

News and Perspectives

First, Do NoHarm: How Pharmaceutical AI Is Improving Care Across Brazil

Luke Taylor, JMIR Correspondent

Abstract

Medication errors are a persistent challenge in health care across the world. In this *News and Perspectives* article, JMIR Correspondent Luke Taylor reports on NoHarm, a nonprofit AI tool changing pharmacy in Brazil, and its potential to relieve burden and improve patient safety elsewhere.

Key Takeaways:

- NoHarm, a new AI tool, is transforming pharmacy across Brazil, with the potential to do the same in other over-stretched health systems.
- Despite its success, data access issues may block more widespread adoption.

As Henrique Dias caught up with his family one Sunday afternoon, he began to understand why his sister's job was pushing her to the brink of burnout once again.

As a clinical pharmacist at the largest public hospital in Porto Alegre in southern Brazil, Ana Helena Ulbrich was responsible for the safety of more than 800 patients.

But despite eight years' experience in the job, she was only able to review a fraction of her patients each day.

"Managing 800 beds, going through every patient and all these documents one by one, manually!? I remember thinking it's absolutely crazy!" Dias says. "And this was just one of her tasks as a clinical pharmacist. She was also responsible for multidisciplinary rounds, managing medication storage, and handling discharge procedures and quality checks."

That day in 2017, Dias—a data scientist—decided to switch the focus of his PhD from using AI to analyze emotions in blog posts to developing a tool to make his sister's job easier.

That idea has since grown into [NoHarm.ai](#), a nonprofit startup and one of Brazil's most successful healthtech companies.

Every month, NoHarm reviews around 5 million prescriptions, with the system flagging potentially dangerous drug interactions, incorrect dosages, and other risks at a speed, scale, and precision impossible for humans.

"NoHarm didn't just make the job of a pharmacist faster. It has fundamentally changed how they actually do their job," says Ulbrich, who cofounded the startup with her brother.

Prescription Errors: More Common Than You Think

Prescription errors are difficult to quantify but studies suggest the burden of medication-related harm is greater than we

think. [One review paper](#) estimated that 13.9% of admissions to emergency departments or inpatient wards were related to adverse drug events, while the [World Health Organization estimates](#) that nearly half of preventable harm in medical care is linked to medication.

The situation is [worse](#) in low- and middle-income nations, including Brazil, which collectively account for two-thirds of the world's adverse events resulting from unsafe care.

[One study at a university hospital](#) in southern Brazil found one problem for every two prescriptions reviewed.

Among the most common issues are incorrect dosages, omitted medicines, and duplicated treatments—but underpinning them all is the fact that pharmacists are overstretched and overworked.

"In a public hospital, pharmacists typically don't have the capacity to review every prescription. So you prioritize, focusing on [intensive care unit] patients for example, because reviewing everyone is not feasible," Ulbrich says.

How It Works

NoHarm's creators—and some of the 200 hospitals and 300 clinics across 65 cities who use the program—say it is transforming the profession by increasing both efficiency and patient safety.

The program's base function is a machine learning algorithm that is fed a year's history of anonymized prescriptions at the hospital or clinic it is being used in so it can recognize any historically unusual prescriptions.

If a pharmacist prescribes 5000 mg of paracetamol instead of 500 mg, or 10 times a day instead of 3 times, for example, it flags the prescription as potentially dangerous to the

pharmacist. It also highlights any uncommon drug combinations.

NoHarm also uses a patient-specific machine learning model that emulates the manual review of pages and pages of scattered information that Ulbrich used to follow.

The program automatically grabs the patient's prescription, demographic information, laboratory tests, diagnoses, and clinical notes from the hospital's electronic health records.

If a patient's lab exam result is outside the expected range, if two drugs could interact, or if a doctor should intervene for any reason, it bumps the patient to the top of the pharmacist's review list, flags them as high-risk, and provides links to any relevant information to review.

Effectiveness Across Brazil

Clayr Madeira, who manages a network that includes 30 public university hospitals that have implemented NoHarm, says the program offers a new level of patient safety as the program is able to cross-check all data points against each other simultaneously in a way humans cannot. In one public hospital in Minas Gerais, the adoption of NoHarm [reduced the error rate](#) of prescriptions from 13% to 0.3%.

It also speeds up a pharmacist's work so they can, on average, check 4 times as many prescriptions.

"To check the interaction of each drug with every other drug and patient characteristics in real time—one of NoHarm's many functions—would be impossible given the time constraints" Madeira says. "This guarantee, or double check, is invaluable as it significantly reduces the chance of error."

AI Care for the Masses

Private hospitals pay 50 reais (around US \$10) per bed per month to use NoHarm. The founders say it saves around R\$1 million (US \$200,000) per year for every 200 beds it is used for, freeing up money and health care personnel that can be better utilized elsewhere.

But NoHarm's biggest beneficiary is Brazil's public health care system, the Sistema Unico de Saude (SUS). NoHarm uses profits from its private clients—a third of its customers—to offer the program for free to the other two thirds: the SUS.

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Clayr Madeira

The SUS is the largest public health system in the world, with around 75% of Brazil's 200 million people relying on its free universal health care.

The system is ambitious but underfunded. Brazil spends US \$1700 per capita on health—about a third of the Organisation for Economic Co-operation and Development average.

And quality of care is uneven, with significantly worse care outside the cities. A riverside town in the Amazon, for example, may have no pharmacist at all to look over prescriptions.

Provided such remote towns have a stable internet connection, even this low-tech tool's simplest function of automatically triaging patients' order of risk could save many lives.

"It's a big win because it means Brazil's public hospitals can offer a level of pharmaceutical safety that before was reserved only for a few elite institutions," Madeira says. "In theory, AI is for everyone, but in practice here in Brazil, few hospitals have the financial means to afford it."

Implementation Barriers and Challenges

Connectivity, Madeira notes, remains a key barrier to NoHarm's implementation. NoHarm is typically deployed as a cloud-based software. In addition to the data security challenges that this can pose compared to running it on an internal network, which would also allow potentially richer data to be shared, Madeira says that "even in a scenario where everything runs in the cloud, in some places we need to have two internet connections, so that if one fails, the other one takes over."

There are other areas of potential improvement, he says, including reducing excess notifications, giving high-priority notifications more prominence, and improving integration—including network-level visualization and management across hospitals.

At a national level, while Brazil's underfunded health care system is ripe for AI solutions, implementation has so far lagged behind the United States and Europe.

That's because Brazil is one of the most unequal and diverse countries in the world, says Alexandre Chiavegatto Filho, PhD, a leading researcher on AI in Brazilian health at the University of Sao Paulo's public health department.

An algorithm that works for a wealthy businessman of Italian ancestry in Sao Paulo may not work for an indigenous person living off subsistence fishing in the Amazon rainforest. But this challenge, if overcome, can also be a strength.

"The plus side is that an algorithm that works in Brazil will be super powerful," he says. "Unlike in a more homogeneous European country where it is only useful there, something made here should work anywhere due to the variety of genetics, socioeconomic statuses, and risk."

NoHarm is currently in discussion with hospitals in Ghana and Vietnam about rolling out the software there, and its founders believe it could have a strong impact across the United States and in Europe.

But Dias says the barriers NoHarm is facing abroad have reinforced what he sees as the biggest lesson from NoHarm's success in Brazil: the importance of who controls health care data.

In Brazil, hospitals own their data—the startup got off the ground because the university hospital where his sister worked allowed them to access their data to create the program. Another public hospital later took the risk of letting NoHarm pilot there. In other countries, where personal relationships are less central and hospitals have less data control, it may not have been possible.

And indeed, they have hit stumbling blocks in bringing their technology to other parts of the world.

In the United States and Portugal, they have found it is generally the hospitals' software providers who have control, and they have either denied their requests or offered to integrate the tool themselves at unaffordable costs.

"These guys are not open to innovation because the health software industry is very lucrative and they don't want to lose a piece of the pie," Dias says. "But if providers around the world continue to block the entrance of AI, it could be a big roadblock to innovation in healthcare."

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