Pharmacological Information Needs Expressed Through a Natural Language Conversational Agent

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Background
Locating answers to medication-related questions can be challenging. The comprehensive pharmacological knowledge base, Micromedex®, has been adopted by over 4500 healthcare organizations worldwide. In August of 2018, Micromedex introduced an artificial intelligence tool, Watson Assistant (WA), a conversational agent that interprets natural language queries and maps them to a pharmacological information type, called an intent, in the Micromedex ontology. Intents are subsequently linked to appropriate content in Micromedex to address the query. WA offers a search method as an alternative to the conventional Micromedex search, which uses a keyword search paradigm that allows users to enter a drug name and returns the related content section, called a drug topic. Users can search for information using either the conventional search or WA, both of which are available on the Micromedex home page. In this work, we examined the types of information sought through this conversational agent to characterize global pharmacologic information needs.

Methods
Intents triggered by WA conversations between August of 2018 and June of 2019 by 3,932 sites were recorded and summarized. Eighty percent of conversations during this period originated from 423 distinct sites. The most common intents triggered by user queries in WA were calculated as a percentage of all intents triggered. Corresponding drug topics that were accessed through the conventional search interface through either keyword searches, hyperlinks, or links to more information arising from conversations within the WA chat window were recorded, summarized, and calculated as a percentage of all drug topic queries.

Results
A total of 126,765 conversations with WA were mapped to 32 different intents during the study period. Table 1 shows the most common types of information sought and an example of a query for each category. The most frequent intents triggered in WA conversations included dosing (n=30,239; 23.9%), administration (n=14,520; 11.5%), drugs that treat specific conditions or diseases (n=10,199; 8.0%), on- and off-label uses (n=8651; 6.8%), pharmacokinetics (n=8495; 6.7%), intravenous (IV) compatibility (n=7942; 6.3%), and adverse effects (n=6676; 5.3%). In the conventional search interface, 79,204,838 queries were mapped to 206 drug topics during the same time period. The most common topics assessed through the conventional search interface during the same time period were dosing (n=34,222,058; 43%), on- and off-label uses (n=5,641,662; 11.5%), and adverse effects (n=5,416,938; 6.8%). The “drugs that treat” intent in WA has no analogous drug topic listing in Micromedex.

Conclusion
Queries to Micromedex from users across the world were most commonly mapped to content about drug dosing regardless of the search interface employed. WA searches of Micromedex mapped to a broader distribution of content compared with conversations using the standard search interface, suggesting that the conversational agent may enable users to access answers to different types of questions. Future research will explore the reasons for these differences, examine mapping failures to improve the search engine performance, and evaluate usability and question answering.