

CAM Documentation in Clinical Notes

Towards an Automated Surveillance System for Drug-Herb Interactions

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Abstract—Herbal dietary supplements are the most popular form of complementary and alternative medicine (CAM) therapy -- they are used by over 38 million US adults. However, treatments involving dietary supplements could potentially interact with prescription medications and have a negative impact on patient outcomes. Despite safety concerns, previous studies indicate that most patients do not discuss CAM use with their physicians. In this preliminary study we set out to: (1) conduct a computer assisted chart review of notes from multiple sclerosis (MS) patients to identify the documentation level of CAM use; and (2) investigate whether any herbal supplement in the resulting list is known to have a negative interaction with prescription drugs commonly taken by MS patients. The outcomes of this study will be used to inform the design of a system to collect CAM information from both patients and physician notes and issue alerts for potential negative interactions. Five percent of the analyzed notes contained descriptions of CAM use, 63% of which were *Biologically-Based Practices*. The notes containing actual mentions of CAM represent a small percentage when compared with the number reported by studies that obtained their data directly from patients. These numbers indicate that the use of CAM is indeed underreported in patient notes. Among the 19 types of herbs which use was positively identified, four had moderate interactions and one had minor interactions with commonly prescribed MS medications. Our findings suggest the need to collect more accurate data on CAM use in order to provide adequate surveillance of drug-herb interactions

Index Terms—chart review, complementary and alternative medicine, drug interactions, pharmacosurveillance.

I. INTRODUCTION

According to the National Center for Complementary and Alternative Medicine (NCCAM), complementary and alternative medicine (CAM) is “a group of diverse medical and health care systems, practices, and products that are not generally considered to be part of conventional medicine.” CAM therapies are classified as either whole medical systems (e.g. homeopathy), mind-body systems (e.g. meditation), biologically-based practices (e.g. dietary supplements), manipulative and body based practices (e.g. massage therapy), or energy medicine (e.g. Reiki). A summary of the NCCAM classification is listed below.

1. Biologically-Based Practice
 - 1.1 Dietary Supplement
 - 1.1.1 Amino Acid

- 1.1.2 Animal-Derived Extract
 - 1.1.3 Herbal
 - 1.1.4 Fatty Acid
 - 1.1.5 Mineral
 - 1.1.6 Prebiotic
 - 1.1.7 Probiotic
 - 1.1.8 Protein
 - 1.1.9 Vitamin
- 1.2 Functional Food
- 1.3 Whole-Diet Therapy
2. Energy Medicine
 - 2.1 Bioelectromagnetic-Based Therapy (Veritable)
 - 2.2 Biofield Therapy (Putative)
3. Manipulative and Body-Based Practice
4. Mind-Body Medicine
5. Whole Medical System

A comparative study between two national surveys (1997-2002) showed that approximately 72 million US adults report using some kind of CAM therapy. Herbal dietary supplements are the most popular form of CAM therapy -- they are used by over 38 million US adults [1]. While many CAM practices are considered safe (e.g. prayer, meditation, yoga, massage), treatments involving dietary supplements could potentially interact with prescription medications and have a negative impact on patient outcomes [2]. For example, ginseng is known to interact with digoxin and St. John’s Wort could interact with both digoxin and warfarin.

Despite safety concerns, it has been reported that most patients do not discuss CAM use with their physicians [3]. Aside from the lack of communication, a recent survey showed that a majority of health care providers believe that both providers and consumers lack knowledge of herbal medicine [4]. As automated alert systems tracking prescription drug-drug and drug-disease interactions have been developed and deployed in pharmacies and clinics, it is highly desirable to have a system that alerts patients and physicians of the safety concerns regarding herbal products. As a first step in developing such an alert system, we conducted a preliminary study on the CAM documentation in medical records as well as the potential interactions.

In this preliminary study we set out to: (1) conduct a computer assisted chart review of notes from multiple sclerosis (MS) patients to identify the documentation level of CAM use among this patient population; and (2) investigate whether any

herbal product in the resulting list is known to have negative interactions with prescription drugs commonly taken by MS patients. The outcomes of this study will be used to inform the design of a system to collect CAM information from both patients and physician notes and issue alerts for potential negative interactions.

II. BACKGROUND

While many CAM treatments are considered safe and somewhat beneficial to patients, biologically-based practices, especially dietary supplements can put patients' health at risk. A number of studies on drug-herb interactions as well as reference books for clinicians and consumers on the topic have been published [5-8]. Indeed, one common factor among these studies is the concern about health risks associated with such interactions [9-11]. A 2009 survey with 130 older adults living in the US-Mexico border revealed that 16% of the sampled population was taking at least two herbal supplements [9]. The study showed that 31% of the participants were at risk of having at least one possible drug-herb interaction. In another study, researchers surveyed 176 patients by phone to determine the prevalence of, and reasons for taking, alternative medications [8]. The survey elicited information about patients' ability to provide self-care, demographics, work status, satisfaction with current disease management, types of alternative medications taken, sources of information about the products, where they obtained the products, and reasons for taking the products. Patients also were questioned about their knowledge on the safety of these products. Prevalence of use in the population was 66%. Most patients thought that the agents were safe and took them because they believed they have "added benefits."

Biomedical researchers have studied CAM use among certain patient populations and a great deal of research on alerts and reminders and pharmacosurveillance has also been conducted. However, these two research strains have seldom intertwined. We believe combining them is essential for the development of systems that can automatically check for and issue alerts concerning potentially negative interactions between prescription drugs and dietary supplements. In this paper we describe the foundational work we have initiated towards that goal.

III. METHODS

This study was composed of two consecutive stages:

1. **Computer Assisted Chart review of MS patient notes** to identify cases of dietary supplement use.
2. **Identification of drug interactions** by cross-checking the positive cases of dietary supplement use and drugs commonly prescribed to MS patients. At this stage, we focused on the herbal dietary supplements

A. Chart Review

To assess the documentation rate and quality of CAM in medical records, we conducted a computer-aided chart review of a large set of the medical records. Clinical notes for all patients with at least one ICD9 code indicating MS (340.*)

were obtained from the Brigham and Women's Hospital between 1/1999 and 1/2009. The data set contained 3,631 patients and 91,179 reports.

We compiled a list of 5,009 CAM treatment terms using the following sources:

- NMCD (n=1,083): List of dietary supplements from Natural Medicine Comprehensive Database (NMCD). These are the 'common names' of those supplements and include herbs, nutraceuticals, natural products, etc.
- NCCAM (n=67): The alternative medicine terms defined in the National Health Statistics Report, December 2008 (No.12)
- UMLS (n=4,900): Concepts from UMLS Metathesaurus (2008AA) that are defined in source=ALT and in the sub-tree defined by root Alternative Billing Concepts (C1140170)

We first looked up the treatment terms from all the reports using the list described above. We then randomly selected 1,460 occurrences for manual review.

Two coders manually reviewed the 1,460 patient notes in order to determine whether the keywords actually referred to CAM therapies. A third person was used to solve coding disagreements. All patient notes were obtained as free-text. Thus, coders were required to decide whether the passage under analysis referred or not to actual CAM use solely based on the text. That is, they could not make assumptions about what the note meant based on the section of the patient record.

B. Identification of Drug Interactions

We used the Interactions Checker from Drugs.com to check for possible interactions between drugs commonly taken by MS patients and the herbal supplements whose use were positively identified in the chart review. The website Drugs.com is endorsed by the FDA. In fact, the two have recently teamed to broaden the reach of FDA's consumer health information. The Interactions Checker classifies interactions in three levels: major, moderate, and minor.

The list of the most common drugs prescribed for MS patients was taken from the website WebMD.com. Seventeen drugs were checked for interactions with herbal supplements.

IV. RESULTS

A. Chart Review

The computer screening identified CAM terms in 11% of the notes. Among the 1,460 randomly selected notes for manual review, less than half of the terms (n=689) reflected actual CAM use. Multiplying the true positive rate from the manual review with the raw occurrence of CAM terms, we estimate the prevalence of the CAM documentation in the clinical notes to be 5%. Since some patients have multiple notes, the estimated prevalence of patients with notes containing actual CAM use was 21%.

Figure 1 displays the break down according to the NCCAM classification system.

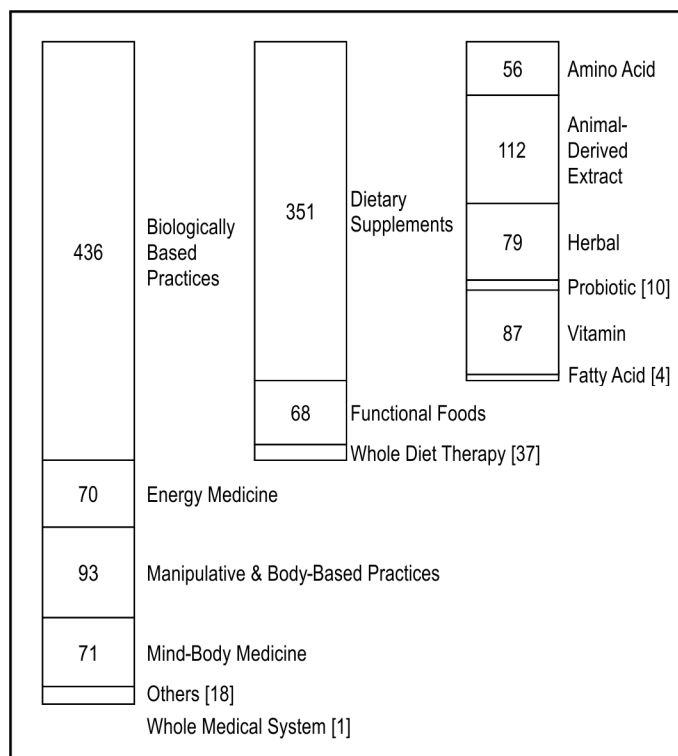


Figure 1. Distribution of CAM information found in medical records.

Of the 1,460 patient notes manually reviewed, 351 notes contained keywords associated with dietary supplements. Of those, 79 notes contained keywords associated with the use of herbal supplements. However, only 35 notes represented actual use of herbal supplements corresponding to 19 different products (see Table I).

TABLE I. HERBAL DIETARY SUPPLEMENTS POSITIVELY IDENTIFIED THROUGH MANUAL REVIEW

Supplement	#	Supplement	#
Bee Pollen	1	Ginseng	1
Beladonna	1	Goldenseal	1
Black Cohosh	3	Green Tea Extract	2
Boldo	1	Hoodia	1
Borage Oil	2	Lutein	1
Butterbur	1	Milk Thistle	1
Cascara Sagrada	1	Oregon Grape Root	1
Evening Primrose	6	Turmeric	1
Flaxseed Oil	8	Uva Ursi	1
Gingko	1		
TOTAL		35	

Two examples of passages in which we could positively identify the use of herbal dietary supplements are provided below:

She is taking a number of supplements including EPA-DHA complex metagest RM-10 riboflavin vitamin C multivitamin garlic supplement iodine estrofactors calcium magnesium vitamin E primrose oil coenzyme-Q-10 and several others she could not readily recall.

John [not real name] also takes milk thistle whey protein garlic glutamine vitamin E multivitamin a preparation called 'Up Your Gas' and not more than three times a week a preparation called 'Liqui-Drenaline'.

B. Identification of Drug Interactions

We identified 22 moderate and 12 minor potential interactions between herbal dietary supplements and the most commonly prescribed MS drugs (see Fig. 2). No major interactions between herbal supplements and MS drugs were detected. Four supplements were identified as having moderate interactions: beladonna, black cohosh, cascara sagrada, and ginkgo. Evening primrose was the only supplement identified as having minor interactions. It is worth noticing that two supplements, evening primrose and ginkgo, showed interactions with 12 different MS drugs. Drugs.com did not have enough data to issue interaction warnings for 6 supplements: boldo, borage oil, butterbur, flaxseed oil, hoodia, and uva ursi.

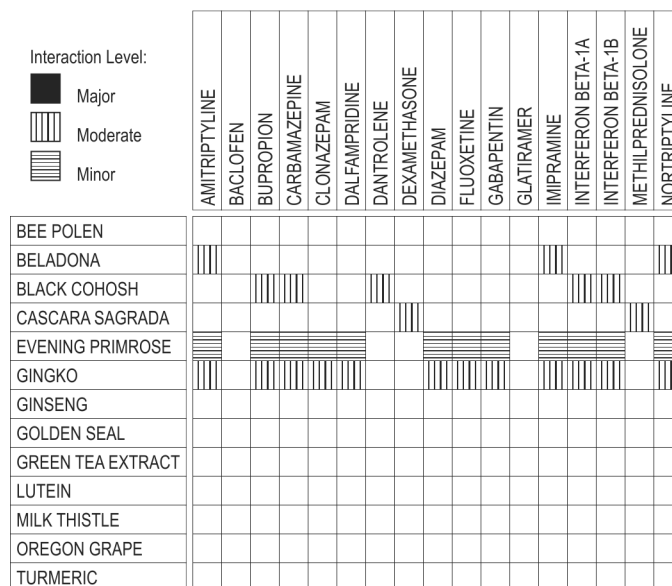


Figure 2. Identified interactions between top MS drugs and herbal dietary supplements.

Two excerpts from Drugs.com describing a moderate and a minor interaction are exemplified below.

Moderate: [Interferon beta-1a] x [Black Cohosh]

GENERALLY AVOID: Concomitant use of black cohosh (Cimicifuga racemosa rhizome) with other agents that are known to induce hepatotoxicity may theoretically increase the risk of liver injury. Black cohosh has been suspected in rare cases of liver toxicity ranging from abnormal liver function tests and jaundice to various forms of hepatitis and hepatic failure requiring transplantation. The onset has typically been within the first 3 months after initiation of black cohosh. Although approximately half of the cases resulted in hospitalization, most improved or resolved following discontinuation of the product.

Minor: [Gabapentin] x [Evening Primrose]

Some clinicians have suggested that evening primrose, which contains the omega-6 fatty acid gamma linolenic acid, may lower the seizure threshold and antagonize the effects of anticonvulsants. However, data regarding the effect of gamma linolenic acid on seizure threshold are conflicting and limited.

V. DISCUSSION

A. Chart Review

Five percent of the notes contained descriptions of CAM use, 63% of which were Biologically-Based Practices. Among the various types of CAM, biologically-Based Practices are the most likely to interact with prescription medications and patient diseases. The notes containing actual mentions of CAM represent a small percentage when compared with what has been reported in studies that obtained their data directly from the patient population. These numbers indicate that the use of CAM is indeed underreported in patient notes. Furthermore, the CAM documentation is typically very brief, often providing little detail beyond the fact that the patient was using or had used some treatments. Nevertheless, some CAM use is indeed documented by physicians and some of this documented use can potentially harm the patient.

B. Identification of Drug Interactions

When investigating the interaction with drugs, we focused on herbal dietary supplements. Among the 19 types of identified herbal supplement use, four had potential moderate interactions and one had potential minor interactions with commonly prescribed MS medications. Since these are documented in the charts, we assume that the use of these products was either considered safe for those specific patients or that the physicians had given patients the appropriate advice. The low documentation of CAM use, however, suggests there are many other patients who are taking herbal supplements that may interact with their medications. Furthermore, as the literature indicates, neither physicians nor patients are fully aware of the potential interactions.

C. Limitations and Future Directions

Our analysis of interactions focused on herbal supplements. There are other forms of CAM as well as the over-the-counter (OTC) drugs that could interact with prescription drugs and affect disease outcomes. We limited the scope of this study to interactions between MS drugs and herbal dietary supplements so that we could pave the way to the development of a robust interaction detection system and demonstrate its potential future impact on documentation, communication, and prevention. Future studies could include other CAM and OTC, as well as other diseases and patient populations.

We have started conducting a parallel study to test the feasibility of collecting information on CAM use directly from patients, given the underreporting rates in clinical documents. In that study we are focusing on the use of herbal dietary supplements among cardiology patients. We developed a simple computer interview application to collect information on CAM use. The application was installed in a tablet computer to facilitate data collection and underwent a usability study.

The study is being conducted in the cardiology clinic at the University of Utah Hospital. Up to this point we have had an encouraging participation rate of 94% and the self-reported use of herbal supplements is quite high, at 81%. This is far above the corresponding chart documentation rate of 36%. We have been also surveying clinicians' perceptions of CAM use in the same clinic. Our preliminary results indicate that collecting self-reported information on CAM use directly from patients is feasible, given the achieved participation rates. It is also quite relevant, given that patient self-reported use of herbal supplements is more than twice of what is actually documented in their charts.

VI. CONCLUSIONS

CAM use is underreported in clinical notes. Nevertheless, we found documentation of every major type of CAM in the corpus we examined. Focusing on documented use of herbal dietary supplements, we identified potential moderate and minor interactions with common medications taken by the patient population represented in the corpus. Our findings suggest the need to collect more complete data on CAM use and to provide adequate surveillance of herb-drug and herb-disease interactions.

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