Evidence-Based Risk Communication

A Systematic Review

Daniella A. Zipkin, MD; Craig A. Umscheid, MD, MS; Nancy L. Keating, MD, MPH; Elizabeth Allen, MD; KoKo Aung, MD, MPH; Rebecca Beyth, MD, MSc; Scott Kaatz, DO, MSc; Devin M. Mann, MD, MS; Jeremy B. Sussman, MD, MS; Deborah Korenstein, MD; Connie Schardt, MLS; Avishek Nagi, MS; Richard Sloane, MPH; and David A. Feldstein, MD

Background: Effective communication of risks and benefits to patients is critical for shared decision making.

Purpose: To review the comparative effectiveness of methods of communicating probabilistic information to patients that maximize their cognitive and behavioral outcomes.

Data Sources: PubMed (1966 to March 2014) and CINAHL, EMBASE, and the Cochrane Central Register of Controlled Trials (1966 to December 2011) using several keywords and structured terms.

Study Selection: Prospective or cross-sectional studies that recruited patients or healthy volunteers and compared any method of communicating probabilistic information with another method.

Data Extraction: Two independent reviewers extracted study characteristics and assessed risk of bias.

Data Synthesis: Eighty-four articles, representing 91 unique studies, evaluated various methods of numerical and visual risk display across several risk scenarios and with diverse outcome measures. Studies showed that visual aids (icon arrays and bar graphs) improved patients' understanding and satisfaction. Presentations including absolute risk reductions were better than those including relative risk reductions for maximizing accuracy and seemed less likely than presentations with relative risk reductions to influence decisions to accept therapy. The presentation of numbers needed to treat reduced understanding. Comparative effects of presentations of frequencies (such as 1 in 5) versus event rates (percentages, such as 20%) were inconclusive.

Limitation: Most studies were small and highly variable in terms of setting, context, and methods of administering interventions.

Conclusion: Visual aids and absolute risk formats can improve patients' understanding of probabilistic information, whereas numbers needed to treat can lessen their understanding. Due to study heterogeneity, the superiority of any single method for conveying probabilistic information is not established, but there are several good options to help clinicians communicate with patients.

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For author affiliations, see end of text.

Shared decision making is a collaborative process that allows patients and medical professionals to consider the best scientific evidence available, along with patients' values and preferences, to make health care decisions (1). A recent Institute of Medicine report concluded that although "people desire a patient experience that includes deep engagement in shared decision making," there are gaps between what patients want and what they get (2). For patients to get the experience they want, providers must effectively communicate evidence about benefits and harms.

To improve the decision-making process, the Institute of Medicine recommended development and dissemination of high-quality communication tools (2). New tools, however, must match patients' numerical abilities, which are often limited. For example, in one study, as many as 40% of high school graduates could not perform basic numerical operations, such as converting 1% of 1000 to 10 of 1000. This "collective statistical illiteracy" is a major barrier to the interpretation of health statistics (3). Physicians may also find statistical information difficult to interpret and explain (4).

See also:

Web-Only
Supplements

Existing literature about methods of communicating benefits and harms is broad. One review, based on 19 studies, concluded that the choice of a specific graphic is not as important as whether the graphic frames the frequency of an event with a visual representation of the total population in which it occurs (5). Another review, involving a limited literature search, found that comprehension improved when using frequencies (such as 1 in 5) instead of event rates (such as 20%) and using absolute risk reductions (ARRs) instead of relative risk reductions (RRRs) (6). The review did not assess affective outcomes, such as patient satisfaction, and behavioral outcomes, such as changes in decision making. Yet another review identified strong evidence that patients misinterpret RRRs and supported the effectiveness of graphs in communicating harms (7). However, they did not examine the comparative effectiveness of such approaches. More narrowly focused Cochrane reviews examined the communication of risk specific to screening tests (8, 9); numerical presentations, such as ARRs, RRRs, and numbers needed to treat (NNTs) (10); and effects of decision aids (11). An expert commentary about effective risk communication recommended using plain language, icon arrays, and absolute risks and providing time intervals with risk information (12). A group of experts identified 11 key components of risk communication, including presenting numerical estimates in context

with evaluative labels, conveying uncertainty, and tailoring estimates (13).

The aim of this systematic review is to comprehensively examine the comparative effectiveness of all methods of communicating probabilistic information about benefits and harms to patients to maximize their understanding, satisfaction, and decision-making ability.

Methods

We developed and followed a plan for the review that included several searches and dual abstraction of study data using standardized abstraction forms.

Data Sources and Study Selection

We searched PubMed (1966 to March 2014), CINAHL, EMBASE, and the Cochrane Central Register of Controlled Trials (1966 to December 2011) using keywords and structured terms related to the concepts of patients; communication; risk–benefit; and outcomes, such as understanding or comprehension, preferences or satisfaction, and decision making. **Supplement 1** (available at www.annals.org) shows the detailed search strategy.

We included cross-sectional or prospective, longitudinal trials that were published in English and had an active control group that recruited patients or healthy volunteers and compared any method of communicating probabilistic information with another method. We focused on different methods of communicating the same specific probabilities to eliminate any independent effects that could result from different probabilities being studied (for example, different magnitudes or directions of effect). Studies of personalized risks, which may vary from person to person, were included when participants were randomly assigned. When studies of personalized risks were not randomized, the risks were considered to differ between the groups and were excluded. No limits were placed on study size, location, or duration or on the nature of the communication method. When needed, we reviewed sources specified in the articles, such as Web sites, to directly review the interventions and determine whether probabilistic information was addressed. Studies of medical students, health professionals, and public health or mass media campaigns were excluded.

One independent reviewer screened each title and abstract and excluded citations that were not original studies or were unrelated to probabilistic information. Two independent reviewers screened the full text of the remaining citations to identify eligible articles. Disagreements between the 2 reviewers were resolved by consensus, with a third reviewer arbitrating any unresolved disagreements.

Data Extraction and Quality Assessment

Two reviewers independently abstracted detailed information about the study population, interventions, primary outcomes, and risk of bias from each included study using a standardized abstraction form, which was developed a priori (**Supplement 2**, available at www.annals.org). A third reviewer resolved any disagreements. We categorized outcomes in 1 of 3 domains: cognitive (or understanding, such as accuracy in answering questions related to probabilistic information, or general comprehension of the probabilistic information), affective (such as preferences for or satisfaction with the method of communicating probabilistic information), and behavioral (such as real or theoretical decision making).

Risk of bias in randomized, controlled trials was assessed on the basis of adequacy of randomization, allocation concealment, similarity of study groups at baseline, blinding, equal treatment of groups throughout the study, completeness of follow-up, and intention to treat (participants analyzed in the groups to which they were randomly assigned) (14). Risk of bias in observational studies was assessed with a modified set of criteria adapted from the Newcastle–Ottawa Scale (15).

Data Synthesis and Analysis

Data were tabulated, and the frequency of all head-to-head comparisons in studies was assessed to identify clusters of comparisons. In many instances, several interventions were bundled in a single study group (such as event rate plus icon array, or event rate plus natural frequencies plus ARRs). Bundles were not separated or combined with similar interventions because it could not be determined which component of the bundle drove the intervention. Descriptive statistics were used. We decided a priori not to do meta-analysis because of study heterogeneity. We emphasized findings from randomized studies as well as nonrandomized studies when findings were supported by more than 1 study.

Role of the Funding Source

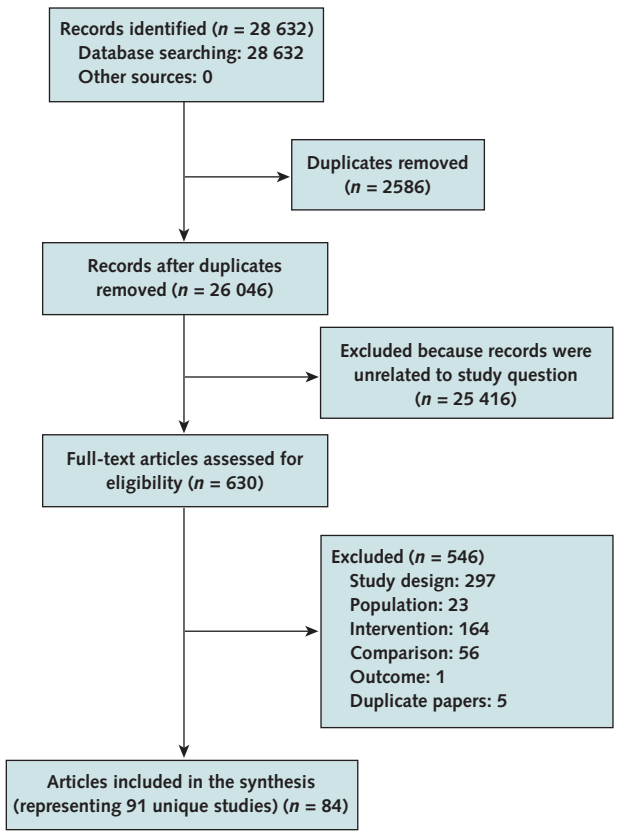
No funding supported this study. The authors participated within their role on the Evidence-Based Medicine Task Force of the Society of General Internal Medicine.

Results

The initial search through December 2011 retrieved 22 103 citations (16 661 from PubMed, 1194 from CINAHL, 2861 from the Cochrane Central Register of Controlled Trials, and 1387 from EMBASE), and 20 076 remained after removing duplicates. We updated the PubMed search through 30 March 2014, yielding 6529 additional citations; 5970 remained after removing duplicates, for a total of 26 046 citations for review. A total of 630 articles were selected for full-text review and 84 were included, representing 91 unique studies (16–99). Reasons for exclusion are noted in **Figure 1**, and study details are provided in **Supplement 3** (available at www.annals.org).

Seventy-four (81.3%) of the 91 included studies were randomized trials, most with cross-sectional designs. The median number of participants in randomized trials was 268 (range, 31 to 4685), and the median in all studies was

Figure 1. **Summary of evidence search and selection.**



268 (range, 24 to 16 133). Thirty-three studies (36.3%) included patients at specific risk for the target condition of interest. Forty-eight studies (52.7%) presented probabilistic data about benefits of a therapy or intervention (with 7 [14.6%] also presenting harms), 21 (23.1%) presented data only on harms, and 9 (10%) involved screening tests. Forty-nine studies (54.4%) delivered interventions on paper and 39 (42.9%) on a computer, typically over the Internet. The characteristics of study participants are presented in **Tables 1** and **2**.

Risk of bias for the included randomized trials was moderate (**Figure 2**). Randomization was adequate in 32 trials (42.7%), inadequate in 3 (4.0%), and unclear in 40 (53.3%). Allocation concealment was not stated in 55 trials (73.3%). Similarity of groups at baseline was adequate in 37 trials (49.3%) and unclear in 32 (42.7%). Blinding, equal treatment, and intention-to-treat items were similarly difficult to assess from reported information.

Study Interventions and Comparators

A frequency table ("heat map") of all study intervention comparisons was created to identify clusters of comparisons (**Supplement 4**, available at www.annals.org). The heat map represents study group comparisons, so one study may contribute several comparisons. The most commonly studied numerical presentations of data were natural frequencies, defined as the numbers of persons with events juxtaposed with a baseline denominator of persons (for example, "4 out of 100 persons had the outcome"); event rates, defined as the proportions of persons with events to total numbers of persons stated as a percentage (for example, "4% of participants had the outcome"); ARRs, defined as the event rates in one group minus the event rates in the other group (stated either as frequencies or percentages); and RRRs (or proportional risk reductions). The most commonly studied verbal or visual methods for presenting data were icon arrays, qualitative risk descriptions (the use of words to describe extent of risk, either spoken or written), and bar graphs. **Table 3** and **Figure 3** show examples of commonly studied methods.

Table 1. **Characteristics of Study Participants**

Characteristic	Studies Reporting Metric, *n*	Median* (IQR)	Total Range
Mean age	58	46.17 y†	19.5–72.0 y
Male sex	74	39.1% (0%–47.0%)	0%–100%
Median educational attainment			
Less than high school	27	9.40% (3.25%–23.00%)	1.0%–86.6%
High school	34	27.80% (18.22%–48.80%)	6.6%–74.0%
Some college	31	36.00% (31.95%–64.00%)	12.5%–100.0%
College graduate	37	35.00% (23.30%–48.50%)	8.0%–88.0%
Numeracy skills‡			
Low	12	–	12.4%–52.0%
High	11	–	48.0%–87.6%

IQR = interquartile range.
* 25th to 75th percentiles.
† Most studies reporting age did so as mean age only; therefore, the median could not be calculated.
‡ High and low numeracy skill levels were defined by each study, using different scales: 56 studies did not report numeracy skills, and 22 studies reported numeracy skills but did not give proportions of low vs. high numeracy skills.

A total of 292 comparisons involved interventions with a single component, and 100 comparisons involved multicomponent or bundled interventions (**Supplement** 4). Among the most frequent direct comparisons were variations of icon array presentations (156 comparisons), icon arrays versus bar graphs (11 comparisons), ARRs versus RRRs (10 comparisons), event rates versus natural frequencies (7 comparisons), icon arrays versus natural frequencies (6 comparisons), NNTs versus ARRs (6 comparisons), NNTs versus RRRs (6 comparisons), natural frequencies versus NNTs (5 comparisons), RRRs versus event rates (5 comparisons), and RRRs versus natural frequencies (5 comparisons). Natural frequencies and event rates were extensively used in bundled interventions; 23 of 30 unique bundles included such presentations. Qualitative risk descriptors were studied in 27 trial groups. Absolute risk reductions were examined as a part of several bundles in 47 trial groups.

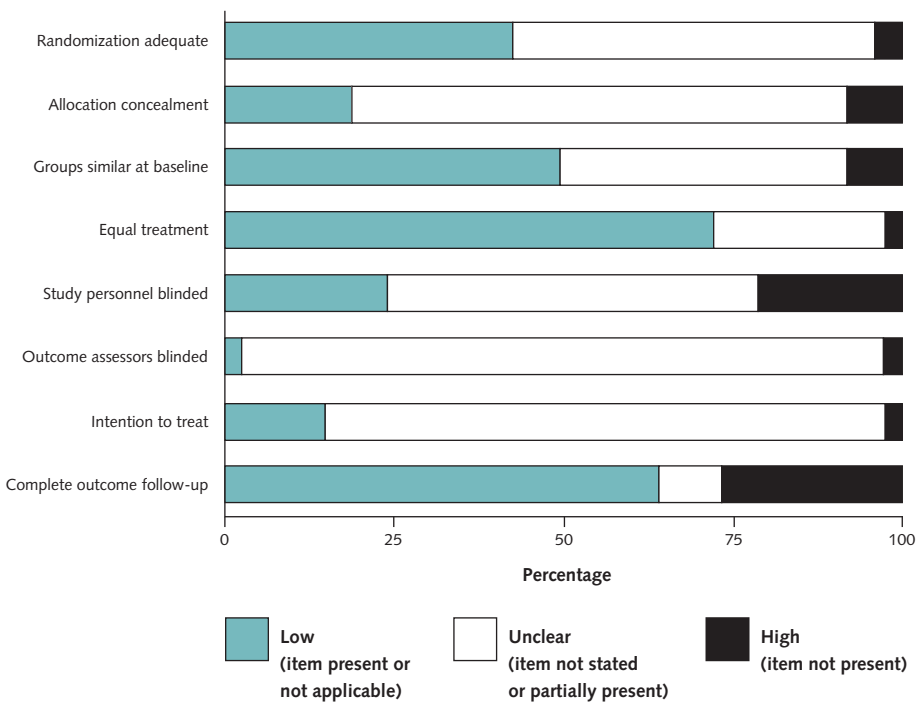
Some studies assessed the effect of contextual factors on outcomes. These included comparisons of the effect of varying sizes of denominators (for example, 30 of 1000 vs. 3 of 100; 14 comparisons total, 7 single-component and 7 bundled), presenting incremental risks (the amount that the risk increased or decreased based on the choice of treatment) versus total risks, adding baseline risks, framing effects, and ordering effects.

Studies depicted many risk scenarios and used various outcomes. Cognitive outcomes included single correct answers to numerical questions to assess understanding of probabilistic information (hereinafter called "accuracy"); participants' general sense of the relationship between 2 or more benefits or harms (hereinafter called "comprehension"); and participants' global sense of the magnitude of risk as measured by items, such as Likert scales (hereinafter called "risk perception"). Studies measured these cognitive outcomes differently and did not use validated scales. Definitions and methods of measurement of affective and behavioral metrics were diverse. Affective outcomes included satisfaction, perceived helpfulness, preference for method, level of decisional conflict, and level of worry. Behavioral outcomes included choice of treatment, willingness to consent to an intervention, and acceptance of a procedure.

Table 2. **Proportion of Studies Including Participants at Risk Versus Not at Risk for Target Condition**

Participant Risk and Recruitment Setting	Total Studies Reporting Risk, *n*	Studies, *n* (%)
Specific risk for target condition	91	33 (36.3)
Recruited in health care setting	–	17 (51.5)
No specific risk for target condition	91	58 (63.7)
Recruited in health care setting	–	10 (17.2)

Figure 2. **Risk of bias for randomized, controlled trials (*n* = 74).**



Adapted from reference 100.

Table 3. **Examples of Common Numerical Methods of Risk Communication to Show Risk for Stroke With Drug A Versus Placebo**

Method	Placebo	Drug A
Event rate	24%	16%
Natural frequency	24 out of 100	16 out of 100
ARR (can be stated as natural frequency or event rate)	–	8% or 8 out of 100
RRR	–	33%
NNT	–	13

ARR = absolute risk reduction; NNT = number needed to treat; RRR = relative risk reduction.

Comparisons of Methods for Communicating Risk

Visual Displays of Data

Several studies demonstrated that the addition of visual displays to numerical formats improved accuracy and comprehension (37, 40, 64, 83, 84, 88, 89, 98), although 2 small studies found conflicting results (68, 85). A large, randomized trial found that natural frequencies were superior to visual displays for accuracy but inferior for general comprehension (48). A randomized trial found no difference in decisional conflict (uncertainty in making decisions) when graphics were added to ARRs, RRRs, or NNTs (32).

Two randomized trials suggested that risk perception and worry were reduced when 2 related risks were compared in the same icon array rather than in 2 separate arrays (called incremental risk formatting) (96, 98), but that presentation may reduce comprehension (98). Icon arrays improved accuracy and comprehension compared with natural frequencies (84, 98). Three studies suggested that icon arrays lowered risk perception more than natural frequencies (53, 77, 84), but 2 smaller studies reported no such differences (49, 68). Preferences for icon arrays and natural frequencies were mixed (49, 68, 83, 84, 96, 98), but icon arrays were seen as more helpful, effective, trustworthy, scientific (84), and useful (40, 77).

Several studies showed no differences in accuracy or comprehension between icon arrays and bar graphs (37, 41, 48, 86, 89, 97). However, one randomized trial found that icon arrays led to better accuracy with small numerators and that bar graphs led to better accuracy with medium and large numerators (67). Both icon arrays and bar graphs were better understood when they were simpler (2 stacked items rather than 4) (97) and represented not only the "sick" population but the healthy population as well, such that the total population was represented by 1 color and the sick members of the population were placed in a contrasting color (37). **Table 3** and **Figure 3** illustrate these concepts. In a large study, icon arrays were preferred (97), whereas bar graphs were preferred in a small study (67). Two very small studies found no difference in preference between graphs and arrays (31, 86).

Several studies examined variations in the presentation of icon arrays. The addition of several types of animation to arrays did not improve accuracy compared with static, grouped arrays (99), and scattering versus grouping of similar icons or having participants "search" for icons by clicking on them did not affect risk perception or intention to accept therapy (17). Level of "iconicity," or degree to which icons are schematic versus realistic, had no effect on understanding in a small, randomized study (34).

Event Rates Versus Natural Frequencies

Although most comparisons included event rates, natural frequencies, or both, bundling of interventions made direct comparisons between the 2 difficult. Cognitive outcomes were mixed in studies of event rates versus natural frequencies. Self-reported understanding and satisfaction were better with natural frequencies than event rates in a study conducted in Canada, Norway, and the United States (27), whereas overall accuracy and comprehension were better for event rates than natural frequencies in 2 U.S. studies (88, 92) and no different in another U.S. study (70). All of these studies were large, well-randomized, and computer-based. Only the study finding no differences was conducted in participants at risk for the condition studied (70). Risk perception was increased with natural frequencies compared with event rates when risks were small (92). The accuracy of diagnostic inference (that is, probability of a woman having breast cancer after a positive mammogram) was better when baseline data were provided as natural frequencies versus event rates. However, accuracy was poor overall (40). Both event rates and natural frequencies performed better when organized into a table rather than when included in text only (83). Only one small, nonrandomized study examined the effect of natural frequencies versus event rates on a behavioral outcome (willingness to participate in a hypothetical clinical trial) and found no differences between formats (28).

ARRs Versus RRRs

Participants more accurately perceived risk differences when presented with ARRs or 2 absolute risks compared with RRRs (37, 70, 74), whereas RRRs increased risk perception (24, 69, 91). Only one study found that accuracy was better with RRRs than ARRs, but the overall accuracy was very poor (76). Both ARRs and RRRs showed improved accuracy and satisfaction when baseline risks were also provided (24, 69, 74). Relative risk reductions had greater effects on decision making in terms of participants' reported acceptance of therapy in 5 studies that presented ARRs in the form of event rates (25, 27, 73, 78, 82); however, the same effect was not seen with screening and preventive therapy in 2 studies that presented ARRs with visual aids: an icon array (51) and a bar graph (91). One study found that providing baseline risks eliminated the differences in decision making between ARRs and RRRs (80).

NNTs

Presentations of NNTs led to lower accuracy compared with presentations of ARRs and RRRs (24, 27, 42, 76). Numbers needed to treat were less preferred than event rates, natural frequencies, RRRs, and bar graphs but had mixed results compared with ARRs (27, 42). Patients shown NNTs were less likely to consent to therapy than those shown RRRs but had similar likelihood of consent compared with those shown ARRs (82).

Qualitative Risk Descriptors

Accuracy and satisfaction were lower and risk perception was higher for qualitative risk descriptions than for natural frequencies plus event rates, ARRs, and natural frequencies plus arrays in several randomized studies (22, 23, 55, 56, 61, 62, 95) but not in 2 other studies (63, 81) (only 1 of which was randomized). Acceptance of therapy was lower or no different for qualitative risk descriptors than for ARRs and natural frequencies plus event rates in 5 randomized studies assessing medication use (22, 23, 55, 61, 95) and higher than both ARRs and RRRs in 1 study assessing choice of surgery (78).

Framing

Positive framing (framing in terms of gains rather than losses) was associated with lesser perception of harm and increased acceptance of harmful interventions (such as high-risk surgery) (16, 38, 71). Framing effects can be offset by preparing participants with questions to help them identify factors relevant to their decision making (16). The addition of visual aids to natural-frequency information can also reduce the effect of positive framing (38).

Order

The presentation of benefits before harms improved accuracy and increased perceived risks and efficacy of therapy (87). However, the presentation of benefits before harms decreased favorability and acceptance of treatment and increased worry (21, 87).

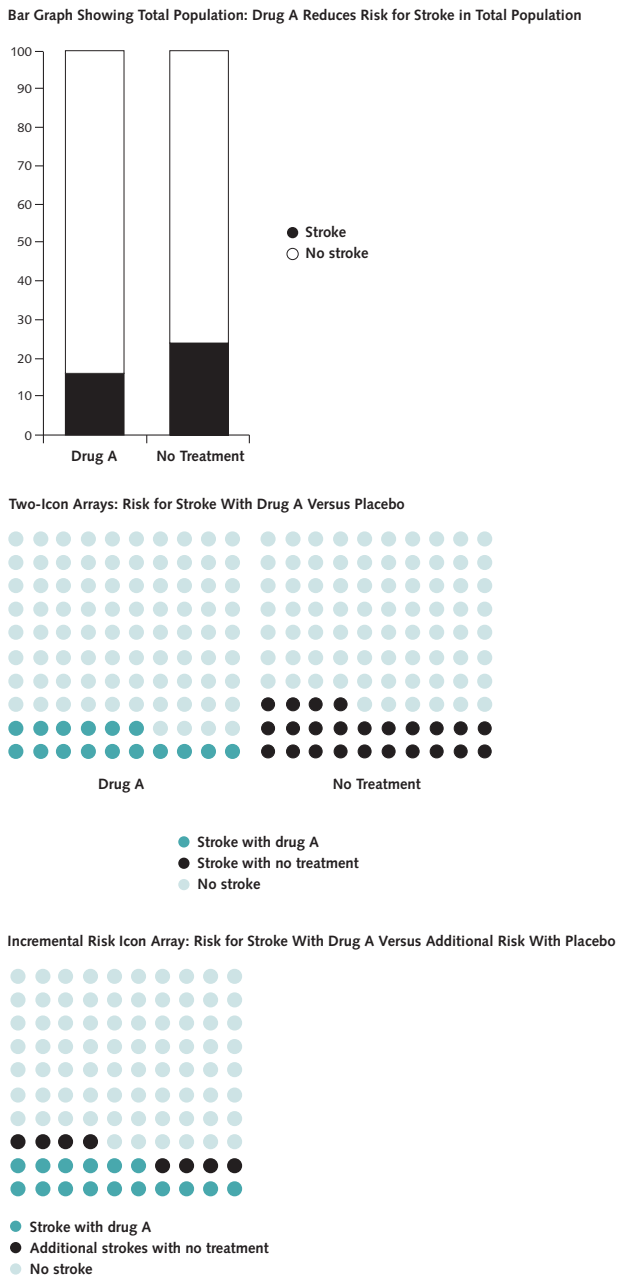
Denominator Effects

The examination of denominator effects was heterogeneous. Studies suggested that use of a denominator of 1000 led to greater accuracy and lower risk perception than using a numerator of 1 (45). Use of a denominator of 1000 also led to greater comprehension when compared with the smallest multiple of 10 needed to keep the numerator greater than 1 (92) or with a denominator of 100 (98). Risks displayed with different denominators may cause confusion, but the addition of icon arrays may improve understanding in these situations (36). Participants with lower numeracy skills may perceive greater differences between risks when both denominators are large (39).

Context

One study of event rates plus pie charts found that adding comparative risks for a population at lower risk than the study participants increased the study participants' perception of their risks (58). Another study found that ordering benefits before harms increased risk perception overall and that adding contextual information about competing risks (for example, providing risks for colon cancer or heart attack when describing the risk for breast cancer) eliminated this effect (87).

Figure 3. **Examples of common visual methods of risk communication.**



Discussion

In this comprehensive review, we found heterogeneous literature on methods of communicating probabilistic information to patients. Our key findings inform best practice (**Table 4**). First, visual aids improve cognitive outcomes when presenting risks. Icon arrays and bar graphs both lead to improvements in accuracy and comprehension, with neither being clearly superior. Graphics should include both persons affected and the total population of interest. Future research should expand use of these methods in different risk scenarios to assess where each may be best suited.

Second, recent studies questioned the long held belief that natural frequencies are clearer than event rates (88, 92). Conflicting results may be due to different populations studied (27, 70, 88, 92). Future research should attempt to create comparisons across different types of risk scenarios and risk levels and directly compare both methods in various populations.

Third, consistent with previous research, we found that ARRs are better than RRRs for maximizing accuracy but may be less likely to influence decisions to initiate therapy. This suggests that absolute differences in risk are more intuitive and easier to grasp, whereas proportional or relative risk differences obscure the true magnitude of benefit or harm—ultimately increasing participant perceptions. When presenting either one, baseline risks should be provided to improve accuracy. Representation of ARRs with visual aids may produce an effect similar to RRRs on decision making. Because RRRs are more persuasive than ARRs, they should be used with care to ensure that patients' best interests are met.

Fourth, we found that NNTs, despite their appeal to clinicians, make understanding probability more difficult for patients than ARRs and RRRs. In addition, summarizing of the full spectrum of therapeutic responses to therapy for a heterogeneous population with NNTs may be oversimplified or exaggerated, potentially restricting its clinical application (101). Therefore, we recommend avoiding the use of NNTs in communicating with patients.

We suggest further exploration of the possibility of differential findings in participants at risk for the target condition versus those not at risk. Regarding both the superiority of event rates versus natural frequencies and the influence of RRRs versus ARRs on decision making, studies finding no differences were conducted with participants who were at risk (28, 70, 51, 91), whereas studies finding differences were conducted with participants who were not at risk (25, 27, 73, 78, 82, 88, 92). Risk presentations may have less effect when patients are considering real versus hypothetical decisions.

We took a novel approach to describing this literature by focusing on comparative effectiveness of methods of communicating probabilistic information. The focus on direct comparisons of approaches allows an assessment of the superiority of one method over another, rather than a comparison of the effectiveness of a method of communication of probabilistic information versus no communication about probabilities. Comparisons of interventions with a variant of "usual care" as the control can be fraught with potential bias because of the heterogeneity of interventions and risk comparisons. Also, by focusing on different approaches to communicating the same level of risk, we eliminated the magnitude and direction of risk as confounders. We found that individual studies addressed meaningful clinical questions, but comparisons across studies were limited by the diversity of risk scenarios, interventions, contexts, and outcomes examined. Although most studies used randomized designs, very few stated enough detail to assess risk of bias. This literature has not routinely considered and reported risk of bias in the same manner as traditional clinical trials.

Our review has several limitations. Despite our comprehensive search strategy, studies could have been missed if they were not indexed with the search terms we used. We included English-language studies only. Although this restriction could potentially result in a reporting bias, a recent study suggested otherwise (102). The studies we found were small and highly variable in terms of setting, context, populations, and methods of administering interventions. Methods of risk communication lacked common definitions, which made firm conclusions about comparative effectiveness a challenge. In the studies with comparisons involving multicomponent or bundled interventions, the effects are a measure of the interventions as a whole rather than that of each individual component. Iso-

Table 4. **Recommended Approaches to Risk Communication**

To improve understanding:
Express probabilities as event rates (percentages) or natural frequencies (numerator/denominator as whole numbers)
When using natural frequencies, use a denominator of 1000 participants
Express benefits and risks in absolute terms, such as ARRs
Avoid expressing benefits as NNTs
Add bar graphs or icon arrays to natural frequencies or event rates
Consider the use of icon arrays with smaller numerators and bar graphs with larger numerators
Place a patient's risk in context by using comparative risks of other events
Avoid the use of qualitative risk descriptors alone (such as "high risk")
To improve satisfaction:
Supplement numerical risks with icon arrays or bar graphs
Use an incremental risk format with icon arrays (risk with and without intervention displayed in the same array)
Avoid the use of NNTs
Avoid the use of qualitative risk descriptors alone
To influence acceptance of interventions:
Realize that expressing numerical benefits as RRRs has the greatest effect on decision making
Add baseline risks to both ARRs and RRRs to equalize their effects on decision making
Realize that positive framing (stating benefits rather than harms) increases acceptance of therapies

ARR = absolute risk reduction; NNT = number needed to treat; RRR = relative risk reduction.

lation of each component's effect poses a great challenge (103); thus, conclusions based on the results from bundled interventions are limited.

In addition, outcome assessment lacked consistency. We did not abstract data about the types or magnitudes of risk presented. Certain methods are possibly better suited for different types or levels of risk. However, we found little consistency in the types of risks presented in studies, so it is likely that the number of studies communicating any particular type of risk is limited. Outcomes from subgroup analyses based on factors, such as numeracy skill or educational level, were not collected because of the heterogeneity in how these subgroups were defined.

Accurate communication of the benefits and harms of interventions to patients is a critical component of shared decision making. This review comparing 2 or more methods of risk communication is unique in its broad scope and focus on comparative effectiveness. Our findings demonstrate benefits of visual displays of data, with icon arrays and bar graphs showing equal efficacy. Questions about the superiority of natural frequencies versus event rates warrant further study. Absolute risk reductions are superior to RRRs for improving understanding when risk reductions are presented, and NNTs should be avoided. Clinicians can implement these findings when communicating with patients about risks and benefits of tests and treatments. Developers of decision aids and materials for communicating benefits and harms can incorporate these findings to maximize patient understanding and improve decision making. Furthermore, software embedded in electronic health records could allow clinicians to create personalized icon arrays and bar graphs for their patients to bring these findings to the point of care and improve shared decision making.

There is likely no single best method of communicating probabilities to patients but rather several good options with some better suited to certain risk scenarios. The diversity of scenarios in this literature limits our ability to determine superiority. Perhaps most critical is the work going forward. We recommend an expansion of this literature through consensus of the research community around improved study method, examination of single component interventions, and greater uniformity of outcome measurement.

From Duke University Medical Center, Veterans Affairs Medical Center, and Duke Center for the Study of Aging and Human Development, Durham, North Carolina; University of Pennsylvania Perelman School of Medicine and American College of Physicians, Philadelphia, Pennsylvania; Harvard Medical School and Boston University School of Medicine, Boston, Massachusetts; Veterans Affairs Medical Center, Portland, Oregon; University of Texas Health Science Center at San Antonio, San Antonio, Texas; University of Florida and North Florida/South Georgia Veterans Health System Geriatric Research Education and Clinical Centers, Gainesville, Florida; Michigan State University College of Human Medicine, East Lansing, Michigan; Veterans Affairs Ann Arbor Health Care System, Ann Arbor, Michigan; School of Information and Library Science, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina; and University of Wisconsin School of Medicine and Public Health, Madison, Wisconsin.

Note: This review was performed by the Society of General Internal Medicine's Evidence-Based Medicine Task Force to inform the development of the Bottom Line evidence summaries available in the Web-only section of the *Journal of General Internal Medicine*. The Bottom Line evidence summaries are single-page tools that distill current, high-effect research findings for health care providers to facilitate patient discussions. Each summary addresses new evidence relevant to general internal medicine that has been covered in the media and may affect patient care. Summaries visually present key information about the potential benefits and harms of a test or treatment along with a clinical "bottom line" recommendation. They are designed to foster clearer and more accurate communication between patients and their doctors while enhancing patient understanding and satisfaction. To learn more about the Bottom Line evidence summaries, visit www.sgim.org/web-only/bottom-line.

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Requests for Single Reprints: Daniella A. Zipkin, MD, Duke University Medical Center, Box 2992, Durham, NC 27710; e-mail, daniella.zipkin@duke.edu.

Current author addresses and author contributions are available at www.annals.org.

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Current Author Addresses: Dr. Zipkin: Duke University Medical Center, Box 2992, Durham, NC 27710.
Dr. Umscheid: Center for Evidence-based Practice, University of Pennsylvania, 3535 Market Street, Mezzanine, Suite 50, Philadelphia, PA 19104.
Dr. Keating: Department of Health Care Policy, Harvard Medical School, 180 Longwood Avenue, Boston, MA 02115.
Dr. Allen: Portland Veterans Affairs Medical Center, P3-Med, 3710 SW US Veterans Hospital Road, Portland, OR 97207.
Dr. Aung: University of Texas Health Science Center, 7703 Floyd Curl Drive, MC 7879, San Antonio, TX 78229.
Dr. Beyth: North Florida/South Georgia Veterans Health System Geriatric Research Education and Clinical Centers T2 (182), 1601 Southwest Archer Road, Gainesville, FL 32608.
Dr. Kaatz: Hurley Medical Center, One Hurley Plaza, Flint, MI 48503.
Dr. Mann: Boston University School of Medicine, 801 Massachusetts Avenue, Suite 470, Boston, MA 02118.
Dr. Sussman: Center for Clinical Management Research, North Campus Research Center, 2800 Plymouth Road, Building 16/343E, Ann Arbor, MI 48109-2800.
Dr. Korenstein: American College of Physicians, 190 N. Independence Mall West, Philadelphia, PA 19106.
Ms. Schardt: School of Library & Information Science, Manning Hall, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599.
Mr. Nagi: Veterans Affairs Medical Center, 508 Fulton Street, Durham, NC 27705.
Mr. Sloane: Center for the Study of Aging, Duke University Medical Center, Box 3003, Durham, NC 27710.
Dr. Feldstein: University of Wisconsin School of Medicine and Public Health, 310 North Midvale Boulevard, Suite 205, Madison, WI 53705.

Author Contributions: Conception and design: D.A. Zipkin, C.A. Umscheid, N.L. Keating, E. Allen, S. Kaatz, D.M. Mann, J.B. Sussman, D. Korenstein, D.A. Feldstein.
Analysis and interpretation of the data: D.A. Zipkin, C.A. Umscheid, N.L. Keating, E. Allen, K. Aung, R. Beyth, S. Kaatz, D.M. Mann, J.B. Sussman, R. Sloane, D.A. Feldstein.
Drafting of the article: D.A. Zipkin.
Critical revision of the article for important intellectual content: D.A. Zipkin, C.A. Umscheid, N.L. Keating, E. Allen, K. Aung, R. Beyth, S. Kaatz, D.M. Mann, J.B. Sussman, D. Korenstein, R. Sloane, D.A. Feldstein.
Final approval of the article: D.A. Zipkin, C.A. Umscheid, N.L. Keating, E. Allen, K. Aung, R. Beyth, S. Kaatz, D.M. Mann, J.B. Sussman, D. Korenstein.
Statistical expertise: J.B. Sussman, R. Sloane.
Administrative, technical, or logistic support: C. Schardt, A. Nagi.
Collection and assembly of data: D.A. Zipkin, C.A. Umscheid, N.L. Keating, E. Allen, K. Aung, R. Beyth, S. Kaatz, D.M. Mann, D. Korenstein, D.A. Feldstein.