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A Collaborative Assessment Among 11 Pharmaceutical Companies of Misinformation in Commonly Used Online Drug Information Compendia

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Abstract

Background: Online drug information compendia (ODIC) are valuable tools that health care professionals (HCPs) and consumers use to educate themselves on pharmaceutical products. Research suggests that these resources, although informative and easily accessible, may contain misinformation, posing risk for product misuse and patient harm. **Objective:** Evaluate drug summaries within ODIC for accuracy and completeness and identify product-specific misinformation. **Methods:** Between August 2014 and January 2015, medical information (MI) specialists from 11 pharmaceutical/biotechnology companies systematically evaluated 270 drug summaries within 5 commonly used ODIC for misinformation. Using a standardized approach, errors were identified; classified as inaccurate, incomplete, or omitted; and categorized per sections of the Full Prescribing Information (FPI). On review of each drug summary, content-correction requests were proposed and supported by the respective product's FPI. **Results:** Across the 270 drug summaries reviewed within the 5 compendia, the median of the total number of errors identified was 782, with the greatest number of errors occurring in the categories of Dosage and Administration, Patient Education, and Warnings and Precautions. The majority of errors were classified as incomplete, followed by inaccurate and omitted. **Conclusion:** This analysis demonstrates that ODIC may contain misinformation. HCPs and consumers should be aware of the potential for misinformation and consider more than 1 drug information resource, including the FPI and Medication Guide as well as pharmaceutical/biotechnology companies' MI departments, to obtain unbiased, accurate, and complete product-specific drug information to help support the safe and effective use of prescription drug products.

Keywords
drug information, medication safety, electronic information, internet, drug safety

Introduction

Health care professionals (HCPs) and consumers often rely on a variety of drug information (DI) resources, including those available online, because they are user-friendly and presumed to be accurate, complete, and current.[1-3] However, studies surveying consumer-focused online DI compendia (ODIC) have shown varying quality in the accuracy of information provided.[4-6] Additionally, inaccuracies, outdated and/or incomplete information, and errors of omission have been identified in DI resources used primarily by HCPs.[1,7-11] Commonly used resources were evaluated to identify inaccurate information about a pharmaceutical company's products and revealed errors (omissions) in 32 of the 37 references reviewed.[1] In another study evaluating 7 commonly used ODIC, significant variations in the scope and completeness of the information provided were noted.[9]

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Furthermore, 5 top DI resources were assessed for pharmacogenetic information that was required by the Food and Drug Administration (FDA) to be included in the certain products' Full Prescribing Information (FPI). On average, pharmacogenetic biomarker information was available for 81.5% of the 65 FDA-listed drugs in 2011, highlighting a notable gap in information.[8]

In practice, the choice of a DI compendium may be influenced by various factors, such as HCP familiarity or accessibility of subscription-based versus freely available databases. Multiple studies have noted better performance, in terms of completeness and accuracy, with subscription-based as compared with freely available DI compendia.[7-9] Considering that recent surveys of HCPs (eg, medical residents, physicians, pharmacists) have suggested increased use of a smartphone or mobile device to access product information, the platform in which DI compendia are available may influence use.[12-14] In regard to consumers, patients and caregivers seem to rely on free, internet-based ODIC to access information.[15]

HCPs and consumers should be aware that DI resources may contain erroneous information, posing the risk of product misuse and patient safety concerns.[1,4-11] The purpose of this study was to evaluate the accuracy and completeness of drug summaries in selected, commonly used ODIC compared with FDA-approved FPIs across a wide spectrum of prescription drug products.

Methods

Pharmaceutical/biotechnology companies involved with a medical information (MI) consortium and/or postdoctoral MI fellowship programs were contacted to participate in the Collaborative Compendia Review Project (CCRP). Purdue Pharma LP served as the lead based on prior compendia review experience and interest in assessing trends across multiple therapeutic areas and evaluating a diverse portfolio of prescription products. Between August 2014 and January 2015, a standardized process in accordance with the FDA's "Guidance for industry. Internet/Social media platforms: correcting independent third-party misinformation about prescription drug and medical devices"[16] and consistent with previously published work on this topic[17] was utilized to review select third-party (ie, ODIC) drug summaries in order to inform such third parties of identified misinformation specific to participating companies' products.

ODIC were selected based on surveys of top DI sources utilized by HCPs and a cross-sectional study evaluating the top DI websites/sources.[5,18-20] For this study, a compendium was defined as follows: a comprehensive listing of FDA-approved drugs and biologicals or a specific subset of drugs and biologicals and may include a summary of the pharmacological characteristics of each drug or biological; it also includes information on dosage as well as recommended or endorsed uses in specific diseases.[21] Five ODIC were included: Medscape Reference,[22] Lexicomp Online: Lexi-Drugs,[23] Epocrates Online,[24] Drugs.com,[25] and RxList.[26] For those ODIC having an online version and a smart device application, the online version was reviewed because the content is generally more comprehensive.

A fellow/specialist, who is a pharmacist with MI expertise, within each company's MI department was identified to participate in compendia review (reviewer) with preceptor/manager oversight (peer reviewer). Participants were asked to select up to 5 of their company's prescription products, one of which was required to be later in its life cycle or a nonpromoted product. Only products with drug summaries available within the selected ODIC, either represented as brand name or drug substance (ie, active ingredient), were considered for review. The objectives of the CCRP were to identify misinformation within drug summaries and to propose truthful, evidence-based content correction requests to ODIC.

Drug Summary Review

The reviewer compared on-label content (ie, content consistent with the FPI) in ODIC drug summaries with the respective products' FPIs, including Instructions for Use (IFU) and Medication Guide, as appropriate. Drug summaries in HCP-ODIC (ie, Medscape Reference, Lexi-Drug, and Epocrates) were reviewed in their entirety. For consumer-ODIC (ie, Drugs.com and RxList), only patient education content within drug summaries was reviewed (eg, user reviews of products and verbatim FPI information provided for HCPs were not reviewed). Reviewers maintained a consistent level of detail and specificity while recognizing the intended audience (HCPs vs consumers). Additionally, drug summary reviews focused on safety information (eg, boxed warnings, dosage and administration, contraindications). However, misinformation that may have an impact on treatment decisions was also evaluated, whereas review of off-label content was deemed outside the scope of this project. For drug summaries based on active ingredient, only content specific to the products selected for inclusion in the CCRP was evaluated. Reviewers acknowledged that drug summaries are written per each compendium's editorial style and are not intended to be identical to FPIs, IFUs, and Medication Guides.

Identification and Classification of Misinformation

The Content-Correction Requests table[17] was the tool used to ensure efficiency and consistency among participating companies. The table, developed by Purdue Pharma LP, is a standardized table designed to capture: (1) misinformation (errors) within drug summaries, (2) proposed corrections, and (3) supporting evidence from product FPIs, IFUs, and/

or Medication Guides. Content-correction requests were to be specific, unambiguous, nonpromotional, and consistent with FPIs, IFUs, and/or Medication Guides.

Identified errors were also classified as one of the following[17]:

- Inaccurate: information within the drug summary was inconsistent with the FPI, IFU, and/or Medication Guide.
- Incomplete: some but not all relevant information from the FPI, IFU, and/or Medication Guide was provided in the drug summary.
- Omitted: information from a section of the FPI, IFU, and/or Medication Guide was missing in its entirety in the drug summary.

The reviewer completed drug summary review and populated the Content-Correction Requests table within a 2-week timeframe. The table was then provided to the peer reviewer for review and approval; simultaneously, the drug summary review for the next compendium was initiated. The peer reviewer was required to complete review of the table within 1 week. On completion of the peer review, the reviewer reconciled changes within a week. Reconciliation disagreements on proposed content-correction requests were resolved by consensus between the reviewer and peer reviewer. If agreement could not be obtained, disagreements were escalated to the lead investigator at Purdue Pharma LP for consultation. The total duration of drug summary review, peer review, and reconciliation was ~1 month per compendium. A strict timeline of 1 month was used because ODIC may update drug summaries at any time. Completed tables were submitted to the lead investigator for data collection. However, content-correction requests were submitted to the respective ODIC editors according to each MI department's practice.

Categorization of Misinformation

Once the Content-Correction Requests table for each compendium was finalized, it was retrospectively evaluated by the reviewer to categorize identified misinformation. Errors were categorized according to the relevant section of the FPI (eg, boxed warning, indications and use) or as patient education if identified in the patient education section of the drug summary. Errors that could not be categorized based on a section of the FPI or as related to patient education were placed in the general category, "other." After categorization, errors were totaled by the reviewer.

Data Analysis

Analyses included: (1) evaluation of errors within the 5 ODIC, (2) evaluation of errors within the 3 HCP-ODIC, and (3) evaluation of errors within the 2 consumer-ODIC. For each of these analyses, the errors were also summed per category and classification. In an effort to avoid the influence of outliers and skewing of the data, the median value (ie, the middle value in the data set) was identified as an appropriate representation of the data for each analysis. The minimum and maximum values were also provided for each analysis.

Results

Overall

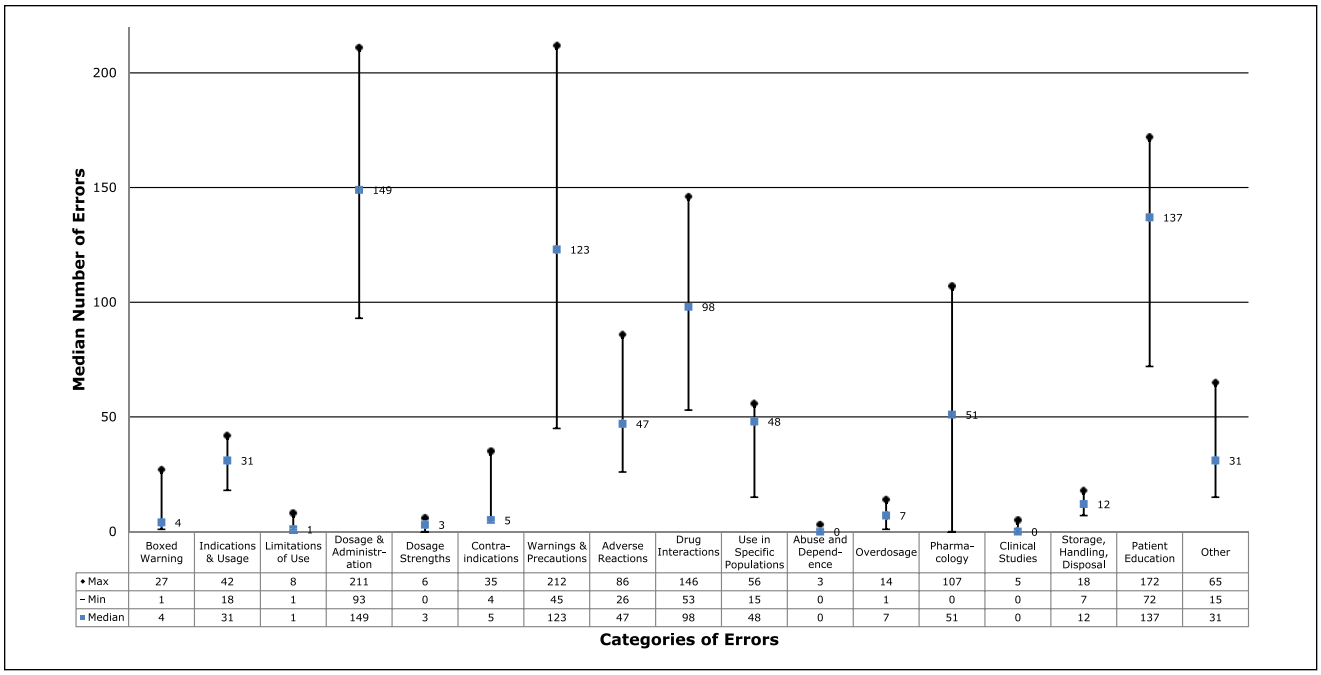
Of the 21 companies invited to join the CCRP, 11 (52%) agreed to participate. Drug summaries for 54 products in 3 HCP-ODIC and 2 consumer-ODIC were assessed, resulting in review of 270 drug summaries. The products included constitute a diverse portfolio of therapies used in the management of various disease states: cancer, n = 12; diabetes, n = 7; infectious disease, n = 6; nervous system/psychiatric, n = 5; pain, n = 5; autoimmune, n = 4; cardiovascular, n = 3; endocrine, n = 3; hematological, n = 3; gastrointestinal, n = 2; musculoskeletal, n = 1; ocular, n = 1; respiratory, n = 1; urogenital, n = 1. Of the selected products, 46% (n = 25) are boxed warning products, 28% (n = 15) are listed in the Medscape's Top 100 Most Prescribed, Top Selling Drugs list,[27] and 19% (n = 10) are products that are later in their life cycle/nonpromoted. Furthermore, 22 products are required to have Medication Guides, 15 have patient package inserts, and 12 have IFUs. Additionally, 11 products are subject to a risk evaluation and mitigation strategy (REMS).[28]

Across the 270 drug summaries in the 5 ODIC reviewed, the median of the total number of errors identified was 782 (range, n = 444-1094). As shown in Figure 1, the categories with the greatest total (median) number of errors were the following: dosage and administration (n = 149), patient education (n = 137), and warnings and precautions (n = 123). Content related to clinical studies, abuse and dependence, and limitations of use had the least (median) number of errors.

Classifications of errors as identified across the 5 ODIC are shown in Figure 2. Errors classified as incomplete were most frequently related to the following categories: dosage and administration, warnings and precautions, and patient education. Most inaccuracies were related to dosage and administration, drug interactions, and clinical pharmacology information within drug summaries. The greatest frequency of errors classified as omitted was in the categories of dosage and administration, warnings and precautions, and patient education.

HCP-Focused Compendia

Across the 162 drug summaries reviewed within the 3 HCP-ODIC, the median of the total number of errors identified



	Boxed Warning	Indications & Usage	Limitations of Use	Dosage & Administration	Dosage Strengths	Contra-indications	Warnings & Precautions	Adverse Reactions	Drug Interactions	Use in Specific Populations	Abuse and Dependence	Overdosage	Pharmacology	Clinical Studies	Storage, Handling, Disposal	Patient Education	Other
Max	27	42	8	211	6	35	212	86	146	56	3	14	107	5	18	172	65
Min	1	18	1	93	0	4	45	26	53	15	0	1	0	0	7	72	15
Median	4	31	1	149	3	5	123	47	98	48	0	7	51	0	12	137	31

Figure 1. Analysis of total errors[a] identified across 270 drug summaries within all compendia.
[a]The median most appropriately represents the number of errors because this value avoids the influence of outliers.

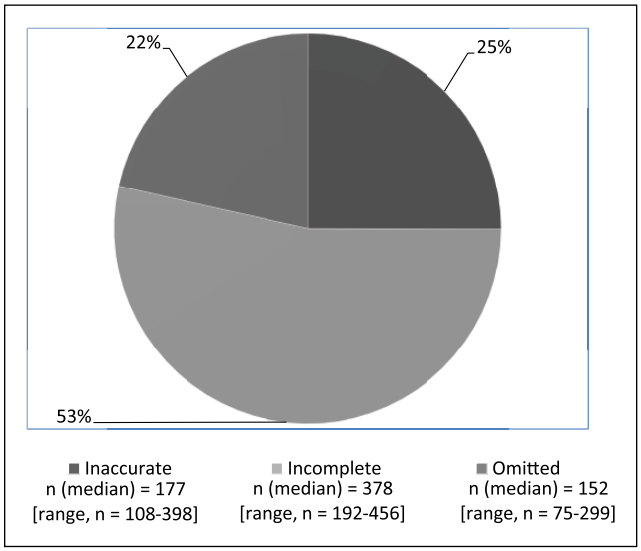


Figure 2. Classification of errors[a] across 270 drug summaries within all compendia.
[a]The median most appropriately represents the number of errors because this value avoids the influence of outliers.

was 899 (range, n = 782-1094); however, when comparing the number of errors per compendium across the 11 participating companies, the median number of errors was 71. The 3 categories with the greatest (median) number of errors were warnings and precautions, dosage and administration, and patient education (Figure 3). Categories with the least (median) number of errors identified were the same as those having the least number among all 5 ODIC (clinical studies, abuse and dependence, and limitations of use).

The proportion of errors classified as inaccurate was similar in HCP-ODIC (24%) as compared to across all 5 ODIC (25%). For errors classified as incomplete or omitted, 46% and 30%, respectively, were observed for HCP-ODIC compared with 53% and 22%, respectively, across all 5 ODIC.

Select examples of HCP-ODIC errors include the following:

- Inaccurate: Dosing information for product A was incorrect for pediatric patients with type 1 diabetes mellitus (dosage and administration, 1 error).
- Incomplete: Boxed warning information for product B was incomplete because the warning regarding addiction, abuse, and misuse was not provided (boxed warning, 1 error).
- Omitted: Warnings regarding product C and the risk of new-onset or worsening heart failure, pulmonary toxicity, and renal impairment and failure were missing (warnings and precautions, 3 errors).

In a separate analysis of errors identified in patient education within HCP-ODIC (median errors, n = 142; range, n = 137-172), the dosage and administration, general patient education, and warnings and precautions categories contained the greatest (median) number of errors (n = 34,

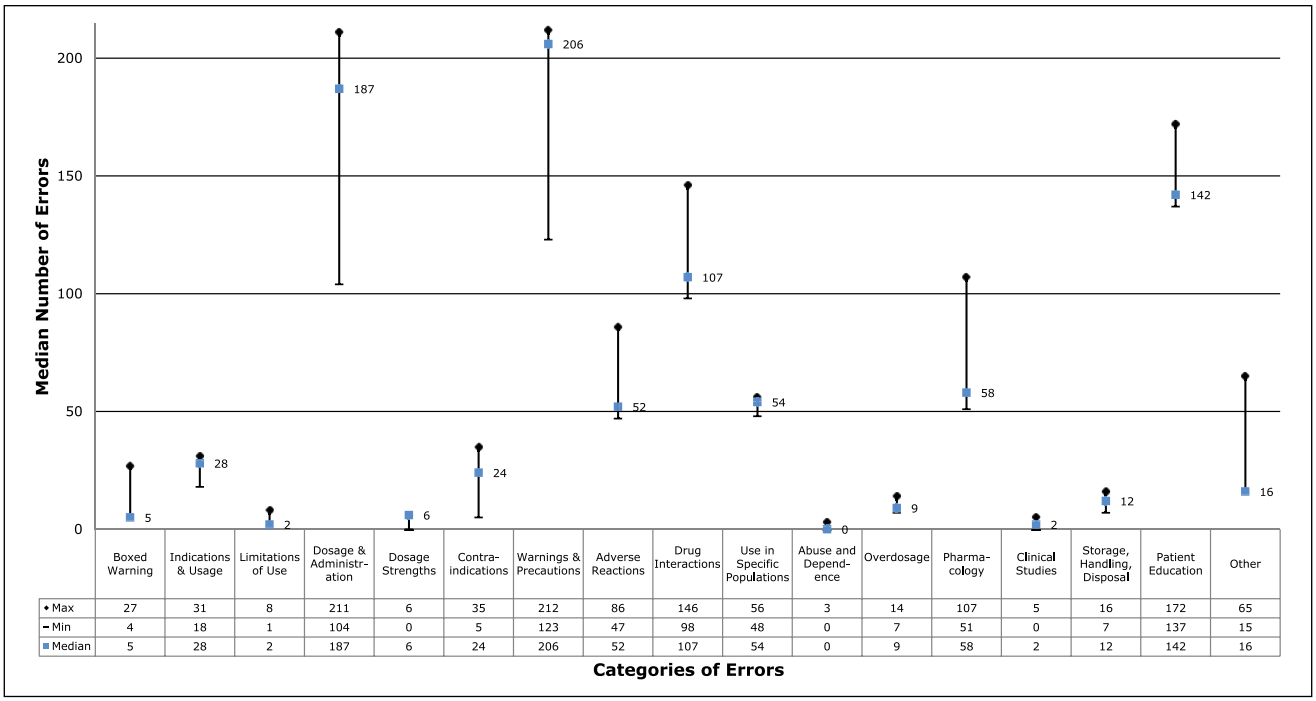


Figure 3. Analysis of errors[a] identified in drug summaries (n = 162) within health care professional–focused compendia.
[a]The median most appropriately represents the number of errors because this value avoids the influence of outliers.

n = 34, and n = 25, respectively), whereas information specific to abuse and dependence contained the least (median) number of errors (n = 0). Furthermore, of the 142 errors (median) identified, a median number of 25 errors (17%) were classified as inaccurate, 62 (44%) as incomplete, and 55 (39%) as omitted. The patient education category demonstrated a shift toward more errors classified as omitted and fewer errors classified as inaccurate compared with all other categories. Median rates for errors identified as incomplete were comparable between patient education–specific content and the overall drug summary.

Consumer-Focused Compendia

Among the 108 drug summaries reviewed within the 2 consumer-ODIC, the median of the total number of errors identified was 456 (range, n = 444-467); however, when comparing the number of errors per compendium across the 11 participating companies, the median number of errors was 24. The greatest (median) number of errors (Figure 4) were identified in the dosage and administration category (n = 121), followed by general patient education (n = 73). The categories with the least (median) number of errors included the following: clinical studies (n = 0), limitations of use (n = 1), and abuse and dependence (n = 1).

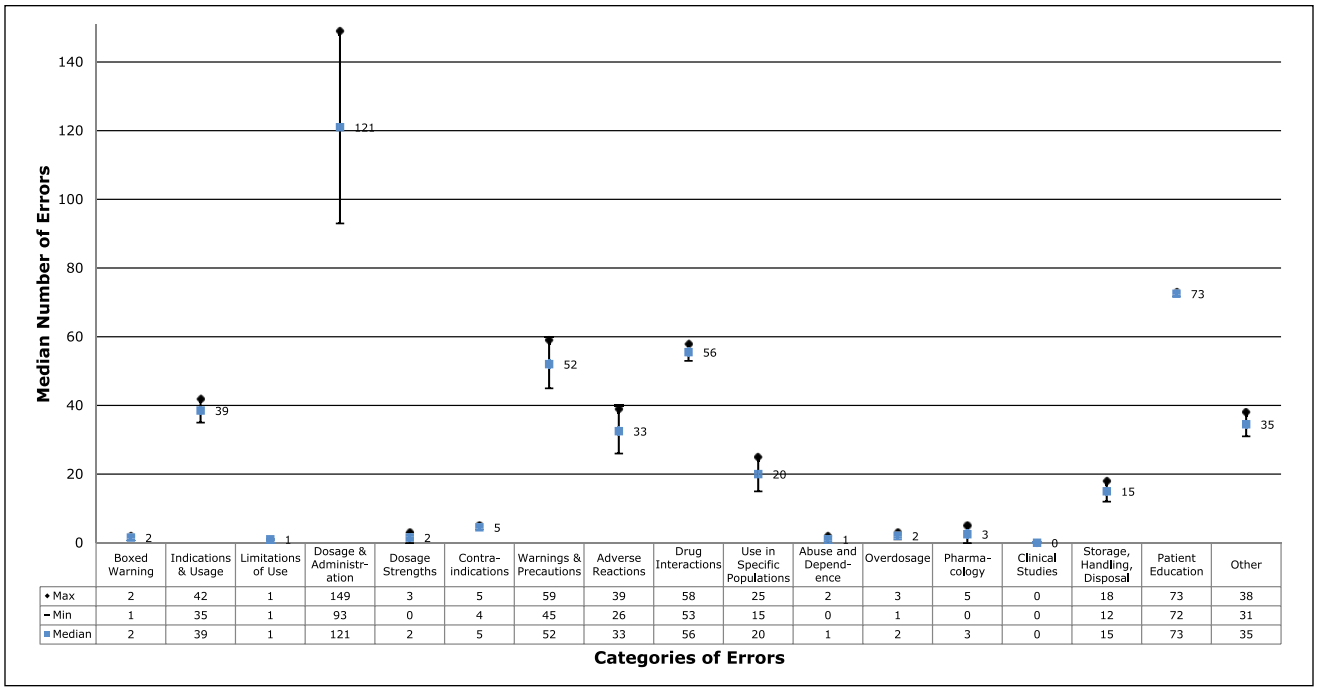
The proportion of errors classified as incomplete in consumer-ODIC (51%) was comparable to that across all 5 ODIC (53%). Of the remaining errors, 31% were classified as inaccurate and 18% as omitted.

Select examples of consumer-ODIC errors include the following:

- Inaccurate: Information related to product D passing into breast milk and "rarely hav[ing] undesirable effects on the nursing infant" is inaccurate as "rarely" minimizes the risk of neonatal opioid withdrawal syndrome, which is described in the Medication Guide (use in specific populations, 1 error).
- Incomplete: Symptoms of overdose for product E were not all provided per Medication Guide (overdosage, 1 error).
- Omitted: The warning that product F may cause dizziness and somnolence and impair the ability to drive or operate machinery as described in the Medication Guide was missing (warnings and precautions, 1 error).

HCP-Focused Compendia Versus Consumer-Focused Compendia

Each CCRP company identified a median of 24 errors per consumer-focused compendium compared with a median of 71 errors per HCP-focused compendium. Whereas the categories with the greatest (median) number of identified errors within drug summaries for the both the HCP- and consumer-ODIC were the same (warnings and precautions, dosage and administration, patient education, and drug interactions), the warnings and precautions category had the



	Boxed Warning	Indications & Usage	Limitations of Use	Dosage & Administration	Dosage Strengths	Contra-indications	Warnings & Precautions	Adverse Reactions	Drug Interactions	Use in Specific Populations	Abuse and Dependence	Overdosage	Pharmacology	Clinical Studies	Storage, Handling, Disposal	Patient Education	Other
Max	2	42	1	149	3	5	59	39	58	25	2	3	5	0	18	73	38
Min	1	35	1	93	0	4	45	26	53	15	0	1	0	0	12	72	31
Median	2	39	1	121	2	5	52	33	56	20	1	2	3	0	15	73	35

Figure 4. Analysis of errors[a] identified in drug summaries (n = 108) within consumer-focused compendia.
[a]The median most appropriately represents the number of errors because this value avoids the influence of outliers.

greatest frequency of errors for HCP-ODIC and the fourth greatest frequency of errors for consumer-ODIC (median number of errors, n = 206 and n = 52, respectively).

For HCP- and consumer-ODIC, the majority of errors identified were classified as incomplete (46% and 51%, respectively). When looking at variations in errors identified, HCP-ODIC had a higher proportion of errors classified as omitted than inaccurate, whereas consumer-ODIC had more errors classified as inaccurate than omitted.

Discussion

Undoubtedly, DI compendia are faced with the difficult task of maintaining current information for a number of products. Although valuable resources to both HCPs and consumers that often aid in clinical decisions, ODIC may contain misinformation, presenting a concern for patient safety.

In this study, 11 MI departments reviewed on-label content contained in 270 drug summaries within 5 ODIC. Although not validated,[17] a standardized approach was utilized to identify misinformation and propose nonpromotional and accurate content-correction requests supported by product FPIs. Products included in compendia review were in all stages of the postmarketing life cycle, including newly approved products as well as established products. The selected products covered a variety of therapeutic areas and had varying levels of risk, with nearly half being boxed warning products, constituting a diverse sample of drug summaries. However, this sampling is small in comparison to the number of drug summaries maintained by ODIC, highlighting the necessity of reviewing and updating drug summaries to help ensure availability of complete and current information.

Potential limitations should be considered when interpreting the study results. No analytical software or technology was used to compare the product FPI with the respective drug summary. Despite the protocol in place to ensure systematic review when evaluating drug summaries for misinformation, drug summary reviews were subject to human error and variability when identifying errors and classifying types of misinformation (ie, inaccurate, omitted, and incomplete). In addition, the approach in identifying misinformation included a particular focus on safety-related information, which may have resulted in more errors in safety-related categories. Other categories may have yielded fewer errors because product FPIs may not contain content in specific sections, whereas a larger number of errors may have been identified in certain sections because of greater detail and depth of drug summary content. Furthermore, the number of errors identified in the drug summaries within each compendium ranged greatly because of the variety of selected products (and thereby, the variety of detail and complexity in drug summaries). As such, to avoid influence of outliers and skewing of the data, the median (ie, the middle value within the data set) was chosen to represent the

number of errors per analysis rather than the mean (ie, the average of the data set).

However, in an effort to address these potential limitations, a standard template was created, reviewed, and distributed to ensure consistency among reviewers. Furthermore, to reduce bias and variability, each drug product was reviewed across all 5 ODIC by the same reviewer. Reviews were conducted within a set timeline to ensure that all ODIC were evaluated during the same time period. In addition, all content-correction requests were consistently reviewed and approved by the same peer reviewer. Additionally, all instances of difficulty in classifying errors were escalated to the lead investigator at Purdue Pharma LP for consultation.

The ODIC included in this study have inherent differences as well. HCP-ODIC drug summaries were more clinical and comprehensive, whereas consumer- ODIC contained information written in plain language for easier comprehension. Although the intent of this study was not to compare one compendium with another, it should not be surprising that HCP-ODIC contained a greater number of errors compared with consumer-ODIC because of the detailed and in-depth nature of HCP-focused drug summaries.

To our knowledge, the CCRP is the largest study of its kind based on the number of drug summaries evaluated and number of companies involved. Given the misinformation identified in this study, it is essential for HCPs and consumers to utilize more than 1 DI resource. Apart from ODIC, useful DI resources may include: (1) the National Library of Medicine's DailyMed,[29] (2) Drugs@FDA,[30] and (3) MI departments within pharmaceutical companies.

Conclusion

As ODIC use expands, it is crucial to have current, accurate, and complete information. Although valuable and presumed to be correct and complete, they may contain misinformation, potentially jeopardizing patient safety. As such, to help support treatment decisions, HCPs and consumers should utilize multiple DI resources, one of which may include pharmaceutical companies' MI departments, consisting of specially trained HCPs, who are readily available to provide evidence-based and balanced product-specific information in response to unsolicited requests.

Declaration of Conflicting Interests

The authors declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Amarita SR is a full-time employee of Purdue Pharma LP; OB is a full-time employee of Celegene Corporation; ZH was a full-time employee of Cubist Pharmaceuticals Inc at the time of manuscript composition; MM was a full-time employee of Boehringer Ingelheim at the time of manuscript composition; TN is a full-time employee of Janssen Scientific Affairs LLC; MO is a full-time employee of Sanofi US; CP is a full-time employee of Novo Nordisk Inc; Anupma SR was a full-time employee of Cubist Pharmaceuticals Inc at the time of manuscript composition; JR is a full-time employee of Pfizer Inc; S Snyder is a full-time employee of AbbVie; and S So was a full-time employee of Novo Nordisk Inc at the time of manuscript composition. The views expressed in this manuscript are the personal opinions of the authors and not those of the pharmaceutical companies.

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References

1. Lum C, Ahn SM. The correction of product information in drug references and medical textbooks. *Ther Innov Regul Sci*. 2012;46:94-98.
2. Phua J, See KC, Khalizah HJ, Low SP, Lim TK. Utility of the electronic information resource UpToDate for clinical decision-making at bedside rounds. *Singapore Med J*. 2012;53:116-120.
3. Isaac T, Zheng J, Jha A. Use of UpToDate and outcomes in US hospitals. *J Hosp Med*. 2012;7:85-90.
4. Hatfield CL, May SK, Markoff JS. Quality of consumer drug information provided by four websites. *Am J Health Syst Pharm*. 1999;56:2308-2311.
5. Kim KY, Metzger A, Wigle PR, Choe PJ. Evaluation of online consumer medication information. *Res Social Adm Pharm*. 2011;7:202-207.
6. Clauson KA, Polen HH, Boulos MN, Dzenowagis JH. Scope, completeness, and accuracy of drug information in Wikipedia. *Ann Pharmacother*. 2008;42:1814-1821.
7. Polen HH, Zapantis A, Clauson KA, et al. Ability of online drug databases to assist in clinical decision-making with infectious disease therapies. *BMC Infect Dis*. 2008;8:153.
8. Vaughan KTL, Scolaro KL, Anksorus HN, et al. An evaluation of pharmacogenomic information provided by five common drug information resources. *J Med Libr Assoc*. 2014;102:47-51.
9. Clauson KA, Marsh WA, Polen HH, et al. Clinical decision support tools: analysis of online drug information databases. *BMC Med Inform Decis Mak*. 2007;7:7.
10. Lapoint J, Perrone J, Nelson LS. Electronic pharmacopoeia: a missed opportunity for safe opioid prescribing information? *J Med Toxicol*. 2014;10:15-18.
11. Cheng MC, Fu C, Guglielmo BJ, Auerbach AD. Boxed warning inconsistencies between drug information resources and the prescribing information. *Am J Health Syst Pharm*. 2011;68:1626-1631.
12. Ness GL, Riggins J, Sheehan AH. Pharmacists' use of electronic handheld drug information applications. *Ann Pharmacother*. 2014;48:1392-1393.
13. Alvarez A. What tasks are physicians performing on their smartphones? http://www.kantarmedia-healthcare.com/what-tasks-are-physicians-performing-on-their-smartphones. Accessed February 11, 2016.
14. Boruff JT, Storie D. Mobile devices in medicine: a survey of how medical students, residents, and faculty use smartphones

and other mobile devices to find information. *J Med Libr Assoc*. 2014;102:22-30. doi:10.3163/1536-5050.102.1.006.
15. Pew Research Center. Health fact sheet. http://www.pewinternet.org/fact-sheets/health-fact-sheet/. Accessed February 11, 2016.
16. US Food and Drug Administration/Center for Drug Evaluation and Research. Guidance for industry. Internet/Social media platforms: correcting independent third-party misinformation about prescription drug and medical devices. http://www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/UCM401079.pdf. Accessed February 11, 2016.
17. Talwar SR, Crudele NT, Dankiewicz EH, Randhawa AS, Haddox JD. Implementing a process to review product-specific misinformation in online drug information compendia. *Ther Innov Regul Sci*. 2015;49:262-268.
18. *Data on File [Manhattan Research. ePharma physician 2014: Pain Management Physician Segmentation—Top Online Information Sources]*. 2014. Stamford, CT: Purdue Pharma LP.
19. Aungst TD. Medical applications for pharmacists using mobile devices. *Ann Pharmacother*. 2013;47:1088-1095.
20. Law MR, Mintzes B, Morgan SG. The sources and popularity of online drug information: an analysis of top search engine results and web page views. *Ann Pharmacother*. 2011;45:350-356.
21. Centers for Medicare and Medicaid Services. CFR 414.930(a) Compendium defined. http://www.gpo.gov/fdsys/pkg/CFR-2011-title42-vol3/pdf/CFR-2011-title42-vol3-sec414-930.pdf. Accessed February 11, 2016.
22. Medscape Reference. WebMD LLC. http://reference.medscape.com. Accessed February 11, 2016.
23. LexiComp® Online, Lexi-Drugs. Hudson, OH: LexiComp, Inc. Accessed February 11, 2016.
24. Epocrates® Online. Epocrates, Inc. http://online.epocrates.com. Accessed February 11, 2016.
25. Drugs.com. http://www.drugs.com. Accessed February 11, 2016.
26. RxList®. RxList Inc. http://www.rxlist.com. Accessed February 11, 2016.
27. Brooks M. Top 100 most prescribed, top-selling drugs. *Medscape Medical News*. http://www.medscape.com/viewarticle/829246. Accessed February 11, 2016.
28. US Food and Drug Administration/Center for Drug Evaluation and Research. Approved risk evaluation and mitigation strategies (REMS). http://www.accessdata.fda.gov/scripts/cder/rems/index.cfm. Accessed February 11, 2016.
29. DailyMed. http://dailymed.nlm.nih.gov. Accessed February 11, 2016.
30. Drugs@FDA. http://www.accessdata.fda.gov/scripts/cder/drugsatfda. Accessed February 11, 2016.