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The next generation of lit reviews

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The use of artificial intelligence and natural language processing is already transforming the process of systematic literature reviews—which means better research, better information for healthcare communicators, and better outcomes for patients.

By Kathy Belk, Nicole Parker, Jan-Willem van Doorn, and Jonathan Wert

A systematic literature review is one of the more time- and resource-intensive undertakings in pharma. It requires teasing out all the articles on a particular subject that might be lurking in the many nooks and crannies of an organization, or externally, or both. Then, if done properly, it requires two separate human screeners with highly specialized knowledge and experience reviewing each and every one of those articles, each of them deciding, "Do we include this article or not?" for every one of dozens or hundreds of articles. Then, if the two screeners ever disagree, which they inevitably do, an arbitrator, another highly specialized human, must make a final decision on inclusion. And then, another highly specialized human must review all the approved articles to tag any information, data, or conclusions relevant to the question at hand, eg "these are the patients in this age group," or, "these are the patients with these particular comorbidities."

And then, another highly specialized human, or several, have to actually extract the relevant tagged data, analyze it, and summarize it in some usefully descriptive quantitative or qualitative way: "this percentage of studies showed this, and this percentage of studies showed that." And all that just to answer one question. Want to answer another question? Go do the whole thing again. For all the extraordinary advances we've seen in the business and science of pharma over the past 50 years, doing a literature review isn't all that much different today than it was for our ancestors in the 1970s.

Sweet relief, though, may be in sight. At Lumen Value & Access, a Healthcare Consultancy Group company, we've been able to introduce artificial intelligence (AI) and machine learning as well as automation technology into the literature review process. It's the early days yet, surely.

But we've had data scientists train an AI algorithm to screen articles and then use that AI process to replace one of the two screeners in the traditional review process. We've also used natural language processing in that same platform to facilitate tagging and extracting data. Manual intervention is still required in those processes, but they've become substantially more efficient, to the tune of a roughly 40-percent decrease in human time required to complete a full review. The outputs we've seen so far are as good as, if not better than, might be expected from a fully human traditional review. Yes, the AI makes mistakes and needs to be retrained periodically. But what the AI doesn't do is suffer the consequences that a human might after reading through 1,200 highly specialized research articles filled with abstruse technical language while hunting for needles. AI doesn't get heavy eyelids or a fuzzy brain, no matter what you throw at it. Its judgment isn't impacted by the length or difficulty of the process. The 1,200th article gets the same treatment as the first.

Introducing AI and natural language processing as well as technology enabling interactive outputs to the literature review process have helped bring other improvements to the literature review process besides plain efficiency and a reduction in heavy eyelids. Your typical pharma organization has a long list of what might be called "centers of knowledge". The health economics and outcomes research (HEOR) folks are doing reviews (the "R" stands for research, after all!), and the med affairs folks are doing reviews, and the marketing folks are doing reviews, and maybe other departments are doing reviews as well. But when someone in HEOR does a review, they are likely only reviewing a limited chunk of the literature available to answer a very targeted question and sharing the results only with fellow HEORs; when someone in med affairs…you see what we're saying. Silo, pharma's favorite four-letter word. But, of course, computers don't care about artificial walls between departments, and they also don't care how big the datasets are. So in the process of integrating AI into the literature review process, we also made sure that the outputs included all of the organization's literature resources, including posters and grey literature, and that the outputs could be dynamically filtered to suit the specific needs of any potential user or department. So now when someone in HEOR orders a review, they are able to look at that knowledge base to answer many different questions, and the results are accessible and useful to everyone, which doesn't sound like a big deal to an outsider but is in fact a substantial innovation over how things have been done in the world of literature reviews pretty much forever.

Another benefit we've discovered is the benefit of being dynamic. In the traditional model, when somebody orders a review in January, the review might answer their question in January, but that answer grows less and less comprehensive and trustworthy the further from January you get. Medical studies and literature don't stop appearing, after all, just because you've finished a review, so you might find yourself ordering the same exact review in October that you did in January. But AI platforms care just as little about time as they do about size, and they can be built to continue to update reviews as new information is entered into their various data sources. With such technology available, literature reviews can be transformed from the equivalent of books on a shelf—static and never-changing—to live, near real-time interactive tools that can be accessed by anyone at any time.

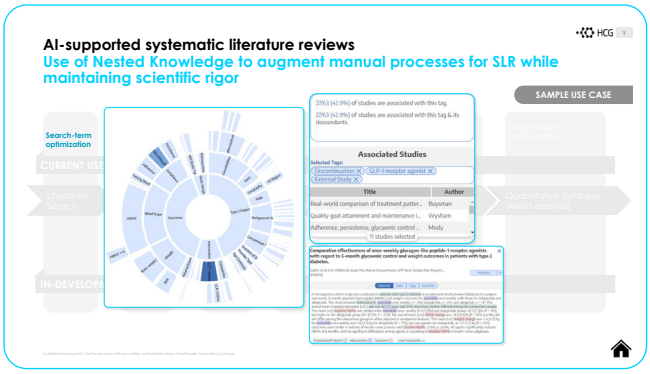
It would be difficult to overstate how valuable a dynamic capability in literature reviews could be during the course of a product's life cycle. Early in the R&D process, you might want a review to better understand your product's potential position in the market and assess readouts from trials.

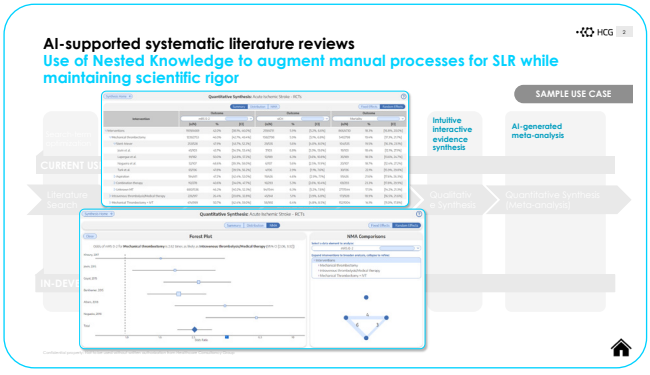
As it moves closer to launch, you might want to use a literature review to demonstrate comparative effectiveness and to develop inputs for economic models to show budget impact for payers. After launch, literature reviews can evaluate your product's efficacy in a real-world setting and demonstrate its value compared with old and new competitors as the market changes around you. Being able to do all this on an ongoing automated basis rather than just at one or two or three static moments in time will mean better- and faster-informed brand teams, payers, health care providers (HCPS), and, best of all, patients.

A related benefit is that AI doesn't have to be trained again the next time you ask a similar question. The first time you do a literature review to investigate, say, comparative effectiveness of diabetes drugs in a specific population, yes, you'll need a specialized data scientist to train the AI properly to recognize exactly what you are looking for. But the following month, when you want to know about, say, relevant comorbidities in that same population, well, that AI is already trained. It might need some brushing up or updating, but the investment has been made. Which means that each subsequent literature review on a similar subject will be quicker and more efficient than the one before.

We've also managed to use AI to begin to automate and "dynamize" (if that's a word!) the process of summarizing and displaying the conclusions of literature reviews. When humans have to create the summary of a complex literature review, it requires a tenuous and manual process to summarize the included studies, never mind any attempts at meta-analysis of those data. But with the help of AI and automated data dashboards, one can rapidly create dynamic summaries that give the user the ability to dig deeper with the click or two of a mouse.

Take a look at the visuals on this page to see what we mean. In the first, each little segment of that sunburst contains more data, more comparisons, and more analysis based on a literature review of balloon guide catheter studies—in this case, with different populations, different ages, different comorbidities, different outcomes, all the data are right there, complete with confidence intervals and odds ratios for easy comparison; any possible interpolation or combination is just a click away. In the second, just a few clicks away from the first, you can see forest plots of odds ratios for the relevant studies, showing the odds of IV-tPA treatment for non-BCG patients versus BCG patients. In the old days, to drill down to that level of specificity in a summary, you'd have to plow through who-knows-how-many pages and indexes, and some poor human would've had to have done a mountain of calculations to even put it on that page in the first place.





The next step? As AI technology gets faster, smarter, and better trained, eventually it'll start asking the questions itself before we humans even think of them. AI can be constantly combing our databases of literature, constantly analyzing and summarizing, so that the answers, the comparisons, the relationships that we might not have seen or even known to look for will be right there to discover at a glance. With human support and guidance, they'll have the power to discover gaps in the research, unmet needs, contradictions, missing pieces that need to be filled in, underserved or under-researched patient populations, and undiscovered economic inequalities or opportunities. The analyses they produce and the discoveries they make will be available outside the walls of pharma companies—to regulators (some of whom are already making strides in this direction), advocacy groups, researchers, and perhaps even HCPs and patients themselves.

And that will mean better research, better assignment of priorities, and—most importantly of all—better outcomes for patients. One of the great challenges in pharma, even today, is that we don't know what we do know. The information available, even on a relatively limited subject, is more than any number of humans can handle unaided. But the expanding use of AI technologies, underpinned by humans able to direct those technologies, is changing that paradigm, which will mean better and faster outcomes for pharma's literature reviewers—and for patients, too.

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Healthcare Consultancy Group

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