
| **Approach A**       |                    |                 |                      |                   |                     |
| Pre                  | 0                  | 15              | 59                   | 19                | 7                   |
| Post                 | 19                 | 59              | 22                   | 0                 | 0                   |
| **Approach B**       |                    |                 |                      |                   |                     |
| Pre                  | 0                  | 44              | 28                   | 24                | 4                   |
| Post                 | 20                 | 64              | 16                   | 0                 | 0                   |

Values are in %. Students were told: Rate your level of confidence in assisting the patient in setting personalized, clear lifestyle change goals for improving the outcomes of lifestyle interventions. Pre and Post, before and after intervention, respectively.
Approach B could also be applied to an entirely virtual session if needed, using an approach previously published (15) that was preferred by the students, and also served the purpose of delivering a session in a period in which the students and the instructor could not be on site.

This study also demonstrated that virtual delivery of the LM curriculum in undergraduate medical education compared with face to face follows similar trends as in other graduate and undergraduate curricula. And, most importantly, that virtual collaboration was as effective as face-to-face collaboration in terms of learning and confidence outcomes for the students. As flexibility is an intrinsic motivator for learning (11, 21, 24, 25, 33), the approach offering learners the flexibility to choose their location for the synchronous session may have acted to improve learning.

Another advantage of the presented educational approach was that the instructors were able to discuss a variety of lifestyle recommendations for management of diseases from various organ systems. The template used for the cases (same lifestyle history but different disease with similar challenges in management) worked well and allowed us to easily make the point that, depending on the medical problem, a variety of lifestyle change management plans are needed in clinical practice. This could be used in the future as a clinical reasoning exercise, where the same portion of a history or examination could lead to several different diagnosis or management plans. More than this, it brought home the point that there are situations when pharmacological management of diseases is not an option anymore, and lifestyle management is required. As a note, previous versions of these clinical cases allowed pharmacological management to be effective and resulted in students proposing mostly pharmacological management (even though lifestyle changes were indicated as first line in the management).

This study has some limitations. Because approach B included the option for face-to-face or virtual attendance, we cannot conclude that the method of delivery alone influenced the outcomes. However, virtual delivery is a common theme with potential significance. Future studies should look at the influence of choice in delivery options for the outcomes targeted. For example, we could omit the mixed delivery format, but instead offer students the choice of attendance to the synchronous session either face to face (control group) or virtually (intervention group) and then compare the two groups in terms of transfer of learning. However, this would require a larger number of students to obtain sufficient statistical power.

Approaches A and B were studied in medical students at the same educational level, in the same academic year, but with two different cohorts of students. This is a limitation commonly encountered in medical educational designs. However, since the students were in the same medical school, their previous exposure to any LM curriculum was the same, which is a fair mitigation of the limitation.

The same educational designs could be used for learning outcomes of similar complexity in other applied physiology-related disciplines. However, there is a possibility that more complex outcomes could not be achieved with this delivery, and this needs to be studied in the future. A similar challenge may be present with more novice students, who may need individualized feedback. These innovative designs could also be used when aiming to provide equivalent experiences for students present at multiple locations (either by assignment or preference), in either the clinical or preclinical curriculum. The educational materials presented here (SLM and active face-to-face session) could be used by other institutions to address the current competencies for a LM curriculum.

**APPENDIX A: SELF-LEARNING MODULE**

This module “Prevention and Management of Common Chronic Conditions Using Lifestyle Medicine,” was presented in a PowerPoint format for the students. APPENDIX A represents the text from the file used.

**Competencies Addressed in Lifestyle Medicine**

1. Demonstrate knowledge of the evidence that specific lifestyle changes can have a positive effect on patients’ health outcomes.
2. Use nationally recognized practice guidelines to assist patients in self-managing their health behaviors and lifestyles.
3. Collaborate with patients and their families to develop evidence-based, achievable, specific, written action plans.

**Learning Objectives**

To discuss the evidence-based practical recommendations for the use of lifestyle medicine in the prevention and/or management of several common chronic diseases:

- Iron-deficient anemia
- Celiac disease
- Type 2 diabetes mellitus
- Hyperlipidemia

**Evidence-based Data on Healthy Lifestyle**

- Increased life expectancy is related to healthy behaviors (7).
- Most noncommunicable chronic diseases can be prevented or reversed by lifestyle changes (5).
- The leading cause of mortality and healthcare costs worldwide are chronic diseases that are caused by unhealthy lifestyle and can be prevented by healthy lifestyle changes (27).
- The majority of cardiovascular diseases can be prevented by healthy lifestyle (13).
- A substantial proportion of cancers can be prevented by healthy lifestyle (30).
- Intensive lifestyle changes for 12 wk can reverse hypertension, hyperlipidemia, and type 2 diabetes in the absence of pharmacological management (9).

**Lifestyle Recommendations for Management of Patient with Type 2 Diabetes Mellitus**

These recommendations are updated annually with the latest evidence in diabetes care. Please review updated recommendations from the American Diabetes Association (2).

1. Medical nutrition:
   - Decrease total energy intake for >5% weight loss for patients who are overweight and obese.
   - Individualized distribution of calories among carbohydrates, proteins, and fats.
   - Carbohydrates: Prioritize foods that are nutrient dense and rich in fiber (vegetable, fruits, legumes, whole grains) and dairy. Avoid sugar-sweetened beverages and sugar-added foods.
   - Fats: Choose mono- and polyunsaturated fat foods (Mediterranean diet).
   - Alcohol: No more than 1 drink/day (women) and 2 drinks/day (men). Educate on the risk for hypoglycemia.
   - Sodium: <2,300 mg/day.
   - Nonnutritive sweeteners: Only to replace sugar. Water intake encouraged.

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• Supplements: No evidence of benefits if no deficiency is present.

2. Physical activity:
• Moderate/vigorous-intensity aerobic activity: >150 min/wk.
• Vigorous muscle/bone-strengthening activities: at least 2–3 days/wk.
• Flexibility/balance training: 2–3 times/wk.
• Decrease sedentary activities.
• Prolonged sitting to be interrupted every 30 min.

3. Other behaviors:
• Smoking cigarettes and e-cigarettes are not recommended.

4. Potential psychosocial issues to be assessed:
• Attitudes about diabetes
• Expectations for medical management and outcomes
• Affect or mood, general and diabetes-related quality of life
• Available resources (financial, social, and emotional)
• Psychiatric history
• Diabetes distress
• Depression, anxiety
• Disordered eating
• Cognitive impairment

5. Practical consideration from American Diabetes Association.

Quick and healthy lunch ideas (3):
• Sandwich: Use two pieces of thin sandwich bread, 2 oz. reduced-sodium lean turkey, hummus, spinach, bell pepper, and mustard. Add some carrot sticks and light ranch dressing on the side.
• Mix together some cooked quinoa, white beans, chopped bell pepper, carrots, and broccoli to make a grain salad. Toss with some olive oil, lemon juice, salt, and pepper. Add a nectarine or some grapes on the side, and a small handful of dry roasted almonds, if desired.
• Make a tuna salad with canned tuna, light mayo, diced celery, lemon juice, and freshly ground pepper. Serve it over greens with an apple and peanut butter on the side.
• Try a quick yogurt parfait with nonfat plain Greek yogurt, diced pineapple, peaches, and a handful of pecans on the side.
• Fill a whole wheat tortilla wrap with rotisserie chicken, hummus, sundried tomatoes, feta cheese, and greens. Add a side of fruit if it fits with your plan.

Lifestyle Recommendations for Management of Patients with Hyperlipidemia

These recommendations are updated periodically with the latest evidence in circulation by a collaboration of organizations that include American Heart Association and American College of Cardiology. Please review updated recommendations (10).

1. Medical nutrition:
   a. Adequate intake of:
      • Vegetables, fruits, and whole grains, legumes and nuts
      • Low-fat dairy products and poultry
      • Fish and seafood
      • Nontropical vegetable oils: canola, sunflower, olive
   b. Limit intake of:
      • Saturated and trans fats
      • Sweets and sugar-sweetened beverages
      • Red meats
   c. Total caloric intake: To avoid weight gain in patients with healthy weight or promote weight loss in patients who are obese or overweight

2. Physical activity:
   a. Aerobic activity
      • Moderate-intensity aerobic intensity: at least 150 min/wk, or
      • Vigorous-intensity aerobic activity: at least 75 min/wk, or
      • A combination of moderate- and vigorous-intensity aerobic activity
   b. Moderate/high-intensity muscle strengthening activities: at least 2 days/week

Lifestyle Recommendations for Management of Patients with Celiac Disease

These recommendations are updated periodically with latest evidence in The American Journal of Gastroenterology. Please review updated recommendations (26).

1. Medical nutrition:
   a. Strict avoidance of products that contain:
      • Wheat
      • Barley
      • Rye
   b. Pure oats should be introduced in diet with caution for adverse reaction.
   c. Correction of potential micronutrient deficiencies for iron, folic acid, vitamin D, vitamin B12.

2. Practical considerations from the National Institutes of Health (NIH) (19):
   a. What should patients with celiac disease eat?
      • Meat, fish, eggs
      • Fruits, vegetables
      • Rice, potatoes, quinoa, buckwheat, bean flower
      • Most dairy products
   b. What do patients with celiac disease need to avoid (unless labeled gluten-free)?
      • Products containing gluten (most cereals, grains, pasta, and many processed foods: barley, rye and wheat).
      • Nutritional supplements, medicines, supplements may that contain gluten.
      • Play-Doh, cosmetics, toothpaste, mouthwash that may contain gluten.
      • Beer, breads, cakes, French fries, pastas.
      • Processed luncheon meats, salad dressings, sauces, seasoned rice mixes.

Lifestyle Recommendations for Management of Patients with Iron-deficient Anemia

These recommendations are updated periodically with the latest evidence by the American Society of Hematology. Please review updated recommendations at the American Society of Hematology (4).

1. Medical nutrition:
   a. Encouraged consumption of the following foods:
      • Meat: beef, pork, or lamb, especially organ meats such as liver
      • Poultry: chicken, turkey, and duck, especially liver and dark meat
      • Fish, especially shellfish, sardines, and anchovies
      • Leafy green members of the cabbage family including broccoli, kale, turnip greens, and collard greens
      • Legumes, including lima beans, peas, pinto beans, and black-eyed peas
      • Iron-enriched pastas, grains, rice, and cereals
   b. There are two types of iron in foods:
      • Heme iron (higher bioavailability): richest source in lean meat and seafood.
      • Nonheme iron: nuts, beans, fortified grain products.
Clinical Case 2

Ms. Buck is a 52-yr-old Caucasian female patient, with type 2 diabetes.

Six months ago: She was diagnosed with type 2 diabetes mellitus (HbA1C 11%). You (primary care provider) discussed with her the dietary recommendations, the implication of the disease, and the risks of not being compliant with the dietary management.

Five months ago: She came back to see you because she missed 3 different work days due to pain in her joints. She is also making it difficult to do things she enjoys, like playing with her children and shopping with her friends. You stopped the statin because of the side effects and start a different statin. You discuss with her the dietary recommendations again and give her a referral to a nutritionist you know to be competent.

Four months ago: Ms. Buck is seen by the nutritionist who gives her a book about hyperlipidemia and talks with her about how to change her diet.

Three months ago: Ms. Buck came to see you again because she missed 3 different work days due to pain in her joints. She is also making it difficult to do things she enjoys, like playing with her children and shopping with her friends. You stopped the statin because of the side effects and start a different statin. You discuss with her the dietary recommendations again and give her a referral to a nutritionist you know to be competent.

Today: Same as last visit. You get frustrated and want to fire her, but you would prefer to find a way to help her.

Clinical Case 3

Ms. Cori is a 25-yr-old Caucasian female patient, with iron-deficient anemia who is trying to get pregnant. She is otherwise healthy and takes no meds.

Six months ago: She was diagnosed with iron-deficient anemia (Hb 9%). You (primary care provider) discussed with her the dietary recommendations, the implication of the disease, and the risks of not being compliant with the dietary management, and you recommended that she start on iron. Ms. Buck refuses insulin. She is a school bus driver and fears she will lose her job if she is on insulin. So you start her on a combo of three oral medicines.

Five months ago: Ms. Buck came back to see you because of “pins and needles in her legs and blurry vision” that interfere with her work. You recognize these as symptoms of hyperglycemia and increase all drug doses to the maximum allowed. You review the dietary recommendations again and provide a referral to a nutritionist you know to be competent.

Four months ago: Ms. Buck is seen by the nutritionist who gives her a book about type 2 diabetes and talks with her about how to change her diet.

Three months ago: Ms. Buck came to see you again and her HbA1c is 10%. You again recommend insulin. She is desperate. She reports that she has tried to follow the diet recommendations but finds it difficult to maintain. You review the foods that she should avoid and send her back to the nutritionist. The nutritionist provides a website for support groups for diabetes and additional education on what not to eat.

Two months ago: Ms. Buck comes back to see you because she is tired all the time. She reports that she has tried to follow the diet recommendations but finds it difficult to maintain. You review the foods that she should avoid and send her back to the nutritionist. The nutritionist provides a website for support groups for diabetes and additional education on what not to eat.

Today: She was diagnosed with iron-deficient anemia (Hb 9%). You (primary care provider) discussed with her the dietary recommendations, the implication of the disease, and the risks of not being compliant with the dietary management, and you recommended that she start on iron. Ms. Buck refuses insulin. She is a school bus driver and fears she will lose her job if she is on insulin. So you start her on a combo of three oral medicines.

Five months ago: Ms. Buck came back to see you because of “pins and needles in her legs and blurry vision” that interfere with her work. You recognize these as symptoms of hyperglycemia and increase all drug doses to the maximum allowed. You review the dietary recommendations again and provide a referral to a nutritionist you know to be competent.

Today: Same as before. You get frustrated and want to fire her, but you would prefer to find a way to help her.

Clinical Case 4

Ms. Mayer is a 38-yr-old Caucasian female with hyperlipidemia.

Six months ago: She was diagnosed with hyperlipidemia (CVD risk 8% in 10 yr) and you (primary care provider) discussed with her the dietary recommendation, the implication of the disease, and the risks of not being compliant with the dietary management. Also, you prescribed a statin.

Five months ago: She came back to see you because she missed 3 different work days due to pain in her joints. The pain is also making it difficult to do things she enjoys, like playing with her children and shopping with her friends. You stopped the statin because of the side effects and start a different statin. You discuss with her the dietary recommendations again and give her a referral to a nutritionist you know to be competent.

Four months ago: Ms. Mayer is seen by the nutritionist who gives her a book on hyperlipidemia and talks with her about how to change her diet.

Three months ago: Ms. Mayer came to see you again because she stopped this statin (due to side effects) and does not want to take any meds anymore, but she is continuing to miss work due to joint pain. She is desperate. She reports that she now knows what to do and has tried to follow your previous recommendations, but she is having difficulty following such a strict diet. You review the foods that she should avoid and send her back to the nutritionist.

Two months ago: Ms. Mayer comes back to see you with same complaint. You tell her that she needs to follow your recommendations, or there will be no improvement, and she is at high risk for cardiovascular events.

Today: Same as last visit. You get frustrated and want to fire her, but you would prefer to find a way to help her.

Clinical Case 5

Ms. Elion is a 36-yr-old Caucasian female with celiac disease.

Six months ago: She was diagnosed with celiac disease and you (primary care provider) discussed with her the dietary recommendations, the implication of the disease, and the risks of not being compliant with the dietary management.

Five months ago: She came back to see you because of “belly gas and pain” that interfere with her work. She missed 3 different work days because of this. You discuss with her the dietary recommendations again and give her a referral to a nutritionist you know to be competent.

Four months ago: Ms. Elion is seen by the nutritionist who gives her a book about celiac disease and talks with her about how to change her diet.

Three months ago: Ms. Elion came to see you again because she is continuing to miss work due to the “belly gas and pain.” She is desperate. She reports that she now knows what to do and has tried to follow your previous recommendations, but she is having difficulty following such a strict diet. You review the foods that she should avoid and send her back to the nutritionist.

Two months ago: Ms. Elion comes back to see you with same complaint. You tell her that she needs to follow your recommendations, or there will be no improvement.

Today: Same as 2 mo ago. You get frustrated and want to fire her, but you would prefer to find a way to help her.

Clinical Case 1

Ms. Elion is a 36-yr-old Caucasian female with celiac disease.

Six months ago: She was diagnosed with celiac disease and you (primary care provider) discussed with her the dietary recommendations, the implication of the disease, and the risks of not being compliant with the dietary management.

Five months ago: She came back to see you because of “pins and needles in her legs and blurry vision” that interfere with her work. She missed 3 different work days because of this. You discuss with her the dietary recommendations again and provide a referral to a nutritionist you know to be competent.

Three months ago: Ms. Buck came to see you again and her HbA1c is 10%. You again recommend insulin. She is desperate. She reports that she has tried to follow the diet recommendations but finds it difficult to maintain. You review the foods that she should avoid and send her back to the nutritionist. The nutritionist provides a website for support groups for diabetes and additional education on what not to eat.

Two months ago: Ms. Buck comes back to see you because she is tired all the time. She reports that she has tried to follow the diet recommendations but finds it difficult to maintain. You review the foods that she should avoid and send her back to the nutritionist. The nutritionist provides a website for support groups for diabetes and additional education on what not to eat.

Today: Same as 2 mo ago. You get frustrated and want to fire her, but you would prefer to find a way to help her.

Clinical Case 2

Ms. Buck is a 52-yr-old Caucasian female patient, with type 2 diabetes.

Six months ago: She was diagnosed with type 2 diabetes mellitus (HbA1C 11%). You (primary care provider) discussed with her the dietary recommendations, the implication of the disease, and the risks of not being compliant with the dietary management, and you recommended that she start on insulin. Ms. Buck refuses insulin. She is a school bus driver and fears she will lose her job if she is on insulin. So you start her on a combo of three oral medicines.

Five months ago: Ms. Buck came back to see you because of “pins and needles in her legs and blurry vision” that interfere with her work. You recognize these as symptoms of hyperglycemia and increase all drug doses to the maximum allowed. You review the dietary recommendations again and provide a referral to a nutritionist you know to be competent.

Four months ago: Ms. Buck is seen by the nutritionist who gives her a book about type 2 diabetes and talks with her about how to change her diet.

Three months ago: Ms. Buck came to see you again and her HbA1c is 10%. You again recommend insulin. She is desperate. She reports that she has tried to follow the diet recommendations but finds it difficult to maintain. You review the foods that she should avoid and send her back to the nutritionist. The nutritionist provides a website for support groups for diabetes and additional education on what not to eat.

Two months ago: Ms. Buck comes back to see you because she is tired all the time. She reports that she has tried to follow the diet recommendations but finds it difficult to maintain. You review the foods that she should avoid and send her back to the nutritionist. The nutritionist provides a website for support groups for diabetes and additional education on what not to eat.

Today: Same as last visit. You get frustrated and want to fire her, but you would prefer to find a way to help her.
Four months ago: All laboratories are normal, except Hb/Hct. Ms. Cori did not take the meds because they are too expensive. You offer to add Colace to prevent constipation, but she said she is sick of meds and does not want to take more. Ms. Cori is seen by the nutritionist who gives information about anemia and talks with her about how to change her diet.

Three months ago: Ms. Cori comes in for follow-up from an emergency room (ER) visit because of chest pain with a Hb of 8. You again recommend medicine and lifestyle changes. She reports that she will not take any meds, but she has tried to follow the diet recommendations. She readily admits that she has had limited success at maintaining any long-term change in her diet. You review the foods that she should increase and send her back to the nutritionist. The nutritionist provides a website for anemia and additional education on what to eat.

Two months ago: Ms. Cori comes back to see you. She is visibly fatigued but reports she is afraid to go to ER again. She is still paying a huge bill for the last visit. She is not pregnant yet. You tell her that things will not improve if she doesn’t follow your recommendations.

Today: Same as 2 mo ago. You get frustrated and want to fire her, but you would prefer to find a way to help her.

Lifestyle History (For All of the Cases)

Social history. She has her own car. She doesn’t make a lot of money, so it is very difficult for her to afford healthy food. She typically buys what is on sale. She has time and knows how to cook. She knows how to cook traditional food like mac and cheese, hamburgers, steak, fried chicken, beans and rice, pasta, and fries. She lives in an unsafe neighborhood, so she cannot go for walks outside for exercise.

Diet history.

- Breakfast: Two pancakes or waffles with syrup and 1 glass of orange juice.
- Lunch: A salad from the cafeteria every day containing lettuce, tomatoes, cheese, croutons, bacon, and two packets of ranch dressing, always with two very good white bread sticks and chicken fingers. Sometimes she gets a canned chicken noodle soup to go.
- Dinner: Fish sticks and baked potato with sour cream, hamburger with fries, or macaroni and cheese.
- Snacks: Crackers, bagels, or chips and cheese dip, at around 10 AM, 2 PM, and 11 PM.
- Drinks: Regular soda (3–4 cans per day) and sweetened tea. Likes beer (1–2 cans/day).
- Salt intake: does not add salt to food.
- She does not like milk or yogurt, fruits, water.
- Restaurant meals: once a day.
- She eliminated most of the deserts because she knows they have lots of calories.
- She is satisfied with her eating habits.
- She thinks she eats more when she is stressed.
- She has never tried to lose weight before.

Activity history. She does some exercise in a park not far from her home:

- Only on weekends, every weekend (Saturday and Sunday), for 30–60 min.
- Leisurely walking, so she can talk on the phone.

LIFESTYLE ACTIVITY.

- She almost never takes the stairs.
- She parks close to the store/house because it is convenient.

SEDENTARY TIME.

- She watches 3 h/day of TV.
- At work she is sitting on a chair most of the time.

Sleep habits. She sleeps 5 h/day; usually she feels rested in the morning.

Alcohol intake history. She likes beer (1–2 cans/day).

Illegal drug use history. None, never.

Tobacco use history. None, never.

GRANTS

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DISCLOSURES

No conflicts of interest, financial or otherwise, are declared by the authors.

AUTHOR CONTRIBUTIONS

M.P. and D.K. conceived and designed research; M.P. and D.K. performed experiments; M.P. analyzed data; M.P. and D.K. interpreted results of experiments; M.P. prepared figures; M.P. drafted manuscript; M.P. and D.K. edited and revised manuscript; M.P. and D.K. approved final version of manuscript.

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