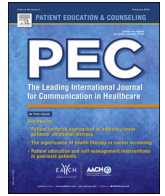




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Information scanning and vaccine safety concerns among African American, Mexican American, and non-Hispanic White women

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ABSTRACT

Objective: A significant number of parents delay or refuse vaccinating their children. Incidental exposure to vaccine information (i.e., scanned information) may be an important contributor to anti-vaccine sentiment. This study examines the association between scanned information, trust in health information sources and vaccine safety concerns among African American, Mexican American, and non-Hispanic White women.

Methods: Women (N=761) in Los Angeles County were sampled via random digit dial and surveyed regarding use of and trust in health information resources and vaccine safety concerns.

Results: Analyses indicate that the sources of information associated with vaccine safety concerns varied by ethnicity. Each ethnic group exhibited different patterns of association between trust in health information resources and vaccine safety concerns.

Conclusions: Information scanning is associated with beliefs about vaccine safety, which may lead parents to refuse or delay vaccinating their children. These relationships vary by ethnicity.

Practice implications: These findings help inform practitioners and policy makers about communication factors that influence vaccine safety concerns. Knowing these sources of information will equip practitioners to better identify women who may have been exposed to anti-vaccine messages and counter these beliefs with effective, vaccine-promoting messages via the most relevant information sources.

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1. Introduction

The recent 2014–2015 measles outbreak in the U.S. illustrates the public health impact of an under-vaccinated population [1]. The number of parents who do not adhere to the CDC immunization schedule by intentionally delaying vaccination or refusing to vaccinate their children altogether has been rising [2–4] in recent years, with estimates placing the percentage of parents refusing at least 1 vaccine for their children at 11.5% [5] and delaying vaccination at 21.5% [3]. The considerable news coverage of the 2014–2015 measles outbreak and the corresponding debates over

vaccination underscore the range of sources through which individuals learn about vaccines. These days, healthcare providers encounter patients whose vaccine beliefs are informed by a wide variety of health information sources, including personal discussion and news reports [6,7]. Increasingly, practitioners are seeking to develop educational and counseling strategies to promote childhood vaccinations. It is thus important to understand how the sources of health information that individuals use affect their vaccine beliefs and behavior [8,9].

There are two key ways that different health information sources may expose individuals to vaccine information: information seeking and through information scanning [10–12]. Vaccine information seeking is the process by which parents deliberately obtain vaccine-related information using means such as asking questions about vaccines to health care providers, friends and family, and looking up vaccine-related information online, in books, and in magazines. It is well-established that the sources

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from which parents seek vaccine information play a key role in the formation of vaccine-related beliefs, ultimately influencing subsequent vaccination behavior [3,13–16]. Parents who use the Internet to obtain information about vaccines, for example, have been found to be more likely to hold anti-vaccine beliefs [13,14] and to delay vaccine administration [3], as were parents who used the library and other types of media [3] and parents who used interpersonal sources (e.g. friends) [13].

While less well-characterized, information scanning may have a significant impact on population-level health outcomes [10,11] that is even greater than information seeking [17]. Information scanning is “information acquisition that occurs within routine patterns of exposure to mediated and interpersonal sources” [12, pp. 154]. These sources also include the Internet, television, print media, friends, family, and healthcare providers, but in this case vaccine information is encountered in a more passive and less deliberate way. For example, an individual watching the local news might incidentally encounter vaccine information when the news features a story about the recent measles outbreak. The vaccine information acquired by watching the news program is scanned information. Thus, while some parents actively seek out information about vaccines, a considerable amount of vaccine information is also encountered and absorbed in a more passive way over the course of more general use of information sources.

It is plausible that scanned information encountered through routine use of information sources impacts vaccine decisions. Individuals encounter a great deal of incidental health information in the course of their general communication patterns [18,19]. In fact, scanned health information is encountered at greater rates than sought information [17,20,21]. Thus, because more individuals are exposed to scanned health information, it likely has a greater impact on population-level health outcomes [10,11]. Scanned information may also prompt additional information seeking [21] that reinforces favorable or unfavorable vaccine attitudes—a pro-vaccination news story encountered while watching TV, for instance, could prompt a parent to ask a pediatrician for more information. Similarly, an anti-vaccination story heard on the radio while driving to work could prompt a parent to search online for anti-vaccine websites when he or she arrives in the office. Additionally, because scanned information is encountered through typical daily patterns of media use, not during active seeking, it may be particularly influential in the formation of initial vaccine attitudes [17]. For example, a young woman may incidentally encounter anti-vaccine information through the media and subsequently form anti-vaccine beliefs long before she has any children.

Lee et al. [22] note that the pathways through which scanned information impacts behavior are not well studied, but research related to information processing and social cognition in persuasion illuminates potential mechanisms through which this effect may occur. The cognitive mediation model [23] theorizes the relationship between exposure to health information in the news and knowledge acquisition and behavioral outcomes [24,25]. In this model, elaboration is a key process through which exposure to information results in behavior. More specifically, elaboration is a process that “relates the incoming information to existing knowledge and images and attaches connotative and associative meanings. Information is linked mnemonically to similar information, placed in an organizational structure, and responses are rehearsed” [26, pp. 19]. Additionally the communication mediation model [27,28] proposes the broad construct of reasoning as a similar pathway mediating the relationship between information exposure and subsequent action.

Lee and colleagues [22] build on these models and test specific pathways through which exposure to scanned health-related information may affect behavior. They find evidence that reflective

integration, a process that includes both elaboration as well as interpersonal discussion about a topic, is a key mediator linking exposure to scanned information and behavioral outcomes. Thus, over the course of everyday patterns of communication, individuals may encounter information related to childhood vaccination. These individuals may then elaborate upon and integrate this information, increasing the likelihood that this information will be retained and ultimately acted upon.

Given this potential for health information scanning to impact childhood vaccination behaviors, the primary aim of this study was to investigate how these “routine patterns” [12, pp. 154] of communication impact vaccine safety concerns (a key factor in vaccine hesitancy) by examining how the general use of different sources of health information is associated with vaccine safety concerns. We also examined the relationship between trust in different interpersonal sources of health information and vaccine safety concerns. Trust is included as a critical factor in how interpersonal sources of health information may influence health behavior [29–31]. In general, people trust sources of health information to which they are routinely exposed [32], including less credible vaccine information sources such as friends and family members [33]. In particular, parents who feel concerned about vaccine safety have been shown to be more likely to trust information from these less scientifically rigorous sources [34–36]. A lack of trust in healthcare providers is one of the factors that may lead parents to reject vaccination protocols despite the healthcare provider's recommendation.

A secondary aim of this study was to investigate the relationships between vaccine safety concerns, information scanning, and trust in interpersonal sources of information among three ethnic groups—African American, Mexican American and non-Hispanic White. Vaccination rates are known to vary by ethnicity [5]. The sources of vaccine-related information that parents trust similarly varies [33]. More broadly, it has been shown that preferred sources of health information vary across ethnicity [37,38]. However, the extent to which these different information sources contribute to varying levels of vaccine safety concerns among members of different ethnic groups has not been well characterized. Because different sources of information may contain very different messages about vaccination, it is important to understand what sources of information are associated with vaccine safety concerns among members of different ethnic groups so that vaccine promotion efforts can be better targeted. Ultimately, understanding the specific sources of health information trusted by parents of different ethnic groups will provide a clearer understanding of how vaccine safety concerns are formed, and will facilitate the development of targeted educational messages that healthcare providers and practitioners can use to combat specific pieces of misinformation.

2. Methods

2.1. Study design

We conducted a secondary data analysis using baseline data from a study on cervical cancer education and communication. A random digit dial (RDD) procedure was used to recruit African American, Mexican American and non-Hispanic White female participants as part of a larger study examining women's health in Los Angeles County. Inclusion criteria were that participants be between 25 and 45 years old and speak English. 761 women completed the measures reported here. All participants provided oral informed consent. The research protocol was approved by the university Institutional Review Board. All interviewing was conducted in English by California Survey Research Services, Inc. Up to six call attempts were made to contact sampled numbers.

Participants received \$25 gift cards as compensation for their participation in the study.

2.2. Measures

To measure vaccine safety concerns, participants were asked the extent to which they agreed with the following statements: “vaccines are unsafe” and “vaccines can have long-term negative side effects.” Response options ranged from “strongly disagree” (1) to “strongly agree” (5). These items were chosen for their ability to predict vaccine refusal [39]. Responses to the two items were averaged. To assess routine sources of health information, participants were asked, “What are the two most important ways you get health and medical information for yourself and your family?” [37]. Responses were coded into nine categories: television; radio; newspapers; Internet; movies, books and magazines; talking with other people; community organizations; leaflets, and flyers and folders. This measure has been used in ethnically diverse, Los Angeles-based communities before to assess individuals’ overall patterns of communication regarding health information and has been found to adequately assess individuals’ sources of information [37,38]. We assessed trust in interpersonal sources of information by asking participants to indicate how much on a scale of 1 (“not at all”) to 10 (“a great deal”) their mother’s, their female friends’, their female relatives’ and their healthcare provider/doctor/nurse’s opinion on health mattered to them. A 1–10 scale was used to reduce participant’s cognitive burden and help the survey progress efficiently.

2.3. Data analysis

The data were analyzed using SPSS 18.0 [40]. After ensuring the data did not violate assumptions of the statistical tests performed, the independent variables of interest were entered into separate regression equations (one for sources of health information and one for trust in health information sources). Separate regression

analyses were conducted for the total sample as well as for each ethnic subgroup after using structural equation modeling by racial/ethnic subgroup (with the beta matrix constrained to be the same pattern) to determine that the subgroups had different sources for trust and health information. The control variables were ethnicity (for the total sample analysis only), level of education (5 categories ranging from ‘some high school or less’ to ‘some graduate school or graduate degree’), income (as a ratio of annual income to number of people supported by that income), age, and health insurance coverage. Control variables were entered into an initial regression analysis by themselves. Only those variables that were associated with vaccine safety concerns at $p < .10$ were controlled for in the analyses for use of and trust in health information sources. All significance tests were two-sided. Sources of media information identified by fewer than five participants were not included in the analysis.

3. Results

3.1. Descriptive statistics

While participants did not have particularly strong vaccine safety concerns, they also did not hold strong pro-vaccine beliefs (see Table 1 for descriptive statistics). Just over one-tenth (11.7%) of participants agreed or strongly agreed with the statement that “vaccines are unsafe” and 19.8% agreed or strongly agreed with the statement “vaccines can have long-term negative side effects.” African Americans held higher levels of vaccine safety concern than non-Hispanic Whites or Mexican Americans (see Table 1).

The Internet (mentioned by 74.2% of participants) was the most popular source of health information, while talking with other people (mentioned by 32.3%), television (mentioned by 22.2%) and books and magazines (mentioned by 16.0%) were also commonly mentioned. Non-Hispanic Whites were less likely to use television than African Americans and Mexican Americans (13.8% compared to 25.1% and 28.5%, respectively) as well as leaflets, flyers or folders

Table 1
Participant characteristics^a.

	Total sample N (%)	African American N (%)	Non-Hispanic White N (%)	Mexican American N (%)
African American	239 (31.4)	–	–	–
Non-Hispanic White	269 (35.3)	–	–	–
Mexican American	253 (33.2)	–	–	–
<High school diploma	155 (20.4)	66 (27.7)	14 (5.2)	75 (19.6)
Income < \$40,000/yr	236 (32.4)	117 (50.5)	32 (12.7)	87 (35.4)
No healthcare coverage	94 (12.4)	34 (14.2)	11 (4.1)	49 (19.4)
Two most important ways to get health/medical information				
TV	169 (22.2)	60 (25.1) ^a	37 (13.8) ^b	72 (28.5) ^a
Radio	29 (3.8)	5 (2.1)	14 (5.2)	10 (4.0)
Newspapers	35 (4.6)	5 (2.1)	17 (6.3)	13 (5.1)
Internet	565 (74.2)	11 (67.4) ^a	216 (80.3) ^b	188 (74.3) ^{a,b}
Movies	2 (.3)	1 (.4)	0 (0.0)	1 (.4)
Books/magazines	122 (16.0)	34 (14.2)	46 (17.1)	42 (16.6)
Talking with other people	246 (32.3)	93 (38.9) ^b	95 (35.3) ^b	58 (22.9) ^a
Community organizations	8 (1.1)	3 (1.3)	3 (1.1)	2 (.8)
Leaflets/flyers/folders	50 (6.6)	16 (6.7) ^a	3 (1.1) ^b	31 (12.3) ^a
Age	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
	38.327 (5.679)	38.046 (5.992)	39.193 (5.155)	37.672 (5.814)
Vaccines are unsafe (range 1–5) ^b	2.160 (1.086)	2.360 (1.153) ^a	1.940 (1.021) ^b	2.210 (1.050) ^a
Vaccines have long-term negative health effects (range 1–5) ^b	2.490 (1.073)	2.640 (1.081)	2.31 (1.121)	2.550 (.987)
Trust in source’s opinion (range 1–10) ^c				
Mother	8.04 (2.728)	8.560 (2.605) ^a	7.460 (2.751) ^b	8.150 (2.716) ^a
Female relatives	6.91 (2.911)	7.330 (3.012) ^a	6.390 (2.711) ^b	7.050 (2.949) ^a
Female friends	6.78 (2.831)	6.840 (3.071)	6.620 (2.473)	6.890 (2.953)
Doctor/nurse/health care provider	9.18 (1.560)	9.180 (1.814)	9.070 (1.449)	9.290 (1.403)

^a Values in the same row with different subscripts are significantly different from each other at $p < .05$.

^b Higher scores indicate increased vaccine safety concerns.

^c Higher scores indicate greater trust.

for health information (1.1% compared to 6.7% and 12.3%, respectively). Non-Hispanic Whites were more likely to use the Internet than African Americans (80.3% vs. 67.4%). Mexican Americans were less likely to talk to other people for health information than were African Americans and non-Hispanic Whites (22.9% compared to 38.9% and 35.3%, respectively). Participants of all ethnic groups reported that their doctor/nurse/health care provider's opinion mattered very much to them (averaging 9.18). Mothers were also strongly trusted (averaging 8.04 on a 10-point scale), while participants reported a moderate level of trust in female relatives and friends (averaging 6.91 and 6.78, respectively).

3.2. Associations between use and trust in health information sources and vaccine safety concerns

Table 2 displays results of the analyses. Results of the regression analysis indicated that among the total sample, being non-Hispanic White ($\beta = -.267, p < .01$) and having a higher level of education ($\beta = -.162, p < .01$) were significantly associated with lower levels of vaccine safety concerns. Age was marginally positively associated with higher levels of vaccine safety concerns ($\beta = .012, p = .065$). Across the total sample, no specific sources of information were associated with vaccine safety concerns ($R^2 = .050, F(11,736) = 3.542, p < .001$). However, trust in one's healthcare provider was associated with less vaccine safety concern ($R^2 = .055, F(7,732) = 6.087, p < .001$). As shown in Table 2, different sources of information predicted vaccine safety concerns within ethnic groups. Among African Americans, using newspapers was associated with increased vaccine safety concerns, while using books and magazines was associated with weaker vaccine safety concerns ($R^2 = .092, F(8,225) = 2.857, p < .01$). Using radio was marginally associated with weaker vaccine safety concerns. Among African Americans, trust in the specific sources of health information (one's doctors, mother, female relatives) was not associated with vaccine safety concerns ($R^2 = .039, F(5,227) = 1.820, p = .110$). Among non-Hispanic Whites, talking to other people for health information was marginally associated with greater vaccine safety concerns ($R^2 = .068, F(8,240) = 2.189,$

$p = .029$). Trust in one's healthcare provider's opinion about health was associated with weaker vaccine safety concerns. Similarly, trust in one's mother's opinion about health was associated with weaker vaccine safety concerns ($R^2 = .109, F(6,238) = 4.871, p < .001$).

Among Mexican Americans, talking to other people for health information was also associated with increased vaccine safety concerns ($R^2 = .078, F(9,238) = 2.225, p = .021$). Trust in one's mother for health information was also associated with increased vaccine safety concerns and trust in one's doctor was associated with decreased vaccine safety concerns ($R^2 = .086, F(6,239) = 3.759, p = .001$).

4. Discussion and conclusion

4.1. Discussion

These findings indicate that different sources for health information scanning are associated with vaccine safety concerns, and that these associations vary by ethnicity. Overall, trust in one's healthcare provider was associated with decreased vaccine safety concerns, while talking with other people as a source of health information was marginally associated with increased vaccine safety concerns. Among African Americans, using newspapers for health and medical information was associated with increased vaccine safety concerns, while using books and magazines was associated with decreased vaccine safety concerns. Among Mexican Americans, talking to other people for health information and trusting one's mother for health information were associated with stronger vaccine safety concerns, while trust in one's healthcare provider was associated with more confidence in vaccine safety. Among non-Hispanic Whites, trust in one's healthcare provider and trust in one's mother for health information were both associated with decreased vaccine safety concern.

Although Internet was the most popular source of health information overall, it was not associated with vaccine safety concerns. This finding differs from other studies which found associations between Internet use and anti-vaccine sentiment

Table 2
Regression analysis of vaccine safety concerns^{a,b}.

	Total sample (N = 761)				African American (N = 239)				Non-Hispanic White (N = 269)				Mexican American (N = 253)			
	B	SE B	β	sig.	B	SE B	β	sig.	B	SE B	β	sig.	B	SE B	β	sig.
Non-Hispanic White	-.267	0.09	-.132	0.003	-	-	-	-	-	-	-	-	-	-	-	-
Mexican American	-.129	0.088	-.063	0.143	-	-	-	-	-	-	-	-	-	-	-	-
Education	-.162	0.06	-.109	0.007	-.109	0.109	-.074	0.317	-.194	0.115	-.108	0.092	-.247	0.095	-.181	0.01
Income	-.01	0.022	-.019	0.635	0.012	0.037	0.024	0.752	-.062	0.037	-.106	0.097	0.024	0.041	0.042	0.553
Has healthcare coverage	-.165	0.111	-.056	0.138	-.333	0.192	-.117	0.084	-.246	0.318	-.049	0.44	-.037	0.144	-.017	0.797
Age	0.012	0.006	0.069	0.065	0.007	0.011	0.04	0.555	0.002	0.012	0.01	0.873	0.024	0.01	0.157	0.015
Important ways to get health information																
TV	0.067	0.095	0.029	0.483	0.114	0.163	0.05	0.485	-.012	0.21	-.041	0.57	0.126	0.139	0.066	0.366
Radio	-.108	0.186	-.022	0.562	-.872	0.456	-.126	0.057	0.047	0.288	0.011	0.869	-.126	0.293	-.029	0.667
Newspapers	0.049	0.17	0.011	0.774	0.989	0.469	0.143	0.036	-.417	0.262	-.104	0.113	0.332	0.257	0.085	0.198
Internet	0.113	0.092	0.051	0.222	0.227	0.154	0.106	0.143	-.038	0.172	-.015	0.825	-.042	0.155	-.021	0.788
Books/magazines	0.028	0.104	0.011	0.789	-.443	0.201	-.154	0.028	0.201	0.186	0.076	0.28	0.108	0.161	0.046	0.504
Talking with others	0.148	0.085	0.072	0.081	-.213	0.15	-.104	0.156	0.283	0.146	0.138	0.054	0.268	0.147	0.13	0.069
Community organizations	0.265	0.338	0.028	0.433	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)	(b)
Leaflets/flyers/folders	-.099	0.152	-.025	0.516	-.168	0.264	-.042	0.525	(b)	(b)	(b)	(b)	-.069	0.192	-.026	0.72
Trust in source's opinion																
Mother	0.01	0.015	0.029	0.503	0.025	0.031	0.065	0.433	-.052	0.026	-.141	0.05	0.062	0.023	0.198	0.008
Female relatives	0.005	0.019	0.014	0.805	0.058	0.037	0.176	0.117	-.023	0.031	-.063	0.461	-.016	0.032	-.054	0.625
Female friends	-.004	0.019	-.011	0.841	-.054	0.034	-.166	0.115	0.056	0.035	0.138	0.111	0.003	0.031	0.009	0.933
Health care provider	-.082	0.024	-.135	0.001	-.048	0.038	-.087	0.206	-.158	0.049	-.232	0.001	-.082	0.04	-.137	0.04

^a Higher scores indicate increased vaccine safety concerns.

^b Item selected by <5 participants.

[3,13,14]. This discrepancy may underscore the difference between deliberate information seeking online and the casual information scanning that was examined in this study. Given the considerable amount of anti-vaccine information online [41,42], an individual deliberately using the Internet to seek vaccine information may be more likely to encounter anti-vaccine propaganda (or may be deliberately seeking it out to support a previously held anti-vaccine belief), while an individual simply scanning the Internet for more general health information or other purposes may be less likely to encounter anti-vaccine websites. Also, individuals who are already vaccine hesitant may seek information online to support their beliefs, while those who use the Internet for day-to-day information scanning may have no anti-vaccine predisposition.

These findings highlight the diversity of health and medical information resources that individuals of different ethnic groups rely on when making health decisions and their subsequent association with vaccine safety concern. These results are further supported by work documenting that African Americans, non-Hispanic Whites, and Hispanics use different sources of information for their health needs [33,37,43]. These findings align with other research on media use which indicates that within any one medium (e.g. TV), members of different ethnic groups often use different specific sources (e.g. TV channels) [38]. Additionally, given the extent to which the relationships between use of these information sources and vaccine safety concerns vary by ethnicity, it is likely that the sources contain different messages about vaccines. For example, the newspapers read by non-Hispanic Whites in this sample may contain more positive messages about vaccines than newspapers read by African Americans. Ongoing monitoring of the extent and valence of vaccine messages in the media channels most used by individuals of different ethnic groups is a logical next step to better characterize the information that engenders anti-vaccine sentiment.

This study's findings regarding trust in healthcare providers should be understood in the context of others' work on general social trust (the extent to which one believes most people can be trusted) and, specifically, trust in one's healthcare provider. This study found overall high levels of trust in healthcare providers, with no significant ethnic differences. Other research, however, finds that African Americans and Hispanics have lower levels of trust in healthcare institutions and providers than non-Hispanic Whites [44–47] and also have lower levels of general social trust [48]. The high levels of trust found in this study could reflect the fact that we asked about one's own doctor/healthcare provider—it has been shown that individuals trust their own healthcare providers significantly more than healthcare institutions or providers more generally [49]. Regardless, the fact that increased trust in one's doctor or healthcare provider was associated with decreased vaccine safety concerns indicates that healthcare providers should build trust with patients as a way to improve confidence in vaccine safety. Trust in a healthcare provider, or other source of information, is a crucial factor that can affect the likelihood that an individual acts upon the information provided by the source.

The strengths of this study include its random-digit dial design, which allows for increased generalizability of the findings and its focus on the three largest ethnic groups in the U.S. [36,50]. Limitations include lack of access to clinical vaccination behavior data to use as a primary outcome. However, vaccine safety concerns are a key predictor of vaccine delay or refusal and are a primary modifiable target of change for clinician communication and intervention. This study was a secondary data analysis and, as such, was constrained by the inclusion criteria pertinent to the primary study. Our sample therefore consisted of English-speaking women ages 25–45 from only 3 ethnic groups and was limited to the Los Angeles area. These constraints could have limited the heterogeneity

of the sample and may have obscured additional variations across ethnic groups. In the future, examining other ethnic groups and including a national sample will allow for greater generalizability. This study described sources of information associated with vaccine safety concern within ethnic subgroups, which can provide insight to vaccine promotion efforts that target individuals by ethnicity. Future studies might go further in testing for ethnicity as a moderator of specific mechanisms of trust building. Examining potential differences within ethnic groups may assist ongoing efforts to promote vaccination among diverse populations. Additionally, our measures of individuals' sources of health information assessed general, overall patterns of communication and were not able to capture fine gradients in the amount of health, or vaccine-related, information individuals were exposed to. We used this measure to be consistent with the definition of information scanning as information that is acquired over the course of "routine patterns" of communication. In the future, researchers may wish to also use more specific measures of exposure. Our measure also allowed participants to select only two sources of information. While it is likely that individuals obtain health information from a wider breadth of sources [12], limiting the number of sources to two provides greater sensitivity for detecting ethnic differences in the information scanning-vaccine safety concern relationship, particularly because research indicates that while individuals may scan a large number of sources for information, few of these sources are actually informative for health decisions [12]. Finally, the cross-sectional design of this study does not allow us to make claims about causality. It is possible that vaccine hesitant individuals turn to different channels for health information than non-vaccine hesitant individuals (e.g. a selective exposure bias) [51,52].

4.2. Conclusion

Regardless of this possible selective exposure bias, the potential impact of incidental or scanned information is immense. Because scanned vaccine information may be an individual's first exposure to vaccine-related information, it can potentially be instrumental in the initial formation of vaccine beliefs. Additionally, scanned information, particularly that in mass media, is encountered by large numbers of people, thus it can produce significant population-level shifts in beliefs and behavior [10,11]. Therefore, scanned information is an important factor to consider when examining both the development and maintenance of concerns about vaccine safety and has a critical part to play in future intervention strategies.

4.3. Practice implication

Clinicians, practitioners and public health officials can use the findings from this study to develop and implement educational interventions. Further studies examining the vaccine-related content of these sources will be key to understanding the specific nature of the anti-vaccine information being disseminated, to whom, and through which medium. This can inform the development of strategies to combat and protect the public from these messages. Using these results, health communicators can coordinate and disseminate culturally tailored pro-vaccine messages in sources associated with vaccine safety concerns appropriate to each group (for instance, placing a pro-vaccine story in a newspaper read by African Americans, where it should have maximum impact).

Moreover, this study's findings illustrate the extent to which the media environment could possibly influence patients' beliefs, which could subsequently impact vaccine decisions. Indeed, the 2014–2015 measles outbreak underscores the public health impact of allowing unreliable sources of information to go unchecked. The

clinical encounter can be a pivotal moment where vaccine safety concerns that stem from the media are either dissolved or coalesce into vaccine delay or refusal. During the clinical encounter, healthcare providers must counsel patients whose vaccine safety concerns are informed by a complex media landscape that patients may not have the health literacy skills needed to navigate [12]. Healthcare providers can take several steps to limit the impact of anti-vaccine information on parents' vaccine-related beliefs and behaviors. First, clinicians can help translate vaccine-related information. This includes dispelling vaccine myths from unreliable sources as well as explaining credible vaccine information in understandable ways. Clinicians can also counsel patients on how to access trusted sources of health information and how to identify information from untrustworthy sources. Clinicians can also take steps to ensure all patients have the capacity to obtain, process and understand accurate vaccine-related information. Increasing the health literacy of patients can empower individuals to evaluate and appropriately use vaccine-related information and thus may be a crucial step to reducing vaccine safety concerns. Given the significant time constraints often faced by clinicians, community-based interventions could also be plausible ways to implement these suggestions.

Because scanned information is encountered throughout one's lifespan, not just during pregnancy or parenthood, it is important to counsel individuals during all phases of life in this regard. Given the emergence of new infectious agents and the re-emergence of old infectious diseases, concerted efforts are needed to combat inaccurate information and to disseminate accurate information through the most appropriate channels to the various groups at potential risk. Practitioners should engage in a continual open dialog with patients regarding recently encountered vaccine information. Having ascertained from which sources the information came, and how much the patient trusts those sources, the practitioner will be better equipped to provide tailored education and counseling regarding the veracity and utility of that information to the patient.

Informed consent

The author confirms all patient/personal identifiers have been removed or disguised so the patient/person(s) described are not identifiable and cannot be identified through the details of the story.

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