

# Understanding Preferences for Osteoporosis Information to Develop an Osteoporosis Patient Education Brochure

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## ABSTRACT

**Context:** Patient education materials can provide important information related to osteoporosis prevention and treatment. However, available osteoporosis education materials fail to follow best-practice guidelines for patient education.

**Objective:** To develop an educational brochure on bone health for adults aged 50 years and older using mixed-method, semistructured interviews.

**Design:** This project consisted of 3 phases. In Phase 1, we developed written content that included information about osteoporosis. Additionally, we designed 2 graphic-rich brochures, Brochure A (photographs) and Brochure B (illustrations). In Phase 2, interviewers presented the text-only document and both brochure designs to 53 participants from an academic Medical Center in the Midwest and an outpatient clinic in the Southeastern region of the US. Interviewers used open- and closed-ended questions to elicit opinions regarding the brochures. In Phase 3, using feedback from Phase 2, we revised the brochure and presented it to 11 participants at a third site in the Southeastern US.

**Main Outcome Measures:** Participants' comprehension of brochure text and acceptability of brochure design.

**Results:** We enrolled 64 participants. Most were women, white, and college-educated, with an average age of 66.1 years. Participants were able to restate the basic content of the brochure and preferred Brochure A's use of photographs.

**Conclusions:** Using feedback from older adults, we developed and refined a brochure for communicating bone health information to older adults at risk of osteoporosis and fragility fractures. The methods outlined in this article may serve to guide others in developing health educational brochures for chronic medical conditions.

bone health, women's health, and national health organizations for review. The Centers for Disease Control and Prevention (CDC) has created a guide for developing easy-to-understand health education materials. Their recommendations include to limit messages to 3 or 4, to identify action steps, to use 12-point to 14-point type with serif fonts, to use headings and bulleted lists, to eliminate medical jargon, to use active voice and short sentences, to use instructive images, to include 40% to 50% white space, and to use an attractive cover with the main message.<sup>8</sup> Additionally, health literacy experts recommend writing health education materials at a sixth-grade reading level and avoiding the use of more than 2 folds in a brochure.<sup>9</sup>

As we searched available osteoporosis materials, products that we identified all had important limitations to their readability and acceptability to older adults with differing characteristics. For instance, most of these materials were written for narrow patient subgroups (eg, patients who already had a diagnosis of osteoporosis, women, nonelderly populations, or highly literate populations).<sup>10-14</sup> Table 1 provides more details on the characteristics of the brochures we found in relation to best-practice guidelines for health education materials and the reasons we chose not to use each brochure for our study. Such focused materials may not be useful to the typical DXA clinic servicing a wide array of patients. Improving

## INTRODUCTION

Half of women and one-fourth of men in the US aged 50 years and older will experience an osteoporosis-related fracture during their lifetime.<sup>1</sup> The gold-standard screening tool for osteoporosis is dual-energy x-ray absorptiometry (DXA), which is noninvasive, inexpensive, and effective at identifying patients at highest risk of fracture.<sup>2</sup> However, studies have shown that patients undergoing DXA receive inadequate information on their test results and the consequences, prevention, or treatment

of osteoporosis.<sup>3-6</sup> Inadequate information is a barrier for patients making behavior changes in support of a lifestyle for good bone health, such as increasing their calcium intake or weight-bearing exercise.

One challenge to clinicians and DXA testing centers seeking to educate patients is a limited library of educational materials suitable for the general population. When searching for an osteoporosis educational brochure to use for a clinical trial (ClinicalTrials.gov NCT01507662),<sup>7</sup> we collected materials from leading

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on existing osteoporosis-related materials can assist clinicians in educating their patients about osteoporosis and fracture prevention.

In concert with a large pragmatic trial,<sup>7</sup> the objective of this study was to report on our rigorous efforts to develop a bone health educational brochure that could be mailed to a broad audience of patients undergoing DXA in a typical testing center.

**METHODS**

We conducted this project in three phases. In the first phase, we developed the written content and two sample brochures that merged excerpts of the written content with graphics and pictures. In the second phase, we pilot-tested the written content and the two brochure formats with a sample of participants at two study sites and analyzed the feedback. In the third phase, we revised the materials and conducted a

second round of testing with a sample of participants at the third study site.

**Phase 1: Development Process**

The Patient Activation After DXA Result Notification Study Investigators<sup>7</sup> are a team of health care practitioners and health education and communication experts in the fields of rheumatology, internal medicine, and public health. To determine the brochure’s scope, we identified topics regarding bone health that we considered relevant to patients undergoing DXA. Topics included: 1) a brief overview of osteoporosis and DXA results; 2) recommended amounts of calcium and vitamin D; 3) weight-bearing and strengthening activities; 4) fall prevention; 5) smoking cessation and healthy amounts of alcoholic beverages; 6) a place to write questions for their clinician; and 7) where to find more information.

Next, we addressed these topics in a text-only document. After reviewing CDC guidelines on best practices for creating print materials, which recommended limiting content to three or four main ideas,<sup>8</sup> we drafted brochure text addressing all seven topics but emphasized the first four topics. This draft brochure text included a brief overview of osteoporosis, its risks, and DXA as well as “steps” for improving bone health. To ensure readability, we evaluated the draft for a sixth-grade reading level using The Health Literacy Advisor software (Health Literacy Innovations LLC, Bethesda, MD).

We next evaluated the draft with The Suitability Assessment of Materials.<sup>15</sup> This set of questions is designed to be used by content experts for evaluating factors of content (eg, purpose, topics, and summary), literacy demand (eg, reading grade level, writing style, sentence construction,

Title	Osteoporosis: Understanding weakening of bone, its prevention and treatments <sup>10</sup>	Bone health for life: Easy-to-read information for patients and families <sup>11</sup>	How strong are your bones? <sup>12</sup>	Osteoporosis: What you need to know <sup>13</sup>	Osteoporosis: FAQ048 <sup>14</sup>
Author/sponsor	Arthritis Foundation	National Institute of Arthritis and Musculoskeletal and Skin Diseases	National Osteoporosis Foundation	National Osteoporosis Foundation	American College of Obstetrics and Gynecology
Size and style	15 pages, 7.6 x 22.9-cm (3 x 9-in) booklet	20 pages, 12.7 x 20.3-cm (5 x 8-in) booklet	15 pages, 12.7 x 20.3-cm (5 x 8-in) booklet	6 pages, 21.6 x 27.9-cm (8.5 x 11-in) trifold	14 pages, 7.6 x 22.9-cm (3 x 9-in) 7 folds
Reading grade level <sup>a</sup>	12th	7th	11th	9th	8th
Font	10 point, serif	14 point, serif	10 point, serif	12 point, sans serif	10 point, serif
Number of messages	8	9	12	8	5
Images	1 cover illustration of an older woman taking calcium and 1 interior drawing of bone matrix with and without osteoporosis	About 1 every other page (black and white sketches of older and younger adults)	One per page (colored photos of diverse people)	2 small, color photos of older adults	2 illustrations of normal and osteoporotic bone and spine and 2 photos of white women on cover
Intended audience (based on cover)	Older women	People of diverse ages and race/ethnicity	People of diverse ages and race/ethnicity	Older adults of diverse race	Older white women
Reasons for not using in Patient Activation After DXA Result Notification trial	Poor readability (small font, too high a reading level, too much text) and did not include men or instructive visuals	Best of the 5 brochures but too long and not suitable to be mailed in legal-sized envelope	Poor readability (small font, too high a reading level, too much text) and not suitable to be mailed in legal-sized envelope	Poor readability (too high a reading level, too much text)	Poor readability (small font, too high a reading level, too much text, too many folds) and did not include men, other races, or instructive visuals

<sup>a</sup> Readability based on Fry Graph Readability Formula.<sup>1</sup>  
 1. Fry E. A readability formula that saves time. J Reading 1968;11(7):513-6, 575-8.  
 DXA = dual-energy x-ray absorptiometry.

vocabulary, and use of advanced organizers), and learning stimulation and motivation (eg, interactions, desired behaviors modeled, and motivation). Each factor was rated as *superior*, *adequate*, or *not suitable* by selected physicians and health communication experts on our team. We revised components they rated as *adequate* and *not suitable*.

This draft text was brought to a graphic designer for the development of 2 graphically rich formats (Figure 1). Brochure A used photographs of people of varying ages (50 years and older), races, and both sexes, as well as photographs supporting each topic (eg, calcium-rich foods). In contrast, Brochure B used simple line illustrations.

**Phase 2: Pilot Testing with First Group**

We recruited participants from patients and/or visitors aged 50 years and older at a large teaching hospital in the Midwestern US (Site A) or a private outpatient clinic in the Southeast US (Site B). We excluded those who were unable to understand English, prisoners, and those with mental disabilities. Research assistants approached potential participants in clinic waiting areas and lobbies (Site A), or they placed advertisements around the clinic (Site B). Participants received a parking voucher or \$20 gift card for their time. The Human Subjects Office at the University of Iowa and the Kaiser Permanente of Georgia institutional review boards approved this research study. Site institutional review boards approved a waiver of written informed consent; thus, research assistants reviewed an elements of consent document with each participant.

We used a mixed-methods approach of quantitative survey questions and qualitative open-ended questions to gain an understanding of what participants liked and disliked with respect to each brochure. This approach allowed us to quantify overall preference trends and averages, and to identify themes in preferences to guide further brochure refinement.

During the first part of the interview, participants focused on the written content. Research assistants presented



Figure 1. Sample of Brochure A (left) and of Brochure B (right) designs. PAADRN = Patient Activation After DXA Result Notification (Study).

**Items from the Semistructured Interview Guide**

**Questions used to assess brochure text**

- If you were going to tell a friend or family member about this brochure, what would you tell him/her that it said?
- Do you think the brochure does a good job of talking about how to help your bones? Please explain your answer.
- Before reading the brochure, did you think taking care of your bones was easy or hard? Please explain your response.
- After reading the brochure, do you think taking care of your bones is easy or hard? Please explain your response.
- Please indicate how much you agree with each of the following statements (1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly agree):
  - The title tells me what the brochure is about.
  - The brochure is hard to read.
  - I can understand all of the medical words.
  - The amount of information is about right.
  - My questions about osteoporosis are answered.
  - The brochure clearly explains where to find more information.
  - The tables are easy to understand (T-score table and Calcium/Vitamin D table).

**Questions used to assess brochure design**

- Would you pick up either of these brochures if you saw them on a table in the waiting room of your doctor's office? If yes, which one (A or B) would you be most likely to pick up first? Please explain.
- Which brochure (A or B) do you think is best for people like you? Why?
- What pictures do you like? Why?
- Are there any pictures you don't like? Why?
- How do you feel about the colors used?
- Do you think the print/style of letters is easy to read? If not, is it too small, not the right style, or both?
- How well do the covers explain what the brochure is about? Excellent, very good, good, fair, or poor? Please explain.
- For each brochure, there are two different titles. Which title do you think does the best job at explaining what the brochure is about?
- Which brochure look is your favorite (A or B) and why?
- Does any part of either brochure seem distracting (or too busy)? If yes, what?
- Is there anything else you want to tell me about the look of the brochure that might help us make it better?

participants with a text-only document, and they audiorecorded the interviews and took notes. Participants evaluated the document in sections: 1) information about osteoporosis and the score from a DXA scan; 2) questions for their clinician and information about calcium and vitamin D; 3) weight-bearing and strengthening activities; and 4) alcohol use, tobacco use, summary, and additional resources.

After participants read each section, the research assistant asked them to identify words, sentences, or phrases that were hard to understand and those that were easy to understand or were well written. Section 1 included a table explaining T-score ranges and their corresponding impression (for example, a T-score of -2.5 or less signifies osteoporosis). To test comprehension, we presented each participant with a hypothetical T-score and asked in which bone density category that person would be.

Next, the interviewer asked each participant a series of questions about the entire brochure text. Items were adapted from other publications.<sup>9,16</sup> See Sidebar: Items from the Semistructured Interview Guide for an overview of assessed items.

Similar to the Rapid Estimate of Adult Literacy in Medicine-Short Form, a health literacy assessment tool,<sup>17</sup> we asked participants to read eight specific words from the brochure aloud to assess readability of words used in the brochure. These words were *bone*, *activity* (two simple words for practice), *osteoporosis*, *supplements*, *density*, *calcium*, *dairy*, and *strengthening*. Interviewers tracked words that participants had difficulty reading or pronouncing.

Participants were then asked to review the two sample brochure designs, Brochures A and B (see Figure 1), with regard to format, visual appeal, pictures, colors, font, and titles (see Table 1).

Interviewers collected health history and demographic information from participants: bone health history (prior DXA scans, previous diagnosis of osteoporosis or low bone density, history of fractures), general health status, sex, year of birth, educational attainment, employment status, and race. We assessed health numeracy, the ability to understand numbers and risk,<sup>18</sup> using the 8-item Subjective Numeracy Scale.<sup>19</sup> We evaluated health literacy using 3 items developed by Chew et al<sup>20</sup>: “How

often do you have someone help you read hospital materials?”; “How confident are you filling out medical forms by yourself?”; and “How often do you have problems learning about your medical condition because of difficulty understanding written information?” Interviews took 20 to 30 minutes to complete.

We analyzed quantitative data using univariate and bivariate methods to examine the association of participant demographics (eg, age, race, sex) and clinical characteristics (eg, history of prior DXA scans, history of osteoporosis or prior fracture) with preference for features of Brochure A vs Brochure B. We used SAS Version 9.2 (SAS Institute, Cary, NC) to conduct quantitative analyses, and we set an  $\alpha$  level of 0.05 as statistically significant.

For the qualitative data, we used a concurrent mixed-methods framework<sup>21</sup> by examining the quantitative data, then coding open-ended interview items to inform what we learned from the quantitative analysis. The qualitative team reviewed data pertaining to brochure preferences and comprehension. To ensure internal validity and reliability, we used a team who independently coded the open-ended interview items. The qualitative team reviewed themes for face validity and the data were recoded using the revised codebook. We used MAXQDA (VERBI GmbH, Berlin, Germany) to analyze qualitative data.

### Phase 3: Revisions to Brochure and Pilot Testing with Second Group

After testing the brochure at Sites A and B, we thought it important to make some minor changes to the brochure before testing it at a third site (Site C). This approach allowed us to get feedback on the modifications. Changes made to the text-only document and the two designs (Brochure A and Brochure B) are described here:

1. Revised some text in the text-only document
  - a. Replaced “Do any of these at least 150 minutes a week” with “Do any of these at least 30 minutes a day, 5 days a week. You can break these into 10-minute sessions.”
  - b. Revised the list of weight-bearing exercises to include “hiking,” replacing “elliptical machines” with “golfing,” and replacing “jogging” with “tennis”

2. Changed 3 photos in Brochure A
  - a. Replaced a close-up of a milk carton with a photo of an older, Asian woman drinking a glass of milk
  - b. Replaced a close-up of a piece of salmon with a photo of a piece of salmon on a plate with more vegetables
  - c. Replaced a photo of an African American couple riding bikes with one of an older African American couple walking
3. Moved the illustrations in Brochure B from the left and right margins to the top margins to improve readability.

Participants for Phase 3 were drawn from a large teaching hospital in the Southern US (Site C). Using the same recruitment approach and interview guide criteria as in Phase 2, research assistants presented the revised brochure text document and sample design formats to Site C participants. The University of Alabama at Birmingham institutional review board approved this study and granted us a waiver of written informed consent.

Quantitative and qualitative data were analyzed using the methods described for Phase 2.

## RESULTS

### Participants

Among 53 participants who agreed to participate in Phase 2, most were white (69.8%), women (75.5%), and had attended college (70.0%), as shown in Table 2. The participants' ages ranged from 53 to 88 years, with the mean age being 66.1 years (standard deviation,  $\pm$  9.1 years). For Phase 3, we enrolled 11 participants from Site C (see Table 2). All but 1 participant was white (90.9%), all were women (100%), and 45.5% had a high school education or less. The mean age of Phase 3 participants was 68.1 years (standard deviation  $\pm$  10.9 years).

### Brochure Text

Participants reported that the brochure had the right amount of information, was easy to read, and answered all osteoporosis questions (Table 3). When participants read the table describing T-score values, most (86.8% from Phase 2 and 63.6% from Phase 3) comprehended the T-score table correctly to identify a T-score of -1.5 as a person having osteopenia. In an

assessment of reading ability, 100% of participants correctly read the words *bone*, *activity*, *calcium*, and *dairy*, 98.4% could read the word *strengthening*, 96.9% could read the words *density* and *supplements*, and 87.5% could read the word *osteoporosis*.

When asked how difficult they thought taking care of their bones was, 41.5% of Phase 2 participants and 45.5% of Phase 3 participants said it was easy before reading the brochure compared with 77.4% of Phase 2 participants and 81.8% of Phase 3

participants saying it was easy after reading the brochure. Approximately 42% of Phase 2 participants said they would increase their calcium intake, and 64% of Phase 2 participants said they would increase their physical activity after reading the text-only document.

Noteworthy qualitative feedback about the brochure text included positive assessments, areas for improvement, and phrases participants had difficulties understanding. Most participants were able to restate the basic content of the brochure suggesting general comprehension of the text. When asked what they would say to a friend or family about the brochure, participants said *“Eating right and exercise will help you have stronger bones and can actually be a preventive measure in order to prevent bone breakage later.”* (Participant 5, Site B, black man, age 52).

*“It tells what osteoporosis is, how to keep bones healthy, and if they are in trouble how to get them on the right track.”* (Participant 61, Site C, white woman, age 70).

The osteoporosis and activity sections of the brochure received the most positive appraisal. Participants stated that this section was clear, as evidenced by the following response:

*“[The osteoporosis section] was very clear; it explains that osteoporosis is not the same as arthritis.”* (Participant 7, Site A, white woman, age 72).

In the activity section of the brochure, participants reported both positive and negative feelings toward the types of exercises listed. For example, one participant stated:

*“I think the examples of what you can do to build strong bones was good. I like that they included the daily household activities like chores.”* (Participant 8, Site B, black woman, age 56).

However, there were concerns about the types of exercises listed; for example, 3 individuals did not know what an elliptical machine was. Also, 5 of 53 participants said the statement that someone should do 150 minutes of activity per week seemed like an unachievable amount of activity and suggested the amount should be broken down to seem smaller. After we revised the text-only document, retesting at Site C demonstrated improvements in the activity section, with all 11

**Table 2. Characteristics of patients by pilot phase**

Characteristic	Phase 2		Phase 3	All phases (N = 64)
	Site A (n = 28, 43.8%)	Site B (n = 25, 39.1%)	Site C (n = 11, 17.2%)	
Women, no. (%) <sup>a</sup>	24 (85.7)	16 (64.0)	11 (100.0)	51 (79.7)
Age, years, no. (%)				
50-59	12 (42.9)	6 (24.0)	2 (18.2)	20 (31.3)
60-69	6 (21.4)	8 (32.0)	4 (36.4)	18 (28.1)
≥ 70	10 (35.7)	11 (44.0)	5 (45.5)	26 (40.6)
Education, no. (%)				
High school or less	8 (32.0)	7 (28.0)	5 (45.5)	20 (32.8)
Some college	6 (24.0)	9 (36.0)	4 (36.4)	19 (31.2)
College graduate or more	11 (44.0)	9 (36.0)	2 (18.2)	22 (36.1)
Race, no. (%) <sup>a</sup>				
White	27 (96.4)	10 (40.0)	10 (90.9)	47 (73.4)
Black	0 (0)	14 (56.0)	0 (0)	14 (21.9)
Other	1 (3.6)	1 (4.0)	1 (9.1)	3 (4.7)
General health, no. (%)				
Excellent	6 (24.0)	3 (12.0)	2 (18.2)	11 (18.0)
Very good	10 (40.0)	7 (28.0)	6 (54.6)	23 (37.7)
Good	9 (36.0)	12 (48.0)	2 (18.2)	23 (37.7)
Fair	0 (0)	3 (12.0)	1 (9.1)	4 (6.6)
Poor	0 (0)	0 (0)	0 (0)	0 (0)
Bone health, no. (%)				
History of previous DXA <sup>a</sup>	13 (54.2)	10 (40.0)	11 (100.0)	34 (56.7)
History of osteoporosis or osteopenia <sup>a</sup>	6 (21.4)	8 (32.0)	9 (81.8)	23 (35.9)
Fracture history	6 (24.0)	4 (16.0)	4 (36.4)	14 (23.0)
Other factors				
Literacy score, <sup>b</sup> mean (SD) <sup>a</sup>	4.4 (0.7)	3.9 (0.8)	4.3 (0.6)	4.1 (0.7)
Numeracy score, <sup>c</sup> mean (SD)	4.5 (1.1)	4.1 (1.2)	4.1 (0.8)	4.3 (1.1)

<sup>a</sup> Indicates characteristics for which the site participants are significantly different (p < 0.05).

<sup>b</sup> Literacy score ranges from 1-5.

<sup>c</sup> Numeracy score ranges from 1-6.

DXA = dual-energy x-ray absorptiometry; SD = standard deviation.

**Table 3. Participants' agreement with brochure text usability factors**

Factor	Average agreement (1-5) <sup>a</sup>	
	Phase 2 (Sites A and B)	Phase 3 (Site C)
Title explains brochure	4.47	4.18
Brochure hard to read	1.51	1.64
Understand all medical words	4.29	4.55
Amount of information right	4.26	4.46
Questions about osteoporosis answered	3.90	4.27
Clear on where to find more information	4.16	4.36
Tables easy to understand	4.20	4.36

<sup>a</sup> 1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly agree.

Site C participants reporting this section as easy to understand.

Additionally, some participants questioned the amount or type of calcium and vitamin D supplements listed in the brochure, as noted in the following responses:

*"I think the recommended vitamin D levels should be higher."* (Participant 52, Site A, white man, age 68).

*"[The section about] how much calcium a person should be getting—the amount is controversial."* (Participant 6, Site A, white woman, age 53).

### Brochure Format

Overall, most participants preferred the format of Brochure A (73.5% for Phase 2 and 63.6% for Phase 3) as opposed to Brochure B (Phase 2:  $p = 0.001$ ; Phase 3:  $p = 0.37$ ; combined:  $p = 0.0008$ ; see Figure 1). Preferences did not significantly differ by subgroup (sex, education, age, site, or race). Most participants also listed Brochure A over Brochure B as the most likely one they would pick up first (70.5% of Phase 2 participants and 60.0% of Phase 3 participants) and the "best for people like you" (66.0% for Phase 2 participants and 63.6% of Phase 3 participants). However, most participants (77.6% of Phase 2 participants and 72.7% of Phase 3 participants) thought the title in Brochure B provided a better explanation of the brochure.

Qualitative feedback received on the format of the brochure provided comments about the graphics, pictures, and colors. The picture that was most well liked was the one used in Brochure A of the woman gardening, with participants explaining that the woman looked "sweet," "healthy," and "happy." Overall, 46.9% of participants disliked one or more aspects of the pictures; 6 participants disliked the bone on the cover of Brochure B, 6 disliked all graphics in Brochure B, 5 participants disliked the milk carton used in Brochure A, and 5 disliked the salmon picture used in Brochure A. In particular, participants stated that the bone "looked like a dog bone" and seemed "juvenile." Participants from Phase 2 said that they were unsure what the milk and salmon photographs intended to show. Last, 3 of the 53 Phase 2 participants commented that the couple riding bikes on Brochure A looked "too young to have osteoporosis" and they were

"too skinny." On the basis of feedback, we replaced each of these pictures, and in Phase 3 all participants were satisfied with the new pictures.

### DISCUSSION

In this article, we described the development of a bone health educational brochure following recommendations for constructing optimal health communication materials. To improve health education materials, the CDC and the Institute for Healthcare Advancement have created best practices for creating health education materials.<sup>8,9</sup> The five osteoporosis health education brochures we assessed before the development of our own brochure all failed to adhere to at least some of the recommendations. Thus, we embarked on our own effort to develop an improved bone-related patient education brochure.

Participants expressed preferences for how information was presented, in particular, in the section on activity. Phase 2 participants believed that breaking the exercise duration into smaller intervals seemed more manageable. They also liked having a choice of everyday activities (eg, chores or walking). Additionally, 38.1% more participants stated that they thought taking care of their bones was easy after reading the brochure than before reading the brochure. These findings suggest that this educational brochure increased bone-related self-efficacy. We are examining the effects this brochure has on osteoporosis-related self-efficacy and osteoporosis-related behavior changes such as adherence to recommended osteoporosis medications, calcium and vitamin D intake, weight-bearing exercise, smoking cessation, and alcohol reduction.

It is important to comment on the graphics and layout as well. We deliberately included pictures of a diverse spectrum of adults, including men and women, adults with varying skin tone or race, and different ages. These efforts were guided by CDC guidelines.<sup>8</sup> Feedback from our diverse group of participants failed to identify any concerns with respect to the diversity of the subjects displayed in our brochure, suggesting that our efforts at diversity were well received. We also found that participants preferred photographs to computer-generated illustrations or

drawings. In total, the graphics and layout of our brochure were well received, and our multiphase testing approach led to tangible improvements in our final brochure draft.

In total, this exercise provides lessons into the development of a state-of-the-art bone health brochure, but also provides guidance to researchers attempting to develop health communication materials for other diseases and conditions. Using comments from clinicians, health communication experts, and older adults, we found that key bone health topics could be distilled into four key topic areas that could be conveyed to patients in a way that was easy to comprehend. We found that participants were able to restate the gist of the brochure, had opinions and preferences for how they wanted both textual and graphical information presented, and after reading the brochure they believed that taking control of their bone health was easier. Our findings are comparable to another project, which used similar methods to develop a brochure about coronary artery disease.<sup>22</sup> The authors also found that considerations in the format and readability were well received and that participants had suggestions for improving content and design.<sup>22</sup> Using an approach that elicits feedback from health care experts, health communication experts, and patients may help improve comprehension and acceptability of health education materials.

This study has limitations. By coincidence, our enrollment yielded an educated sample, with 67.3% of all participants attending college. A sample of participants with a lower educational attainment may have yielded different results. However, this brochure was written so that individuals with at least a sixth-grade reading level could read the brochure. Although our sample was composed of primarily white participants, 21.9% were black or African American, and 4.7% were another race, suggesting moderate diversity. A more racially diverse sample may have produced different responses from participants. However, our sample characteristics match those who undergo DXA screening at each of the 3 sites.

There are also limitations to the brochure, mainly regarding its content. One goal for clinicians is to improve patient adherence to recommended osteoporosis

treatment. Our team decided to only briefly mention medications, because we believe this discussion should occur between patient and clinician because of the very personalized risk of side effects and contraindications. Decision aids have been created for osteoporosis treatment, and these might be better suited for educating patients whose clinicians deemed them in need of osteoporosis medication.<sup>23,24</sup>

## CONCLUSIONS

We used best practices for creating literacy-appropriate educational materials to develop the “What Can I Do for My Bone Health? Steps for Strong & Healthy Bones” brochure (final brochure may be seen at: [www.ncbi.nlm.nih.gov/pmc/articles/PMC3525745/figure/F4/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3525745/figure/F4/)). We have shown it was effective at helping patients understand osteoporosis and reflects health education best-practice guidelines. Because this brochure was designed for a general audience of adults aged 50 years and older of both sexes and varying races, education levels, and bone-related health histories, clinicians may find this brochure useful in educating patients before or after a DXA screening. The final brochure is available on request or can be found in publication.<sup>7</sup> Future publications will describe the effect that this brochure, with an accompanying personalized letter providing the DXA result, has on patients’ health behaviors.

Participants have preferences for how health education is presented to them, and many current osteoporosis-related health education materials have not followed best practices. Others wishing to provide their older adult patients with information on osteoporosis may use this brochure as a template. Researchers and clinicians wanting to develop education materials for other medical conditions can use our methods as a guide for eliciting patient feedback. ❖

## Disclosure Statements

The author(s) have no conflicts of interest to disclose.

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