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The Use of Narrative in Science and Health Communication: A Scoping Review

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ABSTRACT

Background: Many people deny science and reject health recommendations despite widely distributed facts and statistics. Didactic science and health communication is often dry, and relies on the false assumption that people make purely evidence-based decisions. Stories can be a powerful teaching tool by capturing attention and evoking emotion.

Objective: We explore the impact and appeal of, and describe best practices for, using narrative (storytelling) versus didactic methods in science and health communication.

Patient involvement: No patients were involved in the review process.

Methods: We searched PubMed and Web of Science for articles either: assessing effectiveness of narrative science/health communication; assessing acceptability of (or preference for) narrative science/health communication; giving advice on how best to use narrative; and/or providing science-based explanations for how/why narrative succeeds.

Results: Narrative science/health communication is effective and appealing for audiences across a variety of topics and mediums, with supporting evidence across fields such as epidemiology, neuroscience, and psychology. Whether narrative or didactic messaging is most effective depends on the topic, audience, and objective, as well as message quality. However, combining narrative with didactic methods is likely to be more effective than using either strategy alone.

Discussion: Narrative science/health communication merits wider implementation and further research. Narrative communication creates openness to information by delaying the formulation of counterarguments.

Practical value: Science and health communicators should collaborate with cultural and storytelling experts, work directly with their target audiences throughout the message development and testing processes, and rely on popular story elements (e.g., first-person point of view, relatable protagonists) to improve the comprehension, engagement, and thoughtful consideration of their intended audience.

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1. Introduction

Many people deny science and reject public health recommendations despite widely distributed facts and statistics. Unwarranted rejection of science occurs in over 1/4 of residents in western, industrialized countries [1]. It is often rooted in "religiosity and political orientation, morality, and science understanding" [2]. Various factors lead to skepticism in a wide variety of topics, including vaccine safety and efficacy, medication adherence, the creation/age of the universe, climate change, genetically modified foods, and individual and community public health measures to reduce infections and prevent outbreaks of disease. Skepticism manifests as fear, disbelief, mistrust in motivation, and suspicion of hidden or manipulative agendas. Misinformation and dismissal of scientific truths damage individuals, societies, public health, and the global ecosystem [3]. The politicization of the COVID-19 pandemic has only emboldened science denial and rejection of medical and public health advice [4].

Science and health communication professionals have long sought to understand what leads to scientific skepticism and what can be done to combat misinformation and mistrust. The Information Deficit Model (IDM) attributes public skepticism of science and medical advice primarily to a lack of sufficient knowledge. It was originally posited through IDM that the solution to skepticism was to provide adequate, accurate information to the public [5], leading to a didactic approach. Didactic communication focuses on filling information gaps with a strict adherence to objectivity. However, this strategy often leads to dry, sterile communication material, and fails to consider that few people make purely evidence-based decisions. Instead, individual beliefs, values, and lived experience play an important role in human learning, understanding, and decision making [6]. It is now largely recognized that simply providing more information to people does not necessarily change their views [7], and that science and health communication must genuinely engage audiences and take externalities into account [8]. These factors suggest that narrative could be a useful communication tool when aiming to change people's attitudes, beliefs, and behaviors.

Based in rhetorical theory, Fisher's Narrative Paradigm asserts that humans are storytellers by nature; from early cave paintings to folk tales to bedtime stories, humans value stories and use them to comprehend our world, warn of danger, and impart lessons [9,10]. Storytelling is integral to cultures worldwide and has been used as a teaching tool since long before the advent of the scientific method [11]. Stories are persuasive tools, capturing the attention of the audience, evoking emotion and connecting individuals powerfully to a message [12]. Narrative communication has been defined as "any cohesive and coherent story with an identifiable beginning, middle, and end that provides information about scene, characters, and conflict; raises unanswered questions or unresolved conflict; and provides resolution" [13]. The use of narrative in science and health communication has grown, but its effectiveness and best practices are still debated [6, 11–13].

This scoping review sought to collate studies of narrative in science and health communication. The primary goal was to characterize the effectiveness of narrative science and health communication, especially in comparison to didactic communication. Secondary goals included assessing audience acceptability of narrative in science and health communication, synthesizing expert advice on how science and health communication can successfully incorporate narrative, and explaining scientifically how and why narrative communication works.

2. Methods

2.1. Search strategy

We searched the literature to identify studies assessing the impact of using narrative in science and health communication. We performed searches in two databases, PubMed and Web of Science (WoS), in November 2020. Initial PubMed search terms combined Medical Subject Headings (MeSH) indexing terms and title/abstract terms and covered two main concepts: narrative and science/health communication (Appendix A). Relevant synonyms for MeSH terms (listed as Entry Terms on the MeSH page) were included as title/abstract terms. Additional search terms were used to automatically exclude articles not published in English, exclusively studying animals (and not humans), published before 2000 (to limit the scope to evidence from this millennium), and of article types likely to be redundant with other more detailed publications (e.g., preprints, conference abstracts, presentations, commentaries, editorials, letters) or irrelevant due to using narrative presentation and/or research methods instead of researching narrative (e.g., newspaper articles, narrative reviews, case reports). Search terms for WoS matched PubMed terms as closely as possible, despite differences between databases in search term formatting and indexing (Appendix B). Searches were performed iteratively to capture the number of results removed by search term limitations reflecting exclusion criteria (Fig. 1). Search results were exported from PubMed and WoS into Covidence for screening and data extraction.

2.2. Screening

Articles were screened for inclusion based on titles/abstracts, then full text as needed. To be considered for inclusion, articles were required to provide: 1) quantitative data assessing the effectiveness of using narrative as a strategy in science/health communication; 2) quantitative or qualitative data assessing the acceptability of or preference for narrative science/health communication; 3) advice on how science/health communication can successfully incorporate narrative; and/or 4) science-based explanations for how or why narrative is an effective communication strategy. How effectiveness was determined varied by study and depended on study outcomes of interest (Appendix C). If an intervention was deemed by the authors to be effective in any relevant outcome (e.g., improving knowledge, increasing a desired intention or behavior), we considered it effective, even if it was not impactful in all measured outcomes.

3. Results

After screening 1545 articles from PubMed and 2014 articles from WoS, 253 articles were included in this review (Fig. 1). Of these, 149 advise how science/health communication can successfully incorporate narrative, 112 provided quantitative data assessing the effectiveness of using narrative as a strategy in science/health communication, 46 provided quantitative or qualitative data assessing the acceptability of or preference for narrative science/health communication, and 28 presented science explaining how/why narrative communication is effective.

3.1. Effectiveness of narrative science/health communication

Of the 112 articles assessing the effectiveness of narrative science/health communication, 95 were experimental studies, 6 were non-systematic reviews, 4 were systematic reviews without meta-analyses, 3 were observational studies, and 3 were meta-analyses. Studies were conducted most commonly in the United States. Medium and format varied, but most were either written or video. The most common topics were cancer, vaccines, and nutrition/exercise.

The effectiveness of narrative communication varied by study and topic (Table 1, Fig. 2). Seventy-eight articles **compared the effectiveness of narrative and didactic communication strategies**. Of these, 33 (42%) concluded that narrative works better than didactic, 17 (22%) that narrative works better than didactic in some but not all scenarios, 15 (19%) that narrative works the same as didactic, 9 (12%) that narrative works worse than didactic, and 5 (6%) that narrative and didactic together works better than didactic only.

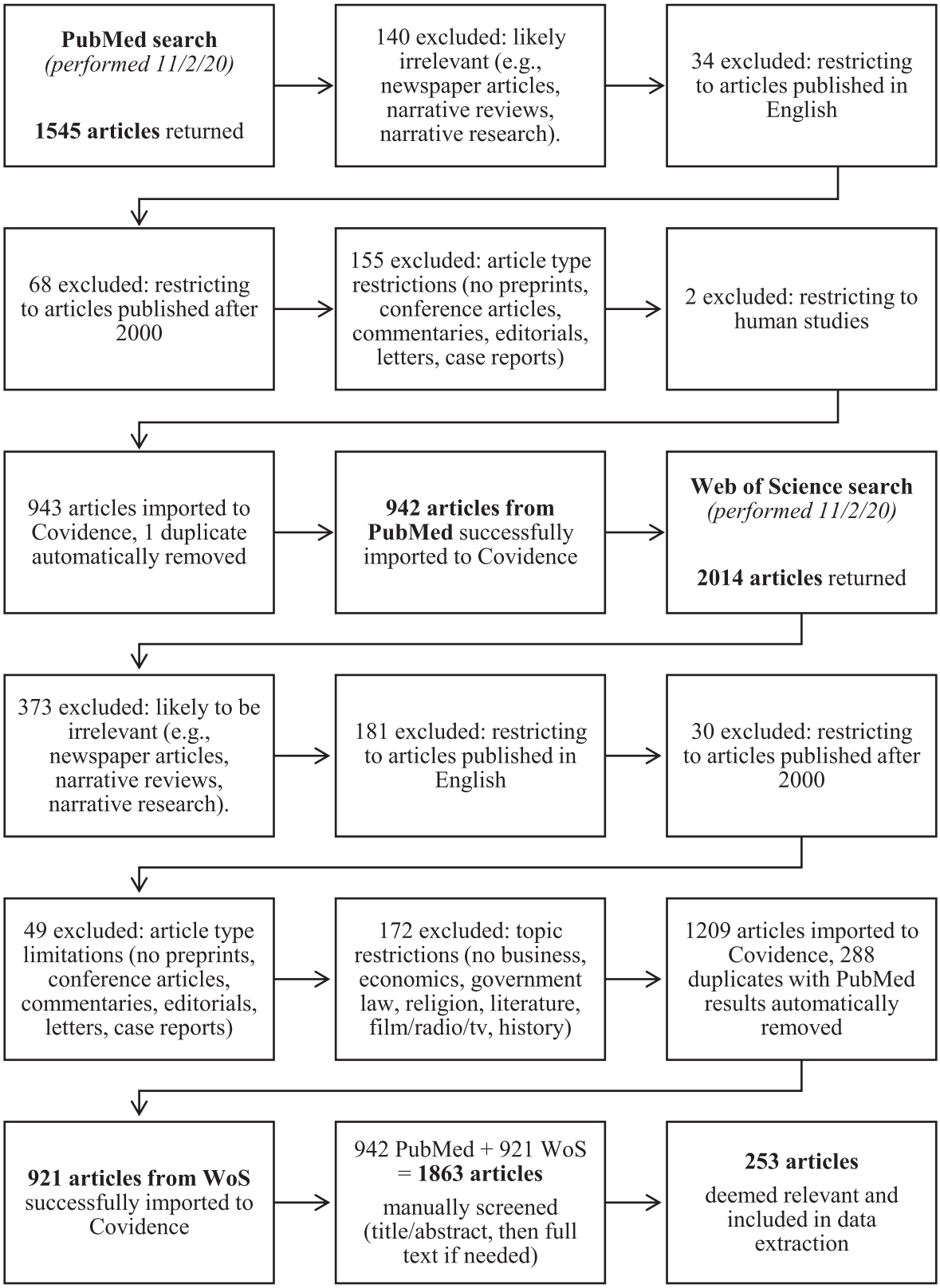


Fig. 1. Literature Review Diagram.

Thirty-four articles **examined the effectiveness of narrative communication alone**. Of these, 30 (88%) concluded that narrative works, 2 (6%) that narrative works in some but not all scenarios, and 2 (6%) that narrative was ineffective.

Overall, findings from 4 systematic reviews and 3 meta-analyses supported the effectiveness of narrative health communication. A systematic review of interventions for cancer screening found that narrative worked better than didactic in some but not all scenarios [14]. A systematic review of mass media campaigns to reduce youth tobacco use found that narrative worked better than didactic messaging [15]. One

Table 1
Effectiveness of using narrative as a strategy in science and health communication.

Topic	Citations	Narrative Compared to Didactic				Narrative & Didactic Together Better than Didactic Alone	Narrative Not Compared to Didactic		
		Better	Same	Depends	Worse		Narrative works	Narrative sometimes works	Narrative does not work
Alcohol	[95,148,149]						3		
Alcohol	[150,151]@		2						
Cancer[1]	[39]								1
Cancer[1]	[59,113, 152–156]						7		
Cancer[1]	[61,157–163]	8							
Cancer[1]	[14,105,135, 164,165]*&			5					
Cancer[1]	[166–168]		3						
Cancer[1]	[77]				1				
Cannabis[1]	[169]	1							
Climate/ Conservation[Ω]	[75,102,116]						3		
Climate/ Conservation[Ω]	[137,138]	2							
Dental Hygiene	[170]	1							
Diabetes[1]	[171–173]~	3							
Doctor-Patient Relationship	[174]							1	
Doctor-Patient Relationship	[175]		1						
Environmental Exposures	[176,177]						2		
Environmental Exposures	[178]				1				
Infectious Diseases	[57,179]	2							
Infectious Diseases	[180]			1					
Infectious Diseases	[181]				1				
Injuries	[182]	1							
Injuries	[183]		1						
Maternal/Child Health	[184]								1
Medication	[185]	1							
Mental Health[2]	[186,187]						2		
Mental Health[2]	[30,188]	2							
Mental Health[2]	[189]			1					
Mental Health[2]	[190]				1				
New Technologies[Ω]	[103]		1						
Nutrition/Exercise	[191,192]						2		
Nutrition/Exercise	[86,193]	2							
Nutrition/Exercise	[46,165]&			2					
Nutrition/Exercise	[194]							1	
Nutrition/Exercise	[70,87,195]		3						
Nutrition/Exercise	[196]				1				
Nutrition/Exercise	[197]					1			
Opioids	[173]~	1							
Organ Donation	[198,199]	2							
Science in General[Ω]	[18–20,141]+						4		
Science in General[Ω]	[108]	1							
Science in General[Ω]	[12,13,16,17, 142]#			5					
Science in General[Ω]	[143]				1				
Sexual/ Reproductive Health[3]	[66,200–203]						5		
Sexual/ Reproductive Health[3]	[151,204]@		2						
Sleep	[79,84]$	1							
Tobacco/Nicotine	[79]$						1		
Tobacco/Nicotine	[15,88]^	2							
Tobacco/Nicotine	[205]		1						
Tobacco/Nicotine	[206,207]				2				
Tobacco/Nicotine	[208]					1			
Vaccines	[209]						1		
Vaccines	[92,210–212]!	4							
Vaccines	[52,213,214]			3					
Vaccines	[28,94]		2						
Vaccines	[215]				1				
Vaccines	[27,40,210]!					3			
Violence[4]	[216]			1					
Totals		33	15	17	9	5	30	2	2

[0] non-health related topic. [1] e.g., screening, prevention, treatment. [2] e.g., suicide prevention, depression, anxiety, body image. [3] e.g., HIV, STIs, Condoms, Birth Control. [4] e.g., domestic, gender.

* includes a systematic review [14]. ^ includes a systematic review [15]. # includes a systematic review [16] and a meta-analysis [17]. + includes a systematic review [18] and two meta-analyses [19,20]. & includes an article categorized in two topics [165]. ~ includes an article categorized in two topics [173]. @ includes an article categorized in two topics [151]. $ includes an article categorized in two topics [79] ! includes an article with two findings [210].

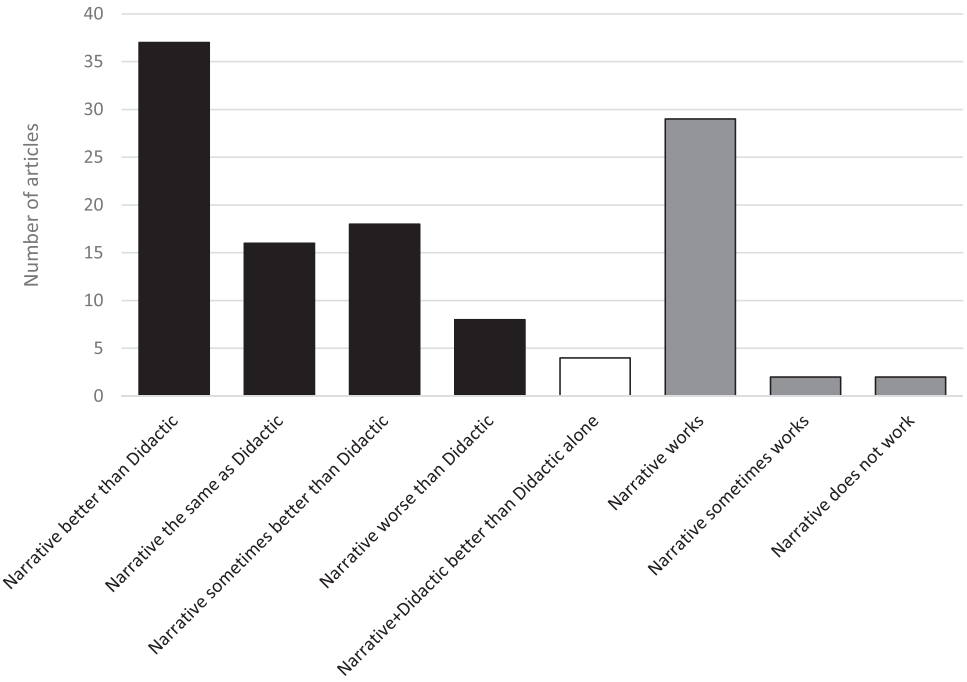


Fig. 2. Comparison of Narrative vs Didactic Methods in Science/Health Communication.

systematic review [16] and 1 meta-analysis [17] concluded that narrative communication worked better than didactic in improving health intention and/or behavior in some but not all scenarios. One systematic review [18] and 2 meta-analyses [19,20] concluded that narrative communication improved health attitudes, beliefs, intentions, and decision-making, although they did not compare to didactic.

Two common findings may partially explain the effectiveness of narrative science/health communication. Facts embedded within narratives induced less counterargument (generation of negative responses) than facts presented without narrative [12]. Although didactic evidence often had a stronger influence on *attitudes and beliefs*, narrative evidence often had a stronger influence on *intention and emotion.*[17].

3.2. Acceptability of or preference for narrative science/health communication

Narrative communication was largely found to be acceptable across science/health topics (Table 2, Fig. 3). Twenty-five studies tested narrative communication alone and all found it acceptable. Twenty-one studies compared narrative and didactic communication strategies and 16 (76%) found narrative preferred to didactic, 2 determined narrative and didactic together was preferred, 2 concluded that didactic was preferred, and 1 concluded narrative was preferred to didactic in some scenarios.

3.3. Advice on how science/health communication can successfully incorporate narrative

Advice varied by article but several themes emerged supported by quantitative data from experimental studies and from qualitative guidance based on experience and expertise (Table 3, Fig. 4). Stories told in first-person (i.e., testimonials) typically performed better than those told in third person (i.e., rhetorical format).[15,16,21–30] Protagonists should be similar to the intended audience in demographics and values [13,24,26,31–47]. By far, the most frequent advice was to gather input from the target audience so the story can be tailored to intended audiences [6,11,21,43–46,48–72].

Stories are intended to appeal to our emotions more than affect our cognition; stories with stronger emotional content performed best.[29,48,49,73–79] However, whether narratives illustrating positive consequences of healthy behavior (gain frame) [23,29,32,80–85] or negative consequences of unhealthy behavior (loss frame) [86–89] are more effective is mixed and may vary by topic and/or delivery.

Narrative communication was found to appeal to, and work better among, cultures with a strong oral tradition (e.g., African Americans, Indigenous People) [13,90–93], people who are more present-minded than future-focused [94], and those with less science literacy [52,95]. Stories presented in person, or as comics, graphics, or videos typically performed better than stories presented exclusively as written text, especially among those with lower literacy [13,18,43,53,92,96–105]. Messaging should be integrated into the story plausibly and subtly; if the persuasive intent of a story is obvious, audiences may react against being manipulated.[106–108] Most popular stories follow common narrative structures (e.g., the hero's journey) and incorporate essential story elements like conflict motivating the protagonist to action, challenging the protagonist to overcome an obstacle, and imbuing the plot with an underlying theme or moral [6,11,48,68,109–112]. Above all, one must *tell a good story*, by featuring a credible, coherent, and compelling plot and cast of characters, and using vivid and engaging language [10,15,48,50,68,111,113–117].

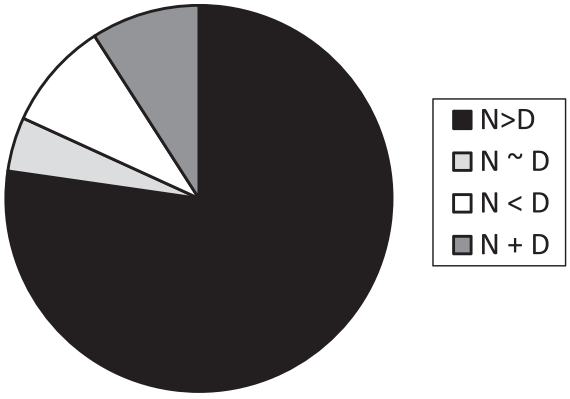
3.4. Science explaining how/why narrative communication is effective

Twenty-eight articles described the scientific analysis leading to a

Table 2
Acceptability of or preference for narrative science and health communication.

Topic	Citations	Narrative Compared to Didactic		Narrative plus Didactic Preferred		Narrative Acceptable - No Comparison to Didactic
		N > D (narrative preferred)	**N ~ D** (narrative preferred in some cases)	**N < D** (didactic preferred)	**N + D**	**N~**
Alcohol	[95]					1
Alcohol	[53,151]@	2				
Cancer[1]	[217]			1		
Cancer[1]	[168,218]				2	
Cancer[1]	[59,60,90,91,93, 156,219]					7
Cancer[1]	[58,159,161,220]*	4				
Cancer[1]	[221]		1			
Cannabis	[47]					1
Climate Change/ Conservation[0]	[116]					1
Crohn's disease	[222]					1
Diabetes[1]	[171]	1				
Doctor-Patient Relationship	[175]	1				
Infectious Diseases	[223,224]					2
Infectious Diseases	[225]	1				
Maternal/Child Health	[184]					1
Natural Disasters[0]	[85]	1				
New Technologies[0]	[139,140]					2
New Technologies[0]	[103]	1				
Nutrition/Exercise	[226]			1		
Pain	[227]					1
Palliative care	[228]					1
Renal Disease	[229]	1				
Science in General[0]	[141]					1
Science in General[0]	[98,108]	2				
Sexual/Reproductive Health[2]	[66,67,230]					3
Sexual/Reproductive Health[2]	[151]@	1				
Sleep	[64]					1
Vaccines	[92,231]					2
Vaccines	[232,233]	2				
Totals		16	1	2	2	25
		N > D	**N ~ D**	**N < D**	**N + D**	**N~**

[0] non-health related topic. [1] e.g., screening, prevention, treatment. [2] e.g., HIV, STIs, Condoms, Birth Control.
* includes a systematic review [58]. @ includes an article categorized in two topics [151].



N>D - Narrative preferred to didactic; N~D - Narrative preferred to didactic in some cases; N+D - Narrative plus didactic preferred; N<D - Didactic preferred to narrative.

Fig. 3. Audience Preference for Narrative when Compared to Didactic Communication. N > D - Narrative preferred to didactic; N~D - Narrative preferred to didactic in some cases; N + D - Narrative plus didactic preferred; N < D - Didactic preferred to narrative.

conclusion about how/why narrative is an effective means of communication (Table 4). Of these, 8 described the complex cognitive processes underlying narrative comprehension and identified the multiple brain regions involved [118–125]. A meta-analysis of 78 task-based functional magnetic resonance imaging (fMRI) studies revealed that narrative comprehension involves widely distributed brain regions demonstrating the depth and breadth of narrative processing. However, narrative comprehension relied heavily on the default network, implying that

Table 3
Advice on how science and health communication can successfully incorporate narrative.

Findings	References	# Citations
Similar protagonist > Dissimilar protagonist	[13,24,26,31–47]	20
Other advice	[72,170,171,210, 217,225,234–246]	19
Using graphics/video > Text only	[13,18,43,53,92, 96–105]	15
Get input/feedback from target audience and tailor story to them	[6,11,21,43–46, 48–72]*	13
1st person POV (testimonial format) > 3rd person POV (rhetorical format)	[15,16,21–29,187]	12
Tell a good story![3]	[10,15,48,50,68,111, 113–117]	11
General support for using narrative in science/health communication	[135,146,164,243, 244,247–250]	9
High emotional content > Low emotional content	[29,48,49,73–79]	9
Positive consequences (gain frame) > Negative consequences (loss frame)	[23,29,32,80–85]	9
Use popular story structure/elements[2]	[6,11,48,68, 109–112]	8
Works better in certain populations[1]	[13,52,90–95]	8
Protagonist as role model/positive deviant/ with high self-efficacy/agency	[13,213,251–253]	5
Negative consequences (loss frame) > Positive consequences (gain frame)	[86–89]	4
Negative valence/emotion > Positive valence/emotion	[15,22,53,254]	4
Use (vicarious) self-affirmation prior to presenting risk information	[131,255–257]	4
Integrate messaging into story plausibly and subtly (conceal persuasive intent – don't make it obvious!)	[106–108]	3
Affective argument > Instrumental argument	[177,258]	2
Combine narrative with didactic information	[144,145]	2
Emotional shift > Consistent emotion	[73,74]	2
External attribution > Internal attribution	[169,189]	2
Positive valence/emotion (e.g., humor) > Negative valence/emotion	[199,259]	2
Use metaphors	[111,260]	2
Likeable protagonist > Unlikeable protagonist	[261]	1

[1] e.g., screening, prevention, treatment. [2] e.g., suicide prevention, depression, anxiety, body image. [3] e.g., HIV, STIs, Condoms, Birth Control. [4] e.g., domestic, gender.
* includes a systematic review [14]. ^ includes a systematic review [15]. # includes a systematic review [16] and a meta-analysis [17]. + includes a systematic review [18] and two meta-analyses [19,20].

narratives are natural patterns of thought [125].

Six articles explored how narratives focus attention by introducing suspense [6,11,22,122,126]. Four articles explored how narratives impact memory noting that, even if information retention is low immediately after exposure, broad features are often retained longer than hearing the same information in didactic format [78,108,127,128].

Five articles discussed how narratives make information easier to understand [11,108,126,129,130], some theorizing that human brains process information most efficiently from narrative [126,130]. Narratives simulate experiences [129,131–133], with 1 article drawing parallels to dreams.[134] *Narrative transportation* refers to when audiences experience a story as though they were in it [12,13,22,135], and *self--activation* refers to when audiences experience a story vicariously [135].

Nine articles reiterated the propensity of narratives to stimulate emotion, important in information processing and decision making [6, 11–13,78,111,124,130,135]. In particular, 2 models of persuasion were contrasted in the context of didactic vs. narrative communication: the Information Deficit Model (IDM) and the Elaboration Likelihood Model (ELM) [6,13,78,135]. IDM attributes science skepticism to lack of knowledge and focuses exclusively on providing deficient information [5]. ELM proposes 2 parallel routes of information processing: a *central route* of logic requires substantial cognition, and a *peripheral route*, unrelated to logic based on peripheral cues, thus requiring little cognition. Perhaps narrative messages incite less counterargument than didactic messages by circumventing the central route in favor of the peripheral [12,13,111]. Narrative also increased perceived friendliness and trustworthiness of the communicator; whereas didactic increased perceived competence of the communicator [136].

4. Discussion and conclusion

4.1. Discussion

Narrative is an effective method of communicating science and health information. When directly comparing narrative and didactic communication, 54 of 78 studies (69%) found incorporating narrative improved effectiveness, 15 (19%) found no difference between the strategies, and 9 (12%) found narrative less effective than didactic (Fig. 5a). When assessing narrative alone (without comparison to didactic), 32 of 34 studies (94%) found narrative effective; only 2 (6%) found narrative ineffective. Findings from 4 systematic reviews and 3 meta-analyses supported the effectiveness of narrative communication in improving various healthy behaviors (e.g., cancer screening, tobacco reduction). This scoping review is the first to our knowledge to synthesize such evidence on effectiveness of narrative communication broadly across all science and health domains, and include evidence on audience preference for narrative communication, evidence in neuroscience and psychology explaining the effectiveness of and preference for narrative communication, and advice on how science and health communication can successfully incorporate narrative.

Audiences found narrative science and health communication appealing and often preferred it to didactic communication. When directly comparing narrative and didactic communication, 19 of 21 studies (90%) found audiences preferred narrative over didactic; 2 (10%) found didactic preferred over narrative (Fig. 5b). In all 25 studies assessing narrative alone (without comparison to didactic), researchers found narrative acceptable and/or appealing to audiences.

The effectiveness and appeal of narrative communication are supported by evidence in neuroscience and psychology. Narrative induces widespread brain activity, stimulates emotion, and increases comprehension and long-term memory. Stories also induce less counterarguing than facts, potentially keeping people open to new information longer.

We structured this review to capture studies of communication in both health-related and non-health-related scientific domains, as we hypothesized that their communication should follow similar cognitive and affective responses, and that many overarching communication challenges and solutions overlap between scientific fields. The majority of the studies included in this review were health-related; the only non-health topics covered by included articles were climate/conservation [75,102,116,137,138], new technologies [103,139,140], natural disasters [85], and science in general [12,13,16–20,98,108,141–143]. Among the 10 non-health-related articles directly comparing narrative and didactic communication, 8 (80%) found incorporating narrative improved effectiveness, 1 (10%) found no difference between the strategies, and 1 (10%) found narrative less effective than didactic. When assessing narrative alone (without comparison to didactic), all 7 non-health-related studies (100%) found narrative effective. The percentages for non-health-related studies are similar to those for all included studies, despite accounting for only a small portion of the total studies, supporting our hypotheses.

This review provides compelling evidence for incorporating narrative into science and health communication. In particular, narratives used with didactic communication appear more likely to succeed than either approach alone [144,145], a fact which is already widely accepted among health communication specialists, in which best practices combine narrative and didactic communication. However,

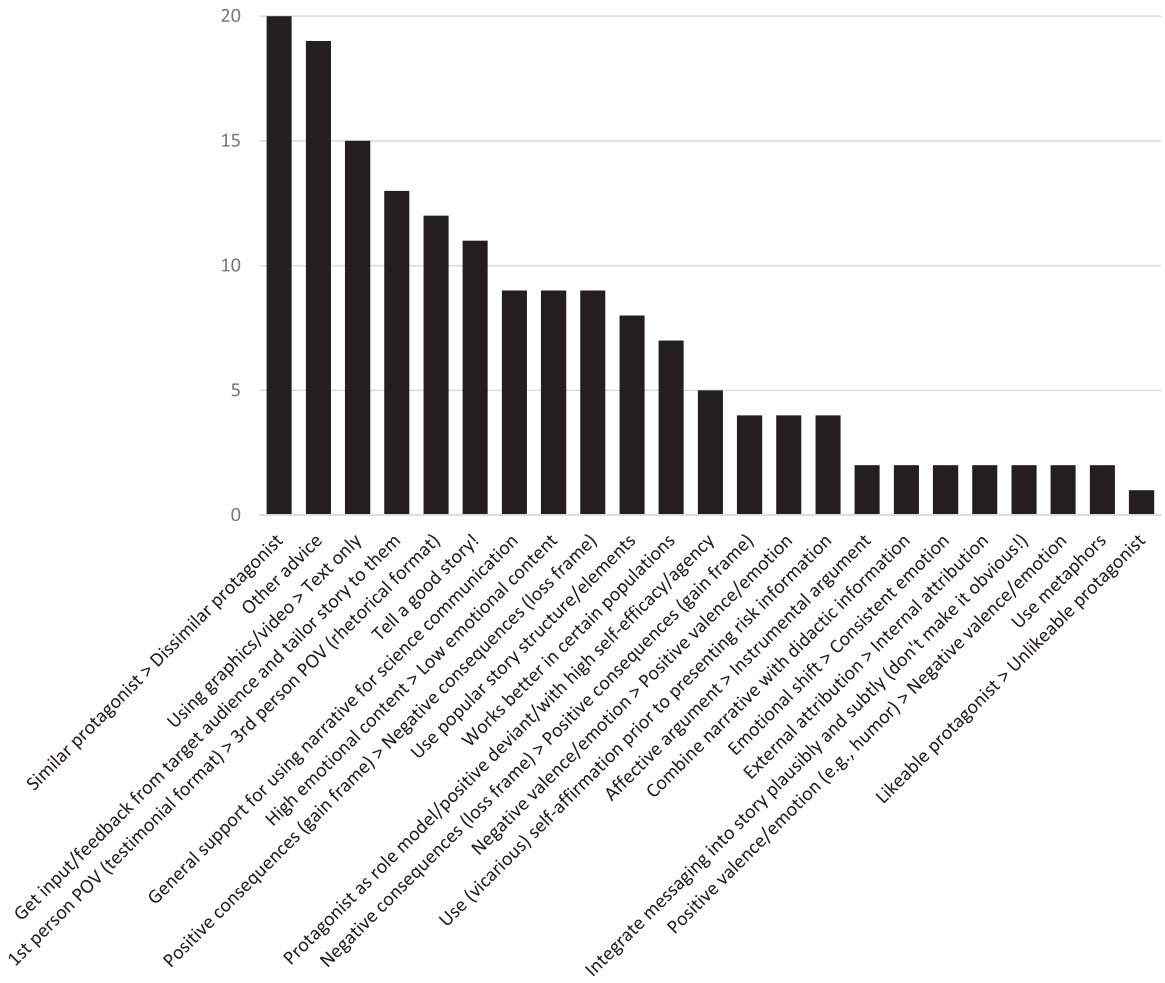


Fig. 4. Frequency of Advice on Integrating Narrative into Science/Health Communication.

Table 4
Science explaining how/why narrative communication is effective.

Findings	References	# Citations
Narratives stimulate emotion	[6,11–13,78,111, 124,130,135]	9
Multiple brain regions identified in complex cognitive processes underlying narrative comprehension	[118–125]	8
Narratives focus attention by introducing suspense	[6,11,22,122,126]	6
Narratives make information easier to understand	[11,108,126,129, 130]	5
Narratives impact memory (broad features of a story are retained longer than didactic information)	[78,108,127,128]	4

narrative is not universally effective; its success is dependent on its audience and the quality of the narrative itself. Features of successful stories included first-person point of view and relatable protagonists. Narratives are more successful among cultures with a strong oral tradition and for individuals with lower levels of traditional education and science and health literacy. Science and health communicators are encouraged to prioritize input from their target audiences and learn from partners in the creative arts about successful story elements to improve engagement with their narrative communication.

Recognizing the power of story, narratives are used effectively by advocacy groups on various issues. For example, anti-vaccine advocates often spread personal tales of children harmed after receiving a vaccine, instilling fear in naturally anxious parents [92]. Public health refutes these claims using statistics [146], assuming that, given facts, parents will make scientifically driven decisions. However, witnessing that a didactic approach does not reach many vaccine-hesitant families, pro-vaccine advocates are now sharing personal accounts of the pain, guilt, and heartache that comes with losing a child to a vaccine-preventable disease [147]. Further research should study the interaction and competition between narratives spreading misinformation and those contextualizing accurate information, especially within social media platforms.

This review has several limitations, mostly in regard to its scope, so that a small team could complete it in a timely manner. The search was limited to English language and articles published since 2000. Only PubMed and WoS databases were searched so relevant articles indexed solely in other databases were missed. Study quality and strengths of associations were not evaluated, thus risking assigning equal importance to studies providing varying levels of evidence.

This review provides a comprehensive summary of a growing body of evidence on a topic of debate within the scientific community. The evidence largely supports the expansion of science and health communication beyond the didactic approach, although not without careful consideration of the messages and target audiences specific to each scenario. There are also ethical considerations science and health communicators must face before using narrative: whether the purpose for doing so is comprehension or persuasion, what level of detail and accuracy must be maintained, and whether narrative is appropriate for their specific topic or situation [108]. And incorporating narrative into

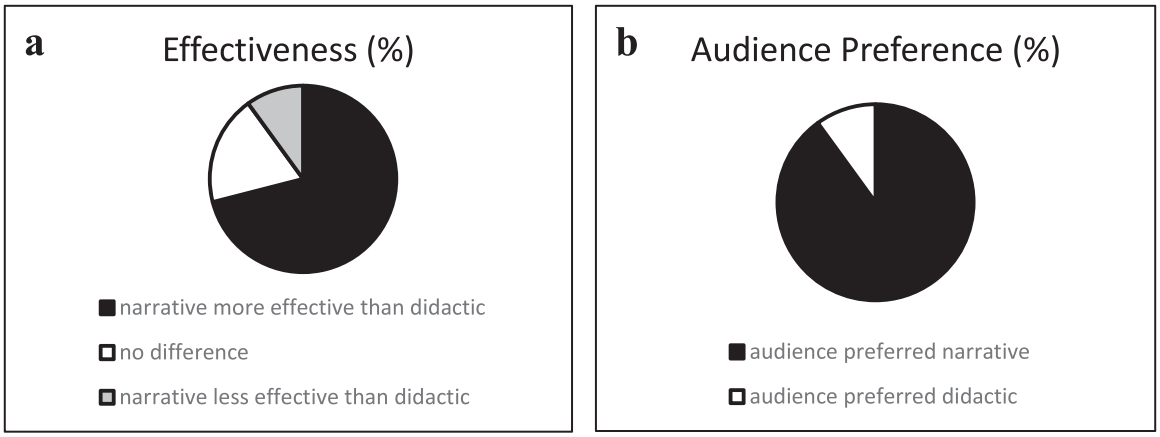


Fig. 5. Effectiveness of (a) and Preference for (b) Narrative vs. Didactic Communication.

communication strategies may require stepping out of many scientists' and health professionals' comfort zones. However, the literature provides a plethora of guidance on how to use narrative successfully, and further collaboration between science and health communicators and experienced storytellers is long overdue.

5. Conclusion

Incorporating narrative into science and health communication was largely found to be effective and appealing warranting further research and wider use. Narrative communication creates openness to information by delaying the formulation of counterarguments. Whether narrative or didactic messaging is more effective depends on the topic, audience, and objective, as well as message quality; however, combinations of narrative and didactic are more likely to succeed than either strategy alone. Science and health communicators should collaborate with cultural and storytelling experts, work directly with their target audiences throughout the message development and testing processes, and rely on popular story elements to improve engagement and influence.

CRediT authorship contribution statement

The first author drafted the search strategy and terms; performed the searches, screening, and data extraction; and drafted the initial manuscript. All authors reviewed and revised the search strategy, and reviewed, revised, and approved the final manuscript.

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Declaration of Competing Interest

Dr. Dudley reports research support from Walgreens and Merck. All other authors declare no competing interests.

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Data Sharing

No primary data was collected for this study (as it was a review of data already published). Search terms are included in the appendices.

Appendix A. PubMed search terms

Concept	Explanation	Logic	Terms
Narrative	Narrative terms used as starting point	–	("Narration"[Mesh:noexp] OR "narrative"[tiab] OR "narratives"[tiab] OR "story"[tiab] OR "stories"[tiab] OR "storytelling"[tiab])
Science Communication	Restricting to articles either about the communication of science or the science of narrative communication	AND	(("Health Communication"[Mesh] OR "Persuasive Communication"[Mesh] OR "Information Dissemination"[Mesh] OR "health communication"[tiab] OR "science communication"[tiab] OR "communication of science"[tiab] OR "communication of data"[tiab] OR "communication of evidence"[tiab] OR "communication of information"[tiab] OR "communicate science"[tiab] OR "communicate data"[tiab] OR "communicate evidence"[tiab] OR "communicate information"[tiab] OR "communicates science"[tiab] OR "communicates data"[tiab] OR "communicates evidence"[tiab] OR "communicates information"[tiab] OR "communicated science"[tiab] OR "communicated data"[tiab] OR "communicated evidence"[tiab] OR "communicated information"[tiab] OR "communicating science"[tiab] OR "communicating data"[tiab] OR "communicating evidence"[tiab] OR "communicating information"[tiab] OR "science explanation"[tiab] OR "explanation of science"[tiab] OR "explanation of data"[tiab] OR "explanation of evidence"[tiab] OR "explanation of information"[tiab] OR "explain

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Concept	Explanation	Logic	Terms
			science"[tiab] OR "explain data"[tiab] OR "explain evidence"[tiab] OR "explain information"[tiab] OR "explains science"[tiab] OR "explains data"[tiab] OR "explains evidence"[tiab] OR "explains information"[tiab] OR "explained science"[tiab] OR "explained data"[tiab] OR "explained evidence"[tiab] OR "explained information"[tiab] OR "explaining science"[tiab] OR "explaining data"[tiab] OR "explaining evidence"[tiab] OR "explaining information"[tiab] OR "convey science"[tiab] OR "convey data"[tiab] OR "convey evidence"[tiab] OR "convey information"[tiab] OR "conveys science"[tiab] OR "conveys data"[tiab] OR "conveys evidence"[tiab] OR "conveys information"[tiab] OR "conveyed science"[tiab] OR "conveyed data"[tiab] OR "conveyed evidence"[tiab] OR "conveyed information"[tiab] OR "conveying science"[tiab] OR "conveying data"[tiab] OR "conveying evidence"[tiab] OR "conveying information"[tiab] OR "comprehension of science"[tiab] OR "comprehension of data"[tiab] OR "comprehension of evidence"[tiab] OR "comprehension of information"[tiab] OR "comprehend science"[tiab] OR "comprehend data"[tiab] OR "comprehend evidence"[tiab] OR "comprehend information"[tiab] OR "comprehends science"[tiab] OR "comprehends data"[tiab] OR "comprehends evidence"[tiab] OR "comprehends information"[tiab] OR "comprehended science"[tiab] OR "comprehended data"[tiab] OR "comprehended evidence"[tiab] OR "comprehended information"[tiab] OR "comprehending science"[tiab] OR "comprehending data"[tiab] OR "comprehending evidence"[tiab] OR "comprehending information"[tiab] OR "understanding of science"[tiab] OR "understanding of data"[tiab] OR "understanding of evidence"[tiab] OR "understanding of information"[tiab] OR "understand science"[tiab] OR "understand data"[tiab] OR "understand evidence"[tiab] OR "understand information"[tiab] OR "understands science"[tiab] OR "understands data"[tiab] OR "understands evidence"[tiab] OR "understands information"[tiab] OR "understood science"[tiab] OR "understood data"[tiab] OR "understood evidence"[tiab] OR "understood information"[tiab] OR "understanding science"[tiab] OR "understanding data"[tiab] OR "understanding evidence"[tiab] OR "understanding information"[tiab] OR "retention of science"[tiab] OR "retention of data"[tiab] OR "retention of evidence"[tiab] OR "retention of information"[tiab] OR "retain science"[tiab] OR "retain data"[tiab] OR "retain evidence"[tiab] OR "retain information"[tiab] OR "retains science"[tiab] OR "retains data"[tiab] OR "retains evidence"[tiab] OR "retains information"[tiab] OR "retained science"[tiab] OR "retained data"[tiab] OR "retained evidence"[tiab] OR "retained information"[tiab] OR "retaining science"[tiab] OR "retaining data"[tiab] OR "retaining evidence"[tiab] OR "retaining information"[tiab] OR "memory of science"[tiab] OR "memory of data"[tiab] OR "memory of evidence"[tiab] OR "memory of information"[tiab] OR "remember science"[tiab] OR "remember data"[tiab] OR "remember evidence"[tiab] OR "remember information"[tiab] OR "remembers science"[tiab] OR "remembers data"[tiab] OR "remembers evidence"[tiab] OR "remembers information"[tiab] OR "remembered science"[tiab] OR "remembered data"[tiab] OR "remembered evidence"[tiab] OR "remembered information"[tiab] OR "remembering science"[tiab] OR "remembering data"[tiab] OR "remembering evidence"[tiab] OR "remembering information"[tiab] OR "processing of science"[tiab] OR "processing of data"[tiab] OR "processing of evidence"[tiab] OR "processing of information"[tiab] OR "process science"[tiab] OR "process data"[tiab] OR "process evidence"[tiab] OR "process information"[tiab] OR "processes science"[tiab] OR "processes data"[tiab] OR "processes evidence"[tiab] OR "processes information"[tiab] OR "processed science"[tiab] OR "processed data"[tiab] OR "processed evidence"[tiab] OR "processed information"[tiab] OR "processing science"[tiab] OR "processing data"[tiab] OR "processing evidence"[tiab] OR "processing information"[tiab]) OR (("persuasion"[tiab] OR "persuasive"[tiab] OR "persuade"[tiab] OR "persuaded"[tiab] OR "persuades"[tiab] OR "persuading"[tiab] OR "convince"[tiab] OR "convinces"[tiab] OR "convinced"[tiab] OR "convincing"[tiab] OR "coax"[tiab] OR "coaxes"[tiab] OR "coaxed"[tiab] OR "coaxing"[tiab] OR "rhetoric"[tiab]) AND ("science"[tiab] OR "sciences"[tiab] OR "scientific"[tiab] OR "evidence"[tiab] OR "data"[tiab] OR "statistic"[tiab] OR "statistics"[tiab] OR "statistically"[tiab] OR "associated"[tiab] OR "association"[tiab] OR "effective"[tiab] OR "effectiveness"[tiab] OR "impact"[tiab] OR "significant"[tiab])) OR "Neurosciences"[Mesh])
English Language	Restricted to articles published in English per exclusion criteria	AND	English[lang]
Date	Restricted to articles published in 2000 or later per exclusion criteria	AND	("2000/01/01"[PDAT]: "3000/12/31"[PDAT])
Human Studies	Excluded animal model (nonhuman) studies per exclusion criteria	NOT	("animals"[MeSH] NOT "humans"[MeSH])
Unwanted Article Types	Excluded types of articles likely to be redundant (e.g., preprints, conference abstracts, presentations) or methodically weak (e.g.,	NOT	("Address"[Publication Type] OR "Autobiography"[Publication Type] OR "Bibliography"[Publication Type] OR "Biography"[Publication Type] OR

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Concept	Explanation	Logic	Terms
	commentaries, editorials, letters, newspaper articles, case reports, etc.)		"Case Reports"[Publication Type] OR "Classical Article"[Publication Type] OR "Clinical Conference"[Publication Type] OR "Comment"[Publication Type] OR "Clinical Conference"[Publication Type] OR "Clinical Trial, Phase I"[Publication Type] OR "Clinical Trial, Phase II"[Publication Type] OR "Clinical Trial, Phase III"[Publication Type] OR "Clinical Trial Protocol"[Publication Type] OR "Clinical Trial, Veterinary"[Publication Type] OR "Collected Works"[Publication Type] OR "Congress"[Publication Type] OR "Consensus Development Conference"[Publication Type] OR "Consensus Development Conference, NIH"[Publication Type] OR "Dataset"[Publication Type] OR "Dictionary"[Publication Type] OR "Directory"[Publication Type] OR "Duplicate Publication"[Publication Type] OR "Editorial"[Publication Type] OR "Equivalence Trial"[Publication Type] OR "Expression of Concern"[Publication Type] OR "Festschrift"[Publication Type] OR "Guideline"[Publication Type] OR "Historical Article"[Publication Type] OR "Interactive Tutorial"[Publication Type] OR "Interview"[Publication Type] OR "Lecture"[Publication Type] OR "Legal Case"[Publication Type] OR "Legislation"[Publication Type] OR "Letter"[Publication Type] OR "News"[Publication Type] OR "Newspaper Article"[Publication Type] OR "Observational Study, Veterinary"[Publication Type] OR "Patient Education Handout"[Publication Type] OR "Periodical Index"[Publication Type] OR "Personal Narrative"[Publication Type] OR "Portrait"[Publication Type] OR "Practice Guideline"[Publication Type] OR "Video-Audio Media"[Publication Type] OR "Webcasts"[Publication Type] OR "Retracted Publication"[Publication Type] OR "Retraction of Publication"[Publication Type])
Irrelevant Articles	Excluded types of articles likely to be irrelevant due to focusing on narrative research methods instead of research on narrative (e.g., narrative reviews).	NOT	("news story"[tiab] OR "news stories"[tiab] OR "media narrative"[tiab] OR "media narratives"[tiab] OR "political narrative"[tiab] OR "political narratives"[tiab] OR "narrative review"[tiab] OR "narrative reviews"[tiab] OR "narrative critical review"[tiab] OR "narrative critical reviews"[tiab] OR "narrative synthesis"[tiab] OR "narrative syntheses"[tiab] OR "narrative summary"[tiab] OR "narrative summaries"[tiab] OR "narrative overview"[tiab] OR "narrative overviews"[tiab] OR "narrative analysis"[tiab] OR "narrative analyses"[tiab] OR "narrative data"[tiab] OR "narrative interview"[tiab] OR "narrative interviews"[tiab] OR "narrative inquiry"[tiab] OR "narrative inquiries"[tiab] OR "narrative medical writing"[tiab] OR "success story"[tiab] OR "success stories"[tiab])

Appendix B. Web of science search terms

Terms	Refinement of Results
TS=(("Narration" OR "narrative" OR "narratives" OR "story" OR "stories" OR "storytelling") AND (("Persuasive Communication" OR "Information Dissemination" OR "Dissemination of Information" OR "health communication" OR "science communication" OR "communication of science" OR "communication of data" OR "communication of evidence" OR "communication of information" OR "communicate science" OR "communicate data" OR "communicate evidence" OR "communicate information" OR "communicates science" OR "communicates data" OR "communicates evidence" OR "communicates information" OR "communicated science" OR "communicated data" OR "communicated evidence" OR "communicated information" OR "communicating science" OR "communicating data" OR "communicating evidence" OR "communicating information" OR "science explanation" OR "explanation of science" OR "explanation of data" OR "explanation of evidence" OR "explanation of information" OR "explain science" OR "explain data" OR "explain evidence" OR "explain information" OR "explains science" OR "explains data" OR "explains evidence" OR "explains information" OR "explained science" OR "explained data" OR "explained evidence" OR "explained information" OR "explaining science" OR "explaining data" OR "explaining evidence" OR "explaining information" OR "convey science" OR "convey data" OR "convey evidence" OR "convey information" OR "conveys science" OR "conveys data" OR "conveys evidence" OR "conveys information" OR "conveyed science" OR "conveyed data" OR "conveyed evidence" OR "conveyed information" OR "conveying science" OR "conveying data" OR "conveying evidence" OR "conveying information" OR "comprehension of science" OR "comprehension of data" OR "comprehension of evidence" OR "comprehension of information" OR "comprehend science" OR "comprehend data" OR "comprehend evidence" OR "comprehend information" OR "comprehends science" OR "comprehends data" OR "comprehends evidence" OR "comprehends information" OR "comprehended science" OR "comprehended data" OR "comprehended evidence" OR "comprehended information" OR "comprehending science" OR "comprehending data" OR "comprehending evidence" OR "comprehending information" OR "understanding of science" OR "understanding of data" OR "understanding of evidence" OR "understanding of information" OR "understand science" OR "understand data" OR "understand evidence" OR "understand information" OR "understands science" OR "understands data" OR "understands evidence" OR "understands information" OR "understood science" OR "understood data" OR "understood evidence" OR "understood information" OR "understanding science" OR "understanding data" OR "understanding evidence" OR "understanding information" OR "retention of science" OR "retention of data" OR "retention of evidence" OR "retention of information" OR "retain science" OR "retain data" OR "retain evidence" OR "retain information" OR "retains science" OR "retains data" OR "retains evidence" OR "retains information" OR "retained science" OR "retained data" OR "retained evidence" OR "retained information" OR "retaining science" OR "retaining data" OR "retaining evidence" OR "retaining information" OR "memory of science" OR "memory of data" OR "memory of evidence" OR "memory of information" OR "remember science" OR "remember data" OR "remember evidence" OR "remember information" OR "remembers science" OR "remembers data" OR "remembers evidence" OR "remembers information" OR "remembered science" OR "remembered data" OR "remembered evidence" OR "remembered information" OR "remembering science" OR "remembering data" OR "remembering evidence" OR "remembering information" OR "processing of science" OR "processing of data" OR "processing of evidence" OR "processing of information" OR "process science" OR "process data" OR "process evidence" OR "process information" OR	*Databases:* Web of Science Core Collection *Language:* English *Document Types:* Article, Review, Book Chapter *Timespan:* 2000–2020 *Citation Indexes:* SCI-EXPANDED, BKCI-S, ESCI *Research Areas (excluded):* Business Economics, Government Law, Religion, Literature

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Terms	Refinement of Results
"processes science" OR "processes data" OR "processes evidence" OR "processes information" OR "processed science" OR "processed data" OR "processed evidence" OR "processed information" OR "processing science" OR "processing data" OR "processing evidence" OR "processing information") OR (("persuasion" OR "persuasive" OR "persuade" OR "persuaded" OR "persuades" OR "persuading" OR "convince" OR "convinces" OR "convinced" OR "convincing" OR "coax" OR "coaxes" OR "coaxed" OR "coaxing" OR "rhetoric") AND ("science" OR "sciences" OR "scientific" OR "evidence" OR "data" OR "statistic" OR "statistics" OR "statistically" OR "associated" OR "association" OR "effective" OR "effectiveness" OR "impact" OR "significant")) OR "Neuroscience" OR "Neurosciences") NOT ("news story" OR "news stories" OR "media narrative" OR "media narratives" OR "political narrative" OR "political narratives" OR "narrative review" OR "narrative reviews" OR "narrative critical review" OR "narrative critical reviews" OR "narrative synthesis" OR "narrative syntheses" OR "narrative summary" OR "narrative summaries" OR "narrative overview" OR "narrative overviews" OR "narrative analysis" OR "narrative analyses" OR "narrative data" OR "narrative interview" OR "narrative interviews" OR "narrative inquiry" OR "narrative inquiries" OR "narrative medical writing" OR "success story" OR "success stories"))	

Appendix C. Study outcomes determining effectiveness of narrative communication

Author	Year	Study Outcomes Determining Effectiveness[1]
Narrative Compared to Didactic		
Combination of narrative and didactic works better than didactic only		
Kim	2012	engagement, intentions
Nan	2015	attitudes, intentions
Okuhara	2018	intentions
Scully	2017	attitudes
Narrative messaging works BETTER than didactic messaging		
Adebayo	2020	knowledge, attitudes, intentions, behavior
Allen	2015	recall
Betsch	2013	attitudes
Clemons	2012	attitudes
Corrigan	2015	attitudes
Cunningham	2013	knowledge, behavior
Dahlstrom	2014	engagement, knowledge
deWit	2008	attitudes, intentions
Gardner	2016	attitudes, intentions, trust
Haase	2015	attitudes
Hébert	2020	knowledge
Janssen	2013	attitudes
Kennedy	2018	intentions
Koopsvan'tJagt	2018	knowledge
Larkey	2009	intentions
Liu	2020	attitudes, intentions
Ma	2018	attitudes
Mazor	2007	knowledge, beliefs
McQueen	2011	engagement, attitudes, recall
Meisel	2016	engagement
Moran	2013	attitudes, intentions
Moran	2016	knowledge
Morris	2019	behavior
Ochoa	2020	knowledge, attitudes
O'Mally	2014	intentions
Panic	2014	behavior
Ricketts	2010	behavior
Robbins	2019	intentions
Sznitman	2018	attitudes, beliefs, intentions
Tien	2019	intentions
Wang	2019	engagement, attitudes, intentions, trust
Weber	2006	behavior
Wirtz	2020	intentions
*Narrative messaging works better than didactic messaging in SOME scenarios, but not all (*e.g.*, it depends)*		
Alber	2020	attitudes (narrative more effective); trust (didactic more effective)
Dillard	2015	attitudes
El-Khoury	2016	attitudes, beliefs
Falzon	2015	attitudes (narrative more effective); knowledge (didactic more effective)
Hinyard	2007	behavior
Jiang	2020	attitudes
Krause	2020	attitudes
Kreuter	2007	knowledge, behavior
Liu	2019	intentions
Negrete	2010	recall
Occa	2016	attitudes, intentions (narrative more effective); knowledge (didactic more effective)
Perrier	2017	behavior
Prati	2012	attitudes
Slater	2003	trust
Winterbottom	2008	behavior
Zebregs	2015	attitudes, beliefs, intentions

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Author	Year	Study Outcomes Determining Effectiveness[1]
Zhang	2020	attitudes, intentions
Narrative messaging works the SAME as didactic messaging		
Bol	2013	recall
DeIorio	2017	knowledge, attitudes
Donné	2017	intentions
Larkey	2015	behavior
Lin	2015	knowledge, attitudes
Liu	2020	attitudes
Liu	2019	intentions
Lu	2013	intentions
Meadows	2020	intentions
Nan	2017	attitudes, intentions
Stavrositu	2018	attitudes, behavior
van'tJagt	2019	attitudes, intentions
Willoughby	2018	attitudes
Wirtz	2014	engagement, attitudes, intentions
Zebregs	2015	knowledge, attitudes
Narrative messaging works WORSE than didactic messaging		
Bekalu	2018	knowledge, attitudes
Bryan	2020	trust
Kim	2020	attitudes
Li	2020	intentions
Ma	2018	attitudes
McLean	2020	attitudes
McQueen	2019	intentions
Thrasher	2012	attitudes
Wolf	2020	attitudes
Narrative Not Compared to Didactic		
Narrative messaging works		
Babalola	2019	attitudes, behavior
Ballard	2020	attitudes, beliefs, intentions, behavior
Bavin	2016	attitudes, beliefs, intentions
Cueva	2013	knowledge, attitudes, intentions
Dillard	2018	intentions
Dillard	2013	knowledge, intentions
Finkler	2019	attitudes, intentions
Gustafson	2020	attitudes, beliefs
Howe	2002	behavior
Hurtado-de-Mendoza	2019	knowledge, attitudes, intentions
Kaur	2019	knowledge, attitudes, intentions
Keller	2017	attitudes
Kennedy	2011	knowledge
Lartigue	2017	knowledge
Lauby	2017	behavior
LimRBT	2019	behavior
Ma	2018	attitudes
Marett	2015	attitudes, intentions
Negrete	2004	knowledge
Niederdeppe	2014	knowledge, attitudes
O'Donnell	2017	attitudes, intentions
Oh	2015	intentions
Rogers	2019	knowledge, attitudes, behavior
Rosenthal	2018	knowledge, attitudes, intentions, behavior
Sabaretnam	2019	knowledge
Sangalang	2019	beliefs, intentions
Slater	2011	attitudes
vanLeeuwen	2013	intentions, behavior
Wang	2016	engagement, knowledge, intentions
Zhou	2020	knowledge, attitudes, behavior
Narrative messaging works in SOME scenarios, but not all (e.g., it depends)		
Greene	2019	attitudes
Parvanta	2007	behavior
Narrative messaging does NOT work		
Neil	2019	intentions, behavior
Riley	2020	attitudes

[1] the outcome(s) for each study which the narrative communication intervention was effective at improving (e.g., engagement, knowledge, attitudes, beliefs, intentions, behavior, trust, recall). If didactic communication was more effective than narrative communication at improving a particular outcome, the outcome(s) improved by each type of communication is specified.

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