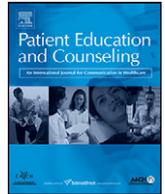




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### Communication Study

## Physician–patient communication about dietary supplements

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#### ABSTRACT

**Objective:** Describe the content and frequency of provider–patient dietary supplement discussions during primary care office visits.

**Methods:** Inductive content analysis of 1477 transcribed audio-recorded office visits to 102 primary care providers was combined with patient and provider surveys. Encounters were collected in Los Angeles, CA (2009–2010), geographically diverse practice settings across the United States (2004–2005), and Sacramento, CA (1998–1999).

**Results:** Providers discussed 738 dietary supplements during encounters with 357 patients (24.2% of all encounters in the data). They mentioned: (1) reason for taking the supplement for 46.5% of dietary supplements; (2) how to take the supplement for 28.2%; (3) potential risks for 17.3%; (4) supplement effectiveness for 16.7%; and (5) supplement cost or affordability for 4.2%. Of these five topics, a mean of 1.13 (SD = 1.2) topics were discussed for each supplement. More topics were reviewed for non-vitamin non-mineral supplements (mean 1.47 (SD = 1.2)) than for vitamin/mineral supplements (mean 0.99 (SD = 1.1);  $p < 0.001$ ).

**Conclusion:** While discussions about supplements are occurring, it is clear that more discussion might be needed to inform patient decisions about supplement use.

**Practice implications:** Physicians could more frequently address topics that may influence patient dietary supplement use, such as the risks, effectiveness, and costs of supplements.

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### 1. Introduction

Over half of all Americans take dietary supplements [1,2], but such supplements may pose significant risks, including potential supplement–drug interactions [3–6], side effects, and other adverse effects [7–11], and may incur unnecessary costs. More than 15 million adults are at risk for interactions between prescription medications and herbal supplements or high-dose vitamins [12]. Furthermore, patients may replace or decrease conventional medication use in favor of a dietary supplement [7,8,13]. Because of these concerns, organizations such as the

United States Food and Drug Administration and National Institutes of Health recommend that patients consult a health professional before starting a dietary supplement [14,15].

Recommendations suggest that physicians engage patients about dietary supplements by inquiring about supplement use, evaluating supplements, discussing available safety and efficacy data, and monitoring for adverse events and therapeutic responses [16,17]. However, these suggestions do not account for potential inadequate physician knowledge about supplements [18], and little is known about what actually transpires during office visits. Some studies have analyzed discussions about complementary and alternative therapies with oncology patients [19] and older patients [20]. But these studies did not focus on dietary supplements, for which there are special safety considerations. In addition, these analyses did not address the actual content of the information exchanged during physician–patient conversations.

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We analyzed three datasets, collected in three different studies during different time periods between 1998 and 2010, to describe the content and frequency of discussions about dietary supplements, and to investigate variations in communication based on supplement type (vitamins/minerals versus non-vitamin non-mineral (NVNM) dietary supplements; the latter may have more potential for medication–supplement interactions).

## 2. Methods

This study combines data from three separate studies, collected during three different time periods across different geographical areas in the United States. Data also were aggregated to increase the potential number of encounters containing dietary supplement discussions, and to ensure a more complete characterization of dietary supplement conversations. Investigators from each of the three studies first recruited primary care physicians for study participation, and then recruited patients of participating physicians. None of the original study aims involved dietary supplements or complementary and alternative medicine. Each study linked audio recordings of physician–patient encounters to patient and physician survey data. Complete details about each of the studies are described elsewhere [21–23]. The current analyses were approved by the University of California, Los Angeles Institutional Review Board (IRB #11-000924).

### 2.1. Setting/participants

The first study contained 256 patient encounters with 27 primary care physicians in Southern California (2009–2010), and investigated the impact of an intervention to improve communication about newly prescribed medications. All patient participants were aged 50 and older, spoke English, and had a new, worsening, or uncontrolled problem. The second study included audio recordings from 733 visits to 41 providers (40 physicians, 1 physician's assistant) in twenty geographically diverse settings across the United States (2004–2005). It assessed the effect of an intervention to improve patient question asking. All patients in the study were aged 18 and older and spoke either English or Spanish. The third study was conducted in Sacramento, CA (1998–1999), and contributed 490 interactions with 34 physicians. This study evaluated the relationship of request fulfillment on patient outcomes. Eligible patients were aged 18 and older, and had a new, worsening, or uncontrolled problem, or were “somewhat concerned” about their health. The combined sample consisted of 1479 individual patients and 102 clinicians.

### 2.2. Definition and classification of dietary supplements

The term “dietary supplement” is often used to denote a wide range of products. In this study, the definition of a dietary supplement came from the Dietary Supplement Health and Education Act of 1994 (DSHEA) [24,25], which states that a dietary supplement is a product containing one or more of the following: “a vitamin, a mineral, an herb or other botanical, an amino acid, a dietary substance for use by man to supplement the diet by increasing the total daily intake, or a concentrate, metabolite, constituent, extract, or combinations of these ingredients.” We refined the DSHEA definition using criteria stipulated in the National Health and Nutrition Examination Survey (NHANES), which suggests including both oral and injectable supplements, and excluding beverages (such as tea), meal replacement beverages, weight loss and performance booster drinks, and food bars [26]. The investigators classified dietary supplements into one of two categories: (1) vitamin or mineral dietary supplement; or (2) NVNM dietary supplement.

### 2.3. Patient and physician characteristics

Patients and physicians in all three studies completed questionnaires asking about their age, gender, and race/ethnicity. In addition, patients were asked about their educational attainment, and physicians were asked about their practice specialty and years in practice.

### 2.4. Qualitative analysis of office visits

Transcripts of audio-recorded office visits were analyzed to assess the content and frequency of discussions about dietary supplements. Three investigators with diverse backgrounds (a practicing primary care physician, a medical sociologist, and an applied linguist) formed the coding team. All had experience in qualitative research concerning physician–patient communication.

The coding team first reviewed all transcripts of the audio recordings to identify those containing conversations about dietary supplements. After the initial review, they independently used an iterative review process to develop themes describing the content of all dietary supplement conversations. Recurrent themes were generated from iterative review of the data, and were based on the investigators' clinical experience, and on their previous work on medication-related physician–patient communication. Themes were discussed with other investigators to reach consensus about the list of themes and their definitions. Categorically similar themes were grouped together.

The coding team applied codes representing each of the themes to transcripts containing discussions about dietary supplements. Coding was conducted at the level of the dietary supplements. One coder (JSG) coded all transcripts, a second double-coded 75% (DMT), and a third double-coded the other 25% (DAP). The coders achieved mean Cohen's kappa for inter-rater reliabilities of 0.88 (SD = 0.12) and 0.87 (SD = 0.09), respectively.

Using established methods, visits also were analyzed to determine whether a new medication was prescribed [27], since the prescription of a new medication might engender more discussion about dietary supplements. A new medication was defined as one that the patient had never taken before, or a medication given for an acute symptom or condition, such as an antibiotic or analgesic.

The investigators also applied codes related to the dynamics of the communication exchange. They coded for whether the first mention of each dietary supplement raised during the office visit was initiated by the patient or by the physician. In addition, they categorized the initial discussion of each dietary supplement as being in the context of medication reconciliation, medication initiation, discussion of a patient's treatment plan or symptom, or other conversation.

### 2.5. Supplement Communication Index

We empirically derived a measure of the quality of conversation about supplements, the Supplement Communication Index (SCI), based on the major themes generated during our transcript analyses. The SCI is analogous to the Medication Communication Index (MCI), which describes the quality of conversations about newly prescribed medications [27]. The SCI is an index ranging from 0 to 5 (a continuous variable) that gives one point for fulfillment of each of five major categories of communication about dietary supplements: (1) reason for taking supplement; (2) how to take supplement; (3) potential risks; (4) effectiveness; and (5) cost/affordability. Higher scores indicate more complete communication. Recognition of supplement discussions is based on qualitative coding and analysis of office visits, and was

evaluated for each individual supplement raised during an office visit. Assessing conversations at the supplement level allowed us to quantify differences in communication about different types of dietary supplements.

2.6. Statistical analysis

STATA version 12.1 (StataCorp, College Station, TX) was used for all statistical analyses. We calculated descriptive frequencies of patient, physician, and dietary supplement characteristics, both overall and by year of data collection. We also calculated frequencies for recognition of discussion topics generated by qualitative analysis. These frequencies were calculated overall and by type of supplement (vitamin/mineral or NVNM dietary supplement).

We assessed the relationship between patient, physician, dietary supplement, and communication exchange characteristics on the Supplement Communication Index (SCI) using generalized estimating equations (GEE) in bivariate and multivariate linear analyses. We also used GEE in multivariate logistic analyses to assess the relationships between a new medication prescription and whether each of the SCI components was discussed (yes/no). GEE accounts for clustering of patients within physicians. Continuous independent variables were patient and physician age, number of years a physician had been in practice, and number of dietary supplements discussed during the visit. Categorical independent variables were patient and physician gender and ethnicity, patient educational achievement, physician

specialty, year of data collection, type of dietary supplement (vitamin/mineral or NVNM dietary supplement), the prescription of a new medication during the visit, initiation of discussion (patient or physician), and context of discussion (medication reconciliation, medication initiation, treatment or symptom discussion, other). Missing variables ranged from 2 to 3.5%. A sensitivity analysis using multivariate normal imputation to account for missing variables produced results similar to the analysis described above.

3. Results

3.1. Patient, physician, and dietary supplement characteristics

Table 1 describes the characteristics of physicians and patients who did and did not have conversations about dietary supplements. Of 1479 patients, 357 (24.2%) had visits with discussions about dietary supplements. Compared to patients who did not discuss dietary supplements, those who had conversations with their physicians were comprised of more females (67.5% versus 60.6%) and had higher educational achievement. The 2009–2010 study had more black and Asian patients than the other two studies. They also were older and more educated.

Overall, 87% of physicians in the study discussed dietary supplements with at least one study patient. Physicians were mostly white, male, and family physicians. Only 74.1% of physicians in the 2009–2010 study had supplement discussions, but all physicians without supplement discussions in the study

Table 1  
 Patient and physician characteristics.

	Did not discuss dietary supplements (all studies)	Discussed dietary supplements			
		All studies	1998–1999	2004–2005	2009–2010
<b>Patient characteristics<sup>a</sup></b>					
N	1122	357	110	152	95
% of all patients	75.8	24.2	22.4	20.7	37.1
Female (%) <sup>†</sup>	60.6	67.5	64.2	71.3	65.3
Age, mean (SD)	53.7 (16.3)	59.5 (13.8)	59.6 (15.0)	56.2 (13.9)	64.7 (10.5)
Race/ethnicity (%)					
White	75.8	79.8	85.1	86.3	63.8
Hispanic	7.1	5.2	4.7	3.4	8.5
Black	10.6	7.2	3.7	5.5	13.8
Asian	3.2	3.2	0.9	0.7	9.6
Other	3.3	4.6	5.6	4.1	4.3
Highest level of education completed (%) <sup>§</sup>					
High school or less	33.3	25.2	22.4	33.3	15.8
Some college	35.0	35.8	35.5	37.4	33.7
College graduate	31.7	38.7	42.1	29.3	49.5
Specialty of physician seen (%) <sup>‡</sup>					
Internal medicine	29.5	36.4	56.9	4.7	63.2
Family medicine	69.6	59.6	43.1	86.0	36.8
Other	0.9	4.0	0	9.3	0
<b>Physician characteristics</b>					
N	14	88	32	36	20
% of all physicians		86.3	94.1	87.8	74.1
Age, mean (SD) <sup>§</sup>	35.4 (9.1)	43.4 (9.7)	42.7 (8.4)	46.6 (9.1)	38.7 (10.9)
Female (%)	50.0	39.1	40.6	31.4	50.0
Specialty (%) <sup>‡</sup>					
Internal medicine	66.7	38.4	53.1	5.9	70.0
Family medicine	33.3	61.6	46.9	91.4	30.0
Race/ethnicity (%) <sup>†</sup>					
White	41.7	71.3	75.0	74.3	60.0
Asian	33.3	17.2	12.5	11.4	35.0
Other	25	11.5	12.5	14.3	5.0
Years in practice, mean (SD) <sup>§</sup>	4.5 (6.3)	13.5 (9.9)	16.1 (9.0)	13.9 (9.1)	8.8 (11.2)

<sup>a</sup> Total of 1479 patients had visits to 102 clinicians (490 saw 34 clinicians in 1998–1999 data, 733 saw 41 clinicians in 2004–2005 data, and 256 saw 27 clinicians in 2009–2010 data); statistical significance assessed for those who did/did not discuss dietary supplements.

<sup>†</sup>  $p < 0.05$ .

<sup>§</sup>  $p < 0.01$ .

<sup>‡</sup>  $p < 0.001$ .

**Table 2**  
Frequency of dietary supplements discussed by year of data collection.

	Total	1998–1999	2004–2005	2009–2010
<i>n</i> (mean per visit)	738 (2.1/visit)	214 (2.1/visit)	265 (1.7/visit)	259 (2.7/visit)
Vitamins/minerals	525	150	191	184
Calcium, vitamin D <sup>†</sup>	169 (22.9)	34 (15.9)	56 (21.1)	79 (30.5)
MVI	80 (10.8)	19 (8.9)	31 (11.7)	30 (11.6)
Prenatal vitamins/folic acid	22 (3.0)	8 (3.7)	9 (3.4)	5 (1.9)
Potassium <sup>‡</sup>	42 (5.6)	12 (5.6)	22 (8.3)	8 (3.1)
Iron <sup>‡</sup>	29 (3.9)	14 (6.5)	13 (4.9)	2 (0.8)
Niacin	13 (1.8)	2 (0.9)	6 (2.3)	5 (1.9)
Other vitamins/minerals	170 (23.1)	61 (28.5)	54 (20.4)	55 (21.2)
Non-vitamin non-mineral dietary supplements	213	64	74	75
Glucosamine chondroitin <sup>†</sup>	40 (5.4)	18 (8.4)	15 (5.7)	7 (2.7)
Fish oil/omega 3 <sup>†</sup>	35 (4.7)	0	13 (4.9)	22 (8.5)
Fiber supplement	22 (3.0)	8 (3.7)	9 (3.4)	5 (1.9)
Other natural products	116 (15.7)	38 (17.8)	37 (14.0)	41 (15.8)

<sup>†</sup>  $p < 0.05$ .<sup>‡</sup>  $p < 0.01$ .<sup>\*</sup>  $p < 0.001$ .

were resident physicians who had five or fewer visits audio recorded.

The office visits analyzed contained discussions about 93 different dietary supplements (Appendix). There were a total of 738 discussions; 525 discussions about vitamins or minerals, and 213 discussions about NVNM dietary supplements. Discussions about calcium/vitamin D and fish oil/omega 3 fatty acids increased in more recent years, while conversations about glucosamine/chondroitin and iron decreased (Table 2).

### 3.2. Content and frequency of dietary supplement discussions

From our qualitative analysis of transcribed office visit audio recordings, we found that the conversational content surrounding dietary supplements fell under five major topics, some of which had several subtopics (Table 3). The major topics included: (1) reason for taking dietary supplement; (2) how to take it; (3) potential risks; (4) effectiveness; and (5) cost. The Supplement Communication Index (SCI) score is calculated by giving one point for discussion about each of these five major topics.

The most frequently discussed topics were: the reason for taking a dietary supplement (46.5% of supplements), and how to

take a supplement (28.2%). All other topics were discussed for fewer than 20% of supplements. More discussion about all sub-topics related to potential risks and effectiveness occurred for NVNM dietary supplements than for vitamins and minerals. In addition, NVNM supplements engendered more discussion about the reason for taking a supplement and also about cost. Discussions about how to take a supplement occurred more frequently for vitamins and minerals than for NVNM dietary supplements.

Conversations about how to take a supplement included the number of pills taken at a time, how often it is taken (frequency of use), how long the patient has been taking or should take it (duration of use), and dosing of major ingredients in the supplement. Dosing discussions included comments or questions about supplement dosing (e.g., “And how much iron are you taking?”) as well as conversations about high or low dosing. Communication about potential supplement risks touched upon topics such as potential supplement side effects or adverse reactions, supplement–drug or supplement–supplement interactions, and evaluations of supplement safety (e.g., “It is typically safe in most patients”) or potential for harm (e.g., “I’m a little cautious about herbals because there are some things that could be potentially hazardous”). Risk discussions included statements

**Table 3**  
Frequency of discussion topics by supplement type (%).

Discussion topics	Total frequency of discussion	Vitamins/minerals	Non-vitamin non-mineral dietary supplements
<i>N</i>	738	525	213
(1) Reason for taking (purpose/justification) <sup>†</sup>	46.5	39.1	64.8
(2) How to take	28.2	29.9	23.9
Number of pills	11.8	11.4	12.7
Frequency of use	13.8	14.1	13.2
Duration of use <sup>*</sup>	7.1	5.5	10.8
Dose <sup>†</sup>	15.2	18.9	6.1
(3) Potential risks <sup>†</sup>	17.3	13.7	26.3
Side effects	9.5	8.6	11.7
Interactions <sup>†</sup>	4.2	2.5	8.5
Safety <sup>*</sup>	1.4	0.8	2.8
Harmfulness <sup>†</sup>	6.1	3.8	11.7
(4) Effectiveness <sup>†</sup>	16.7	13.0	25.8
Evidence for use <sup>†</sup>	6.0	3.6	11.7
FDA regulation/purity <sup>†</sup>	1.0	0.2	2.8
Utility <sup>†</sup>	18.4	14.5	28.2
(5) Cost/affordability <sup>*</sup>	4.2	3.2	6.6
Supplement Communication Index, mean (SD) <sup>†,a</sup>	1.13 (1.2)	0.99 (1.1)	1.47 (1.2)

<sup>a</sup> Mean score ranges from 0 to 5 and indicates the number of major topics (of the 5 listed above) touched upon during office visits.<sup>\*</sup>  $p < 0.05$ .<sup>†</sup>  $p < 0.001$ .

**Table 4**

Examples of physician–patient discussions about dietary supplements.

**Example 1: patient asking for physician's opinion about a list of dietary supplements:**

Patient: What kind of a professional would look at that page and tell me, in my condition, is any of this any good?

Doctor: Whether these herbs are any good?

Patient: Yeah.

Doctor: Well, I actually know a fair bit about herbs and vitamins.

Patient: I think I'm overkilling here.

[some intervening conversation]

Doctor: Ginkgo biloba. You know, I really don't think that is going to be very helpful for you. There is some weak evidence, probably out of Europe, that for people who have mild dementia it might help, and you don't have mild dementia. [Both chuckle.] No, 'you don't have dementia' is what I should say, and that is probably quite pricey, isn't it?

Patient: No, about five or six bucks. I get so many catalogs that I can shop [for supplements].

Doctor: I bet there is some ginkgo in this [other supplement on your list] here. I think both of those may not be all that helpful for you.

**Example 2: Physician cautions against taking high doses of vitamins**

Doctor: ...a multivitamin is perfect. Now, taking too much of vitamins can have toxicity. So never take more than just a simple multivitamin a day, okay? So if you're taking high doses of vitamin E, vitamin C..., let me know, because I need to know how much you're taking. High doses do have toxicities in the vitamins

you know. Little bit is a good thing, a lot is a bad thing.

Patient: Of anything.

Doctor: Of anything.

orienting patients about how to evaluate potential risks as well as those indicating physician knowledge (or lack thereof) about supplement risks. Conversations about effectiveness consisted of statements evaluating the evidence for taking supplements, mentions about supplement purity, and comments about

supplement utility (usefulness for a certain condition; e.g., "it's supposed to be good for your health").

Table 4 presents two examples of interactions that touch upon some major topics delineated in this study. In the first example, the patient asks for advice about taking dietary supplements. The

**Table 5**

Bivariate relationships and multivariate model predicting Supplement Communication Index.<sup>a</sup>

Independent variables	Mean score	Correlation coefficient	b-Coefficient for multivariate relationship
Type of supplement			
Vitamins or minerals	<b>0.99 (1.10)<sup>*</sup></b>		
Non-vitamin non-mineral dietary supplements	<b>1.47 (1.23)<sup>*</sup></b>		<b>0.39<sup>*</sup></b>
Patient age		−0.0004	−0.001
Female patient	1.09 (1.17)		−0.04
Male patient	1.22 (1.14)		N/A
Race/Ethnicity			
White	1.11 (1.14)		N/A
Hispanic	1.31 (1.31)		0.23
African-American	1.20 (1.07)		0.08
Asian	1.57 (1.41)		<b>0.47<sup>†</sup></b>
Other	1.12 (1.27)		−0.05
Educational achievement			
High school or less	1.08 (1.00)		−0.08
Some college	1.08 (1.20)		0.02
College graduate	1.19 (1.19)		N/A
Physician age		−0.004	−0.02
Female physician	1.02 (1.07)		−0.16
Male physician	1.19 (1.19)		N/A
White physician	1.12 (1.17)		N/A
Non-white physician	1.15 (1.13)		−0.04
Physician years in practice		−0.001	0.01
Year of visit			
1998–1999	1.24 (1.07)		0.02
2004–2005	1.07 (1.14)		0.05
2009–2010	1.09 (1.24)		N/A
New medication prescribed	1.22 (1.19)		−0.08
No new medication prescribed	1.11 (1.15)		N/A
Number of dietary supplements discussed		−0.04	−0.03
Patient-initiated discussion	1.15 (0.06)		−0.16
Physician-initiated discussion	1.11 (0.06)		N/A
Context of discussion			
Medication reconciliation	<b>0.77 (1.06)<sup>*</sup></b>		<b>−0.39<sup>‡</sup></b>
Medication initiation	1.42 (1.30)		0.14
Treatment plan or symptom	<b>1.57 (1.08)<sup>*</sup></b>		<b>0.36<sup>‡</sup></b>
Other context	1.11 (1.18)		N/A

<sup>a</sup> Supplement Communication Index score ranges from 0 to 5.  $n = 693$ ;  $R^2 = 0.13$ . Independent variables have reference groups as follows: patient age: per year; female patient: male; race/ethnicity: white; educational achievement: college graduate; physician age: per year; female physician: male physician; non-white physician: white physician; year of visit: 2009–2010; new medication prescribed: no new medication prescribed; number of dietary supplements discussed: per dietary supplement; patient-initiated discussion: physician-initiated discussion; context of discussion: other context.

<sup>\*</sup>  $p < 0.001$ .

<sup>†</sup>  $p < 0.05$ .

<sup>‡</sup>  $p < 0.01$ .

ensuing discussion includes topics related to the purpose (“for people who have mild dementia”) and effectiveness of ginkgo biloba. The physician mentions that the evidence for using it is “weak,” and states that its utility is likely low (“I don’t think that is going to be very helpful for you”). In addition, they talk about how much ginkgo biloba costs. In the second example, the physician cautions the patient about the potential risks of taking high doses of vitamins.

### 3.3. Characteristics associated with dietary supplement discussions

The mean Supplement Communication Index (SCI) score for the 738 dietary supplement discussions was 1.13 (SD = 1.2) out of five points, indicating that less than 25% of the major topics were discussed during outpatient office visits. For 281 supplements (38.1%), no major topics were discussed. All five major topics were discussed for only six supplements (0.8%). The SCI was significantly greater when discussions focused on NVNM dietary supplements (mean 1.47 (SD = 1.2)), compared to vitamins or minerals (mean 0.99 (SD = 1.1)) ( $p$ -value < 0.001). The SCI had a Cronbach’s alpha of 0.53.

In both bivariate and multivariate analyses (Table 5), significant predictors of higher SCI scores included discussion about NVNM supplements, and discussion of supplements in the context of medication reconciliation or in the context of a patient’s treatment plan or symptom. There was no association between the person initiating the discussion about a dietary supplement (patient or physician) and the SCI. Patients receiving a new prescription had more complete supplement discussions than those not prescribed a new medication (SCI = 1.22 versus 1.11), though this relationship was not statistically significant. In addition, the prescription of a new medication was not significantly related to discussions about the individual components of the SCI (data not shown).

## 4. Discussion and conclusion

### 4.1. Discussion

This study combines data from three different time periods, collected in diverse geographical settings in the United States, to provide a description of primary care physician–patient information exchange about dietary supplements. Prior studies did not specifically examine conversations specific to dietary supplements because they grouped supplement discussions with other complementary and alternative medicine treatments [19,20]. This study demonstrates that discussions about meaningful topics that could inform patient dietary supplement use occurred infrequently in outpatient visits from all three studies. Clinicians touched upon fewer than 25% of five major topics of conversation identified, and mentioned information about potential risks and effectiveness for less than 20% of the dietary supplements discussed. Though supplements were discussed more frequently in more recent visits (driven mostly by discussions about calcium, vitamin D and fish oil), the number of topics presented for individual supplements was not significantly different.

It may be unfair to expect physicians to convey complete information about dietary supplements. The literature suggests that providers advise patients by asking why they are using dietary supplements, touching upon regulatory issues, and addressing available safety and efficacy data [16,17]. However, many dietary supplements may consist of a blend of natural products, some of which may be obscure. Physicians may have limited training and knowledge about dietary supplements [18,28], may be unaware of resources from which to seek information, or may have difficulty finding information in medical references or in the medical literature. It also may be unrealistic to expect physicians to seek

information about obscure supplements during time-constrained office visits in which competing demands abound [29]. Patients often fail to disclose supplement use to physicians because they believe their physician does not have enough knowledge to provide substantive feedback [30]. However, regardless of a physician’s fund of knowledge about an individual supplement, s/he could discuss the information that patients should consider or investigate when making decisions about supplement use [31].

Our findings indicated that discussions of major topics about dietary supplements were not determined by patient or physician characteristics. However, these discussions were associated with the contexts in which the topic of supplement use was raised. More topics were initiated when supplements were brought up in the context of patient symptoms or treatment for medical conditions, while fewer topics were raised in the context of medication reconciliations. Future studies could examine whether other contexts, such as discussion about nutrition or lifestyle, might influence the content of dietary supplement discussions. We found no relationship between the content of conversations and the person (patient or physician) initiating dietary supplement discussions, but detailed interactional analyses may reveal sequencing patterns in the discourse that may influence the types and detail of supplement conversations between physicians and patients.

Providers and patients reviewed more major topics when discussing NVNM dietary supplements than when talking about vitamins or minerals. This finding suggests that physicians may be attuned to the possibility of supplement–drug interactions, since many NVNM supplements may interact with prescription medications [3–6]. Alternatively, it could indicate that patients are initiating more discussions about NVNM products, perhaps because they are concerned about adverse reactions. More investigation is needed to determine the source of conversation initiation for NVNM supplements.

The prescription of a new medication was not associated with discussion about more major topics or with increased communication about individual topics. On the surface, this may seem concerning because of the risk of supplement–drug interactions. However, these results should be interpreted cautiously. When a new medication is prescribed, patient disclosure of dietary supplement use is more important than discussion about the supplement because disclosure will allow a physician to assess for potential problems or interactions. More investigation is required to ascertain whether better disclosure of dietary supplement use occurs when a new medication is prescribed, and to examine whether potential supplement–drug interactions were appropriately addressed.

This study is subject to the limitations inherent in each of the individual studies, and by the fact that each of the studies collected different survey data. First, we were unable to quantify the total number of dietary supplements patients were taking, so we could not assess whether the lack of a supplement discussion indicated non-disclosure or lack of supplement use. Since the data analyzed for this study represents only the supplements that were actually mentioned during the office visits, it likely over-estimates the frequency of discussion topics because we did not include supplements that were not discussed in our analyses. Second, we did not have complete information about patient medical conditions or medications and were unable to assess whether the patients were at risk for supplement–medication interactions or for adverse events. Third, we do not know whether dietary supplements were discussed during earlier physician–patient visits. Fourth, the data are subject to the Hawthorne effect, in which physicians and patients alter their behavior based on the presence of the audio recorder in the room. It is unlikely that specific conversations about dietary supplements were affected

because none of the study aims pertained to complementary and alternative medicine topics. Lastly, this study examined only the content of the information exchanged about dietary supplements and did not focus on interactional elements such as style of communication, which also could influence patient decisions to use supplements.

4.2. Conclusion

This study provides an understanding of the information exchanged when dietary supplements are discussed during primary care outpatient office visits; our findings indicate that topics of potential influence to patient decisions about supplement use are infrequently reviewed.

Future studies should examine the relationship between physician–patient discussions on patient decision-making about dietary supplements, and investigate whether discussions are effective for preventing adverse events and supplement–drug interactions. A better understanding about these relationships could inform future interventions to enhance physician–patient communication about dietary supplements.

4.3. Practice implications

Since dietary supplements are available over the counter, patients can obtain them without a physician’s knowledge. Yet some supplements may result in adverse events or interact with a patient’s prescription medications [3–6]. Physician–patient communication about a dietary supplement may influence a patient’s decision to use a supplement, and may prevent patient harm. This study suggests that physicians could more frequently address topics that may influence patient dietary supplement use, such as the risks, effectiveness, and costs of supplements.

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

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Appendix. Complete list of supplements discussed

	Total
n (mean per visit)	738
Vitamins/minerals	525
1. Calcium	100
2. MVI	80
3. Vitamin D, calcium	69
4. Potassium	42
5. 'Vitamin'	35
6. Vitamin C	33
7. Iron	29
8. Vitamin E	29

Appendix (Continued)

	Total
9. Prenatal vitamins/folic acid	22
10. Magnesium	15
11. Niacin	13
12. Vitamin B complex	11
13. Vitamin B12	11
14. Zinc	6
15. Vitamin B6	5
16. Beta carotene	3
17. 'Natural vitamins'	3
18. Vitamin B1	3
19. Vitamin B	2
20. Vitamin liquid	2
21. Calcium, mag, zinc vitamin	1
22. Chromium	1
23. 'Minerals'	1
24. 'Ocular vitamins'	1
25. Powdered vitamins	1
26. Selenium	1
27. Vitamin B50	1
28. 'Vitamin with D'	1
29. 'Vitamin with calcium'	1
30. Vitamins with iron	1
Non-vitamin non-mineral dietary supplements	213
31. Glucosamine chondroitin	40
32. Fish oil/omega 3	35
33. Fiber supplement	22
34. Gingko biloba	11
35. Saw palmetto	9
36. Flaxseed oil	7
37. Weight loss supplement	6
38. CoQ10	5
39. Cod liver oil	5
40. 'Supplements'	5
41. Garlic pills	4
42. 'Herb supplement'	4
43. Valerian	3
44. Acidophillus	2
45. Black cohosh	2
46. Cranberry	2
47. Melatonin	2
48. Probiotics	2
49. Prostate supplement	2
50. Protein supplement	2
51. DHEA	1
52. NADH supplement	1
53. Arthrozyme	1
54. Beano	1
55. Cholesterol supplement	1
56. Cinnamon	1
57. Circulation supplement	1
58. Creatine monohydrate	1
59. Dandelion	1
60. Digestive enzyme	1
61. Echinacea	1
62. Echinacea and goldenseal	1
63. Enzymes	1
64. Ephedra – ma huang	1
65. Estroven	1
66. Gano	1
67. Ginger	1
68. Ginseng	1
69. GNC herbs	1
70. Gotu kola	1
71. Green vibrant	1
72. Hydrochloric acid	1
73. Lactobacillus	1
74. Lipoflavin	1
75. Lutein	1
76. Lysine	1
77. Male enhancement	1
78. Natural papaya	1
79. Peppermint	1
80. Peppermint oil	1
81. Policosinol	1
82. Psyllium husks	1
83. Pycnogenol	1
84. Red yeast rice	1

Appendix (Continued)

	Total
85. Royal jelly	1
86. Salmon oil	1
87. Shark cartilage	1
88. Slippery elm	1
89. St. John's wort	1
90. Stevia	1
91. Tribulus terrestris	1
92. Venostat	1
93. Wild yam root	1

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