



Title: Getting into Pharmacy Informatics: What to Know

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Description: This article has specific details for pharmacy students and current pharmacists that have interest in the field of pharmacy informatics, but is suitable for all audiences, because there are many other specialists or people with different backgrounds that work on these teams. From computer sciences, pharmacy technicians, educators, nurses, to you name it! So welcome, this might be a career that works for you.

Introduction

About Barry McClain

I have over a decade of leadership in pharmacy informatics, specifically in the large health system space. I have been part of a lot of mass electronic health record conversions, totaling to date 27 inpatient hospitals. I also have oversight over retail information systems and have integrated over 70 pharmacy stores within electronic health records. I am also a residency program director for pharmacy informatics and have done that since 2015. Overall, I have a lot of experience with developing, educating, and hiring folks in this space, and now, I am injecting that wisdom from experience into this article.

Basic definitions

What is pharmacy informatics?

I am going to level set with some basic definitions. Per American Medical Informatics Association (AMIA), informatics is the science of how to use data, information, and knowledge to improve human health and the delivery of health care services.¹ I read that definition, and it is pretty abstract. It does not sound very exciting. So maybe through a simpler lens, my definition of pharmacy informatics is a specialty that is involved with bringing Innovation (particularly information technology) to life within healthcare and supporting and maintaining it, so it is reliable and improving over time.

So that is informatics. if you take a small subset of that pie, then you have pharmacy informatics. And really, the focus of pharmacy informatics medication use process (I will define what the medication use process briefly). Thus, pharmacy informatics is the result of integrating the medication use process using informatics (as above) for the purposes of better patient outcomes. To make better sense on how to achieve this, I have provided the typical areas of focus and goals of pharmacy informatics.

Some common elements of pharmacy informatics include the follow list (but not limited to):

- Medication and prescription records
- Clinical decision support, drug warnings, alerts

- Drug information, references, education
- Data transactions, interfacing, communication
- Barcoding, radio frequency identification, product identification
- Automation, robotics, other third-party technologies
- Data analytics
- Information sharing and transparency
- Finance and billing
- Printouts, labels
- Enhancing safety and workflows (e.g. barcoding, recalls, medication rec) using these tools

Main Goals of Pharmacy Informatics

There are two fundamental goals of pharmacy informatics:

- Using information technology to provide world class pharmacy service anytime, anywhere, to any person/living thing (because animals need medications too).
- And to optimize the medication use process, making it more efficient, safer, and cost-effective while keeping it legal and compliant as well.

That is how pharmacy informatics can lead to better patient outcomes!

A Little Intro to the Medication Use Process

So what is this medication use process? Figure 1 provides a very simple illustration to understand how the medication use process works. This can easily be a presentation on its own. This process starts with the generation of a medication order or prescription from an electronic health record of some sort. That application pulls up a medication record and is ideally designed to guide the right dosing and use of the medication therapy. Once the order is signed and transmitted to a pharmacy for a particular patient, the prescription order is reviewed and verified and by a pharmacist. Assuming there are no issues, the medication will get dispensed. It might get dispensed by robotics, be sent to automation dispensing cabinets to allow nurses/providers to obtain, or manually dispensed. Any labels and/or other printouts accompany the dispense. If a patient is in a hospital or other controlled setting, there can be more documentation on the medication administration record, be barcode scanned, and/or use smart pumps too. Outside of a controlled environment, remote patient monitoring and other patient level technology can be a contributor to the medication use process too. This life cycle of a medication order and how it starts from the beginning to end is the basic concept of the medication use process. For a robust implementation of the medication use process, it is in continuous oversight/monitoring to optimize patient outcomes

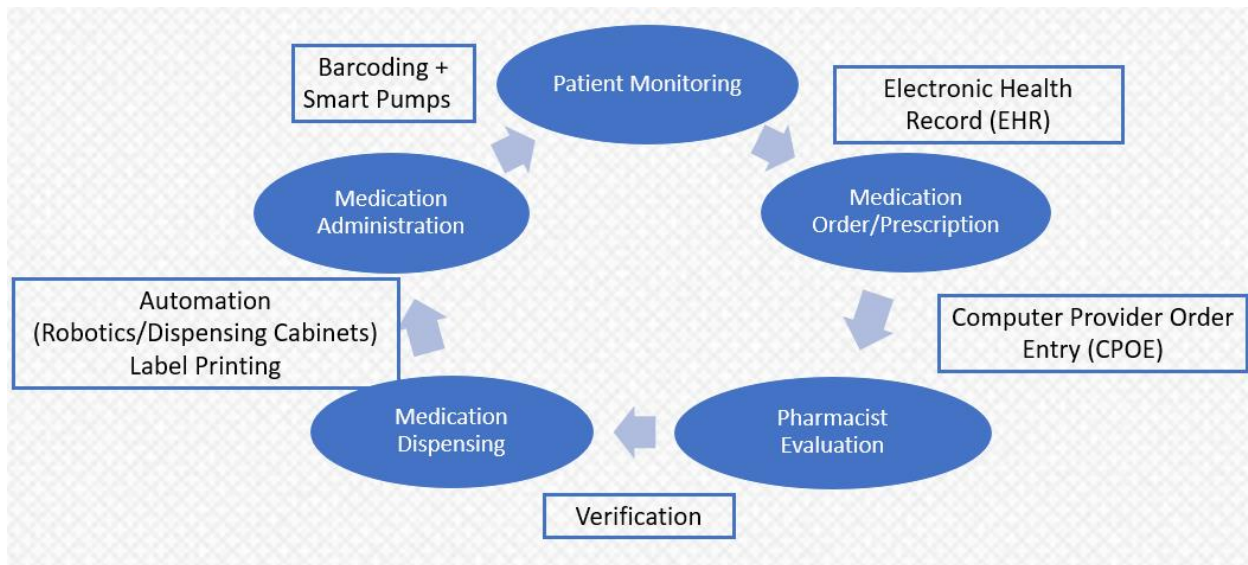


Figure 1. Diagram of the medication use process

A Brief History of Pharmacy informatics

The history of pharmacy informatics starts with paper. That is the way this began and was for a very long time. In a nutshell, the history of pharmacy informatics, and pretty much all informatics, is the story of interoperability. Starting with paper and then introducing computers, was like having a fancier version of paper in the beginning. Databases are big file cabinets. Then computers and servers continue to increase data storage, processing, and reporting. Then throw the internet on top of that, and that is where the story of interoperability explodes with having clinicians, payors, third-party vendors, electronic prescribing networks, pharmacies, and patients starting to communicate with each other. The 2009 HITECH Act became another major player in the story, which paved the way to having the US government fund “meaningful use” and the adoption of electronic health records.²

Now we can even see “smart” devices like watches and cell phones acting as digital diagnostic and therapeutic tools, making the world of interoperability bigger and bigger. I will get into the world of artificial intelligence in later publications.

Hopefully this brief walk-through history helps prove the importance in having healthcare professionals involved in the research, design, implementation, use, and optimization of these various software and hardware solutions.

A Little Dose of Typical Pharmacy Informatics Activities

Typical pharmacy informatics activities include:

- Application deployments and redeployments
- Medication records, order sets, protocols and order groups
- Alerts, warnings, and other types of decision support

- Creating reports/data analytics
- Interface activities: e-prescribing, printing, dispensing systems
- Automation, robotics, smart pumps, and other hardware
- Support: Reviewing tickets, troubleshooting, break/fixes, training
- Maintenance: Imports, upgrades, release notes

To provide some perspective on the activities that people do in pharmacy informatics, it is typically working a lot in databases. As I mentioned in my bio, I have been involved with a number of mass electronic health record conversions. A health system and/or pharmacy going live with a new application deployment will have build associated with the location that will need to be setup. You will also have an immense number of medication records, order sets, protocols, and order groups that help guide clinical judgment and documentation in a lot of ways. For example, having the right drug information such as suggested and/or default doses and frequencies entered on the medication record. There is also the development of alerts, warnings, and other types of decision support that prevent errors/optimize outcomes. Other important areas include reports and data analytics, interface activities (e.g. electronic-prescribing, billing/adjudication, dispensing systems, etc.), and implementing/managing hardware (e.g. automation, robotics, printing, labeling, barcoding/product identification, etc.).

Like any information technology team, there is application support typically with some type of ticketing system. So there is a constant influx of support tickets that requires triage, troubleshooting, and break fixes. Requests requiring more time and prioritization will go through a project enhancement process.

Simultaneously, there is the necessary upkeep of maintaining application software and hardware. This typically involves regular upgrades and release notes. Once review, build, and testing is completed, there is training, education, and communication to end-users to handle new changes and/or adjustments. Just keeping any technology-based system up to date requires a lot of work.

What Pharmacy Informatics Should Not Be

- The entire IT department
- A complaint line

So we talked a bit about what pharmacy informatics is, but here are some important considerations of what it is not. First and foremost, pharmacy informatics is not typically the whole IT department. A lot of companies can have IT departments that have large numbers of individuals and teams. There are lots of different specialties within IT, so keep in mind that we really do not do everything. I am not, for example, a good contact when a personal computer breaks. Pharmacy informatics has a specialized focus.

Another thing pharmacy informatics is not, is a complaint line. Sometimes, when working in very intense situations, having additional stress or anger escalation is never a helpful thing. Particularly when folks are putting all their energy into focusing on something, there really needs to be a two-way street between a project team and the business to really problem solve a complex issue.

The Big Question

“What can I be doing to get into pharmacy informatics?”

The number one question I get from pharmacy students and other interested professionals about getting into pharmacy informatics is “what can I be doing to help me get into pharmacy informatics?”

“What coding languages, experience, skills, and opportunities should I be taking?” I pretty much answer it the same way every single time. I have a pharmacist first mentality, and every day I come to work, I remind myself why I do this and why it is important. It is really all about patient care. So having that focus is what I consider the most important aspect to start with.

What Skills do you Need?

Art or science?

- There are a significant range of skills necessary to “bring innovation to life” in healthcare and medication use
- Many good candidates begin with very little technical backgrounds

Depends on the type of setting you work in. If you are talking about working in the research and development department of a software company, yes, you should probably know a lot about computer programming. However, if you are targeting working in a health system where you are working primarily with third-party applications, you likely do not need to be a computer scientist at all. A lot of background and training is provided by the vendors. Despite that, the real-life essential skills that vendors (and a lot of schools) do not teach you typically are things like good project and time management. Leading change through a complex environment. Leading an effective meeting. Good documentation. Those “soft” skills are what I call the art of informatics. Notably, if you are intimidated and/or struggle with computers and technology, this is probably not a good fit out of the gate.

Who do I Hire?

- Passionate and hard-working professionals
- Individuals focused on customer service and having a positive attitude

For hiring, my priority is finding passionate and hard-working professionals. Those are the most key variables for someone that is going to be successful for a long time and be a good investment. I will also say attention to detail is important and relates to the thoroughness that that is necessary to perform database build, testing, and quality assurance. Good attention to detail is usually a firm quality pharmacists innately have, and they tend to be pretty good analysts based on that.

To continue with what skills matter, I would say having a “role-model” customer service and a positive attitude is important. Consider knowledge/skills like pharmacotherapy, aseptic technique, surgery, VPN tunnels, Java, HL7 interfacing...all these things are learnable. Having a good customer service and positive attitude is not always very natural for people, but are necessary traits, especially if you want to be successful and have a rewarding experience in the field. It is just my opinion, but something I do look for.

Back to the Original Question

How do you get into pharmacy informatics?

- Practical experience
- Experience with doing projects
- Always be looking for opportunities
- Talk to folks in the field. Shadow. Network!
- Vendors. Pharmacy informatics is in a lot of places. Not just in places with pharmacies/medications
- There are technical skills that are helpful
- Residency training

Going back to that original question, what can you really be doing right now? So first things first. Practical experience, especially for student pharmacists or newer practitioners, is a very important baseline to obtain. This means understanding the inner operations of a pharmacy department, clinical practice, and all the real-life aspects of those things that have taught all those years of school. Literally, all the applications and technology being discussed here are directly facing and interacting with the frontline of healthcare.

Another important aspect I would put on the list is being adjusted to project work versus shift work. There is a big difference between clocking in/out in a job that is very routine versus a job that is less structured and requires you to organize the planning, doing, assessing, and optimizing of a project (and usually numerous ones at the same time). Not to say there are no routines with informatics or complexity to working on the frontline. The point is that not everyone is well adjusted to project-oriented/self-directed work. So getting your hands dirty doing projects, whether they are informatics or anything else is a helpful test and will let you rule in/rule out this type of work early. To put into perspective, there are many days I have no idea what I am going to get myself into. There can be a lot of variation and unknowns that can throw you into a loop one way or the other. So you must be very flexible and consider the “unknown” in your planning, as you do not want to be pushing out your promises to complete jobs indefinitely.

Get involved. Another way to get your feet in the door is to be always looking for opportunities. If you work in a healthcare environment and you are looking for project opportunities or problems to solve, you will find them. Being a supervisor myself, I can say whenever someone is raising their hand to do something, I usually do not say no. So I feel like you can find your way into this world, even if it is just a project here or there. What else can you do to get involved? Talk to folks in the field, shadow, and/or network. Even this article. I have my contact information listed, so feel free to reach out. Learning from professionals in the field is a great way to get to know a little bit more about what the day-to-day activities really look like. There is also a lot of different vendors out there, so pharmacy informatics is not just isolated to healthcare settings.

The Technical Stuff

- Know your standard Microsoft applications (Excel, Access, Visio, etc), and more enhanced apps if you have access (Power BI, SharePoint, Power Automate, PowerApps, etc)
- Managing data: SQL

- Web development: HTML, CSS, JS/jQuery
- Programming languages: From all the options, I usually recommend starting with Python.

I purposefully leave necessary technical skills at the end. However, if you are someone that has a technical background, then that is a good foundation as well. It is just another angle into pharmacy informatics. Whether you start pharmacy and go to informatics, or start informatics and come into pharmacy, you are going to have something to learn. I still stand by everything I have said and put priority on everything before this section.

The first technical skill I put on here, because I think it is the most accessible, is just knowing your standard Microsoft applications. I know that sounds kind of corny, but Excel, Access, Vizio, even PowerPoint and Word, have a lot of advanced features and functionality that you can be exploring. So take advantage of those tools that you already have in front of you. That is really what we kind of do in a lot of ways in pharmacy informatics, working to solve medication use problems with the tools we have.

There are more integrated applications that Microsoft have too (note I am not a Microsoft Champion by any means). Some of the more advanced things I have seen are Power BI for data visualization and SharePoint, Power Automate, and PowerApps for developing business solutions. These are very useful skills to solving practical problems.

Getting a little bit more technical, I put structured query language (SQL) next for developing reporting skills. There are tools based on SQL that serve as powerful reporting platforms out there. Microsoft SQL Server, SAP Web Intelligence, Snowflake, Databricks, etc are some examples. Just even knowing how to query information and work through a database's columns and tables is only going to benefit you.

Another set of skills that is useful and relatable to pharmacy informatics is web development with HTML, CSS, and JavaScript/jQuery. Using web development skills helps you get an appreciation for how a web browser reads and formats web pages. Using JavaScript and/or jQuery also enables you create your own front-end calculators, forms, scripting, and other quick and dirty solutions.

Lastly, I put more comprehensive object-oriented programming languages on the list. Generally if you have never programmed in your life, I would generally advise trying Python just because it is more accessible and more usable than some of the other languages (not that there is anything wrong with C#, Java, etc). Python is something that can be picked up a little bit easier for beginners, but again, it is about giving you more appreciation on how computers think and how databases work.

All these suggestions are beneficial and there are certainly numerous formal and informal ways to learn them.

What the Specialty Needs More than Anything Else

- Professionals with enough practical experience and technical skills that can translate the needs for the business
- Can-do attitudes
- Overall great leaders!

I feel overall, pharmacy informatics needs professionals that have enough practical experience and technical skills that can work and translate the needs for successful projects. I think a good balance of those skills are highly valued.

Additionally, attitudes, specifically can-do attitudes are very important. Even if you are not able to accomplish a fix or solution to a problem when working with your end-users, good customer service just goes a long way, and it is typically appreciated.

Lastly, we have a lot of shortages of different types of professionals in healthcare, however, there is no bigger shortage than overall great leaders. Emphasizing the word great here. I feel everyone, especially on a pharmacy informatics team, is functionally a leader informally or formally. Effective leadership is what is necessary to carry a project and/or manage a piece of information technology safely and successfully.

Why I Believe in Pharmacy Residency Training for Pharmacists

- Pharmacy residency is a bolus of clinical and informatics experience
- Direct flight into a pharmacy informatics career
- Hands-on experience
- Quality graduates are sought after

From a pharmacist hiring standpoint, as of 2023, the last five pharmacists I can think of I hired, all graduated with a pharmacy informatics residency (post-graduate year two) whether it was my own residency or a different program. So the residency pipeline is a very popular trend, and the reasons are clear. Residency is a great bolus of both clinical and informatics experience. Even better if you get a program where you can get both two years at the same organization, you are only going to benefit seeing how things come together. You get good hands-on experience within a residency. They are going to train you to be one of the members on the team, do that necessary vendor training, and get your hands dirty. I know I am biased in this topic, and there are a lot of different opinions about it, but I do advocate pretty heavily for the residency training.

Because it is a valuable training program, residency ends up being kind of a direct flight for a lot of pharmacists getting into pharmacy informatics. It is unfortunate that there are not a ton of these pharmacy informatics residency programs out there, and getting into one these residencies is not necessarily an easy thing either. But if you get in, this is your best way of getting a job in in the field.

Note, it does not mean that if you do not get in residency at all that you cannot get into pharmacy informatics. It is just more likely you are not going to have that direct flight I was talking about. You might have a lot of different stops along the way with jobs and experiences, which I feel will only benefit you. Eventually you might find that opportunity pop up. There are a lot of health systems and companies out there that are hungry for people. So again, if you are looking, you will probably find something.

Further Observations/Realities

Expectation setting

Some reasonable advice, especially for folks that are new coming into pharmacy informatics, is that you will likely never become competent in everything. Especially if you are looking at developing your innovative software or solution. To fully design, engineer, implement, project manage, deploy, train, educate, sell, contract, maintain, support, interface, invest, etc. a new piece of technology is quite the effort. Sounds a lot like a company! I don't want to discourage dreams, innovation, or pioneering. I love seeing folks that have crafted their own ideas. Nothing cooler than that. That is what makes this field fascinating. I just want to point out it is a lot of work, and in all honesty, health information technology is a team sport, or at least it is typically best driven by a team. When needing expertise, you are better off finding intelligent people to work with that will make you more successful much quicker (yes, it will cost more). That is why I think passion is so important in the end, as it is going to take a heavy lift to get through a major development project whether you are learning new skills or finding those that can help.

Bigger than US

When it comes to providing the best care and having the best "system", we are all on the same team

- We should be helping each other

Another perspective that I have learned over the years is that it is bigger than "pharmacy informatics". Early in my management career, when working on a team that is split between reporting to pharmacy and IT, I realized quickly that we are one team. After leading for a little bit longer and looking at the multi-disciplinary teams and integration in the organization, I realize again we are all one team. But then I think it took a little bit longer to realize an even bigger perspective. In the bigger scheme of things when you look at patients, we are again all one big team...across all sites of care around the globe. So when it really comes to providing the best care and having "the best system", we just are on the same team, and we should all be just helping each other as much as possible because these are all our patients, and everyone really deserves the best. So the more we can work together, the better.

Healthcare is a very challenging environment

It takes a lot of:

- Coordination and planning
- Grit/thick skin
- Dealing with setbacks
- Dealing with limitations
- Change
- Care!

For the last point, it is important to highlight healthcare is a very challenging environment. It takes a lot of work to get anything done, even very simple changes can take a lot of coordination and planning. It takes having thick skin, engaging some hard conversations, and dealing with setbacks and limitations.

Moving the needle forward takes a lot of change. We push a lot of change on frontline staff, providers, patients, and even ourselves in this field. This requires adapting to new ways of thinking and doing

things differently constantly. The goal is to always be improving safety, user experience, efficiency, etc. It is not to create busy work or drive anyone crazy for no reason.

Success in any area of healthcare, well, takes a lot of care. Providing care is the main purpose of coming into this informatics role. Once you can make that connection of how you can help deliver patient care through technology, databases, and interoperability at a population-level, you get kind of hooked and get what I call the “informatics bug”.

In the end, good luck! hopefully this article helped you come to some conclusions. Feel free to contact me. I have my LinkedIn information and email on the pharmacyinformatics.net site.

- 1) *Informatics: Research and practice*. AMIA. Retrieved March 19, 2023, from <https://amia.org/about-amia/why-informatics/informatics-research-and-practice>
- 2) Office for Civil Rights. *Hitech Act Enforcement Interim Final Rule*. HHS.gov. Retrieved March 19, 2023, from <https://www.hhs.gov/hipaa/for-professionals/special-topics/hitech-act-enforcement-interim-final-rule/index.html>