Tailored Educational Approaches for Consumer Health: A Model to Address Health Promotion in an Era of Personalized Medicine

Wendy F. Cohn, PhD[1], Jason Lyman, MD, MS[1], Donna K. Broshek, PhD[2], Thomas M. Guterbock, PhD[3], David Hartman, PhD[3], Mable Kinzie, PhD[4], David Mick, PhD, MHA[5], Aaron Pannone, PhD[1], Vanessa Sturz, MS[1], Jane Schubart, PhD[6], and Arthur T. Garson, MD, MPH[1]

Abstract

Purpose: To develop a model, based on market segmentation, to improve the quality and efficiency of health promotion materials and programs.

Design: Market segmentation to create segments (groups) based on a cross-sectional questionnaire measuring individual characteristics and preferences for health information. Educational and delivery recommendations developed for each group.

Setting: General population of adults in Virginia.

Participants: Random sample of 1201 Virginia residents. Respondents are representative of the general population with the exception of older age.

Measures: Multiple factors known to impact health promotion including health status, health system utilization, health literacy, Internet use, learning styles, and preferences.

Analysis: Cluster analysis and discriminate analysis to create and validate segments. Common sized means to compare factors across segments.

Results: Developed educational and delivery recommendations matched to the 8 distinct segments. For example, the "health challenged and hard to reach" are older, lower literacy, and not likely to seek out health information. Their educational and delivery recommendations include a sixth-grade reading level, delivery through a provider, and using a "push" strategy.

Conclusion: This model addresses a need to improve the efficiency and quality of health promotion efforts in an era of personalized medicine. It demonstrates that there are distinct groups with clearly defined educational and delivery recommendations. Health promotion professionals can consider Tailored Educational Approaches for Consumer Health to develop and deliver tailored materials to encourage behavior change.

Keywords

health promotion, model, market segmentation, educational design, communication

[1] Department of Public Health Sciences, University of Virginia, Charlottesville, VA, USA
[2] Department of Psychiatry and Neurobehavioral Sciences, University of Virginia, Charlottesville, VA, USA
[3] Center for Survey Research, Weldon Cooper, University of Virginia, Charlottesville, VA, USA
[4] Curry School of Education, University of Virginia, Charlottesville, VA, USA
[5] McIntire School of Commerce, University of Virginia, Charlottesville, VA, USA
[6] Department of Surgery, College of Medicine, Pennsylvania State University, Hershey, PA, USA

Corresponding Author:
Wendy F. Cohn, PhD, Department of Public Health Sciences, University of Virginia, Box 800717, Charlottesville, VA 22908, USA.
Email: wfc2r@virginia.edu

Purpose

The current health-care environment increasingly depends on individuals to play an enhanced role in their health and wellness in order to achieve the optimal benefits from public health efforts and the health-care system. Current and effective information transfer among public health practitioners, health-care providers, and the consumer is necessary to support health promotion efforts. Fortunately, new strategies are emerging to enhance the effectiveness of health information delivery to the public.

Consumers need accessible and fact-based information that meets their individual needs and preferences. This information

is more likely to be utilized in a way that leads to health behavior change when it is geared to an individual's information processing style and it is perceived as relevant and credible.[1,2] Research suggests that such information can empower and encourage confidence to make behavior changes, especially for those with chronic illnesses.[3-5]

Health promotion programs are addressing the need for personalization using newer evidence-based strategies such as tailoring a method to design and match communications based on actual, measured characteristics of an individual.[1,6] Some of these tailored communications are theoretically based with interventions being matched to an individual's stage of change.[7] Tailored print or web-based communications leading to improved outcomes, including increases in intentions and behavior, have been documented in areas such as smoking cessation, physical activity, dietary change, and mammography uptake.[1,8-18]

These types of evidence-based practices in health promotion are critical to achieving results, yet it is also important to have interventions that are efficient and cost-effective. The practice of tailoring may not always be efficient when considering larger populations or multiple health topics as it requires information to be gathered about each individual. Also, new algorithms to develop materials and match their delivery are required for each instance of health information provision.

In an era of personalized medicine, health promotion and communication efforts need to continue to develop methods to increase the level of personalization without sacrificing quality or cost. Market segmentation, traditionally used by advertisers to target products to specific audiences, is one potential method to consider. The premise of market segmentation is that broad markets that appear to be heterogeneous can be divided into smaller, more homogenous subgroups to provide targets for specific and efficient marketing strategies.[19] Only a handful of studies report the use of market segmentation in health; some of these are focused on social marketing, which uses marketing principles for the social good to build public awareness and change public behavior.[20] Market segmentation has been demonstrated to distinguish between audience members (health information targets) to tailor behavior change strategies to predict health behaviors.[21-23]

We hypothesized that a market segmentation–based approach could form the basis of a new model for the efficient delivery of health information. We developed the Tailored Educational Approaches for Consumer Health (TEACH) model to explore the potential of a broad segmentation approach for use with a large, diverse population with a variety of health issues and information needs. This article focuses on the development of the model including the segmentation analysis to group the population into relatively homogenous subgroups of individuals and the resulting, specific recommendations for educational and delivery methods for each segment. Additional discussion includes how this model can be used efficiently in practice with the development of shorter assessments and automation of processes.

Methods

Design

Market segmentation was used to create groups based on a cross-sectional questionnaire measuring individual characteristics and preferences for health information. Educational and delivery recommendations were developed for each group.
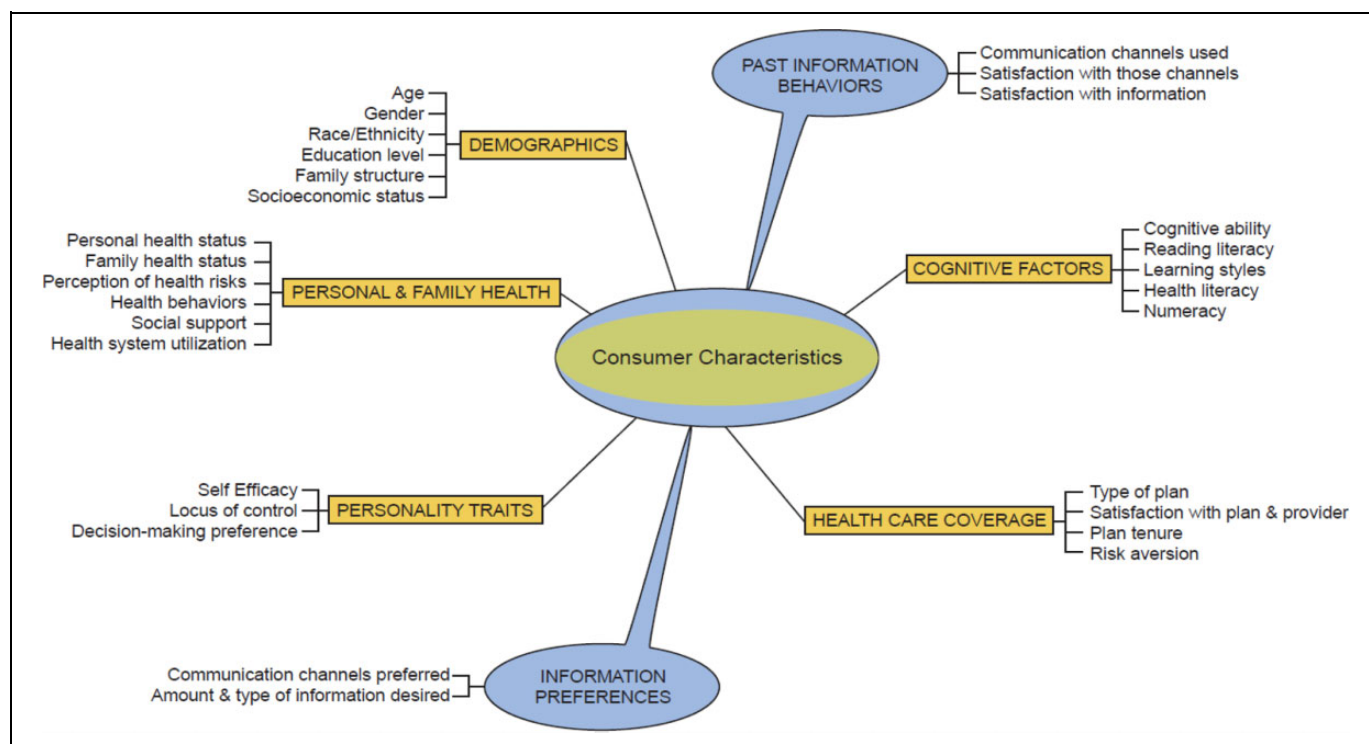
Sample

The study was reviewed and approved by the institutional review board for the Social and Behavioral Sciences at the University of Virginia. The questionnaire was administered by telephone in English with trained interviewers using Computer-Assisted Telephone Interviewing software. A random digit dial sample of 6372 landline phone numbers and 2 targeted directory-listed samples of 750 African American residents and 750 with median household incomes less than US$35,000 were purchased. Advance letters with a US$2.00 incentive were sent to those sampled households for which an address was available[24] (this included all those in each targeted group and over half of the others). We combined random selection by computer with the "last-birthday" method, in which we ask to speak to the adult in the household who had the most recent birthday month.

Measures

An expert panel comprised of an interdisciplinary group of health-care providers, health evaluation specialists, and educators evaluated the factors important to the design and delivery of health information. The panel nominated initial factors for consideration and for each factor reviewed the theoretical and research literature.[25] A visual depiction of these factors was developed that represents demographic, health-related, psychographic, behavioral, cognitive, and information need characteristics (Figure 1).

Final factors for inclusion in the questionnaire were chosen based on the extent to which there was evidence that they impacted knowledge or behavior change and were measurable.

Since there was no single existing validated questionnaire to measure all of the selected factors, we used well-established design methods including focus groups, cognitive interviews, and pretesting to create a questionnaire that could measure as many factors as possible with established scales and measures while trading off length and respondent burden considerations. A draft questionnaire (125 questions presented on 24 pages) was used to document length and understanding while gathering general feedback leading to a large pilot test (n = 600) of a revised instrument as a self-administered, paper questionnaire (the length of the questionnaire at this stage prohibited telephone administration). This sample included 150 households from each of 6 geographic regions in Virginia, with an additional 400 households from census tracts with low median household incomes and 400 having 35% or more African American residents. An advance letter was sent to each

Figure 1. Consumer health information behavior and preferences.

Table 1. Factors Considered to Construct and Describe Segments.

Demographics	Health Related	Psychographics	Lifestyle/Behaviors	Cognitive Factors/ Information Capacity	Information Needs
Age, gender, race/ ethnicity, education, income, employment, household size, marital status	Perceived health status, presence of chronic illness, utilization of health-care system	Patient autonomy, health attitudes, self-efficacy, locus of control	Decision-making styles, risk averseness, physical activity, tobacco/ alcohol use, dietary habits, social support, body mass index	Internet use, learning styles, reading literacy, health literacy, numeracy	Prior information- seeking behavior— sources used, prior information-seeking behavior—topics searched

sampled household with a US$2.00 incentive.[24] A total of 633 were returned with a response rate of 41%. Analysis of each factor, using a combination of discriminant function loadings and log linear regression coefficients, determined its contribution to creating the segments. During this process, only one factor, self-efficacy, was eliminated in its entirety, but other factors had scales that were shortened by removing individual items that did not form or predict segments.[25] All measured factors considered in the segmentation analysis are in Table 1.

Analysis

A series of segmentation solutions based on the telephone survey were developed using cluster analysis and were iteratively reviewed to identify the segment solution that offered (1) clearly differentiated and robust groups, as measured by discriminant function analysis,[26] (2) actionable characteristics (requiring different educational and delivery approaches that

could be addressed by altering a particular strategy), and (3) defensible (linked to variables identified as potentially important for determining information need or preference).

Since each factor was assessed with a different measure, with a different response scale, we computed "common-sized means" to allow between-segment comparison of a set of factors. The common-sized mean is calculated by dividing each segment's mean on a factor by the overall mean. Thus, a common-sized mean that is over 1.0 indicates that a segment is higher than the total sample mean on that factor; likewise, a common-sized mean below 1.0 represents a segment mean that is lower than the total sample mean on that factor. When a segment yielded a common-sized mean that was significantly greater than the overall sample mean ($P = .05$), the segment was labeled as being "higher" or "greater than" the overall mean. When a segment's common-sized mean was significantly less than the overall sample mean ($P = .05$), it was categorized as "lower" or "less than."

Development of Educational and Delivery Recommendations

The educational recommendations were developed by educational and instructional design experts on our team, based on instructional theory[27] and supported by research, where existing, to accommodate groups responding at all levels of each factor assessed. For example, segments identified as having "higher" literacy were matched with a corresponding educational recommendation of high-literacy materials (eg, 12th-grade reading level or higher) and segments with "lower" literacy were matched with a corresponding educational recommendation of low-literacy materials (6th grade or less). The information delivery recommendations were developed by combining 3 questions that assessed attitudes and preferences regarding a range of delivery channels and sources. "To what extent do you trust information from (each source—eg, your physician, the Internet)?" "How often have you used (each source) for health information?" and "How likely is it that you will use (each source) in the future?" Each segment received a total score based on responses to these 3 items. Information delivery recommendations were ranked for each segment according to these scores. Higher scores indicated the most amount of trust, most frequent use of the source, and highest likelihood of using the source in the future. When scores were high, the source would be highly recommended.

Results

There were 1201 calls completed of 6132 valid phone numbers attempted, for a response rate of 24% (see note 1) with a margin of error of ±3%. The interviews took 29 minutes on average. The sample was 52% female; 58% married, 15% never married, 14% divorced, 13% widowed; 74% white, 18% African American, 7% other, and 4% Hispanic. The resulting sample was similar in demographics to the state of Virginia in all areas except age. The TEACH sample was significantly older (54 years) than the state average (46 years).

When asked to rate their health status, 22% of respondents selected excellent, 55% good, 18% fair, and 4% poor. Eighty-six percent reported going to a doctor in the past 12 months. When asked about history of disease, 44% reported high blood pressure, 16% heart disease, 13% had cancer, and 11% diabetes. There were 30% of individuals who indicated that a family member was not in good health.

Sixty-nine percent of the sample used a computer on at least an occasional basis and 64% used the Internet. Most (81%) of the sample had looked for health information in the past 12 months. Sixty percent had looked for more than 1 topic and 15% had looked for 5 or more topics. When asked where they would most likely go to get health information in the future, 73% indicated they would be very likely (and 24% somewhat likely) to get information from a health-care provider. Only 23% said they would be very likely to get information from the Internet (and 39% somewhat likely).
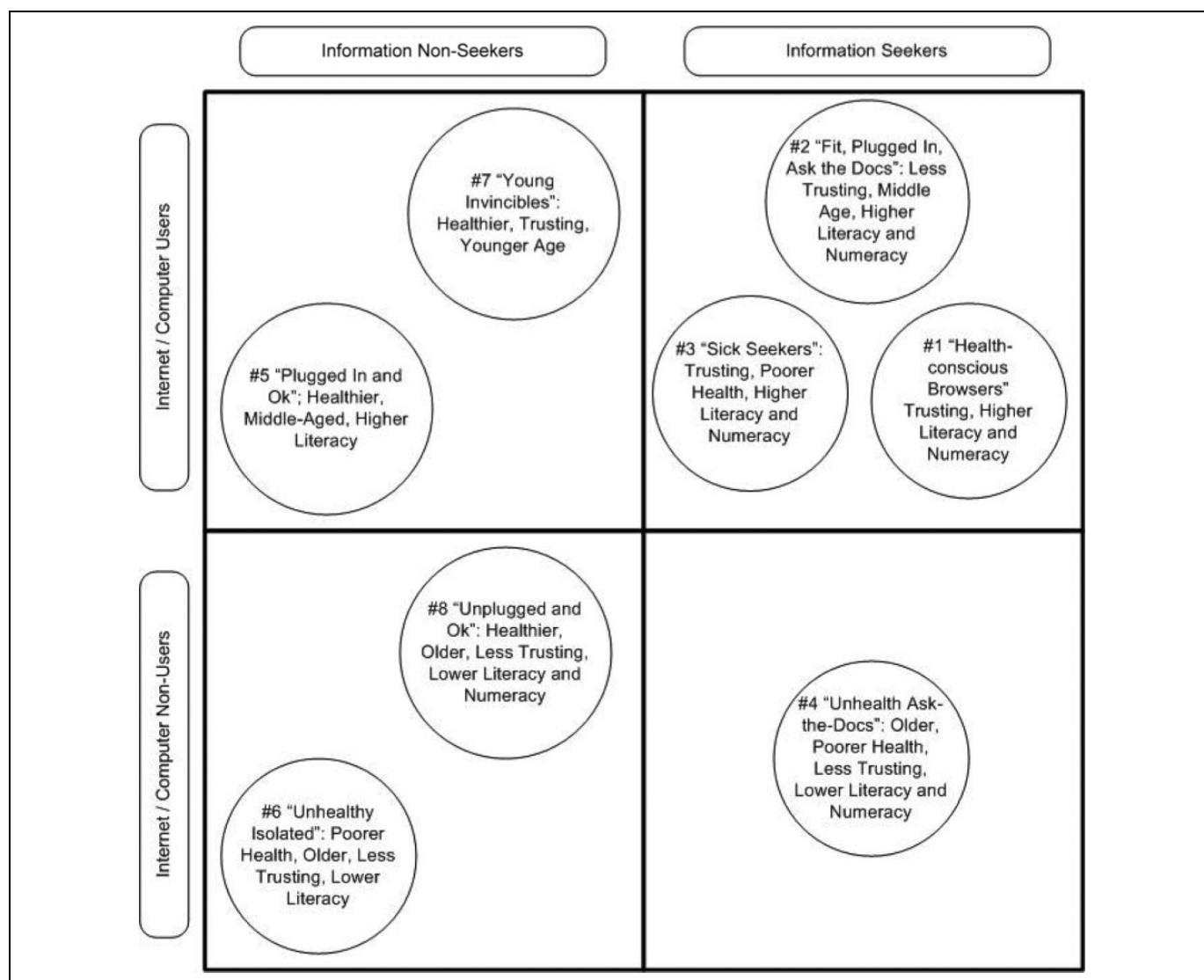
Segments

Following established methods for market segmentation[26] and the criteria outlined for segment selection in the methods, we identified 8 segments of sizes varying from 35 to 316 people. Based on the discriminant function analysis, there were 2 primary factors that predicted group membership—computer/Internet use and information-seeking behavior (type and amount of health information sought in past). Four segments representing approximately 80% of the sample are "health information seekers," indicating that they had looked for health information in the past 12 months, whereas 4 segments were not health information seekers. Other factors were important in distinguishing the segment membership; however, these factors varied by segment and included age, literacy, health status, and trust in information sources. Figure 2 represents the segment classification scheme. The factors most significant in distinguishing among all the segments (computer/Internet use and information seeking) form the primary axes, with other factors indicated for each segment when such factors were important in distinguishing that segment. Segment names (eg, "Young Invincibles" or "Health Challenged, Hard-to-Reach") were chosen as an aid in discussing the characteristics of each segment. These names capture important features of each segment, however, they will not characterize all of the segment or its potential members.

Of the 4 "health information seeker" segments, 3 use the Internet and the fourth ("Unhealthy Ask the Doctors" #4) does not. This segment has less reading ability than the overall sample and prefers information coming directly from their health-care provider. The 3 other "health information seeker" groups are distinguished from one another by health status, age, and trust of information sources.

Of the "information non-seeker" segments, 2 ("Plugged In and OK" #5 and "Young Invincibles" #7) are computer/Internet users. These 2 segments are distinguished from one to another predominantly by age. The other 2 information non-seeking segments ("Health Challenged, Hard-to-Reach" #6 and "Unplugged and OK" #8) are distinguished by health, age, and trust of information.

When demographic characteristics were considered, we found that only 2 segments were significantly different from the total sample in terms of gender. The "Plugged In and OK #5" group was more likely to be women and the "Health Challenged, Hard-to-Reach #6" group was more likely to be women and have nonwhite group members (though individuals identifying themselves as white still made up more than half [67%] of the group). Both marital status and age varied by segment. Three of the segments ("Health-Conscious Web Browsers" #1, "Sick and Seeking Researchers" #3, and "Plugged In and OK" #5) are more likely to be married (65%-70% per segment). The youngest segment was the "Young Invincibles" #7 with an average age of 38 years; the oldest segment was the "Health Challenged, Hard-to-Reach" with an average age of 68 years. Table 2 presents a comparison of demographic, literacy, health, and information-seeking results for each segment.

Figure 2. Segment classification scheme.

Educational Design and Delivery Recommendations

For each segment, there are educational recommendations that can be used to match existing materials to the members of that group or used to develop new materials. These recommendations are categorized into 2 sections. *Design recommendations* include strategies to accommodate differences in reading and numeracy, health literacy, health status, learning style, and demographic factors. These recommendations may be most useful for the development of new materials or the selection of existing materials that are specific to particular segments. *Delivery recommendations* are those that determine the most effective ways to transfer information to consumers. These recommendations include prioritized information delivery sources, type of delivery, and amount of information. Because 5 of the 8 segments ranked the health-care provider as the number 1 recommended source, and the remaining 3 segments expressed the greatest preference for the Internet, recommendations suggest the primacy of these sources as delivery

channels. Table 3 contains the educational and information delivery recommendations by segment.

Discussion

This work demonstrates that it is possible to segment a broad population into distinct groups and utilize these groups to devise educational and delivery recommendations. We applied market segmentation techniques to a broad population of Virginia residents to explore its potential utility in facilitating more efficient health promotion efforts. Data collected on 1200 consumers describing their health information–seeking behaviors and other factors relevant to health education were analyzed and used to create 8 segments with distinct preferences and characteristics. These segments differ along several axes that we believe impact health education, including literacy level, information-seeking behaviors, computer use, and health status, among others. The model provides an opportunity to

Table 2. Characteristics of the 8 Segments.[a]

	Information Seekers				Information Non-Seekers				Total Sample
	Segment 1: "Health-Conscious Web Browsers"	Segment 2: "Healthy Plugged In"	Segment 3: "Sick and Seeking Researchers"	Segment 4: "Unhealthy Ask the Doctors"	Segment 5: "Plugged In and OK"	Segment 6: "Health Challenged, Hard-to-Reach"	Segment 7: "Young Invincibles"	Segment: "Unplugged and OK"	
	n = 316 (27%)	n = 100 (9%)	n = 264 (22%)	n = 258 (22%)	n = 100 (9%)	n = 51 (4%)	n = 35 (3%)	n = 54 (5%)	N = 1178
Demographics									
Women, %	49	48	54	63↑	41↓	46	43	42	52
White, %	73	78	81↑	67↓	77	63	64	82	74
Age, years	45↓	53	50↓	64↑	51↓	68↑	38↓	65↑	54
Education, n[b]	5.06↑	4.93↑	4.86↑	3.14↓	4.58	2.84↓	3.62↓	2.80↓	4.25
Health status									
Diagnosed with chronic disease such as cancer, diabetes, heart disease, %	8.3↓	13	18.9	25.5↑	10.4	50.1↑	7.3	13.3	16.0
Health perception (mean, 5-point scale)	3.3↑ Good to excellent	3.1	2.8↓ Fair to good	2.6↓ Fair to good	3.2↑ Good to excellent	2.3↓ Fair to good	3.2↑ Good to excellent	3.2↑ Good to excellent	3.0
Information-seeking behaviors									
Number of topics sought in past year	2.8↑	2.0	4.1↑	2.4	0↓	0↓	0↓	0↓	2.3
Number of sources used for each topic	1.2↑	1.3↑	1.6↑	1.3↑	0↓	0↓	0↓	0↓	1.1
Reading and health literacy									
Reading literacy, mean (# correct of 5)	4.7↑	4.6↑	4.7↑	3.9↓	4.6↑	4.0↓	4.3	3.4↓	4.4
Health literacy, mean (# correct of 5)	3.8↑	3.7	3.9↑	3.3↓	3.7	3.5	3.3	2.9↓	3.6
Internet use									
Percentage used at home, work, or school	98.45↑	97.27↑	93.79↑	2.34↓	92.49↑	1.60↓	91.58↑	0.0↓	64.5

[a] Bold values represent data that were significantly higher or lower (as indicated by the arrow) than the overall sample mean.

[b] Response choices for education were 1 = less than 9th grade, 2 = 9th to 12th, 3 = high school, 4 = some college, 5 = 2-year college degree, 6 = 4-year college degree, 7 = graduate work, 8 = completed master's or professional degree, and 9 = advanced graduate work or PhD.

Table 3. Educational and Information Delivery Recommendations by Segment.

	Segment 1: Health-Conscious Web Browsers	Segment 2: Healthy Plugged In	Segment 3: Sick and Seeking Researchers	Segment 4: Unhealthy Ask the Doctors	Segment 5: Plugged In and OK	Segment 6: Health Challenged, Hard-to-Reach	Segment 7: Young Invincibles	Segment 8: Unplugged and OK
Educational design recommendations								
◦ Reading level	10th-grade reading level	10th-grade reading level	10th-grade reading level	6th-grade reading level	10th-grade reading level	6th-grade reading level	8th-grade reading level	6th-grade reading level
◦ Health terms	Define uncommon health terms	Define uncommon health terms	Define most health terms	Define all health terms	Define uncommon health terms	Define all health terms	Define most health terms	Define all health terms
◦ Numbers	Explain complicated numeric concepts	Explain complicated numeric concepts	Explain complicated numeric concepts	Explain all numeric data	Explain complicated numeric concepts	Explain all numeric data	Explain numbers less well understood	Explain all numeric data
◦ Acknowledgment of health status	Very healthy	Very healthy	Fair to good	Fair to good	Very healthy	Fair	Good	Moderate
◦ Learning preferences	Kinesthetic preference	Visual, kinesthetic preference	Visual, reading preference	Avoid reading, kinesthetic	No preferences or avoidances	Auditory preference; avoid visual, reading, kinesthetic	Avoid auditory	Auditory preference; avoid kinesthetic, visual
◦ Age depiction	30-65	30-65	30-65	Older than 65	30-65	Older than 65	18-49	Older than 50
Informational delivery recommendations								
◦ Primary mode of delivery	Internet and Health Care Provider	Health Care Provider	Internet and Health Care Provider	Health Care Provider	Internet and Health Care Provider	Health Care Provider	Health Care Provider	Health Care Provider
◦ Prioritized health information delivery	Consider newspapers, magazines, and medical journals to supplement	Primarily Health Care Provider, consider other sources via Health Care Provider (pamphlets books, Internet)	Consider family and friends, support groups	Consider family and friends, spiritual advisor; avoid Internet	Consider pamphlets, family and friends, support groups	Primarily Health Care Provider; consider family and friends, spiritual advisor	Primarily Health Care Provider; consider family and friends, support group, books Internet	Health Care Provider primarily; consider family friends, pamphlets, do not use or trust Internet
◦ Amount of information	Provide as much information as possible	Provide information from multiple sources	Provide as much information as possible	Provide information from multiple sources	Provide summary information primarily	Provide summary information primarily	Provide summary information primarily	Provide summary information primarily
◦ Primary type of delivery	Make information available	Make information available	Make information available	Make information available	Push strategy	Push strategy	Push strategy	Push strategy

develop or provide health information based on differences of multiple factors simultaneously without separate assessments for each instance of health promotion.

Practical Implications

There are multiple ways in which these 8 segments and associated educational and delivery recommendations can be utilized to improve both population and individual health promotion initiatives.

Facilitate efficient personalized health information delivery. There are numerous examples of a one size fits all approach to communicate health information to consumers that could be enhanced if their segment and associated recommendations were known. For example, the ubiquitous medication information sheets that are distributed with pharmacy-dispensed prescriptions are clearly developed using a one size fits all approach that is likely useful to very few. A redesign of this information according to generally accepted user interface design principles and analysis of the task function of these sheets can greatly improve their usability. However, knowledge of segment membership could lead to presenting information about an individual's medication (how to use, potential side effects, etc) at a lower literacy level and accompanied by visual iconography. Additional online information that contains both narration and visual displays would be provided for some segments while offering a different strategy for others.

Develop materials to suit audience. As new health promotion efforts get underway, an organization seeking to develop and communicate health information to a broad population could benefit from knowing how their population is distributed among the segments. This would allow for more informed decisions about developing the format and delivery channels that would best serve them.

Identify an audience that existing materials might be suited for. Given a set of existing materials or educational interventions (eg, classes, support groups, etc), organizations or individual providers could assess the extent to which those approaches meet the needs of segments that are most common in their population. For example, a diabetes health educator who is selecting or developing educational materials for his or her clinic might select a more effective approach by knowing that 90% of their patient population fits into 3 of the 8 segments.

Limitations

Although we believe our results are promising, they are limited by several factors. Our survey instrument combined a broad variety of factors and included some measures or subscales that have not been fully validated. In addition, our response rate, while typical for telephone surveys, is lower than desired. The length of the questionnaire did not appear to be a significant factor in response rate as there were few (n = 105 of more than 1300) who started the questionnaire but did not complete. We

are reassured in this regard by the demographics of respondents, which show that while our sample is somewhat older than the broader population of Virginia residents, the racial and gender breakdown appear consistent with the larger pool. The older age of our respondents may account for the relatively low computer and Internet use (60%) as compared to the general population.[28] Commonly, selection bias can result in fewer respondents with lower literacy or socioeconomic status (SES), however, in our study design, we sought to minimize this effect by targeting higher proportions of individuals from regions characterized by lower SES. We also ensured that we had good representation across our sample by race. Consistent with the procedures of the Behavioral Risk Factor Surveillance System (BRFSS) (added cell phones in 2012),[29] we chose to rely on landlines for survey administration, thus excluded households that only use cell phones. This could also contribute to the older age of our survey respondents.[30]

Future Directions

It will be important to understand how segment membership might change based on numerous factors including cues to

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SO WHAT: Implications for Health Promotion Practitioners and Researchers

What is already known on this topic?

Efforts to improve communication about health-related topics have included tailoring strategies with some promising results. Less is known about the impact of market segmentation and whether it is a useful strategy for the efficient provision of health information to consumers.

What does this article add?

This article adds to the existing literature by providing evidence that market segmentation is a useful strategy to explore for providing more efficient and effective tailored health information to consumers.

What are the implications for health promotion practice or research?

Health promotion practitioners can use this model to match interventions to consumers' needs and preferences to foster preventive and health maintenance knowledge and behaviors. Both public health practitioners and health-care providers can use the model to improve communication with patients who are too often treated in a one size fits all manner. Future research should focus on assessing the impact of the TEACH model in a variety of settings and across a range of health conditions and topics.

action such as a new diagnosis. We hypothesize that segment membership will be fairly stable, however, this is an active research question.

The practical implementation of the TEACH model requires a fast approach to segmentation. A shortened version of the questionnaire has been developed for future use that takes only 5 minutes to complete. This short version accurately predicts segment membership with greater than 80% accuracy.

It will be important to evaluate the model in different settings and with different conditions. The model is currently being evaluated as a strategy to improve childhood immunizations in a Federally Qualified Health Center with results forthcoming.[31]

Declaration of Conflicting Interests

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Note

1. A total of 8471 phone numbers were attempted—1497 were listed (275 completes, 28 partials), 4529 were mailed an advance letter (964 completes, 78 partials), 3942 not mailed (236 complete, 27 partials), with a total of 33 673 dialing attempts. Response rate is American Association of Public Opinion Research (AAPOR) standard RR4.

References

1. Kreuter MW, Wray RJ. Tailored and targeted health communication: strategies for enhancing information relevance. *Am J Health Behav*. 2003;27(suppl 3):S227-S232.

2. Noar SM, Benac CN, Harris MS. Does tailoring matter? Meta-analytic review of tailored print health behavior change interventions. *Psychol Bull*. 2007;133(4):673-693.

3. Nguyen HQ, Carrieri-Kohlman V, Rankin SH, Slaughter R, Stulbarg MS. Internet-based patient education and support interventions: a review of evaluation studies and directions for future research. *Comput Biol Med*. 2004;34(2):95-112.

4. Krumholz HM, Amatruda J, Smith GL, et al. Randomized trial of an education and support intervention to prevent readmission of patients with heart failure. *J Am Coll Cardiol*. 2002;39(1):83-89.

5. Bull FC, Holt CL, Kreuter MW, Clark EM, Scharff D. Understanding the effects of printed health education materials: which features lead to which outcomes? *J Health Commun*. 2001;6(3):265-279.

6. Kreuter MW, Strecher VJ, Glassman B. One size does not fit all: the case for tailoring print materials. *Ann Behav Med*. 1999;21(4):276-283.

7. Prochaska JO, Redding CA, Evers K. The transtheoretical model and stages of change. In: Glanz K, Rimer BK, Lewis FM, eds. *Health Behavior and Health Education: Theory, Research, and Practice*. 3rd ed. San Francisco, CA: Jossey-Bass, Inc; 2002:99-120.

8. Brinberg D, Axelson ML. Increasing the consumption of dietary fiber: a decision theory analysis. *Health Educ Res*. 1990;5(4):409-420.

9. Brug J, Glanz K, Van Assema P, Kok G, van Breukelen GJ. The impact of computer-tailored feedback and iterative feedback on fat, fruit, and vegetable intake. *Health Educ Behav*. 1998;25(4):517-531.

10. Kreuter MW, Bull FC, Clark EM, Oswald DL. Understanding how people process health information: a comparison of tailored and nontailored weight-loss materials. *Health psychol*. 1999;18(5):487-494.

11. Richards KC, Enderlin CA, Beck C, McSweeney JC, Jones TC, Roberson PK. Tailored biobehavioral interventions: a literature review and synthesis. *Res Theory Nurs Pract*. 2007;21(4):271-285.

12. Skinner CS, Campbell MK, Rimer BK, Curry S, Prochaska JO. How effective is tailored print communication? *Ann Behav Med*. 1999;21(4):290-298.

13. Marcus BH, Bock BC, Pinto BM, Forsyth LH, Roberts MB, Traficante RM. Efficacy of an individualized, motivationally-tailored physical activity intervention. *Ann Behav Med*. 1998;20(3):174-180.

14. Haerens L, Deforche B, Maes L, Brug J, Vandelanotte C, De Bourdeaudhuij I. A computer-tailored dietary fat intake intervention for adolescents: results of a randomized controlled trial. *Ann Behav Med*. 2007;34(3):253-262.

15. Woolford SJ, Clark SJ, Strecher VJ, Resnicow K. Tailored mobile phone text messages as an adjunct to obesity treatment for adolescents. *J Telemed Telecare*. 2010;16(8):458-461.

16. Resnicow K, Davis R, Zhang N, et al. Tailoring a fruit and vegetable intervention on ethnic identity: results of a randomized study. *Health Psychol*. 2009;28(4):394-403.

17. Strecher VJ, McClure JB, Alexander GL, et al. Web-based smoking-cessation programs: results of a randomized trial. *Am J Prev Med*. 2008;34(5):373-381.

18. Friedman DB, Hoffman-Goetz L. A systematic review of readability and comprehension instruments used for print and web-based cancer information. *Health Educ Behav*. 2006;33(3):352-373.

19. Slater MD. Theory and method in health audience segmentation. *J Health Commun*. 1996;1(3):267-283.

20. Gordon R, Mcdermott L, Stead M, Angus K. The effectiveness of social marketing interventions for health improvement: what's the evidence?. *Public Health*. 2006;120(12):1133-1139.

21. Williams JE, Flora JA. Health behavior segmentation and campaign planning to reduce cardiovascular disease risk among Hispanics. *Health Educ Q*. 1995;22(1):36-48.

22. Forthofer MS, Bryant CA. Using audience-segmentation techniques to tailor health behavior change strategies. *Am J Health Behav*. 2000;24(1):36.

23. Slater MD, Flora JA. Health lifestyles: audience segmentation analysis for public health interventions. *Health Educ Q*. 1991;18(2):221-233.

24. Medway RL, Tourangeau R. Response quality in telephone surveys: do prepaid cash incentives make a difference? *Public Opin Q*. 2015;79(2):524-543.

25. Literature Review and Analysis Report. https://med.virginia.edu/phs/faculty-and-staff-directory/wendy-f-cohn-m-ed-ph-d/. Accessed January 20, 2016.

26. Wedel M, Kamakura W. *Market Segmentation: Conceptual and Methodological Foundations*. 2nd ed. Boston, Dordrecht, London: Kluwer Academic Publishers; 2000.

27. Dick W, Carey L. *The Systematic Design of Instruction.* 4th ed. New York, NY: Longman; 1996.

28. Thom F, Ryan C. Computer and Internet Use in the United States: 2013. American Community Survey Reports, ACS-28. Washington, DC: US Census Bureau. 2014:P20-P569.

29. BRFSS Landline and Cell Phone Methodology. http://www.cdc.gov/surveillancepractice/reports/brfss/brfss_faqs.html. Update February 6, 2013. Accessed January 20, 2016.

30. Blumberg SJ. Coverage bias in traditional telephone surveys of low-income and young adults. *Public Opin Q*. 2007;71(5):734-749.

31. American Public Health Association. TEACH presentation: 312462 improving child health using the TEACH model in a FQHC. APHA 142nd Annual Meeting and Expo, November 15-19, 2014, New Orleans, LA. 2014. https://apha.confex.com/apha/142am/webprogram/Paper312462.html. Accessed December 1, 2014.