Research on Users' Health Information Literacy and Information Source Preferences

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Abstract: The ability to select appropriate information sources is a key component of users' health information literacy. The investigation of preferences regarding the sources of health information can assist in the analysis of the diverse range of information sources utilized by individuals with varying degrees of health information literacy. The findings of this research have the potential to enhance users' health information literacy and the quality of the information they obtain. A questionnaire is used to measure users' health information literacy, and interviews are used tracking users' health information seeking behavior. NVivo 12 is used to analyze data. The research results show that users with different levels of health information literacy have different preferences for information source selection. Users with high levels of health information literacy are more inclined to choose online information sources to search for health information, and the selected information sources are very rich. The information source selection preferences of users with medium health information literacy level are the most unique. In addition to doctors, family and friends, search engines, they also choose low trust sources. Users with low levels of health information literacy have a relatively limited selection of information sources, including doctors, family and friends, television programs, and search engines. In addition, the influencing factors of user information source selection vary with different levels of health information literacy.

1. Introduction

As the first step in acquiring health information, information source selection affects the quality of health information acquired by users. A deeper understanding of how individuals with different levels of HIL select information sources are invaluable for several key reasons. Firstly, it could illuminate the specific diversity in the way that individuals with different levels of HIL select health information sources. Secondly, by gaining insight into the biases and errors that individuals with different levels of HIL are prone to in the source selection process, it could help them to avoid these pitfalls themselves. Finally, it could provide empirically-grounded evidence to relevant departments seeking to enhance users' HIL.

But fewer studies have addressed the preferences and influencing factors of information source selection of different HIL level users. Most are separate users with age, physical health status, and health search scenarios as criteria, and explore their health information source preferences. Most

studies, related to this theme, have explored the selection of information sources for users of different ages or users with low Health Information Literacy (HIL) users [1].

It has been found that older adults tend to preferentially seek health information from "Baidu Knowledge" and online medical platforms, while also relying on traditional offline media (e.g., television, advertisements, etc.) and interpersonal information sources to a greater extent [2]. However, they demonstrate a lesser inclination towards utilizing new media sources [3]. Search engines are the preferred source of health information for college students, however, due to privacy concerns, they are less likely to use online healthcare platforms [4]. Moreover, Dobransky and Hargittai [5] found that interpersonal sources are among the most frequently utilized sources of health information by college students.

In most cases, patients typically utilize online sources to obtain health information before seeking medical care [6]. A review of the literature reveals that patients with severe medical conditions, including cancer, multiple sclerosis, and diabetes, tend to utilize search engines as their primary source of information. In contrast, those with less severe conditions, such as headaches, stress, and coughs, are more inclined to engage with online resources, including social networks, to access information related to their illnesses [7]. In addition to specific groups, researchers have conducted studies related to the selection of users' health information sources in different contexts. In emergency situations, users were found to prioritize medical personnel as a source of health information, with the Internet being the second most preferred option due to its convenience in obtaining health-related data [8].

While a few researchers have studied health information literacy and users' information-seeking behavior, and obtained some results, for example, Cristina and Baban [9] and Quinn et al. [10] analyzed the role of health literacy in online health information-seeking behavior and users' emotions. Dawson-Rose et al. indicated that high and low levels of health information literacy were positively correlated with the ability to evaluate online health information [11]. Additionally, higher health information literacy was found to improve the effectiveness of individual health treatment. And Diviani et al. had found low health information literacy was negatively associated with trust in the online health information received [12]. Nevertheless, there is a paucity of research examining the behavioral differences between users with different levels of health information literacy.

Accordingly, in this study, the Everyday Health Information Literacy Scale (EHIL), developed by Niemelä et al. [13], to quantify the health information literacy levels of participants. The results were classified into three levels: high, medium, and low. Based on these classifications, the different literacy levels of various user groups were investigated through follow-up interviews to gain insight into their information source selection preferences. The specific research questions are as follows:

RQ1: What are the differences in information source selection among users with different levels of health information literacy?

RQ2: What factors influence the selection of information sources by users with varying levels of health information literacy?

2. Research Methods and Data Analysis

2.1 Research Methods

In this study, a questionnaire was designed based on the EHIL scale, and the health information literacy level of 50 participants was investigated by it. Semi-structured in-depth interviews were conducted to elucidate the discrepancies in information source selection and the factors that influence the choices of 30 users with varying HIL levels (the interview outline see table 1). Of these, 10 participants with high HIL levels accounted for 33%. A total of 30% of participants were identified as having low HIL levels, while 36.7% were classified as having medium HIL levels (see Appendix

3 for the sample basic statistics). All 30 participants had prior experience with online health information searching. Ten interviews lasted longer than 60 minutes, 12 lasted 45-60 minutes, and the rest lasted at least 30 minutes.

Table 1: Outline of follow-up interviews

		Questions
Follow-up interview	1	What types of health information do you usually seek for?
	2	Can you share a recent search experience?
	3	What is the purpose of your seek?
	4	What is the main source of information you seek for? When would you choose these sources of information? why?
	5	What made you choose this source of information in this case, can you talk about it specifically?
	6	What online information source do you use? Why do you use it?
	7	What is it about this source that makes you feel the way you do that you choose to use it?
	8	Are there any other sources of information besides the ones you just mentioned?
	9	What keywords are you seeking for?
	10	Can you recall the general content of your search?
	…	…
	21	How would you normally choose to cross sources? Is it from doctors to networks to friends?Can you give me a specific example?

2.2 Data analysis

The level of health information literacy was determined by calculating the Mean of the participants' responses to each scale question item. The interview texts were analyzed using "open coding", with the analytical tools SPSS26 and NVivo12. The open coding was conducted concurrently by two coders, after which the research team engaged in a discussion to confirm the coding results. The coding consistency was then calculated using Holsti's formula, with a resulting value of 91.08%.

3. Research Results

3.1 Information Source Selection and Influencing Factors for High HIL level Users

The findings of the study indicate that individuals with high HIL levels tend to access health-related information from a diverse array of sources, encompassing online platforms such as search engines (Baidu, Bing, and WeChat's search function), Weibo, Zhihu, health forums, and online healthcare portals (Dr. DingXiang, Good Doctor Online), Bilibili, RED, WeChat's public number and others; offline sources include friends and relatives (friends with relevant medical backgrounds), doctors in hospitals, and TV programs (health TV programs on CCTV or local TV stations, etc.). Furthermore, the study identified convenience, dependability and adoptability as the key factors influencing the selection of health information sources by users with high HIL levels.

3.1.1 Convenience

The study revealed that convenience plays a pivotal role in determining the choice of sources when accessing health information for users with high HIL levels. It encompasses ease of browsing, identification, and utilization of the sources. In accessing health information, users with high HIL

demonstrated a preference for sources that were easily browsing: a diverse range of content or were clearly categorized. Individuals with high HIL consider sources offering a wide range of information is more integrated, including all types of information, presented in an intuitive manner and easy to browsing. Consequently, they tend to choose these sources to access health information. As stated in P4:*"The info you get from Baidu is easy to understand and well-organized. It's also comprehensive and accessible, plus it includes links to related major websites."* In the context of accessing health information, selecting Baidu as a source can facilitate the direct provision of a diverse range of information types and formats, offering multiple types of search results for convenient browsing. Another example is provided in P1:"... *I got some useful info from WeChat. It has a great search feature that groups results by topic. For instance, you can find info from hospitals, info from company apps, news, and official stats. It's really straightforward to choose the category you want.*" It is evident that effective information classification significantly enhances the efficiency of users in browsing health information, provides convenience, and fosters user satisfaction.

In addition to the ease of browsing information sources, users with high HIL levels also tend to select sources that are readily identifiable as to the identity of the information content generator. That is to say, they are drawn to sources that are easily source-identified. For example, P1: *"... Some of the information sources I've come across have a lot of content that looks like ads, which I don't like and don't go to for health info. The info from these sources also needs to be evaluated for quality, which is a hassle."* P2: *"I'm not sure what professions the people writing the information on Zhihu are in. On Baidu, I can tell which ones are organizations, which ones are online healthcare platforms, and which ones are advertisements. I can also judge these things better."* P2 said that although she would go to websites such as Zhihu to search for information in her daily life, she still preferred Baidu to search for health information when she felt unwell because the health information on Baidu could easily observe the identity of the information provider, such as the doctor on the online healthcare platform, the writings of people from the for-profit website, the answer of a certain blogger, or the answer of an anonymous netizen, etc. Therefore, they are more likely to choose Baidu, a source that is easy to recognize the identity of the content generator, to search for health information.

Furthermore, the ease of utilization is a reason to selection of information sources by users with high HIL levels. The convenience of utilization can be categorized into three principal areas: time, operation and form. The term "time" refers to the ability of the information source to be accessed at any moment and from any location. The study revealed that users frequently opted for information sources that were readily accessible at any moment, regardless of location. This was exemplified by P6:*"Baidu is more convenient because you can access it on your phone or computer at any time and place."* The ease of operation guarantees the realistic accessibility of the information source. For example, P2 states, *"Google still has to using some aid...then I choose to use Baidu."* The convenience of form can be defined as the ease with which the information content of a source can be presented. For example, P19:*"Text without images is pretty useless. I'd go for forums with lots of pictures and descriptions that match them. Plain text just doesn't look right."*

3.1.2 Dependability

Dependability represents a significant factor influencing the selection of sources by users with high HIL levels when accessing health information. Dependability mainly includes "reality habit" and "psychological dependency". The concept of 'reality habit' refers to the habitual choice of information sources that users often select due to the familiarity that they have with these sources as part of their daily lives. As stated in P6: *"Baidu is the better choice because it's more familiar."* In addition to familiarity, the act of sharing one's daily routine and lifestyle also affects users' choice of information sources to preferred choose friends and family to get information, as described in P20: *"... I prefer to communicate with my mom at home, so if I need health information, I'll ask her for it....*

". psychological dependence denotes the tendency of users to select a subconscious preferred information source in the event of physical discomfort or the emergence of a more pressing health issue, which can be categorized into two factors: subconscious preference and psychological comfort. Lots of high HIL users indicated that their decision to search for disease-based health information on Baidu was largely subconscious, without a clear rationale. For instance, P20 stated, *" I'm used to asking Baidu about everything, subconsciously."* In addition to subconscious choices, the utilization of information sources that are habitual in daily life will provide users with psychological comfort and security when they are not feeling well. For example, P4 states, *" I'm used to using Baidu, so I'll probably choose it. It's become a bit of a habit. I'm not sure I'd use another one at the moment. "* It can be observed that the utilization of information sources pertaining to daily lifestyle provides users with a sense of psychological comfort in the face of the unknown and the potential for physical discomfort. In summary, Dependency is one of the factors that influence high HIL users' selection of health information sources.

3.1.3 Adoptability

In addition to the factors of convenience and dependability, the adoptability of a source also plays a role in the user's selection. Adoptability can be classified according to two categories: authority and relational trust based on authority. As the term implies, authoritative denotes a source of information that is regarded as authoritative, such as doctors in hospital. The authority of the information source affects the user's decision to utilize it. For instance, P21: *" I've found that online medical platforms that work with some big hospitals are good. Some of them work with doctors from hospitals I haven't heard of, which I don't think is very reliable. So I chose a platform that works with big hospitals."* The collaboration between the online healthcare platform utilized by this participant and the physical hospital physicians ensured the credibility of the information source, which served as a key motivating factor for users in selecting this source. In addition to complete authority, relational trust based on authority also plays a role in the choice of information source for high HIL users. Relational trust based on authority can be expressed as a willingness to rely on friends with relevant expertise or experience. Such sources of information are perceived to have a certain degree of authority, and at the same time, they provide users with a sense of security due to relational trust. As described in P20: *"(I like to) go to ask the doctors at the school hospital because they are teachers at the school, and they are the ones that I know, and they are comparatively speaking, they are considered to be friends, and are more affable, and may not be as good as hospital doctors. The doctors at the school hospital tend to be more holistic, especially for the minor illnesses they don't even recommend medication, and I trust them, they'll take into account the relationship we have."* It can be observed that although the "doctor at the school hospital" is perceived to possess a certain degree of authority, relational trust is the primary factor influencing this participant's decision to seek information from this source.

3.2 Information Source Selection and Influencing Factors for Medium HIL level Users

The information sources used by those with a medium HIL level in searching for health information are also relatively diverse. Offline sources include doctors in hospitals, friends and relatives, "traditional" Chinese medicine practitioners, and experts in various fields. Online sources include customer service on shopping platforms (JD.COM, Pinduoduo) and search engines (like Baidu).

The selection of information sources by users with medium HIL is influenced by a number of factors, including convenience, recommendation and dependency of information sources. Those with a medium HIL similarly perceived that information sources with a broader range of content could be convenient for them. Consequently, they tended to choose this type of information source to obtain

health information. For example, P3 stated: *"After reading, I have access to a wide range of information form this source, so I prefer to use it rather than searching elsewhere."* P3 elected to utilize Baidu as a search engine for online health information, primarily due to the convenience of the information source. The recommendability of the information source is also a significant factor influencing the selection by users with medium HIL. Medium HIL users indicated a preference for sources with robust recommendation features, enabling the identification of numerous relevant keywords that may not have been considered otherwise. For instance, P3 stated, *" As well as showing me the search results I'm looking for, the source can also recommend similar content based on my search history. This gives me more options and helps me to learn more about topics I wasn't aware of before."* Furthermore, as with high HIL users, dependence on the information source is also a factor that influences users' whether to choose it. For example, P7: *"...just tend to use it, so I don't look at other platforms either. When I have a problem, if I have to search on the internet, I will go to Baidu to look at it...I usually get used to it ...and I go to Baidu for all health-related questions..."*

3.3 Information Source Selection and Influencing Factors for Low HIL level Users

The study revealed that the prevalent sources of information for users with low HIL levels were doctors in hospitals, friends and relatives, TV programs (specifically, health TV programs broadcast on CCTV or local TV stations) and search engines (Baidu). These sources of information are safer and more trustworthy. Users with low HIL levels usually tend to go directly to the hospital to see a doctor instead of searching for health information on the Internet. Furthermore, they are more inclined to seek medical care at hospitals than to search for health information online. This indicates that hospitals represent the primary source of health information for individuals with low HIL. The analysis of the interview data revealed that the primary factors influencing the selection of information sources by users with low HIL levels encompass insufficient searching skills, the convenience of information sources, a lack of trust in online information, and a subjective perception of inadequate assessment skills.

Insufficient searching skills are attributed to lack of time or experience in utilizing electronic devices, such as computers or mobile phones, to access the Internet. Consequently, users may lack proficiency in retrieval techniques. Insufficient searching skills represent a significant barrier to the utilization of online information among users with low HIL levels, who tend to rely on in-person sources such as visiting a doctor. As P13:*" I wasn't sure how to search for information on my cell phone before, and I didn't use it much. Now I know how to use it (a little), and I'll look on Baidu, but I don't see much."* And *P10: "There is nothing else but Baidu (I haven't used any other online information sources except Baidu), no more, because the computer and cell phone play (use) is not very good (computer and cell phone use is not good, won't go to other online information sources to get health information, will only use Baidu)."*

The convenience of the source ("fear of trouble") is one of the reasons for the choice as well as the high HIL users. The high HIL users, who are reluctant to visit a doctor to obtain health information due to fear of trouble, and the low HIL users, who are apprehensive about searching for health information online due to similar concerns. All participants who were interviewed at the low HIL level reported that searching for health information online was a time-consuming and energy-consuming process, in comparison to see a doctor. E.g. P11: *" I will check on the Internet if it is minor, but I still have to go to the hospital as well, so I don't like to search and browse on the Internet. After reading the health information on the internet, I still have to go to the hospital and ask the doctor about it...and then I went to the hospital and didn't diagnose the condition. Anyway, I generally do not search (health information) on the Internet, too much trouble, go directly to the hospital is simple and convenient"*. For some individuals with low HIL, searching for health information online is

perceived as a burdensome task. Conversely, visiting a hospital is perceived as a relatively a convenient way. Consequently, individuals with low HIL are more inclined to seek health information from hospitals.

Furthermore, a lack of trust in online information is a significant factor influencing users with low HIL to seek health information through hospital. Those with low HIL levels tend to perceive the credibility of network information as being very low. Consequently, they are reluctant to utilize it as a basis for judging their own health and making health decisions. This is exemplified by P10, who states, *"I will believe the doctor. The information on the Internet is personal views or just some paragraphs. Therefore, I would prefer to register a number and see a doctor in person."* Furthermore, the absence of physical contact can also result in users' distrust of online health information. The network is virtual, and the generator of online information cannot be informed. This can lead to a sense of insecurity, which may prompt users to refrain from seeking information from the network. For example, P13 stated: *"There are just too many virtual ones on the internet. So, no matter how many sites you visit to retrieve the information, you still have to go to the doctor afterward."*

In addition to insufficient searching skills, accessibility of information sources, and low trust in online information, the subjective perception of inadequate assessment skills is one of the main reasons why users with low levels of HIL do not tend to search for health information from online platforms. Those with a low HIL are prone to perceive their ability to assess advertising and fake health information on the internet as inadequate. This extends to their capacity to appraise the quality of online health resources, resulting in a tendency to avoid seeking health information online. Like P12 said, *"I don't trust information on the internet, but I do trust hospitals. We don't trust online information because we don't use it well. We can't judge it well, we can't utilize it well, and we don't know which one we should listen to and which one we shouldn't, so we feel it's not trustworthy and we don't like to use them."*

4. Conclusion and Discussion

4.1 Key Findings

Individuals with different health information literacy (HIL) levels exhibit distinct patterns in their utilization of information sources during the process of health information seeking. Those with high HIL are more inclined to leverage the Internet as a primary way for health information searching, whereas individuals with low HIL are more prone to rely on in-person interactions with doctors for the acquisition. Furthermore, users with high HIL levels accessed health information from a greater number of sources, including online sources such as search engines (Baidu, Bing, and WeChat search function), Weibo, Zhihu, health forums, and online healthcare platforms (such as Dr. DingXiang, Good Doctor Online), as well as Bilibili. Additionally, offline sources including friends and relatives (friends with a medical background), doctors in hospitals, and TV programs (health TV programs on CCTV or local TV stations).   It is notable that the information sources used by users with medium HIL in searching for health information are also relatively rich. Offline sources mainly include doctors in hospitals, friends and relatives, and "old Chinese doctors". The offline sources mainly included doctors and "old experts," while the online sources were primarily customer service on shopping platforms (JD.COM, Pinduoduo) and search engines (Baidu). The information sources selected by users with low HIL in searching for health information were relatively homogeneous, including doctors in hospitals, friends and relatives, TV programs (health TV programs on CCTV or local TV programs), and search engines (Baidu).

Moreover, the factors vary across users with different levels of HIL. The reasons for the selection of information sources by users with high HIL levels are numerous and varied. These include considerations of convenience, dependability, and adoptability. The reasons for the selection of

information sources among users with a medium HIL level include convenience, recommendations, and dependability. For those with low HIL levels, the primary factors influencing their selection of information sources are insufficient retrieval skills, convenience, a lack of trust in online information, and inadequate evaluation skills.

4.2 Discussion

4.2.1 Medium Health Information Literacy Levels and Assessment Deficits

In general, a reduction in HIL level will result in a corresponding decline in the capacity to evaluate the quality of information sources. Nevertheless, the results of this study indicate that users with medium HIL levels exhibit the greatest deficiency in their ability to assess the quality of information sources. The analysis of the interview data revealed that the health information sources selected by users with medium HIL levels included "traditional Chinese medicine" practitioners and other traditional healers which actually are liars, which were not included in the information sources selected by users with high or low HIL levels. In the course of the interviews, it became evident that users with medium HIL levels evinced particular trusts with respect to "biased prescriptions" and "secret prescriptions." Additionally, the tendency to "try before judging" health information was discernible. Furthermore, individuals with moderate health information literacy (HIL) levels tend to prefer self-treatment. Once the need for health information arises, individuals typically make one of two decisions: to pursue medical treatment or to engage in self-care. Self-treatment is a salient feature of users at the medium HIL level that is absent in users at other literacy levels. These individuals do not adhere to the physician's recommendations and instead formulate their own treatment plans. For instance, they may elect to forego the medication prescribed by the physician in favor of a different, more palatable option. Moreover, individuals with a medium level of HIL will also select the customer service of JD.COM or Pinduoduo to obtain health information. The customer service of JD.COM or Pinduoduo is a salesperson, and the health information provided by them is not only unprofessional, but also somewhat misleading, so it is definitely unwise to listen to the advice of such people.

4.2.2 Information source selection preferences and the principle of least effort

In this study, groups of users with high, medium, and low literacy levels were analyzed separately in order to facilitate comparison. The findings of the study indicate that health information literacy (HIL) level is a significant determinant of users' selection of health information sources. Individuals with different literacy levels evince disparate preferences with respect to the types of health information sources they utilize. Individuals with high HIL tend to utilize online information sources as a primary way for obtaining health-related information. Conversely, those with low HIL often prefer to obtain health information through direct interactions with doctors at hospitals. The follow-up interviews revealed that the convenience of the information source was a significant factor influencing the preference for a particular type of information source, regardless of the user's HIL level. It is important to note that the term "convenience" in this context does not refer to the conventional understanding of convenience, but rather reflects the perception and cognition of users with varying HIL levels regarding the convenience of specific types of information sources. This is a subjective experience that manifests in the daily lives of users. Individuals with high HIL demonstrate a higher ability to acquire and evaluate online health information. They are typically well-educated, possess more sophisticated thinking, and engage in high-intensity mental work. Consequently, they perceive visiting a doctor as an onerous task. Conversely, users with low HIL levels, due to their subjective belief in their lack of acquisition and evaluation abilities, are resistant to online information and are relatively more engaged in manual work. Consequently, they tend to believe that it is

convenient to obtain health information by going to the hospital and seeing a doctor. Searching for online information, evaluating online information, and selecting and utilizing online information are perceived as "troublesome," which aligns with the "principle of least effort." This behavioral characteristic is consistent with the "Principle of Least Effort". The "Principle of Least Effort" is a methodology for solving problems by minimizing the effort expended on problem-related matters. Furthermore, the term "least effort" does not represent the optimal choice in a practical sense. Rather, it is simply a way to align with everyday experience and minimize the effort that individuals believe is required to access information. For users with high HIL, reducing physical effort and using web-based information to solve most of their health problems at any time and in any location, without leaving their homes, represents the least-effort way of obtaining health information. Consequently, web-based information sources are the optimal information sources for users with high HIL. For users with low HIL levels, seeking assistance from medical professionals and obtaining treatment directly represents their optimal approach to acquiring health information. This is due to their limited proficiency in navigating the Internet to access information. Consequently, medical professionals are regarded as the most reliable source of health-related information. In addition, the physician is regarded as the most reliable source of information.

5. Limitations and Implications

The study revealed that users with different levels of health information literacy exhibit divergent preferences with regard to information sources and the factors that inform those preferences. By synthesizing the deficiencies that users with high, medium, and low health information literacy levels respond to from their behaviors, it is possible to provide more targeted training and guidance to groups with different levels with less effort. Individuals with high HIL tend to utilize the Internet as a source of health information and to monitor their own health conditions, as opposed to seeking medical care. It is therefore crucial that they are introduced to and trained in the use of a variety of high-quality information sources. Moreover, a community doctor's consultation service should be made available, which could take the form of phone calls or web chats for the initial diagnosis of milder diseases. Individuals with medium levels of HIL tend to place a high degree of trust in information sources that appear professional but are not, such as traditional Chinese medicine, personal acquaintances with no formal medical training, and customer service representatives from online shopping platforms. Additionally, they frequently engage in self-treatment based on their own perceptions and preferences, rather than following a medical treatment plan prescribed by a healthcare professional. It is thus imperative to disseminate information regarding the characteristics of advertisements, fake health information, and low-quality health information sources to this demographic. Additionally, guidance should be provided to address their deficiencies in health information literacy and maladaptive behaviors. Those with low HIL lack the ability to search for, evaluate, and utilize online health information. Furthermore, they are more inclined to obtain health information by visiting hospitals than by obtaining online health information. Consequently, it is imperative to assist these users in becoming less apprehensive about online information and to equip them with fundamental abilities such as information retrieval and assessment. This will enable them to leverage high-quality online information to develop their own health strategies.

This study is limited in two parts. Firstly, this study exclusively examined the health information pertinent to diseases in everyday life, and did not consider the types of health information such as weight loss and fitness, healthcare, and so forth. It is recommended that future research be conducted on the health information of weight loss, fitness, and health care in order to enhance the content of research in the field of health informatics. Secondly, the study did not categorize or limit the age and education of the participants, which constrained its ability to explore the selection of information

sources and the influencing factors of different levels of health information literacy. In the future, it would be beneficial to focus on each sample group to fully explore the preferences of age, education, and literacy on the selection of information sources.

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