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A Framework for Health Numeracy: How Patients Use Quantitative Skills in Health Care

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Abstract

Objective—To develop a conceptual framework for the construct of health numeracy based on patient perceptions.

Design—Cross-sectional; qualitative.

Participants—Interested participants (n=59) meeting eligibility criteria (age 40–74, English speaking) were assigned to one of 6 focus groups stratified by gender and educational level (low, medium, high). 53% were male and 47% were female. 61% were white non-Hispanic and 39% were of minority race or ethnicity.

Setting—Participants were randomly selected from 3 primary care sites associated with an academic medical center. The focus groups were held in May, 2004.

Procedure—Group discussions focused on how numbers are used in the health care setting. Data were presented from clinical trials to further explore how quantitative information is used in health communication and decision-making. Focus groups were audio and videotaped; verbatim transcripts were prepared and analyzed. A framework of health numeracy was developed to reflect the themes that emerged.

Results—Three broad conceptual domains for health numeracy were identified: primary numeric skills, applied health numeracy, and interpretive health numeracy. Across domains, results suggested that numeracy contains an emotional component; with both positive and negative affect reflected in patient numeracy statements.

Conclusion—Health numeracy is a multifaceted construct that includes applied and interpretive components and is influenced by patient affect.

Keywords

Communication; decision making; communication skills; health literacy; health numeracy

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Introduction

A number of models of health care delivery expect patients to take an active role in the spectrum of their care; from setting goals and managing medications, to deciding upon a treatment plan (1–5). Models that engage patients in their care have been shown to improve the control of chronic diseases (6), increase compliance with medication regimens (7, 8), and raise satisfaction with physicians (9). However, it is important to address what skill sets patients require in order to be active participants in their health care. One skill set that is essential in order for patients to understand basic health information as well as participate in medical decision making is that of numeracy. At its most basic level, numeracy refers to a cognitive and language system for counting. Anthropologic research has found that counting systems exist even in societies that are very remote or societies that have not developed language systems for numerical concepts (10, 11). In the modern world, numeracy includes a range of skills that have in common a facility with manipulating and interpreting quantitative information such as calculations, understanding time, and the ability to interpret graphs and labels (12). Health numeracy also involves skills that allow one to understand concepts of risk, probability, and the communication of scientific evidence.

Numeracy skills have demonstrated a positive association with communication and medical care outcomes including greater understanding of health information and risk statistics (13–17); better comprehension of data from medical studies (18), and improved control of chronic disease (19). Definitions of numeracy in the literature vary in scope (14, 20–25); some focus on a basic understanding of math and probability (24), others include skills needed to appreciate the strengths and limitations of evidence based data from medical studies (24). Empiric data from the patients' perspective to support the scope and structure of the health numeracy construct is lacking. The objective of this study is to develop a theoretical framework for the construct of health numeracy that reflects the patients' perspective of the ways in which the use of quantitative information is important to health care.

Methods

Recruitment and Study Participants

Participants were recruited from patients enrolled in one of 3 internal medicine clinic sites. Inclusion criteria were ages 40 to 74, enrollment in a primary care clinic, and the ability to speak English. The three participating clinics were affiliated with an academic medical center. Two clinics were located on-site at a tertiary care hospital; one of which served a greater proportion of minority and underserved urban patients. A third clinic was free standing in a suburban community. The clinics were identified as recruitment sites because they served patients that were diverse in age, gender, race, and socioeconomic status. In addition, their location in geographic proximity facilitated participant's attendance at the focus group sessions. Patients with a personal history of cervical, breast, prostate, or colon cancer or a life expectancy of less than 5 years as judged by their primary care physician were excluded. These exclusions were made so that the cancer screening, prevention, and treatment vignettes would be approached from the perspective of patients that had not experienced these disease states. A random sample of patients was selected and mailed an invitation letter. The sampling frame included all patients 40 years and older who had at least one visit in one of the participating clinics from 3/3/03 to 3/31/04. The sample was then stratified by race and gender and a random number table was used to identify the patients who were mailed a recruitment letter. Non-white patients were over-sampled to ensure 40% participation in each focus group. Focus groups were stratified by gender and level of formal education; the purpose of making the groups homogeneous with regard to gender and education was to facilitate the comfort level and interaction regarding the topic of mathematics and the use of numbers in health. All participants provided written informed consent and were reimbursed $75.00 for participation. Study protocols were approved by the IRB of participating sites.

Focus Group Protocol

The focus groups were conducted by a professional female moderator. The moderator had experience conducting focus groups in the area of health care for both the academic and corporate clients. The investigators chose to use an experienced moderator outside of the research team so that investigators could focus on their role as observers and analysts for the focus group session. The focus groups occurred at a qualitative research facility equipped with one-way mirrors enabling the investigators to observe groups and record field notes. The focus groups were both audio and videotaped. Domains covered in the focus group guide included perceptions of the use of numbers in everyday life and health care, concepts of probability and chance, understanding of results from scientific studies, and interpretation of uncertainty. Clinical vignettes were used to gain insight into how patients interpret quantitative information presented from medical studies (26–28) using methods successfully applied in qualitative studies (29, 30). Six focus groups were scheduled with the option of adding additional groups if thematic saturation was not reached.

Analysis

Audio transcripts of focus groups were transcribed verbatim with video-transcripts used to edit the transcripts. Investigators independently reviewed transcripts, identified major themes and, through a consensus process, developed a coding scheme using the qualitative software QSR NVivo (31). The data was initially approached without a predetermined framework; an analysis approach designed to remain open to new constructs that could emerge from the data. An initial review of the focus group data was conducted and the criteria for coding data were developed. At this phase of analysis the coding scheme included the 3 main domains of primary numeric skills, applied numeracy, and interpretive numeracy. However, the relationship between these domains had not been determined. Four investigators then served as the primary coders with each focus group assigned a unique coding team of 2 investigators. After independently coding a transcript, the two person coding team reviewed the data and resolved points of disagreement. Remaining discrepancies were resolved by a third investigator acting as an adjudicator. A debriefing session was held among all coders to review the frequency of codes used among the groups and come to a consensus regarding aspects of the coding scheme that required clarification or revision. One investigator not involved in the initial coding or adjudication reviewed all focus group transcripts to identify the dimensions of each code that made it unique, a

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method supporting the validity of the coding system (32). The framework of numeracy was developed based upon a review of the coded data and consideration of the relationships between coded data content. The frequency of coded statements was not directly interpreted as an indicator of the importance of a given domain because it could be influenced such factors as group dynamics and the level of agreement within the group on a given theme. Iterations of the framework were discussed by the investigative team in face-to-face meetings and via conference calls. The framework was also presented to colleagues of general internists for comments.

Results

Study Population

Nine hundred recruitment letters were mailed. Of these, 18 were undeliverable and 7 patients were determined to be deceased, leaving 875 potential respondents. The overall participation rate was 20.9%. Participation did not vary by gender. There was a trend towards higher participation among whites than other race and ethnic groups (24.5% vs. 19.1%, p=0.06). Of those willing to participate and who met study criteria, participants were randomly invited to join the study until the groups were filled by the specified criteria of education, gender, and race/ethnicity. Six focus groups, each uniform in age and gender, were conducted (Table 1).

Coding Results and Numeracy Framework

Investigators agreed that thematic saturation had been reached after review and coding of the six transcripts. A hierarchical coding scheme was developed. There were between 191 and 298 segments coded for each group with rates of agreement ranging from 91.6% to 98.6%. Each domain included a number of sub-categories that represent the types of skills in that domain (Table 2). In consideration of the domains that emerged from the focus groups a conceptual framework was developed. The framework can be represented as a pyramid with three levels of numeracy domains. At the base sits primary numeric skills. Upon this base sits the applied health numeracy. At the apex of pyramid is interpretive health numeracy. Positive and negative affect were emotional components that were found to influence the domains of numeracy. Below, excerpts from the qualitative data are used to illustrate the domains that comprise the numeracy framework.

Primary Numeric Skills

The domain of primary numeric skills can be defined as the ability to use basic arithmetic functions and graphs as well as apply numbers to concepts of dates and times. Participants across groups described a wide range of activities in everyday life that used numeric skills including recreational, household, and work activities. In the focus group discussion, both positive and negative affect regarding the use of basic numeric skills was expressed as illustrated in the quotations below.

Positive affect describing comfort with numeric ability:

> I would say I’m probably very comfortable because everything is cut and dried. A number is a number. It’s either there or it isn’t 1, 2, 3, 4.

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-Some college, male group

Negative affect describing discomfort with experience with mathematics:

> I can just remember having a really hard time in high school with doing wonderfully well in algebra, straight A's and the next year in geometry the direct opposite. I think I never really got over getting those grades. -

College graduate, female group

Applied Numeric Skills

The domain of applied numeric health tasks describes the use of quantitative information in health tasks that range from basic counting skills used to take medication to balancing the likelihood of risks and benefits in a medical decision making task. Our framework placed these skills into three categories; 1) basic tasks, 2) risk communication tasks, and 3) decision-making tasks (Table 2). The following quotation illustrates how a patient is asked to use a numeric scale to convey his severity of chest pain symptoms.

> I just had a stress test. It took me all the way up and goes about as fast as they could get it. Then they ask you "how do you feel?" I'm starting to feel a little chest pain. They want to know where that is and then a time later then they say 'now how is that number?" to give them an idea whether it is increasing or decreasing. It puts everything in some form of perspective.

-High school, male group

The second category of applied numeracy in our framework is that of risk communication. Participants considered the use of numbers to convey the risk of disease and adverse events, treatment efficacy, and prognosis as important aspects of physician-patient communication. The following quotations illustrate these points.

Risk of an adverse event:

> I had an arthroscopy on my knee and it developed a blood clot in my leg, which went to my lungs that was pretty serious. My surgeon came to see me in the hospital that I was taken to on an emergency basis. He said the probability, and I've done hundreds of arthroscopies, the probability of this happening is just practically not in existence. I've never seen this before in all of my years 'that I' practiced. So he could have said the odds of it happening in one of my patients are just practically one in a million.

-Some college, female group

Efficacy:

> I had back surgery in 1983 or something. We were looking at the options and one that came up for pain was papaya. I talked to the doctor, I said, what are the results? I need something that is 80–90% relief. What are you saying about this… Well, I said, no, 50%, we have to go with something else… the numbers helped me that way.

College graduate, female group

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Prognosis/Survival:

> Well, it (numeric information) is especially helpful if you have been diagnosed with cancer and they are going to give you so many days to live or so many months or something like that. In terms of that's the way of presenting end of life issues really. You are going to live this long.
>
> -College graduate, female group

The third category of applied numeracy on our framework is that of decision making. Decision-making reflects an integrative conceptual task; probabilistic information is considered as well as other attributes of a decision such as quality of life and personal preferences. The following quotations illustrate how people may balance such attributes with numeric information when making health decisions.

Balancing life expectancy and quality of life:

> I remember my mother at 90 years old was diagnosed with kidney cancer…she was infirm and couldn't walk and I took her to the kidney doctor and he said "Oh, I can remove that kidney and the surgery will be a success". Well, we knew that at 90 years old the chances of surviving that, yeah, he can remove it but the patient dies anyway and it's miserable besides. So those are the things when they hand you those statistics.
>
> -College graduate, female group

After considering numeric efficacy data from chemotherapy trials:

> I just have an individual feeling about the quality of life on chemotherapy, which cancer it is and which therapy it is and whether or not I would choose for myself to go through that. I've known people who've had fatal cancer and have chosen not to be treated.
>
> -Some college, female group

Both positive and negative affect were expressed with regard to the use of numbers in risk communication and decision making. One salient affect that emerged was that of trust. Some expressed distrust of the use of numbers to communicate, suspicious that numbers could be used to misrepresent information for the purpose of persuasion. However, numeric communication could also increase trust in a physician as illustrated below.

> I'm just thinking it just tells me a lot about the doctor if he has that much information for me. That means he has done his homework... and then list everything about what could be done.
>
> -College graduate, female group

Other examples of affect engendered by the use of numbers were feeling in control (a positive emotion) and or annoyance (negative emotion), as illustrated respectively in the quotations below.

> The more information I have the better judgment that I can make…what's going to be done to me with my treatment and my outcome.

-High school, female group

> I don't want to feel bombarded or overwhelmed with all of it. I need just specific parts of it just for my needs.

-College graduate, female group

Interpretive Numeric Skills

Interpretive numeracy is defined as the ability to understand the strengths and limitations of numbers to represent health or disease states, the efficacy of an intervention, or other expected health outcomes. This domain encompasses a more abstract understanding of numeric information. Below we describe selected categories of the interpretive numeric skills domain.

Probability and Statistical Inference—The focus groups explored how participants perceived statements of probability, chance, and odds. Statements using these terms to convey probabilistic information were correctly interpreted to indicate a degree of uncertainty and to reflect some level of past experience in medicine. However, we found that participants sometimes misinterpreted terminology in this domain. For example, the terms "probably" and "probability" were often used interchangeably. Participants were asked to discuss the meaning of the term "statistics". Some focused their discussion on descriptive statistics, such as the number of people in a country. Others conveyed an understanding of principles of statistical inference as illustrated in the following definition and example, respectively.

> It's taking a known to predict the unknown.

-Some college, male group

> Well, one of the basic examples used in statistics is you take a pair of dice and you throw that pair of dice 100 times, how many times does the 2,3,4,5 each number, the combination of numbers, how often do they come up in that 100 sampling?

-Some college, male group

Principles of the Scientific Method—Participants across focus groups of all educational strata raised a number of basic principles of study design when asked to discuss what made a good scientific study. For example, participants commented on the importance of adequate sample size, the inclusion of control groups, the reproducibility of results, the credibility of those conducting the study, and the importance of making the results understandable to the lay person. The following quotation is illustrative of this aspect of the discussion.

> You have to have control parameters. You have to have a controlled group. You use a lot of numbers and it doesn't matter what kind of scientific study that you are doing if it is with plants or animals or human beings. If it is scientific it is controlled and it involves numbers.

-Some college, female group

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Participants from all educational level focus groups questioned the source of numeric information and the quality of studies from which it was obtained. In some cases, the discussion illustrates a sophisticated understanding of the source of numeric data as in the comment below.

> I think that the negative (of using numbers) can be that they sometimes can mask or discourage somebody from asking "what are the assumptions behind the number?". You can jump too quickly to a conclusion without understanding what's behind it because almost any type of occurrence is a risk profile involving certain assumptions…The numbers may or may not be misleading.
>
> -College degree, male group

Concept of Uncertainty—Participants' understanding of uncertainty in science was explored through the presentation of a series of clinical vignettes using data from cancer clinical trials (Appendix). Results were presented with point estimates of effect and a 95% confidence interval. Although some participants were familiar with these concepts, uncertainty was often thought to represent weaknesses, mistakes, or dishonesty in the study design or presentation of results. In the quotation below, the confidence interval is likened to a margin of error in a political poll. In the subsequent quotation, the confidence interval is interpreted as a mistake.

> Well, as an example, you can say in a presidential election, they say between the vote and this candidate and that candidate. He's got 50, he's got a 40. There is a margin of error of 5 percent so it can go up or down. People might give the wrong thing on the telephone just to lie about it. They don't want the other person on the other end of the phone knowing who they are really going to vote for. So they are going to give false information.
>
> -Some college, female group

> When I ask who is making these mistakes and I don't understand how they get lots of little things, the margin of error, and I understand the mistakes made but how they came to those mistakes, I have no idea.
>
> -Some college, female group

Individual Variation and the Representative Nature of Numbers—Individual variation in health was a recurrent theme as participants considered the importance of numeric goals and indicators for their personal health situation. The following quotation illustrates this domain.

> But you know, I have a problem with dealing with a lot of numbers because to me it's like everybody is different. How are you going to compare me to this person or that person by numbers? You know everybody's makeup is totally different.
>
> -High school, female group

Some participants expressed an awareness of numbers as an imperfect indicator of a given health state; one that may not reflect how the patient experiences their health. This domain was labeled "the representative nature of numbers" and is illustrated in the quotation below.

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Interpreting an abnormal blood count:

> So the fact that the numbers are still low and the fact that I do have these low numbers, I'm healthy, I work out, I exercise, I play golf, it didn't mean anything to me. I guess to the doctor and the medical community I'm abnormal. I've run into other people who have had similar scenarios. So I don't know what is behind the number. I'm not sure what the number means. I'm working and I'm alive.
>
> -College graduate, male group

Discussion

Health numeracy is a complex construct that encompasses the range of skills required for patients to use and interpret numeric information in the context of their health care. In this study we explored the construct of health numeracy with attention to the patient perspective. Our study supports a framework of health numeracy that includes three major domains; primary numeric skills, applied health numeracy, and interpretive health numeracy. The framework also highlights the role of affect, or emotion, in the numeracy construct.

The hierarchical framework presented here reflects other constructs that have approached health literacy and/or health numeracy from a broad perspective. In her expanded framework of health numeracy, Golbeck defines four levels of numeric skill; basic, computational, analytical, and statistical (24). Our framework is similar to Golbeck's in that both emphasize the hierarchical nature of skills in the health numeracy construct and both include a basic understanding of probability and statistical concepts in the highest skill domain. Both frameworks also recognize the ability to interpret and apply quantitative information in medical decision making as a component of health numeracy. However, our framework differs in important ways. First, our framework highlights the affect, or emotional, component in the numeracy construct. Second, we have constructed our framework with empirically collected data that represents the patient's perspective. A hierarchical structure was also proposed in a general health literacy model put forth by Nutbeam in which he defines three levels of skills; functional health literacy, interactive health literacy, and critical health literacy (33). In this model, functional health literacy is defined as the ability to understand basic patient education information, interactive health literacy refers to personal skills and traits needed to act on the health information received, and critical health literacy refers to skills in working within a given social and economic context. Our framework differs in its scope with an emphasis on the skills used by an individual in the health care setting rather than skills relevant to the broader social and economic arena. The International Adult Literacy Survey (IALS) recognizes 5 levels of literacy across prose, document, and quantitative domains (34). In the IALS framework, levels 1 through 5 represent an increasing level of skill in completing arithmetic operations that require a person to identify and abstract quantitative information from printed materials. Although the IALS framework of quantitative literacy is similar to ours in recognizing various levels of skill, it does not explicitly recognize the domains of risk communication, decision-making, or interpretive numeracy as is put forth in our framework.

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Scientific literacy can be defined as “levels of competence with science and technology, including some awareness of the process of science” (25). Some frameworks of general health literacy or health numeracy consider scientific literacy to be a separate domain from numeracy (25, 34). Our data suggest that the effective use of numeric information in health care depends upon one’s ability to understand and trust information obtained from scientific studies. Whereas fundamental numeracy skills such as counting are needed in order for patients to take their correct dose of medication, some understanding of the scientific process is needed in order for a patient to trust data from a clinical study while understanding it’s limitations including concepts of scientific uncertainty. As risk communication and shared decision making become a greater focus of medical practice, the ability to appreciate both the power and limitations of scientific data becomes an increasingly important aspect of health numeracy. Our framework for health numeracy is broad and attempts to be inclusive of the range of skills that patients require in order to use numbers effectively in health care. Therefore, our framework holds that some understanding of the scientific process as it relates to interpreting data from medical studies is an important component of interpretive health numeracy skills.

Our findings support the role of affect and emotion in the health numeracy construct. The finding that emotions can affect the way that people use numeric information has support in the literature. Mathematics is known to evoke anxiety in some people, an emotion that could inhibit the processing of information (35). Theoretical frameworks of decision making suggest an interaction between cognitive and psychological factors in how people process risk information and use that information to make decisions (36,37). For example, the affective response, or emotion of worry has been found to influence the how cancer risk information is processed and decisions regarding the adoption of preventive interventions (36). In the context of cancer care communication, the interpretation of numeric information by patients has been closely associated with the emotions of both hope and fear (38). The current study provides data from the patient’s perspective supporting the importance of affect in the construct of health numeracy. Our framework implies that the emotional response to the use of numbers to communicate information be considered when trying to assess a persons’ ability to process numeric information in the medical care setting.

Through consideration of the patient perspective in this study, we were able to identify some common misperceptions that patients have in the application of numbers to health care. For example, in the focus group discussions the terms “probability” and “probably” were often used interchangeably. Although related, these terms differ in meaning. In mathematical terms, “probability” represents the likelihood of an occurrence and can range from 0% to 100%. In contrast, the term “probably” indicates that an outcome is more likely than not to occur, corresponding to a mathematical probability between 50% and 100%. Differences between mathematic and common usage of terms may help to explain the lack of correlation between qualitative and numeric estimates of risk in the literature (39–41). We also found that statistical concepts of uncertainty are widely misunderstood and could cause patients to mistrust information conveyed. Scientific uncertainty is an important concept for physicians to communicate effectively if the goal is to share evidence based data in a participatory model of patient care.

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The findings of this study have applications to the assessment of health numeracy. Available measures related to health numeracy skills focus on selected elements of numeracy but do not provide a comprehensive measure of the numeracy construct as represented by our framework (14, 20–23, 42–44). A measure of numeracy that could assess the level of skill in the primary, applied, and interpretive domains would have both research and clinical applications in medicine. For example, a patient found to be weak in basic applied numeracy skills may benefit from color coded charts to assist in medication dosing. In contrast, a patient who has strong applied skills but weak interpretive skills may know *how* to take the medication but may not understand *why* the medication is thought to be efficacious. The later patient may benefit from an explanation of the strength of evidence from relevant clinical trials. Strategies for risk communication could thus be tailored according to the level of skill across various domains of health numeracy. The proposed framework could serve as a conceptual model for the development of a comprehensive measure of health numeracy.

Our study has some limitations. The model was developed among a sample of English speaking participants who were adults 40–74 years of age and enrolled in a primary care clinic. Concepts of numeracy may differ among other languages and cultures or in other groups of patients. The study had a 21% participation rate that may lead to a volunteer bias. More numerate persons may have been more likely to participate than the less numerate. Monetary incentives of $50 to $100 are used by convention in focus group research (45). However, few focus group studies have used randomized methods for recruitment or report participation rates from those approached to participate. Our response rate is consistent with the literature regarding survey research in primary care, especially those that focus on minority recruitment (46), and with community based recruitment of participants for the Women's Health Initiative Trial (47). Despite the potential for volunteer bias, the study population was diverse in age, race, ethnicity, level of education, and background in mathematics. The study used qualitative methods and therefore the findings are considered exploratory. As in any qualitative study, the disciplinary interests and prior work of the investigative team could have influenced the interpretation of data (48). However, several approaches were deliberately taken to maintain objectivity. The analysis plan was designed to encourage the emergence of new themes and relationships (49). In addition, the investigative team included members from a range of disciplines (psychology, education, medicine, and biostatistics) including some that have not worked previously in the area of numeracy.

In summary, this study supports a broad framework for the construct of health numeracy. The framework includes a hierarchical set of skills that reflect ones ability to use and interpret numeric information in the health care setting. Affect, or emotion, is recognized as an important factor in the health numeracy framework. These findings have implications for the measurement of health numeracy and the development of strategies to tailor communication in the health care setting.

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Table 1

Participant Characteristics

Group Characteristics	Group #1 n=10	Group #2 n=10	Group #3 n=11	Group #4 n=9	Group #5 n=8	Group #6 n=11
Gender	Male	Male	Male	Female	Female	Female
Age in years median (range)	63 (47–69)	58.5 (40–70)	57 (48–68)	58 (42–74)	56.5 (50–74)	55 (44–73)
Race/Ethnicity (%)						
White	60	60	55	56	75	64
Black	20	40	18	33	12.5	27
Hispanic	20	0	0	11	12.5	0
Asian/Pacific Islander	0	0	27	0	0	9
Educational Degree (%)						
No degree	40	-	-	22	-	-
GED/High School	60	100	-	78	100	-
Some College	-	-	-	-	-	-
4 Yr College Degree	-	-	36	-	-	55
Graduate Degree	-	-	63	-	-	44
Math Background						
HS math	100	100	100	100	100	100
College math	0	80	73	11	63	73
Algebra	40	80	100	67	88	100
Geometry	10	60	91	44	88	73
Statistics	0	40	64	11	25	64
Calculus	0	10	36	0	13	27

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Table 2

Primary Domains and Sub-Categories of the Health Numeracy Framework

Domain Definitions	Sub-Categories of Domain	Frequency* Median	Frequency* Range
Primary Numeric Skills			
Ability to use basic arithmetic functions and graphs as well as apply numbers to concept of dates and time	• Counting	3	1–5
	• Basic math functions	8.5	5–13
	• Estimating and projecting	3	1–5
	• Dates and time	3.5	2–5
	• Scales and graphs	2.5	0–3
Applied Numeracy			
Basic Tasks The use of numbers in day to day health care tasks such as taking your medications as prescribed.	• Interpretation of lab values	2	0–4
	• Medication Adherence	1.5	0–4
	• Symptom scale (pain)	2	1–4
	• Scheduling appointments	0	0–2
	• Paying bills	0	0–3
Risk Communication Tasks The use of numbers to communicate probabilistic information about health outcomes including risk, severity, and outcomes of disease.	• Disease Incidence	2	0–20
	• Modification of incidence by risk factors or health behaviors	16.5	0–20
	• Prognosis, Survival	2.5	1–7
	• Adverse outcome of intervention	7	1–11
	• Efficacy of intervention	4	1–8
	• Results of diagnostic tests	2.5	0–5
	• Measures of disease severity	1	0–2
Decision-Making Tasks The use of numbers to help consider the risks and benefits of a given medical decision.	• Information seeking	23	15–29
	• Balancing risks and benefits	15	7–15
	• Assessment of evidence	21.5	15–31
Interpretive Numeracy			
The ability to understand the strengths and limitations of numbers to represent health or disease states, the efficacy of an intervention, or other expected health outcomes.	• Probability and chance	36.5	31–47
	• Principles of scientific method	19	8–42
	• Concept of uncertainty	13.5	8–16
	• Representative nature of numbers	4	1–11
	• Graphic and verbal formats	38.5	10–52
	• Individual and biologic variation in expected outcomes	3	1–5

*Segments may have addressed more than one domain or sub-domain but each coded segment was assigned only one code at the most specific level agreed upon by the coders. Additional codes were used but not included in the final framework.