

Medication Reconciliation and Polypharmacy Committee Final Report

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Submitted to: Medication Reconciliation and Polypharmacy Committee

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Executive Summary

The Medication Reconciliation and Polypharmacy Committee (MRPC) was formed to build upon the Medication Reconciliation and Polypharmacy Work Group's eleven recommendations¹. The work group was established by Special Act 18-6 and concluded its work on June 30th, 2019. The MRPC was officially approved for two years, as a standing committee by the Health Information Technology Advisory Council (HITAC) on September 19th, 2019.

The MRPC's inaugural year coincided with the onset of the COVID-19 pandemic. Despite this significant headwind, and the impact on many members who faced substantial professional challenges, the committee made progress. The progress was the result of the steadfast commitment of the MRPC membership and OHS support. Progress made by the MRPC's activities has included: (1) convening a multi-stakeholder group, including two patient advocates, a number of physicians, pharmacists, informaticians, vendor representatives and state agency representatives; (2) supporting deprescribing, through Continuing Professional Education and outreach efforts to facilitate the adoption of an NCPDP script standard for electronic medication discontinuation called CancelRx; and (3) developing and publishing through its final report, a robust set of business² and functional³ requirements for a "Best Possible Medication History" (BPMH). At the close of its first year, the committee approved five goals for it to accomplish in its second year. More information about the year's work can be read in the [MRPC 2020 Annual Report](#).

In its second year, the committee began with five goals identified in the January 2021 report. In April of 2021, in recognition of available time and funding constraints the committee focused on two main topics:

Environmental scan of relevant policy and technologic implications of medication data sources for a Best Possible Medication History. Information for this section was gathered via interviews with representatives from Health Information Exchanges (HIEs), state Prescription Drug Monitoring Programs (PDMPs), other state and federal government agencies, technology vendors, and individuals who were identified as subject matter experts in relevant domains. The main findings confirmed that medication data is stored in a number of different source HIT systems, in varied data formats and structures but that increasingly exchange of this information was being accomplished for a number of different clinical and business scenarios. There was no comparable efforts to what Connecticut is attempting with regards to a single BPMH identified in this effort. Several efforts did utilize an HIE to perform Medication Reconciliation and also to aggregate prescription fill data. Legislative enablement of one states PDMP to collect all fill data, was complex and required careful consideration of access policies to protect patient's privacy and security. While it results in a comprehensive history, and still has value for prescribers, it does not fulfill the fully described use case for medication reconciliation.

BPMH user interface requirements feedback and analysis for patient and clinician-facing tools. Feedback from 70 clinicians, patients and caregivers were collected from July 16th thru August 19th, 2021 to develop a catalogue of features that would be necessary for medication reconciliation to be performed. A series of interactive screens were created so participants could better visualize the potential features and capabilities for develop the tool. The main themes that participants voiced for such a tool were: existing gaps, user interface optimization, safety considerations, data sources, best use considerations and value proposition. A summary of the report is available in the [accomplishments](#) section and the full report is in [Appendix C](#).

¹ <https://portal.ct.gov/-/media/OHS/Health-IT-Advisory-Council/MRP/Final-Recoms-Med-Rec.pdf>

² Business Requirements identify the goals of the Best Possible Medication History based on problems statements identified by committee members. Business requirements define the 'why' for the BPMH, including: How the BPMH relates to the objectives, vision, and goals of the MRPC, and the scope of the needs to be addressed. The business requirements are high-level and can be broadly defined.

³ Functional Requirements identify the specifications and detailed functions desired of the Best Possible Medication History. Functional requirements define the 'what' for the BPMH including the specific behaviors of the BPMH, specific steps the MRPC and its support will take to achieve the business requirements. The functional requirements are specific and well defined.

The main body of this report presents a high-level overview of the committee's activities and accomplishments during 2021.

Impact towards future healthcare outcomes

Since the start of this committee, its work has been recognized at national forums and attracted the attention of others seeking to address medication reconciliation and polypharmacy. Locally, the committee has been able to engage state leaders and entities to discuss the implications of its work to improve the health and wellbeing of Connecticut citizens. On May 3rd, 2021 Connecticut's health information exchange, Connie, launched. Connie has stated that one of its priority Use Cases for development in 2021-2022 is the BPMH. The MRPC's co-chairs and several members have been solicited and made themselves available to Connie to continue to inform the work of the HIE as appropriate. Connie's Board of Directors have officially authorized the continued work of the creation of a Best Possible Medication History (BPMH).

At the level of the HITAC work also continues on the [Five-Year Statewide Health Information Technology Plan](#), which is the responsibility of the Office of Health Strategy (OHS). Medication reconciliation is a major component of the plan and is anticipated to be further refined as the work is finalized.

As the MRPC concludes its work in September 2021, its contributions will live on in, be expanded upon, and implemented through these two impactful mechanisms. It is the will and hope of the committee that the work it has accomplished will inform the state's future development and progress in improving health care for its citizens by addressing the challenges of medication reconciliation and polypharmacy.

Acknowledgements

The committee members would like to thank the Office of Health Strategy and the HITAC, who two years ago, requested that the MRPC convene to push Connecticut towards improving the state of medication reconciliation and polypharmacy. The members of this committee are honored and humbled to have served as representatives of their areas of expertise.

Background

The Health IT Advisory Council was established per [Conn.Gen.Stat. § Sec. 17b 59f](#) to advise the Executive Director of the Office of Health Strategy and the Health Information Technology Officer (HITO) on coordination of health IT activities in Connecticut.⁴ The Medication Reconciliation Polypharmacy Working Group (9/2018- 6/2019) was established by Special Act 18-6, the major output of which was a report with eleven recommendations related to medication reconciliation and polypharmacy. The Medication Reconciliation and Polypharmacy Committee (MRPC) was chartered on September 17th, 2019 as a standing committee of the Health IT Advisory Council (HITAC) to continue the work of the MRPWG. The committee met 18 times from November 4th, 2019 until September 20th, 2021. Meeting minutes, materials, and recordings can be viewed [online](#).

Medication Reconciliation and Polypharmacy

Medication reconciliation and polypharmacy continue to be a challenge for prescribers and patients. The MRPWG's 2019 report notes the risks posed to patients with chronic diseases, particularly older adults who are more likely to be prescribed multiple medications, also known as polypharmacy.^{5,6} Polypharmacy can result in situations that lead

⁴ https://www.cga.ct.gov/current/pub/chap_319o.htm#sec_17b-59d

⁵ Ekstrand, MJ. *Transforming "Med Wreck" into "Med Rec.": One Health System's Journey*. Webinar presentation: Pharmacy Quality Alliance; July 2017.

⁶ <https://www.cdc.gov/nchs/data/databriefs/db347-h.pdf>

to adverse drug events (ADEs) and medication-related problems (MRPs), which can harm patients. Transitions of care (i.e. hospital to long-term care, or discharged for home health) can be common sources of medication errors making a single list of medications from a BPMH particularly valuable during that time. For that reason, the MRPC was mobilized to continue the work of the MRPWG. A guiding principle for the MRPC was to keep the patient as the “North Star”. This focus led to the following precept:

Safe, quality and timely delivery of healthcare requires access to the ‘Best-Possible Medication History’ (BPMH). The BPMH should include all prescription and non-prescription medications, supplements and herbal products. The BPMH should be accurate, up-to-date and accessible to stakeholders (including but not limited to patients, caregivers and health care providers) at the point of decision making. Access to the BPMH will support collaborative care, reduce medication costs and errors and improve clinical outcomes.

With this vision in mind, the MRPC developed a set of business and functional requirements for a BPMH solution. The committee started with a list of 22 known issues from the MRPWG work group’s recommendations and then developed 32 business requirements and 82 corresponding functional requirements. These functional requirements may be used by technology vendors to develop technical requirements and produce a solution that the committee believes would satisfy the needs of patients and providers.

In order for it to be most effective, the BPMH would need to be a resource accessible to all relevant clinicians, to carry out patient care by receiving medication data from reliable resources (i.e. EHRs, PDMP, pharmacies, pharmacy benefit managers, Claims, disease specific patient advocacy organizations etc.), and aggregating the data into an actionable and practical resource for clinicians (Figure 1). To ensure that the BPMH produces actionable interventions for prescribers, clinical decision support will need to be a component of the solution. However, the severity of the notification should be reflected in the method that the prescriber is alerted to reduce alert fatigue so that patient safety is not at risk. The committee deferred making a recommendation about who should arbitrate the BPMH data. This will remain an important consideration that needs to be addressed going forward. In addition, the

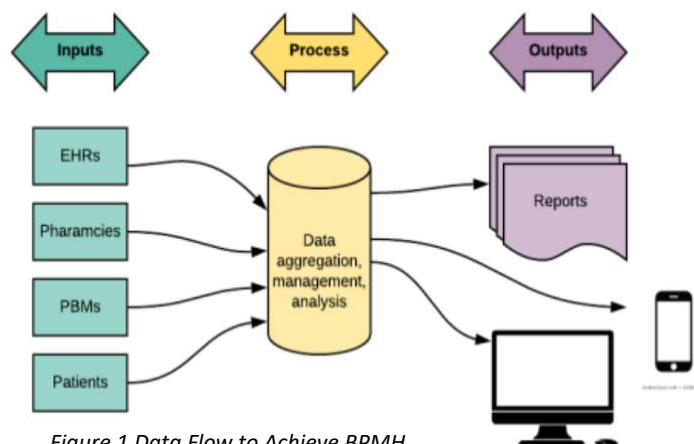


Figure 1 Data Flow to Achieve BPMH

MRPC acknowledges and emphasizes that any entity seeking to implement a solution must ensure that the data are stored securely, and that privacy and appropriate use considerations are paramount in the solution’s design and access. It was postulated that for the state of Connecticut, the health information exchange, Connie, will be responsible for the development of a potential solution.

Proceeding with the development of the business and functional requirements on October 19th, 2020, the committee established five goals for 2021 to build upon the progress made. All activities would continue to be patient centered and focused on engaging all stakeholders in the continuum of care. The goals were to:

1. Develop an approach for the creation of a BPMH;
2. Create an online directory of relevant tools and solutions for communication to key stakeholders;

3. Support⁷ development and implementation related to key medication reconciliation activities;⁸
4. Develop an implementation plan for the eleven recommendations from the working group;
5. Actively monitor and support funding opportunities related to the purpose and goals of the MRPC.

These five goals are closely tied to the eleven recommendations from the working group in its previous report. A description of the goals is provided later in this report in the [committee progress](#) section under develop and plan. The remainder of this report will focus on the efforts the committee made to accomplish each of the five goals and the future of the MRPC.

Current State of Technology

Connecticut Prescription Monitoring and Reporting System (CPMRS)

The CPMRS, also known as the Prescription Drug Monitoring Program (PDMP), has been used to track and report all controlled substances dispensed pursuant to a prescription in Connecticut since July 2008.⁹ Effective January 2021 insulin drugs and diabetes devices were also required to be uploaded into the CPMRS.¹⁰ In July of 2022 the Substance Abuse and Mental Health Clinics will also be required to report prescription information on controlled substances.¹⁰ As of April 2020, over 100 entities in Connecticut have integrated the CPMRS into their EHRs so that access to the portal is part of the clinician's workflow and over 2 million searches were conducted that year.

In a collaboration between the Department of Social Services (DSS), Office of Health Strategy (OHS), and Department of Consumer Protection (DCP) an implementation advanced planning document (IAPD) was submitted to the Center for Medicare and Medicare Services (CMS) to receive funds to expand the CPMRS. CMS awarded the funds through the SUPPORT Act (Substance Use-Disorder Prevention that Promotes Opioid Recovery and Treatment for Patients and Communities Act) to expand PDMP integration. The funds were used to cover the cost of integration with the system until September 30, 2022. Organizations have taken advantage of the dollars available to expand the use of the system.

Connie, Connecticut Information Exchange

On May 3rd, 2021 Connie officially commenced operations, triggering a mandate that requires hospitals and clinical labs to connect to the health information exchange (HIE) within one year. Other providers with capable EHRs are required to connect within two years¹¹. Connie has been actively onboarding participating organizations and has ramped up its operations since its commencement. To learn more about Connie or to reach out to them, please visit <https://conniect.org/>.

Connie employs [CRISP](#), a HIE technology vendor that has provided technology services to Maryland, Washington DC and West Virginia. CRISP is familiar with integration of PDMP data dashboards into its portal and InContext views of HIE data. A similar approach was undertaken in Connecticut. In the summer of 2021, Connie began the process of integrating the state PDMP system into its platform so that participating organizations have an additional method of accessing the PDMP system. As of September 2021 the PDMP data was anticipated to have been fully available

⁷ The MRPC is to support: The Office of Health Strategy, Health Information Alliance, Inc., the Department of Social Services, and the Department of Consumer Protection

⁸ Activities related to deprescribing and CancelRx are described in Appendix D.

⁹ Since the CPMRS was established, certain other designated prescription-only medications have been added to controlled substances as data that must be reported to the PDMP by pharmacies and practitioners who dispense medications for outpatient use. As of the date of this report, narcotic treatment programs are not required to report medications that are dispensed for treatment of substance use disorder to the CPMRS.

¹⁰ <https://portal.ct.gov/DCP/Prescription-Monitoring-Program/Prescription-Monitoring-Program>

¹¹ <https://portal.ct.gov/OHS/HIT-Work-Groups/Health-Information-Alliance>

within Connie. At this time, exploration of how the PDMP data can be utilized for assistance in creating the BPMH is anticipated in the coming year.

Even prior to its launch, medication reconciliation was anticipated to become one of the priority Use Cases for HIE services in CT. Connie's Board of Directors recently voted on the priorities for the upcoming year and the creation of the BPMH was one of them. With this vote and a pending funding request through DSS to CMS, Connie is now well positioned to take over leadership for the design, development and testing of the likely iterative solutions towards a BPMH. This will allow the MRPC as an advisory committee under the HITAC and OHS to formally disband at the end of September 2021. It then permits a transition of the roles and functions the MRPC played to evolve into a new format and approach appropriate for the non-profit HIE. The MRPC leadership has already begun discussions with Connie about staying engaged in the process and implementing the work done by the committee beyond September 2021.

Return on Investment

There is growing evidence showing the economic value of medication reconciliation. This section will only highlight a few of these papers as examples representing the outcomes of medication reconciliation initiatives in the United States.

A Harvard Medical School research team developed a simulation model to prospectively simulate the sequence of events within 30 days post hospital discharge of a hypothetical cohort of patients who did and did not receive medication reconciliation.¹² These researchers based their model estimates from the peer-reviewed literature describing incidences of medication discrepancies, preventable Adverse Drug Events (ADEs), emergency department visits, rehospitalizations, costs, and net benefits. Based on their model's assumption that medication reconciliation can reduce medication discrepancies by 52%, the cost of preventable ADEs could be reduced to \$266 (95% CI, \$150 - \$423) and result in a net benefit of \$206 (95% CI, \$73 - \$373) per patient after considering intervention costs.¹⁰ These researchers also estimated that a medication reconciliation intervention that reduced medication discrepancies by at least 10% would cover initial intervention costs. They also indicated that a highly sensitive and specific screening tool could help target medication reconciliation of high-risk individuals and lead to a greater net benefit than a non-targeted intervention.

In a recent 2020 study, Iowa researchers evaluated a pharmacy technician medication reconciliation intervention program at the time of admission for adults being hospitalized.¹³ The team reported among their 817 patients a mean of 6.1 medication discrepancies per patient (SD \pm 0.4) and various types of errors occurring between 50 - 82% of medication histories.¹¹ Cost avoidance was estimated to be \$210.33 per patient in the program.¹¹ A 2013 study reported the value of a clinical pharmacist doing post discharge medication reconciliation (within 1 week of hospital discharge) in ambulatory care setting of a large integrated group practice and health plan (Group Health, Washington State).¹⁴ These latter researchers conducted a comparative analysis of 243 patients who received medication reconciliation by a pharmacist and 251 patients who did not receive a medication reconciliation intervention. Patients who received medication reconciliation had significantly fewer readmission rates than the non-intervention group at 7 and 14 days ($p \leq 0.05$); no significant difference, however, at 30 days.¹² The net financial savings (adjusting for the costs of the intervention) from medication reconciliation for every 100 patients was estimated at \$35,000 and \$1,500,000 in annual savings.¹²

¹² Najafzadeh M, Schipper JI, Shrank WH, Kymes S, Brennan Ta, Choudhry NK. Economic value of pharmacist-led medication reconciliation for reducing medication errors after hospital discharge. *Am J Manag Care* 2016;22(10):654-661.

¹³ Uhlenhopp DJ, Aguilar O, Dai D, Ghosh A, Shaw M, Mitra C. Hospital-wide medication reconciliation program: error identification, cost-effectiveness, and detecting high-risk individuals on admission. *Integ Pharm Res Prac* 2020;9:195-203.

¹⁴ Kilcup M, Schultz D, Carlson J, Wilson B. Postdischarge pharmacist medication reconciliation: impact on readmission rates and financial savings. *J Am Pharm Assoc* 2013;53:78-84. doi:10.1331/JAPhA.2013.11250.

There are several other US and international examples of the cost savings associated with medication reconciliation. These examples highlight that medication reconciliation interventions have been shown to be associated with greater patient safety, more positive clinical outcomes, and a positive return on investment. Further, there is evidence that the initial targeting of medication reconciliation interventions for those patients at greatest risk for rehospitalization and/or other negative outcomes will yield significant return of investments.

Regulations and Policy Considerations

Connecticut does not currently have any regulation that either requires or prohibits that all medication data be collected, stored, aggregated or analyzed for any purpose. This is not unique in the country as most states are similar in this regard. The only state identified in the environmental scan that required submittal and aggregation of prescription fill data is Nebraska, which utilizes its HIE and its PDMP to collect that data daily from pharmacies. This offers an example, albeit complex, of what is possible to collect and store the data, but not how this could be utilized for the creation of a BPMH as this would require substantial processing and analytics of this medication data as well. The lessons to be observed from that example, as well as from other states who have had legal challenges related to access to PDMP data, indicate that careful protections need to be considered regarding access to the data, with legislation spelling out carefully who can and should have access and under what circumstances. As Connecticut considers options for creation of a BPMH, it would be prudent to observe those lessons. It also might be possible to create a series of policies at the HIE level, which rely on already permitted access to healthcare data based the HIPAA definition of an established clinical care relationship as well as the option for patients to provide agreement for healthcare providers to access their medication related information. It should be noted, that in order to prevent information blocking under the 21st Century Cures Act regulations that patients should be provided a consumer friendly method of accessing their healthcare data via a standard API (in this case a FHIR API based on ONC standards). This should be built into the policy considerations for the HIE as they contemplate the design and implementation of a BPMH service.

Committee Membership and Goals

Membership of the MRPC broadly represents stakeholders involved in matters of medication reconciliation and polypharmacy. Per the charter for the group, experience and expertise is to involve, at a minimum a diverse group of healthcare professionals, consumer advocates, industry representatives, informaticians, and subject matter experts, as detailed in Table 1 below. The committee meeting schedule is presented in Table 2 below. A team of support staff provide ongoing strategic planning and functional support to the MRPC, and is identified in Table 3. All meeting materials including agendas, minutes, and recordings can be found on the OHS website¹⁵

¹⁵ <https://portal.ct.gov/OHS/HIT-Work-Groups/Medication-Reconciliation-and-Polypharmacy-Committee/MRPC-Meeting-Agenda>

Table 1: MRPC Members, Affiliations, and Membership Categories

Member Name	Membership Category	Term Served
Sean Jeffery, Co-Chair, PharmD, BCGP	Expert in medication reconciliation	11/2019- 9/2021
Nitu Kashyap, Co-Chair, MD	Expert in medication reconciliation	11/2019- 9/2021
Alejandro Gonzalez-Restrepo, MD	Expert in psychopharmacology	12/2019- 9/2021
Amy Justice, MD, PhD	Expert in polypharmacy	11/2019- 5/2021
Anne VanHaaren, PharmD	Pharmacist	11/2019-4/2021
Diana Mager, RN-BC	Represents LTPAC/Hospice	11/2019- 9/2021
Ece Tek, MD	Prescribing practitioner	11/2019- 4/2021
Elizabeth Taylor, MS	Represents DMHAS	11/2019- 9/2021
Jason Gott, RPh	Represents DSS	2/2020-9/2021
Jennifer Osowiecki, JD, RPh	Represents expertise in law	11/2019- 9/2021
Jeremy Campbell, PharmD, MSHI	Represents pharmaceuticals	11/2019-9/2021
Kate Sacro, PharmD	Expert in medication reconciliation	11/2019-6/2021
Lesley Bennett	Represents consumers	11/2019- 9/2021
Margherita Giuliano, RPh	Pharmacist	11/2019- 9/2021
Marie Renauer, PharmD, MBA, BCACP	Represents hospitals	11/2019- 9/2021
Mark Silvestri, MD	Represents a FQHC	11/2019-4/2021
Mike Couturie, MD	Represents a FQHC	5/2021-9/2021
MJ McMullen, MBA	Represents expertise in CancelRx	11/2019- 9/2021
Nate Rickles, PharmD, PhD, BCPS	Expert in polypharmacy	11/2019- 9/2021
Patricia Carroll, MS, RN	Represents consumers	12/2019-9/2021
Rachel Petersen, MBA	Represents expertise in CancelRx	11/2019-9/2021
Rod Marriott, PharmD	Represents DCP	11/2019- 9/2021
Shawn Ong, MD	Expert in medication reconciliation	5/2021- 9/2021
Stacy Ward-Charlerie, PharmD	Represents expertise in CancelRx	11/2019- 9/2021
Valencia Bagby-Young, EdD, BCFNP	Represents DDS	6/2020-9/2021

Meeting Schedule of the MRPC	
November 4, 2019	October 19, 2020 *
December 16, 2019	November 16, 2020 *
January 13, 2020	December 21, 2020 *
February 27, 2020	February 25, 2021 *
March 16, 2020 *	March 25, 2021 *
April 20, 2020	April 22, 2021 *
May 18, 2020 *	May 27, 2021 *
June 25, 2020 *	June 24, 2021*
July 20, 2020*	July 22, 2021 *
August 17, 2020	August 26, 2021 *
September 24, 2020 *	September 20, 2021 *

Table 2: MRPC Meeting Schedule 2019-2021

OHS	UConn Health	CedarBridge Consulting
Adrian Texidor	Thomas Agresta, MD, MBI	Pete Robinson
	Rachel Rusnak, MPA	Katie McGee
	Ryan Tran, MHS	Valencia Georgia
		Terry Bequette
		Kassi Miller

Table 3: MRPC Support Staff

Note: In light of Covid 19, in March 2020 the committee moved to virtual meetings. All virtually held meetings are marked with an (*). Additionally, two planned meetings were cancelled, those dates are identified with a strike through (-).

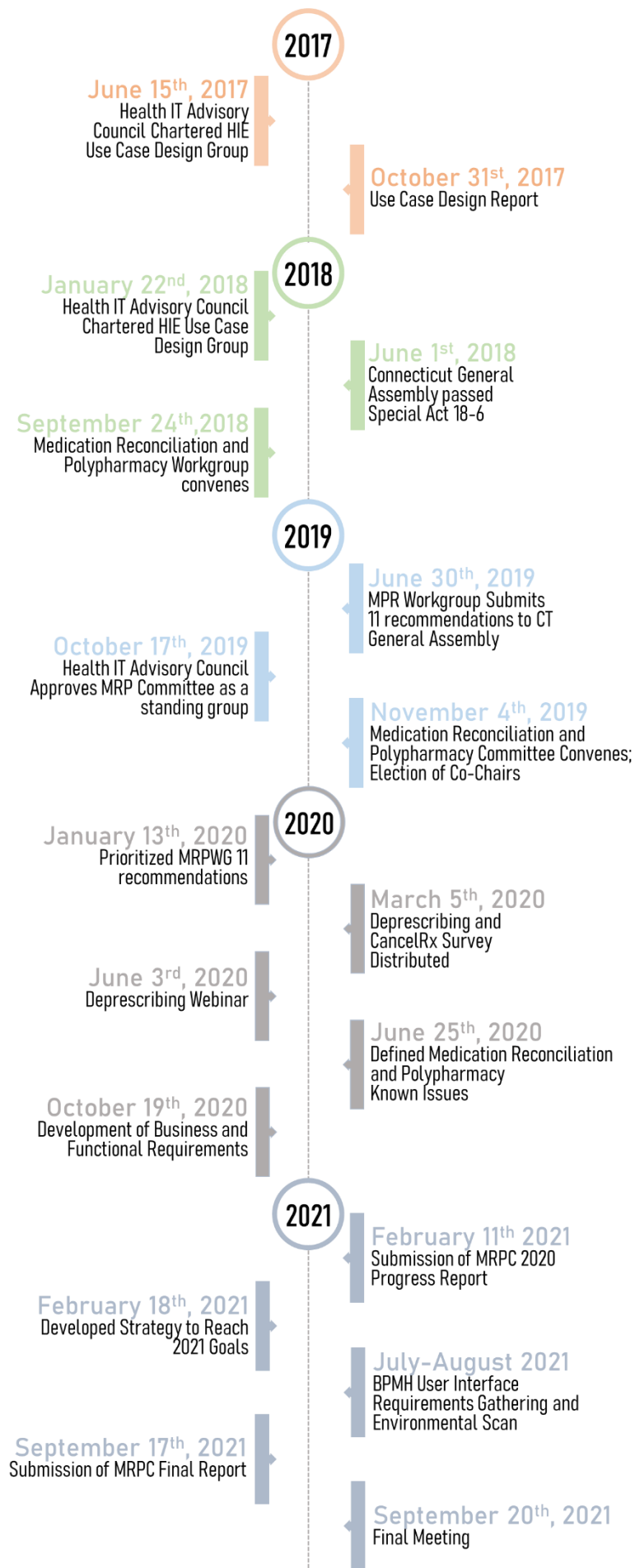


Figure 2: MRPC Evolution and Activities

Figure 2 shows the timeline of how the MRPC started. The Use Case Design Group, chartered by the HITAC, was the impetus for the start of the MRPWG and ultimately led to the formation of the MRPC as a standing committee. The figure highlights the major accomplishments of the MRPC since its conception.

Committee Progress

Following the submission of the 2020 MRPC Annual Report, covering the progress of this committee up until December of 2020, the group sought to accomplish the goals laid out for 2021:

1. Develop an approach for the creation of a BPMH;
2. Create an online directory of relevant tools and solutions for communication to key stakeholders;
3. Support¹⁶ development and implementation related to key medication reconciliation activities;¹⁷
4. Develop an implementation plan for the eleven recommendations from the working group;
5. Actively monitor and support funding opportunities related to the purpose and goals of the MRPC.

Knowing the goals that were stated for 2021, committee members were engaged in different exercises to gather feedback on priorities and approaches to these, such as online surveys and breakout groups. To accomplish the goals and mission of the committee, the methods below were utilized:

1. Layout tactics and strategies – To approach the five goals the MRPC members were divided into two breakout groups. Each group was provided a table to determine the target completion date, objectives and tactics for each of the goals. The feedback was then compiled into a master table to determine the overlap and differences between the group discussions. Objectives and tactics for each goal were well aligned between the two groups.
2. Develop plan– Based on the objectives and tactics suggested by the committee, four potential activities were put forth for prioritization as follows:
 - a. Approach for Creation of BPMH
Goal: Develop a description of desired features for some user interactions and technical requirements for consideration of incorporation into a Health Information Exchange.
Activity: Perform a literature search and an environmental scan of how some current HIE represent medications to support reconciliation, including how CRISP performs this with other state HIEs. Utilize key informants including user interface experts, informatics experts and members of the MRPC to produce recommendations for best practices for an HIE. Create and submit recommendations in a report similar to the report developed by the MRPC for Business and Functional Requirements.
 - b. Online Directory of Tools & Solutions
Goal: Launch a user-friendly repository with current resources for identified key audiences, including clinicians, pharmacists, patients and caregivers.
Activity: Compile best practice recommendations for the state regarding medication reconciliation across key audiences e.g., best practices for medication reconciliation to avoid physician burnout, provider toolkits, how consumers can interact with physicians (FAQ to ask your physician). Produce 1-3 videos that can be used to promote the experts and work of the MRPC to showcase the above.
 - c. Development of Deprescribing Standards & Practices
Goal: Develop and submit a report of suggested best practices and standards for deprescribing.

¹⁶ The MRPC is to support: The Office of Health Strategy, Health Information Alliance, Inc., the Department of Social Services, and the Department of Consumer Protection

¹⁷ Activities related to deprescribing and CancelRx are described in Appendix D.

Activity: Identify recommendations for clinicians, health care organizations, clinical pharmacists, pharmacy systems, policymakers, and the NCPDP. This work should incorporate updates regarding the CancelRx standard and adoption in Connecticut and could be developed into a paper for publication.

- d. Assessment of the Pros & Cons of an Expanded PDMP Prescription Reporting System for achieving the BPMH

Goal: Evaluate the pros and cons of an all-drug PDMP for Connecticut.

Activity: This will include an environmental scan and comparative analyses of other all-drug PDMPs, the current capabilities of Connecticut's PDMP infrastructure in terms of its capacity to facilitate medication reconciliation and deprescribing as well as any legislative or legal barriers implications. Consideration about the pros and cons of all-drug PDMP versus another single-source of truth for medications as the BPMH should be included.

An electronic survey was created in Qualtrics for committee members to rank each activity to determine the two that should be addressed. The results from the survey showed that the top two activities were an approach for creation of BPMH and the assessment of the pros and cons of an expanded PDMP prescription reporting system for achieving the BPMH.

3. Regroup and Adjust Goals- The survey results were presented to the committee for final approval. After a thorough discussion, the members agreed that the scope of the activities should be adjusted to be more encompassing. The approach for creation of the BPMH activity was amended to concentrate on the gathering of feedback from clinicians, patients and caregivers through focus groups to collect input on the user interface requirements for a BPMH tool. The assessment of the pros and cons of an expanded PDMP Prescription Reporting System for achieving the BPMH was broadened to conduct an environmental scan of stakeholders across the nation to learn how they are implementing medication reconciliation solutions and the challenges they currently face towards a solution.
4. Identification of Activity Leaders – To complete the two work streams, the committee identified the key parties to carry out the activities described. A faculty member at the UConn School of Pharmacy was selected to receive a sub-award to work on the approach for the creation of a BPMH. The faculty member was provided some support from the administrative team and with the funds recruited a team to move forward with the work. The CedarBridge Group, which is currently conducting a 5-year statewide health IT plan for OHS, was tasked with having some of their efforts focused on an environmental scan of medication reconciliation and polypharmacy, which aligned with its scope.
5. Timeline and Deliverables- A timeline for each activity was developed with key milestones laid out until mid-September. The timeframe to complete each activity was short and required rapid turn-around. Collection of feedback and data started in mid-July. The activities related to these deliverables are summarized in the accomplishments section and the appendix, which includes a full report of the methods to collect the feedback and the findings.



Figure 3: The Approach for Creation of BPMH: User Requirements Gathering Timeline

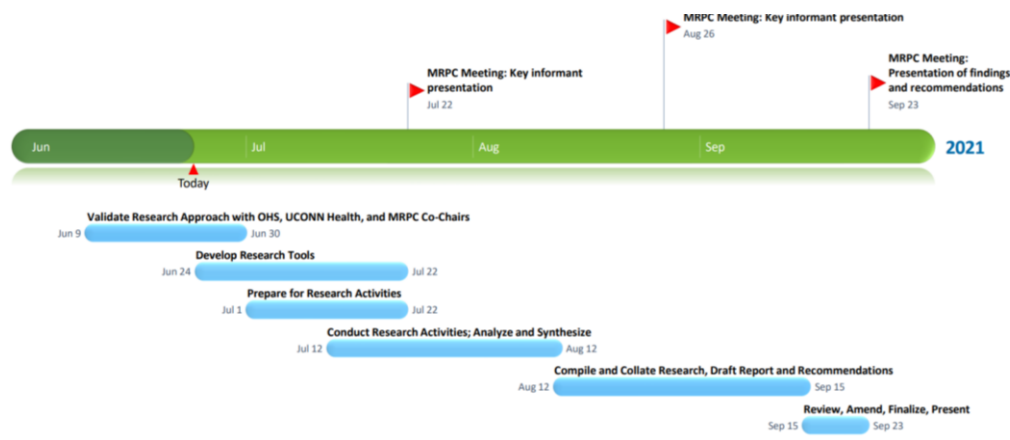


Figure 4: Environmental Scan Timeline

6. Finalize Work and Amplify Vision – The MRPC is wrapping up its work with this report, which includes its major accomplishments since its formation. The committee intends that this document will be a practical and informative resource for the state and Connie as they work to implement a BPMH solution to improve the health and well-being of Connecticut citizens. The goal of achieving a BPMH requires collaboration and support at state and local levels. Throughout the year, the co-chairs have continued to promote the vision of the MRPC and its accomplishments at state and national levels. The MRPC leaders have continued to provide periodic updates to the Health Information Technology Advisory Council (HITAC).
 - a. Additionally, submissions made to two conferences were accepted and the work of the MRPC piqued the interest of attendees at The Patient and The Practitioner In The Age of Technology: Promoting Health Relationships¹⁸ and the AMIA Clinical Informatics Conference- May 2021.¹⁹
 - b. To ensure that the work of the committee would align with the Connecticut Information Exchange (Connie) mission, the leadership from the HIE were invited to participate and occasionally present on the organization’s progress.

¹⁸ Agresta T, Kashyap N, Jeffery S. Improving Medication Safety-A Multi-stakeholder Approach to use Health IT in Connecticut: The Patient and The Practitioner In The Age of Technology: Promoting Health Relationships. International Webinar Conference, Brown University. 2020; Webinar

¹⁹ Thomas P. Agresta, Nitu Kashyap, Shawn Y. Ong, Sean Jeffery, Ryan Tran, Rachel Rusnak, Adrian Texidor. Creating Business and Functional Requirements for Connecticut State’s Best Possible Medication History

It is the hope of the committee that the foundation that it has laid will continue to be built upon into the future and will help to inform the decisions of healthcare leaders.

Accomplishments

On April 22nd, 2021 the Medication Reconciliation and Polypharmacy Committee agreed to move forward with two goals: (1) an approach for the creation of a best possible medication history (BPMH); and (2) initiate an environmental scan of current methodology and consensus. This portion of the report will summarize the key results from the activities carried out.

The Approach for Creation of BPMH

On September 17th, 2021 a Best Possible Medication History (BPMH) User Interface Requirements Development Report was delivered to the MRPC. This work was made possible through a sub-award from UConn Health that was granted to Christina Polomoff at the UConn School of Pharmacy from OHS to focus on creating and utilizing a method to gather end-user feedback.

Computer science and engineering (CSE) students from UConn Storrs were provided funding by the UConn Summer Health Research Program and developed mock-up screens for patient and provider facing BPMH user interfaces. From July 16th, 2021 through August 19th, 2021, a total of 70 participants were identified through a convenience sample consisting of clinicians, patients, and MRPC members; a complete breakdown of the participants is provided in table 4 and 5. Qualitative feedback from focus groups and individual sessions were collated to inform BPMH wireframe designers (CSE students) on key features and functionality of the BPMH user interface.

Type of Participant (n=70)	Number	%
Clinicians	34	49%
MRPC Members	6	9%
Patients (in-person)	15	21%
Patients (survey)	15	21%

Table 4 Participant Breakdown

Type of Clinician (n=34)	Number	%
Physicians	6	17.6%
Medical Residents	13	38%
Pharmacists	4	12.5%
Home Care Nurses	5	14.7%
Primary Care Nurses	2	5.8%
Nurse Care Managers	2	5.8%
Medical Students	1	2.9%
Medical Assistants	1	2.9%

Table 5 Clinician Breakdown (includes other members of the healthcare team)

One key finding from all stakeholders was broad feedback that the current mechanisms in place to perform medication reconciliation and determine a BPMH are woefully inadequate, time consuming and create undue risks for patients and providers. There was strong support for development of an effective, efficient and work-flow friendly alternative.

The following themes emerged from the feedback sessions:

Existing Gaps: Currently it is challenging to accurately perform medication reconciliation given the gaps that exist in medication data. There is also a lack of communication between providers/EHRs.

User Interface Optimization: Participants recognized the wireframe mockups are prototypes. They were able to appreciate the intent and provided recommendations to enhance the user experience. For example, simplifying the collaboration code process, adding a hamburger menu of options on the home screen, and having the ability to filter medications in different ways (alphabetically, chronologically, by medication class, etc.). There were suggestions to optimize the Medication History calendar by enabling reminder alerts. Recommendations to enhance visual appearance included adjusting the font size and color and adding pictures of medications.

Safety Considerations: Both clinicians and patients expressed concerns regarding patient autonomy over prescription medications. Most felt patients should be able to modify OTC medications only (not prescriptions), and that they should be able to add comments on all medications. Clinicians raised concerns regarding alert fatigue since they might be alerted to real-time updates made to their patients' medication list. Also, it was suggested to simplify the language in order to accommodate patients with low literacy levels.

Data: A reoccurring theme was the need to seamlessly incorporate data from many sources including electronic medical records, insurance dispense records, health systems, pharmacies and other data banks. Clinicians felt this should be integrated into their EHR as well.

Best Use Considerations: This could be valuable for health systems, pharmacies, and health plans. Clinicians recognized the expanding capabilities of already existing EHRs pulling data from multiple sources, and questioned what this could add. Patients felt this could facilitate bidirectional communication with their providers, and enhance their autonomy.

Value Proposition: Many felt this would improve patient care across the healthcare landscape, and would facilitate patient autonomy over their medications. This could also be used in population health to close gaps in care such as adherence gaps, which could ultimately improve plans' star ratings.

For more information on the methods and results used to conduct the sessions, go to [Appendix C](#) to read the full report submitted to the committee.

Environmental Scan

Over the spring of 2021 the MRPC, its leadership and the Admin team, identified a number of relevant organizations and individuals who had information about medication data creation, storage and transmission standards, retrieval, analysis and usage in clinical and public health contexts. They were then prioritized into quartiles and CedarBridge or one of the MRPC Co-Chairs reached out to the high priority groups to arrange interviews based on a previously discussed interview guide. When feasible, members of the MRPC or one of its Co-chairs, also attended.

Over two months, during the summer of 2021 a number of relevant subject matter experts from the following organizations were interviewed to get a varied perspective on medication fill sources and their potential pros and cons, including:

- Seven Health Information Exchange (HIEs) organizations
- Four state Prescription Drug Monitoring Programs (PDMPs)
- The State of Connecticut, Department of Social Services
- The State of Connecticut, Office of the Healthcare Advocate
- The Pharmacy Health Information Technology Collaborative
- The U.S. Department of Veterans Affairs
- Four health information technology vendors

The findings of these outreach efforts concluded that while there is no specific state or program doing what Connecticut is contemplating with the BPMH, there are a number of lessons to be learned from that work. There are also several case examples of successful programs that use an HIE as a data transport tool for Medication Reconciliation, such as the one in Hawaii, that can demonstrate a likely positive return on investment for our efforts from both a patient outcome (fewer hospital readmissions) as well as cost perspective. Some organizations utilize a third party vendor to assist in medication reconciliation through algorithms and is potentially feasible to share this data within an HIE and is an option that can be further explored. All of the methods utilized have incremental value and should be explored as initial steps for the HIE.

Conclusion

Achievement of Charter Goals

On September 19 2019, the MRPC charter was approved by the Health Information Technology Advisory Council allowing the committee to continue its work. Written in the charter was a purpose statement and a list of five goals for the group to focus on for the next two years. The goals are listed below with a description of activities that were completed to meet each one.

- Goal 1: Develop a detailed strategic approach for the creation of a BPMH, supported by active patient engagement, that results in near-term value for stakeholders while laying the foundation for a longer-term, more extensive and integrated solution.
 - Achievement
 - BPMH Vision Statement
 - BPMH Business and functional requirements
 - UI requirements gathering
- Goal 2: Create an online directory of medication management and medication reconciliation tools and solutions for communication of evidence-based, best practice medication tools; patient engagement strategies; technical advisories; subject matter experts; and policy and regulatory guidance documents.
 - Achievement
 - Repository of work on UConn Health Site
 - <https://health.uconn.edu/health-interopability-learning/resources/medication-reconciliation-and-polypharmacy/>
- Goal 3: Serve as a resource to OHS, Health Information Alliance, Inc., Department of Social Services, and Department of Consumer Protection to support development and implementation related to: technical solutions and use cases; workflow integration; medication reconciliation pilot activities; stakeholder engagement; and measurement and evaluation.
 - Achievement
 - Connie Participation in meetings
 - Participation on the MRPC of representatives from DSS and DCP
 - Development of 2020 MRPC Report and Final Report
 - BPMH Business and Functional Requirements
 - Environmental Scan
- Goal 4: Develop an implementation plan for the Medication and Polypharmacy Work Group recommendations related to deprescribing transaction standards, including CancelRx.
 - Achievement:
 - CancelRx Survey
 - Deprescribing Webinar
 - Follow up presentations regarding CancelRx update in CT

- Goal 5: Support Implementation Advance Planning Document (IAPD) and Substance Use Disorder Prevention that Promotes Opioid Recovery and Treatment for Patients and Communities (SUPPORT) Act funded initiatives and actively monitor funding opportunities related to the stated purpose and goals of MRPC.
 - Achievement:
 - Funding provided to expand PDMP
 - Funds drawn to support UI requirements gathering work and environmental scan

BPMH Technical Requirement Considerations

There are a number of technical requirement considerations that result from the business and functional requirements detailed in the MRPC’s 2020 Annual Report. The technical requirements largely fall into categories of person management, medication management, interfaces, and front-end design. A brief review was done of these requirements and some initial recommendations to consider are made below. A more systematic undertaking of these technical requirements was beyond the scope of the committee and should be attempted in the next phases of work under Connie.

- For person management, the BPMH should maintain a master person index for patients, their representatives (e.g. family member, guardian, healthcare proxy, conservator), and relationships to the patient. A master provider index is needed, possibly using an existing identifier such as NPI. A master index number is needed for non-prescribing healthcare team members, such as Medical Assistants or Nurses. The person management process must also accept and track changes to person identification information. BPMH access for users will likely depend on the method of access. For example, clinical users accessing BPMH through an EHR could use automatic authentication using OAuth 2.0, but non-clinical users may need multi-factor authentication. Users should be assigned role profiles or classes with varying levels of authorization.
- Medication data management should occur in a dedicated database and may require a combination of existing terminology standards such as RxNorm, FDA NDC, and NLM-FDA DailyMed to accommodate medication information as detailed in Business Requirement #2. The BPMH database should handle medication updates from various source systems, non-prescription substances, and the level of confidence in the accuracy of information (as detailed in Business Requirement #8).
- Interfacing to other systems will require bidirectional interfaces with many HIT systems, preferably through existing APIs. FHIR or USCDI APIs could be used to exchange medication information and alert end-systems of medication changes. HL7 v2 or NCPDP SCRIPT standards can be used to exchange information from pharmacies, such as transaction dates. CancelRx functionality can be leveraged for medication cancellations.
- The BPMH will need a separate front-end interface build for the various ways that users will access the system, which includes desktop web browser, desktop within an EHR, and a mobile app. Separate UI/UX design principle will apply to the different modes of end-user interaction with the BPMH.

Final Recommendations and Future of Committee

On September 20th, 2021, the MRPC convened for the last time, however, its work, deliverables, and vision will continue beyond through other fronts in the state of Connecticut. With the state of Connecticut moving towards developing a BPMH solution and the MRPC’s conclusion, the committee would like to express some future considerations. The MRPC recommends that its deliverables, namely the contents of this final report and the 2020 MRPC Report, to the HITAC are used as resources and guides for future work in the state. As progress is made to implement a BPMH, the committee would be remiss in not reminding those who are producing a solution to incorporate needs and desires of patients, which should be at the forefront. The patient, as the “North Star,” should not be lost and their engagement and participation in the process is important to the success of a BPMH. The MRPC believes that patients should be solicited to contribute valuable insight and input to assist in creating a BPMH solution. In keeping with the MRPC’s openness to explore other solutions currently being executed, it recommends

that the state remains informed about the technological advances, new products and tools, and novel practices and technologies that other entities are implementing. As previously mentioned in this report, Connie has been engaged in the committee's work and has announced its plan to develop a BPMH Use Case Workgroup. The MRPC co-chairs will co-chair this group and help Connie move Connecticut towards a viable BPMH solution. The committee supports the steps that Connie has taken, and it hopes the entity will continue to receive the necessary support and traction to move forward. Although the committee members will no longer be acting in a formal capacity, the members will continue to advocate for the MPRC's vision and are committed to seeing a solution in the state of Connecticut.

A Message from Members

“The MRPC’s most important contribution has been in its collaborative efforts to address a universal concern with polypharmacy and medication reconciliation. Despite the challenges of the COVID-19 pandemic, committee leadership and members never lost focus on the patients and best practices for healthcare providers and community agencies. This commitment is evident in the MRPC’s final report”

“MRPCs greatest contribution is using an intercollaborative approach that includes the viewpoint of patients and health care professionals from a variety of care settings, to develop ways in which medication use can be safer and more efficient for all of CTs citizens.”

“The most important thing to come from our efforts on the MRPC is the coalescing of talented, thoughtful and passionate people together to solve the challenges of medication reconciliation. We have helped advance the science and bring tangible solutions forward that will benefit all of Connecticut’s citizens. Our medication reconciliation work has put Connecticut in a position of leadership. It has also created momentum for Connie to tackle the ‘final mile’ of medication reconciliation – the technical requirements of connecting data and displaying our end goal of a Best Possible Medication History.”

“The MRPC developed patient-centered accessible solutions to allow patients and their care teams to get the medications right, so more time could be focused on improving their health and lives.”

“To me the MRPC’s most important contribution is to PATIENT SAFETY...and ultimately lowering health care costs by preventing avoidable adverse medication reactions/interactions.”

“MRPC provides a comprehensive foundational structure to support the development of resources and tools that will ultimately provide a safer and more inclusive healthcare environment.”

Appendix A: Summary of Key Terms and Concept

Medication Reconciliation: As defined by the Joint Commission, a process of comparing the medications a patient is taking (and should be taking) with newly ordered medications. The comparison addresses duplications, omissions, and interactions, and the need to continue current medications. The types of information that clinicians use to reconcile medications include (among others) medication name, dose, frequency, route, and purpose.

Polypharmacy: Masnoon, et al. conducted a systematic review to identify and summarize polypharmacy definitions in existing literature.²⁰ Their findings indicated there is no consensus definition for polypharmacy. However, of the 138 definitions of polypharmacy identified, 111 (80.4%) were numerical only. For purposes of the MRP Work Group, polypharmacy refers to patients who are on 5 or more medications simultaneously. Note that this definition aligns with the definition of polypharmacy contained within Special Act 18-6, “Polypharmacy means the simultaneous use of multiple drugs by a patient to treat one or more ailments or conditions.”

CancelRx: This is a technical messaging standard (SCRIPT Standard 10.6) developed by the National Council for Prescription Drug Programs (NCPDP) and adopted by the Office of the National Coordinator for Health IT (ONC). The cancel prescription request transaction is used to notify the pharmacy that a previously prescribe prescription should be canceled, and no additional product should be dispensed. The transaction is originated by the prescribing system as a Cancel Prescription Request Message (CancelRx).²¹

Deprescribing: Thompson, et al define deprescribing as “the process of tapering, stopping, discontinuing, or withdrawing drugs, with the goal of managing polypharmacy and improving outcomes. Clinicians typically attempt to taper or stop agents on the basis of clinical experience and judgment, rather than using an approach guided by evidence.”

Health Information Exchange (HIE): ^{Verb} A process of sharing health information electronically; ^{Noun} An entity that provides technology and services to allow its stakeholders to securely share health information electronically.²²

Adverse Drug Events (ADEs): As published on the Center for Disease Prevention and Health Promotion website,²³ an adverse drug event is an injury resulting from medical intervention related to a drug and includes medication errors, adverse drug reactions, allergic reactions, and overdoses.

Pharmacy Benefits Manager (PBM): As published by the American Pharmacists Association, a PBM is a third-party administrator of prescription drug programs.²⁴ PBMs are primarily responsible for developing and maintaining the formulary used to determine insurance coverage or reimbursement, contracting with pharmacies, negotiating discounts and rebates with drug manufacturers, and processing and paying prescription drug claims. For the most part, they work with self-insured companies, insurance carriers, and government programs striving to maintain or reduce the pharmacy expenditures of the health plan while concurrently trying to improve health care outcomes.

Community Pharmacy: The MRP Work Group prefers the term “community pharmacy” to refer to independent pharmacies, chain pharmacies, and grocery store pharmacies that have state licenses to dispense medications

²⁰ *What is polypharmacy? A Systematic Review of Definitions*; Nashwa Masnoon, Sepehr Shakib, Lisa Kalisch-Ellett and Gillian E. Caughey, BMC Geriatrics 2017;17:230, <https://doi.org/10.1186/s12877-017-0621-2>

²¹ National Council for Prescription Drug Programs: SCRIPT IMPLEMENTATION RECOMMENDATIONS (Version 1.46). (2018).

Scottsdale, AZ: National Council for Prescription Drug Programs. Accessed at <http://www.ncpdp.org/NCPDP/media/pdf/SCRIPT-ImplementationRecommendations.pdf>

²² <https://strategichie.com/about/#1601563275277-109c4b48-8320>

²³ <https://health.gov/hcq/ade.asp>

²⁴ *Pharmacy Benefit Management*; American Pharmacists Association. July 9, 2009.

https://www.pharmacist.com/sites/default/files/files/Profile_24_PBM_SDS_FINAL_090707.pdf

to consumers in retail settings. Not included, generally, are online pharmacies, PBMs, and pharmacies in institutional settings such as acute care hospitals and long-term care facilities

NCPDP (National Council for Prescription Drug Programs): Serves as a forum for healthcare, using consensus-based standards development. For more information visit [NCPD.org](https://ncpd.org).

API (Application Programming Interface): A software intermediary that allows two applications to talk to each other.

Alert fatigue²⁵: a phenomenon in which health care workers and clinicians are desensitized to safety alerts, which results in an inadequate response or lack thereof. This is caused when workers are continually inundated with medical alerts that do not rise to the level of any intervention causing them to neglect both inconsequential and important alerts. Therefore, patient safety is reduced and the likelihood of patient harm increases.

Interoperability and Data Exchange Standards

FHIR (Fast Healthcare Interoperability Resources): A specification, which is a standard for exchanging healthcare information electronically. For more information visit [HL7.org](https://hl7.org)

HL7 (Health Level 7): “‘Level Seven’ refers to the seventh level of the International Organization for Standardization (ISO) seven-layer communications model for Open Systems Interconnection (OSI) - the application level. The application level interfaces directly to and performs common application services for the application processes. Although other protocols have largely superseded it, the OSI model remains valuable as a place to begin the study of network architecture.”²⁶

RxNorm: RxNorm provides normalized names for clinical drugs and links its names to many of the drug vocabularies. For more information visit the National Library of Medicine

NCPDP Script Standard: The National Council for Prescription Drug Programs (NCPDP) SCRIPT® standard covers electronic transfer of prescription data between retail pharmacies and prescribers for new prescriptions, prescription changes, prescription refill requests, prescription fill status notifications, and cancellation notifications. <https://ncpdp.org/>

NDC (National Drug Code): A unique 10 or 11 digit, 3-part identification code that drug manufactures report to the Food and Drug Administration. The 3 segments of the NDC identify: the labeler, the product, and the commercial package size.

USCDI (United States Core Data for Interoperability): The United States Core Data for Interoperability (USCDI) is a standardized set of health data classes and constituent data elements for nationwide, interoperable health information exchange. <https://www.healthit.gov/isa/united-states-core-data-interoperability-uscdi>

²⁵ AHRQ. (2019). Patient Safety 101: Primers- Alert Fatigue. <https://psnet.ahrq.gov/primer/alert-fatigue>

²⁶ <https://www.hl7.org/about/index.cfm?ref=footer>

**Appendix B: An Environmental Scan
of Relevant Policy and Technological
Implications of Medication Data Sources for a
Best Possible Medication History**



***An Environmental Scan
of Relevant Policy and
Technological Implications of
Medication Data Sources
for a Best Possible
Medication History***

**Submitted to:
Connecticut Office of Health Strategy and
The Connecticut Health Information
Technology Advisory Council**

**Prepared by:
CedarBridge Group, LLC**
with support from UConn Health
and the Co-Chairs and Members of
Connecticut's Medication Reconciliation
and Polypharmacy Committee



CedarBridge Group®

September 30th, 2021



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Summary Introduction

Better information flow of medication data across organizational boundaries and between health information technology (health IT) vendor systems is critical for effective medication reconciliation to occur for individuals who receive healthcare services from multiple, unaffiliated providers or purchase medications from multiple sources (most of us). Accurate and timely medication information is also essential (prescribed, dispensed, and refilled), if the value-add service of a “Best Possible Medication History” (BPMH) is to be offered by Connecticut’s new health information exchange (HIE), known as Connie. The researched compiled in this report, *An Environmental Scan of Relevant Policy and Technologic Implications of Medication Data Sources for a Best Possible Medication History* is intended to inform Connecticut’s legislatively mandated Five-Year Statewide Health Information Technology Plan (Health IT Plan), currently being developed by Connecticut’s Office and Health Strategy (OHS) with support from the Connecticut Health Information Technology Advisory Council (HITAC).

Information for this report was gather via interviews with representatives from Health Information Exchanges (HIEs), state Prescription Drug Monitoring Programs (PDMPs), other state and federal government agencies, technology vendors, and individuals who were identified as subject matter experts in relevant subject matter domains, including:

- Seven Health Information Exchange (HIEs) organizations
- Four state Prescription Drug Monitoring Programs (PDMPs)
- The State of Connecticut, Department of Social Services
- The State of Connecticut, Office of the Healthcare Advocate
- The Pharmacy Health Information Technology Collaborative
- The U.S. Department of Veterans Affairs
- Four health information technology vendors

Additional information was gathered through informal interviews/conversations with subject matter experts across the fields of medicine, pharmacy, medical terminology and informatics, technology and data standards, patient privacy, state and federal regulations and policies for prescription drug monitoring programs, value-based care models, and others. Staff and physician leaders from UConn Health, UConn School of Pharmacy, Yale New Haven Health, and the members of the MRPC were significant contributors to the detailed information in this report. Published literature sources that were used are cited throughout this report as footnotes.

The goal for this report is to provide a foundation of objective information for policymakers, regulators, state agency program administrators, the management and board of Connie, and the advisors on the HITAC and its subgroup, the Medication Reconciliation and Polypharmacy Committee (MRPC), as they engage stakeholders in planning and implementation of the Health IT Plan. While strong support has been indicated by many stakeholders for Connie to offer a BPMH service, the access to affordable medication data sources is a well-known problem for HIEs across the country. Some interest has been expressed in exploring expanded use of the technology platform used by Connecticut’s Prescription Drug Monitoring Database (CPMRS) as a source of medication data for medication reconciliation and BPMH services; this report provides information to inform further discussions on that and on other medication data sources.

HIEs are uniquely positioned to facilitate more effective and comprehensive medication reconciliation, and to present a consolidated view of the current and past medications that have been prescribed, dispensed, and refilled as part of a longitudinal summary of a person's health record. This report provides an overview of the potential sources for medication data, the use cases those data can potentially support, and potential technological and regulatory implications that may be relevant to the use cases and future services.

Potential Use Cases for Medication Data

Medication Reconciliation

The need for medication reconciliation across the healthcare ecosystem is growing. Medications are a crucial component to a patient's overall health, but they also pose potential health risks through side effects, adverse drug-drug or drug-disease interactions, or inadvertent dosing complications. Modern health information technology can help reduce the risk of adverse drug events, but much of this functionality is limited by the information contained within the technology system. Medication reconciliation, the process of updating medication lists based on current information to remove obsolete, discontinued, or otherwise inactive medications, relies on comparison of medications ordered within a prescribing clinicians EHR and those self-reported medications that a patient shares with their clinical provider and are entered into that EHR. Errors in medication lists can be caused by a number of factors, including:

- 1) A clinician has discontinued a medication, but the record persists in other health IT systems.
- 2) Lists in some health IT systems may be created by a patient self-report and may be incomplete and/or inaccurate.
- 3) A pharmacy refills a medication that had previously been prescribed by a clinician but was ultimately discontinued or modified.
- 4) A patient receives medications from more than one pharmacy that are duplicates (brand name and generic of same drug) or overlapping in effect (drugs in the same pharmaceutical class or for the same indications).
- 5) A clinician inadvertently responds to an electronic refill request that the pharmacy sends on a previously discontinued medication.

Access to medication data can enable members of a patient's care team to have a complete, holistic view of the medications that a patient has been prescribed, have been filled by a pharmacy, and potentially whether the medication has been administered to the patient or picked up at a pharmacy. Timeliness and completeness of the medication data are essential for the data source to be effective for medication reconciliation purposes because there is no way to tell if absent data are a null result or missing.

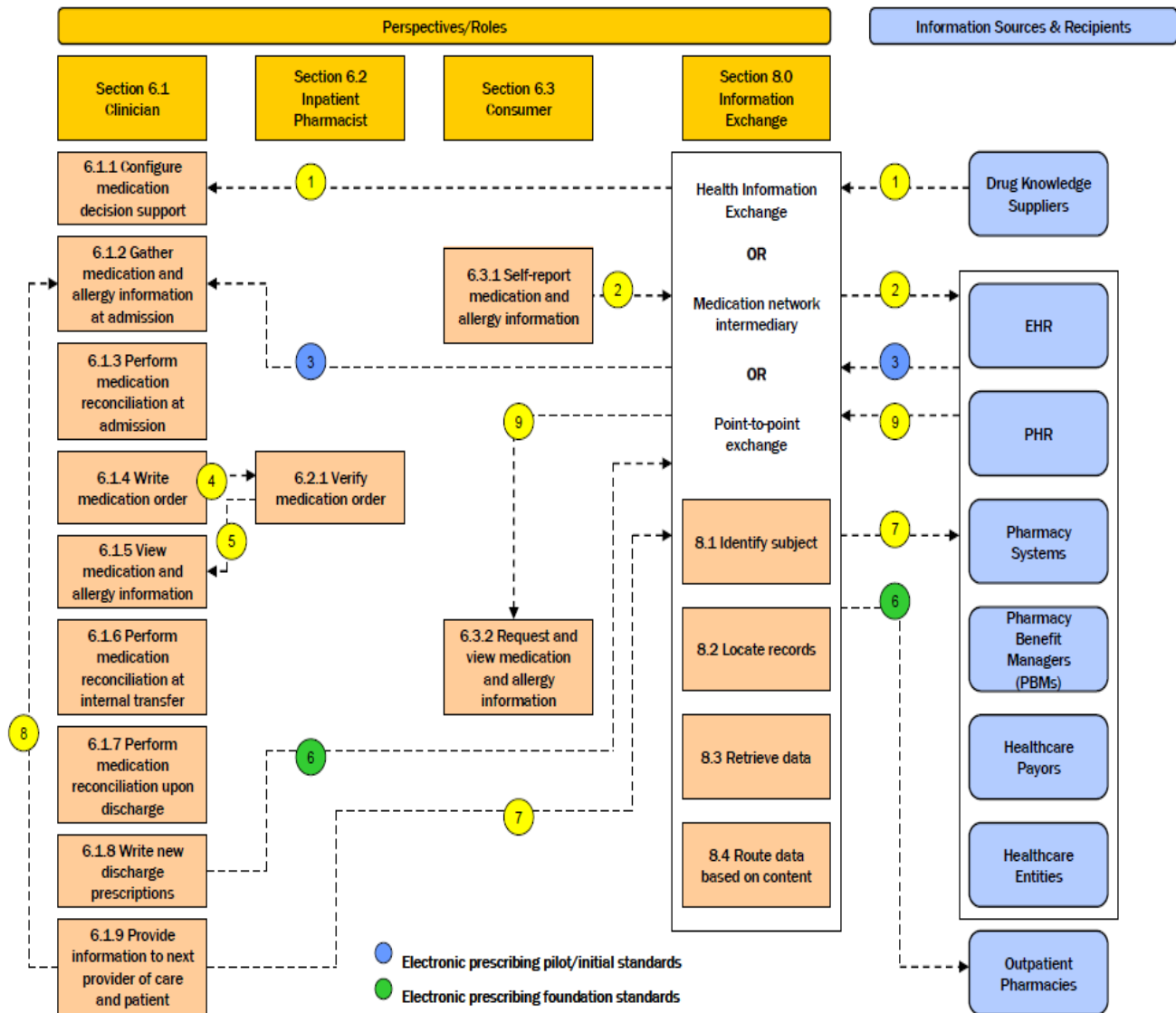
The development of medication-related use cases for electronic health records and HIEs were historically prioritized by the Office of the National Coordinator for Health Information Technology, and medication management was one of the first prototype use cases created in 2007.¹ The prototype use cases describe the information sources and workflows for hospital inpatient medication reconciliation and ambulatory setting medication listing and allergy information to support electronic prescribing. The use case scenario

¹ Office of the National Coordinator, Medication Management: Detailed Use Case, June 18, 2007
<http://bok.ahima.org/PdfView?oid=77270>

below illustrates a representative example workflow for inpatient medication reconciliation as a patient is being discharged from a hospital. This example assumes access to an electronic information exchange.

6.0 Scenario 1: Inpatient Medication Reconciliation

Figure 6-1. Inpatient Medication Reconciliation



The Michigan Health Information Network published a discharge medication use case scenario in March of 2019 that helps healthcare providers share patient medication information at the time of discharge with other care team members and/or organizations - including physicians, practices, pharmacies, hospitals, and transitional facilities such as outpatient and skilled nursing facilities.² Medication information at discharge for this use case follows the path in the diagram below, with prominent use of the health information network.

² <https://mihin.org/discharge-medication-reconciliation-use-case-2/>

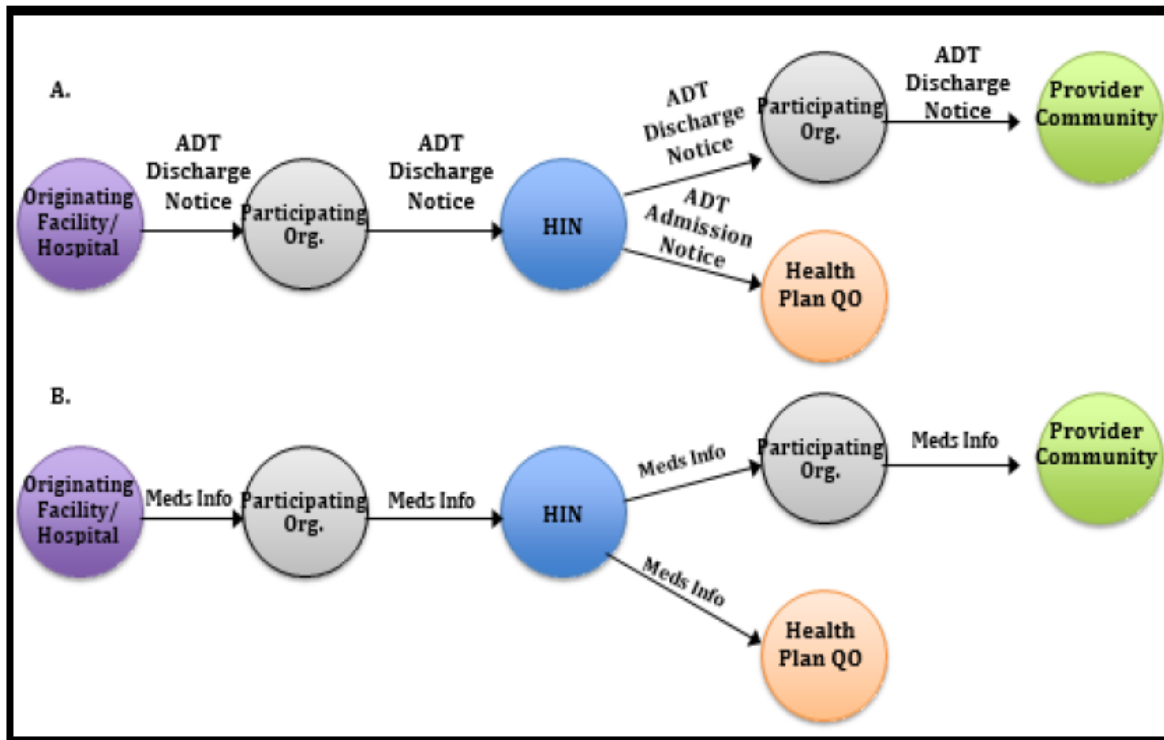


Figure 1. Data Flow for Discharge Medication Reconciliation

- A. A discharge notification for the patient is sent from the originating facility/hospital to the providers in an active care relationship with the patient and the health plan(s) via the statewide ADT notification service.
- B. Information containing medication reconciliation for the patient is sent at the time of discharge from the originating hospital/facility to the providers in an active care relationship with the patient and to the health plan(s) via Medication Reconciliation.

Note: This use case indicates that discharge medication history and changes to that from admission are shared in an XML / CCD format with medication prescriptions listed in a standardized RxNorm format through the HIE and does not indicate the HIE does anything except acting as a transmission service to other appropriate providers and organizations with a care relationship with that discharged patient. So: no transformation, deduplication or comparisons are done. It is helpful to receive, but requires all of the receiving organizations to ingest, interpret and act on the information independently.

Chronic Disease Management

Medications are particularly important to the management of many chronic diseases. To monitor conditions over time, clinicians must oftentimes adjust medication doses or types based on their clinical effectiveness³. According to a McKinsey report on medication adherence, “Studies show that 50 to 60 percent of patients with chronic illnesses miss doses, take the wrong doses, or drop off treatment in the first year.”⁴

³ <https://www.cdc.gov/mmwr/volumes/66/wr/mm6645a2.htm>

⁴ Improving patient adherence through data-driven insights, McKinsey (2018):

<https://www.mckinsey.com/industries/pharmaceuticals-and-medical-products/our-insights/improving-patient-adherence-through-data-driven-insights>

Clinicians often rely on patient self-reporting to determine whether medications are being taken and/or have been discontinued. This information is typically provided after the fact, if at all as patients often do not recognize or want to admit their own adherence to prescribed medications. Medication fill data at the time of the visit may provide greater insight into adherence along with patient self-report and improve the accuracy of the data, although it is generally infeasible for clinicians to determine whether data is accurate and complete. Increasingly, it has been demonstrated that team-based care in which pharmacists, as well as the patients primary care and specialist providers, co-manage their medication regimens, result in optimal health outcomes.

Utilization of medication data and care plan documentation data associated with Chronic Care Management (CCM) and Medication Therapy Management (MTM) is essential for optimal patient care and complying with Medicare program requirements. This is particularly important during transitions of care. Multiple projects are ongoing in Colorado, Iowa, North Carolina, Ohio, and Tennessee which use medication data obtained through the HIE to improve patient care as delineated by the Pharmacy Health Information Technology Collaborative, which has also developed guidance for creating a Pharmacists eCare Plan C-CDA document that meets Medicare MTM requirements and is used for information exchange of medications, patient medication-related health concerns and goals, pharmacist's assessments, planned activities and interventions, recommendations, referrals and related clinical services.^{5,6}

Value-Based Payment and Quality Reporting Measures

There may be opportunities to leverage incentive-driven quality initiatives to help finance the integration of medication fill data into HIEs. In the context of Value Based Payment (VBP), payers and their networks may find it worthwhile to help cover the costs of acquiring or connecting medication fill data sources and interfacing them with an HIE, if doing so enhances the performance and/or reduces health care costs of the network. Indeed, research has shown medication management services are a key enabler of healthcare quality improvement and lower healthcare costs.⁷ Comprehensive medication data and health information access through HIEs can play a pivotal role in advancing high quality professional services that positively impact value-based programs and quality measures.

Value based models require comprehensive medication information and information access by pharmacists and healthcare teams. These programs include:

- Chronic Care Management (CCM)
- Care Coordination (Transitions of Care)
- Medication Therapy Management
- Medication reconciliation
- Preventative Care Services (disease screening, immunizations)
- Patient education and behavioral counseling⁸

A pharmacist-provided medication-related electronic care plan to share functional assessments and patient-centered goals of care that meet CMS value-based payment models for CCM has been developed by

⁵ Pharmacy Health Informatics Technology Collaborative, Integrating Pharmacists into Health Information Exchanges – Update Version, February 9, 2018.

⁶ <https://www.ncpdp.org/NCPDP/media/pdf/Pharmacist-eCare-Plan.pdf>

⁷ <https://www.ncbi.nlm.nih.gov/pubmed/30528252>

⁸ <http://avalere.com/expertise/life-sciences/insights/exploring-pharmacists-role-in-a-changing-healthcare-environment>

the Pharmacy HIT Collaborative.⁹ It will help pharmacists participate in team-based care and provide documentation for care coordination services furnished to patients with multiple chronic conditions. There are a number of Medicare endorsed CPT codes (99490, 99487, 99489, or future codes for CCM) that allow for reimbursement for these services. The Collaborative is pursuing health IT standards that support the delivery, documentation, revenue generation, and quality measures through value-based payment models for pharmacist-provided patient care services across all care settings. A pilot of the care plan program was completed in North Carolina.¹⁰

As organizations participate in the various Alternative Payment Models (APMs) available in a VBP arrangement, they ultimately need to partner with the payors in their market in order to deliver, measure and receive credit for high quality care. One such method for analysis of quality with regards to Medicare is the [CMS Stars Rating program](#) for health plans. There is a section of this rating program that cover prescription drugs. The plan's quality is assessed in four areas:

- Drug plan customer service: How well the plan handles member calls and questions.
- Member complaints and changes in the drug plan's performance: How often members had problems with the plan. Includes how much the plan's performance improved (if at all) over time.
- Member experience with the drug plan: Member ratings of the plan.
- Drug safety and accuracy of drug pricing: How accurate the plan's pricing information is and how often members with certain medical conditions are prescribed drugs in a way that is safer and clinically recommended for their condition.¹¹

Because they play a critical role in medication management for the VBP, pharmacies increasingly need access to clinical data to successfully accomplish the program goals and HIEs offer a valuable opportunity to meet this need. This provides an interesting opportunity for multi-organizational benefit from bidirectional medication data exchange. The value of receiving medication fill data from pharmacies may help to offset the cost and burden of onboarding pharmacies to the HIE. Other stakeholders, such as health plans, ACOs, and Medicaid may also be interested in subsidizing their share of the cost of connections because of the value that pharmacy participation in the HIE may bring.

Population Health / Analytics

Medication data can be used to better inform and refine population health risk models and other analytic approaches to managing healthcare quality and delivery. Medication use may be of particular importance in patient populations with high prevalence of chronic diseases, as well as high-cost, high-utilizer populations.

Use cases have been developed for creation of HIE dashboards at the community level, organization level, and patient level which identify medication related problems (non-adherence, allergies, etc.) and adverse events.^{12,13} These dashboards were configured to aggregate data on multiple levels to monitor for

⁹ Pharmacy HIT Collaborative documents on file.

¹⁰ <https://www.pharmacist.com/article/model-will-better-connect-community-pharmacy-systems-ehrs-and-more>; <https://365.himss.org/sites/himss365/files/365/handouts/550235823/handout-296.pdf>

¹¹ <https://www.medicare.gov/find-a-plan/staticpages/rating/planrating-help.aspx>

¹² <https://www.healthitoutcomes.com/doc/hie-for-population-health-management-a-case-study-0001>

¹³ <https://www.scnsoft.com/case-studies/bi-solution-for-a-us-leading-hie-vendor>

adverse events and display propensity data to predict patients at risk at the organization level who are most in need of intervention.

Regulatory / Policy Implications

Case Study: Nebraska

Cync Health (formerly the Nebraska Health Information Exchange), the statewide HIE for Nebraska, offers a novel case study in that the HIE operates the state's PDMP program. Further, Nebraska's PDMP is unique in that it is the first, and the only (as of 2021) PDMP program to collect all prescriptions that are filled within the state, including veterinary prescriptions and drugs that are not DEA controlled substances. This has been made possible by legislation that was enacted in Nebraska ([LB471, 2016](#)) that requires pharmacies and other dispensers to report all dispensed prescriptions to the PDMP on a daily basis. Consequently, Cync Health is able to provide users of its HIE with a comprehensive medication history, providing value by supporting a broader spectrum of clinical decision support use cases far beyond preventing the misuse of medications that are DEA controlled substances.

A key takeaway from Nebraska's experience was that strong data governance, including legislative safeguards related to security and privacy, as well as technical safeguards, had to be addressed to obtain buy-in from stakeholders and address concerns that were raised during the legislative process.

Patient Privacy & PDMP Access by Law Enforcement

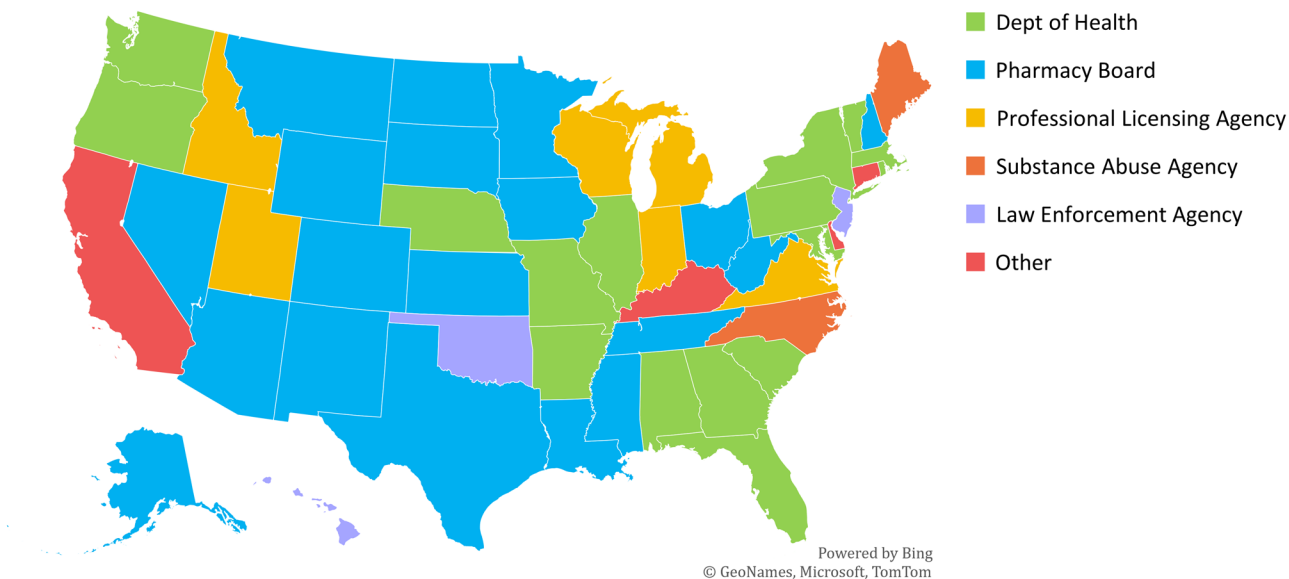
Requirements and preconditions for law enforcement entities to obtain access to records in PDMP databases varies widely. Eighteen states require law enforcement to obtain a court order, a warrant, or permission from a grand jury as a precondition for accessing information in the PDMP. Thirty-five states require that an active investigation be underway before granting access to law enforcement¹⁴. The State of Connecticut's relevant statute currently permits certain state and local law enforcement officers to obtain access to the PDMP without a warrant or judicial oversight.

Underscoring the need for policymakers to carefully consider what systems of checks and balances are appropriate for governing access to the PDMP, including access for law enforcement purposes, one can look to an example from Utah's PDMP program. In 2013, a detective who was investigating the apparent theft of morphine vials from a local fire station ultimately pulled the PDMP records of all 480 employees of the local fire authority¹⁵. The data from those records were ultimately used to bring criminal charges for prescription fraud against at least two of those employees (a firefighter paramedic and an assistant fire chief); charges that were completely unrelated to the alleged theft of the morphine. While all charges against both individuals were eventually dropped, the individuals and their families nonetheless suffered emotional, reputational, and financial consequences. The fallout from those cases ultimately resulted in the State of Utah changing its laws in 2015 to require law enforcement officers to obtain a search warrant with a standard of probable cause before accessing the PDMP.

¹⁴ <https://www.pdmpassist.org/>

¹⁵ <https://arstechnica.com/tech-policy/2015/05/the-big-drug-database-in-the-sky-one-firefighters-year-long-legal-nightmare/>

PDMP Administrator Organization



The extent to which law enforcement should be able to access data in a PDMP is an inherently controversial topic. The data being stored in a PDMP that collects DEA Schedule II-IV controlled substances can easily be used to determine if a given individual suffers from anxiety disorders, chronic pain, insomnia, Attention Deficit Hyperactivity Disorder, AIDS, or if the individual identifies as transgender. It's also a topic where the legal particulars have yet to be settled by federal courts. A 2014 decision by a federal judge for the Oregon district (Or. Prescription Drug Monitoring Program v. U.S. Drug Enforcement Admin) found the DEA's use of administrative subpoenas, which do not require judicial review to violate the Fourth Amendment's constitutional protection against unreasonable searches and seizures.¹⁶ The DEA appealed the ruling to the U.S. Court of Appeals for the Ninth Circuit, while the Litigation Center for the American Medical Society, along with all of the medical associations of the states in the Ninth Circuit (Alaska, Arizona, California, Idaho, Montana, Nevada, Oregon, Washington, and Hawaii) filed an Amicus Brief supporting the lower court's decision. In 2017, a judge for the Ninth Circuit reversed the lower court's ruling, finding the federal subpoena statute preempted the state-law warrant provision – an outcome the American Medical Association categorized as “very unfavorable.”¹⁷ Specifically, the brief disagreed with the DEA's argument that their request for PDMP data “did not unreasonably intrude upon any legitimate privacy expectation.” The AMA's Litigation Center counter-argued that “the patient's high expectation of privacy is not diminished when a patient fills a prescription provided by her physician for her treatment, merely because the state then collects and centralizes that data. The brief also cited a report from the Congressional Research Service, which found “that physicians may fear prosecution if they prescribe in good faith, and that studies have shown that physicians may use less efficacious drugs to treat patients out of fear that law enforcement will focus on prescriptions for more potent medications.” The brief concluded by arguing the integrity of the patient-physician

¹⁶ <https://casetext.com/case/or-prescription-drug-monitoring-program-v-us-drug-enforcement-admin>

¹⁷ https://searchltf.ama-assn.org/undefined/documentDownload?uri=%2Funstructured%2Fbinary%2Fcase%2FCase-Summary_OR-PDMP-v-US-DEA.pdf

relationship was at stake if patients are unable to expect that their communications and treatment will remain private.¹⁸

Potential Sources for Medication Data

Medication Data Vendors

Several companies vend products that make medication data available to authorized entities.

Vendor Overview	Summary of Offering(s)
<p>Surescripts®</p> <ul style="list-style-type: none"> • Headquartered in Arlington, VA • Founded in 2001 (Merger with RxHub in 2008) • Privately Held – Ownership includes National Association of Chain Drug Stores (NACDS), National Community Pharmacists Association (NCPA), and CVS Health 	<p>Surescripts has network connections with at least 22 payers and PBMs including Aetna, Catamaran, CVS/Caremark, Express Scripts, McKesson, and RESTAT. Between 90% and 95% of US pharmacies are reported to be connected to Surescripts including major chain stores CVS, Rite Aid, and Walgreens. Surescripts provides programs for Medication History for Reconciliation, Medication History for Populations, National Record Locator Service (NRLS), Real Time Prescription Benefit solution which includes price and formulary-based information, e-Prescribing and electronic prior authorization, and clinical message exchange.</p> <p>The Surescripts Medication History for Reconciliation service provides real-time medication data inclusive of the last 12 months and includes PBM and pharmacy claims. Pharmacy data is provided to Surescripts daily, and they run internal quality and validation checks on the information provided. PBM data is queried as requests are made to Surescripts, and the combined data results are shared back to the requester.</p>
<p>DrFirst®</p> <ul style="list-style-type: none"> • Headquartered in Rockville, MD • Founded in 1999 • Privately Held 	<p>Medication data sources include:</p> <ul style="list-style-type: none"> • Surescripts/e-prescriptions • Pharmacy Information Systems • Prescription Benefits Managers (PBMs) • Payor claims data <p>DrFirst has customers of its medication history product (typically hospitals/health systems) who contribute data to an HIE. Some of these customers have chosen to permit DrFirst to send all queried medication histories responses</p>

¹⁸ <https://www.ama-assn.org/delivering-care/patient-support-advocacy/pdmp-case-pits-patient-privacy-against-law-enforcement>

to HIE (in duplicate) for a patients' medication history to the HIE serving the customer. DrFirst reported that its customers who utilize this service are not charged any fees in addition to those which are normally charged for "medication history" transactions.

Product offerings related to medication data include:

MedHx™ - Leverages local and national data sources to provide a normalized, de-duplicated medication history within EHR workflows.

Rcopia® - Electronic prescribing software, with integrated medication history, formulary, drug interaction, and medication adherence functionality.

EPCSGoldSM and PDMP - Two-factor authentication system with DEA-level security to transmit controlled substance prescriptions. The product supports in-workflow check of state Prescription Drug Monitoring Program (PDMP) databases to identify potential abuse and comply with and automatically document mandated checks.

iPrescribe® - Mobile app supporting in-workflow PDMP check, medication history, and drug alerts.

SmartSuiteSM - Translates, infers, and normalizes data into consistent formats. Once a med history is normalized, it is clinically actionable and able to trigger safety checks for drug interactions or allergy alerts as well as match drugs from compendia to pharmacy shelves.

Pharmacies

Most pharmacy information systems are capable of transmitting fill data in batch files to meet state reporting regulations (PDMP). One state, Nebraska, has expanded this mandate to include all filled prescriptions. States usually require reporting within 24-72 hours of a prescription pick-up. These transactions are structured per the ASAP format.¹⁹

Pharmacy information systems may also transmit claims electronically through intermediaries or switches, to health plans or pharmacy benefit managers. These transactions are typically sent following the NCPDP standard.²⁰ Because pharmacies are likely to be reporting certain information to a state's prescription drug monitoring program, there is an established mechanism in place for acquiring limited prescription fill information. A regulatory approach may take longer initially to build stakeholder support

¹⁹ <https://www.asapnet.org/pmp-implementation-guides.html>

²⁰ <https://www.ncdp.org/Standards-Development/Standards-Information>

but could lead to a significant amount of data being made available at relatively low cost. Some important data elements may not be available through this approach. Diagnosis codes, for instance, are not currently supported by most PDMP systems.

Payors

Commercial and public health plans may be able to provide medication data originating from claims files, including data on prescription drug claims; however, lags in data submission and processing can make the data less useful for use cases where the timeliness of data availability is important. Because health plans are often also participants and/or stakeholders of an HIE organization, HIEs may be able to acquire the medication fill data at relatively low cost as part of a negotiated participant agreement.

Data originating from payors' claims files is generally only available for the members of a given health plan, and only for submitted and/or paid claims. Furthermore, it is common for patients to transition from one health plan to a different one depending on factors such as their employment and eligibility status for publicly funded plans - this "member churn" has implications for HIEs regarding the need for effective "health plan identifiers" that are indexed to the HIE's master person index solution. There may also be issues in matching claims records up with clinical records when a person has supplemental coverage, creating the potential for duplicate records of medication dispensations to be created.

Providers

As of 2021 a vast majority of providers / care delivery organizations in the U.S. are using Certified EHR Technology²¹ that uses computerized provider order entry (CPOE) to place orders for medications that are either printed or sent through an ePrescribing vendor such as Surescripts or DrFirst. The medication SIGs and histories are typically stored in a structured format within those EHR systems, but it was reported that barriers exist to the semantic interoperability of those medication data across vendor and organizational boundaries, in part because of variances in standards / terminology vocabularies that are used by various vendors and their customers (i.e., the same medication concepts can be variously represented by RxNorm, SNOMED CT, etc.).

Pharmacy Benefits Managers (PBMs)

PBMs facilitate the payment for prescription drugs between health plans and pharmacies. Most PBMs participate in the Surescripts network, though some are known to provide data offerings outside of Surescripts.

Patients

Patients should be viable sources of medication data. Several applications have been developed to support medication adherence, although as of 2018 their use and effectiveness had not been widely studied²². As patient-generated data becomes more readily available to HIEs, there may be value in exploring the feasibility of collecting medication data from patients directly.

²¹ <https://www.healthit.gov/topic/certification-ehrs/certification-health-it>

²² Medication Adherence Apps: Review and Content Analysis: <https://www.ncbi.nlm.nih.gov/pubmed/29549075>

Potential Challenges / Barriers to Building a Comprehensive Medication Database

It was reported during interviews that there are common gaps where it can be particularly difficult or impossible to obtain prescription and/or medication fill data, including prescriptions prescribed and/or dispensed by:

- Home healthcare settings
- Home infusion settings
- Hospice care settings
- LTPAC settings
- The Department of Veterans Affairs

The potential challenges for obtaining data from the afore-mentioned entities may be the result of several root causes, including exemptions from mandates to implement e-prescribing. Use of billing processes and/or systems that are not required to conform to the same standards and conventions required of those used by hospitalist and ambulatory providers.

Technological Implications

Standards & Terminologies: Use Case Implications

Standardization of nomenclature and processes is critical to most of the afore-mentioned use cases. A variety of standards and ontologies have been developed to support use cases where syntactic and semantic interoperability for medication data is necessary in human and/or machine-readable formats.

RxNorm	
<p>Overview:</p> <p>The National Library of Medicine (NLM) produces RxNorm.</p> <p>RxNorm is two things²³:</p> <ul style="list-style-type: none">• A normalized naming system for generic and branded drugs.• A tool for supporting semantic interoperation between drug terminologies and pharmacy knowledge base systems. <p>RxNorm:</p> <ul style="list-style-type: none">• Represents drugs from prescribers' point of view• Ingredient + Strength + Dose Form (e.g., Warfarin Sodium 1 MG Oral Tablet)• Derived from other commonly used public and private drug terminologies, including FDA structured product labeling (SPL)	<p>Implications for Use Case(s):</p> <p>RxNorm is intended to standardize medications by normalizing disparate terminologies / standards. It was reported that RxNorm is currently the ideal standard for a comprehensive medication list for use by prescribers.</p>

²³ <https://www.nlm.nih.gov/research/umls/rxnorm/overview.html>

<ul style="list-style-type: none"> Does not contain drug classes, indications, adverse events, drug-drug interactions²⁴ 	
SNOMED CT	
<p>Overview:</p> <p>Clinical terminology with global scope covering clinical specialties, disciplines, and requirements.</p> <p>SNOMED CT contains over 330,000 concepts in 19 domains.</p>	<p>Implications for Use Case(s):</p> <p>It is used in over 50 countries and in popular EHR systems including EPIC.</p>
National Drug Code (NDC)	
<p>Overview:</p> <p>The National Drug Code (NDC) is a unique proprietary identifier used in the United States for human drugs to identify the manufacturer/labeler, the product, and package size of all drugs that a drug establishment manufactures, prepares, propagates, compounds, or processes, and reports to the Food and Drug Administration (FDA). It is a 10-digit numeric code with a three-segment numeric identifier assigned to each medication listed under Section 510 of the Federal Food, Drug, and Cosmetic Act (FDCA).</p> <p>Usually, the NDC can be found on the drug container (i.e., vial, bottle, or tube).</p>	<p>Implications for Use Case(s):</p> <p>It was reported that the FDA is attempting to standardize NDC codes.</p>
ASAP	
<p>Overview:</p> <p>The American Society for Automation in Pharmacy develops and publishes standards for a variety of pharmacy needs. These include but are not limited to PDMP, REMS Programs, Medication Therapy Management, etc.</p>	<p>Implications for Use Case(s):</p> <p>Several of the PDMP vendors use the ASAP standard to deliver data to and from their systems.</p>

²⁴ <https://ncvhs.hhs.gov/wp-content/uploads/2017/06/Day1-Humphreys-SNM-LOINC-RXN-002.pdf>

Case Study: Pharm2Pharm

Project Title: Pharm2Pharm, a formal hospital pharmacist to community pharmacist collaboration

Geographic Reach: Hawaii

Funding Amount: \$14,346,043

Estimated 3-Year Savings: \$27,114,939

Funded by the Centers for Medicare and Medicaid Services Innovation Center, *Pharm2Pharm* was a proposed service model that was piloted to improve care and reduce cost by leveraging the use of pharmacists to optimize medication lists across care settings. Initially implemented by the University of Hawaii at Hilo as a care transition and coordination model designed to improve patient safety and reduce medication-related hospitalizations and emergency room visits.

The Pharm2Pharm project, named because of the collaboration between the hospital pharmacist and the community pharmacist, initially focused on three rural communities in Hawaii, and was later expanded to Honolulu County and consisted of approximately 2,500 patients.

As part of the Pharm2Pharm model, the hospital pharmacist would evaluate patients for potential medication related issues upon discharge. Specific criteria such as the number of medications prescribed, types of medications, and previous acute care, were among the criteria that was used to identify the patients. The patient was then matched with a community pharmacist with whom they would speak within three days of discharge. The hospital pharmacist would then complete the medication reconciliation and send the transition of care to the community pharmacist. The community pharmacist would then work with the patient for up to a year to provide education and monitor the patient's outpatient medication therapies and adherence.

The initial pilot group was composed of 2,083 adult patients who met the criteria for being at risk for medication-related problems. 62% of these patients were over 65-year-old. The predicted, case mix-adjusted medication-related hospitalization rate of individuals aged 65 and older was 36.5% lower in the Pharm2Pharm hospitals after implementation than in the nonintervention hospitals ($P = .01$). The estimated annualized cost of avoided admissions was \$6.6 million. The annual cost of the pharmacist services for all Pharm2Pharm participants was \$1.8 million. The Pharm2Pharm model was associated with an estimated 36% reduction in the medication-related hospitalization rate for older adults and a 2.6:1 return on investment, highlighting the value of pharmacists as drug therapy experts in geriatric care.

The Hawaii Health Information Exchange and the HCS implemented the health information technology to support the Pharm2Pharm model. This includes a hospital medication reconciliation module and drug therapy problem assessment module. Documents from these modules have been interfaced with the HHIE Community Health Record so that they are available for other authorized clinicians. Consulting Pharmacists also have access to the HHIE Community Health Record and Clinical Inbox which notifies them of important information such as new lab results, hospitalization, and ED visits among their patients.

Challenges: A shortage of pharmacists and the lack of compensation for services beyond dispensing were the chief challenges noted by the Pharm2Pharm pilot. Health Care Innovation Award has provided funding for both HCPs and CCPs in Hawaii. However, this funding source is time-limited and must be

replaced by other sources for these pharmacists to continue providing Pharm2Pharm services. It was reported that the pilot was a demonstrable success and has since been operationalized in various forms by several Medicaid Managed Care Organizations in Hawaii.

The following are key points pertaining to the sustainability of the Pharm2Pharm model:

- **HCP enrollment volume:** In hospitals with adequate infrastructure and support, each full-time HCP can enroll and hand-off over 20 patients per month. Placing an HCP in the hospital is an efficient and effective way to find high cost, high risk patients and get them on a path toward medication optimization and lower acute care costs. Additionally, HCPs provide specialized patient education and resolve discrepancies missed by other clinicians. In Hawaii, seven hospitals have participated in the Pharm2Pharm model.
- **Community pharmacy payment:** The payment to community pharmacies for providing this comprehensive medication management service in the current model is \$695 per patient per year. For patients who exit the service early, the payments are prorated to a lower amount. HCPA-member pharmacies have provided the CCP services in the Pharm2Pharm model.
- **Baseline hospital cost per patient:** The average baseline acute care cost of Pharm2Pharm patients prior to their enrollment and handoff to a CCP is over \$26,000 per patient per year (these data are based on actual inpatient, observation, and ER charges provided by Hawaii Health Information Corporation, with a 0.385 cost-to-charge ratio applied per CMS methodology, a common approach that uses hospital charges to estimate acute care cost).

Appendix C: BPMH User Interface Requirements Gathering Report



Medication Reconciliation & Polypharmacy Committee (MRPC) Best Possible Medication History (BPMH) User Interface Requirements Development Report

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Introduction

Accurate medication lists are essential data required to make clinically informed decisions. Obtaining comprehensive, up-to-date medication lists are difficult for clinicians and patients to access. Ideally, a medication list would comprise a 360-degree view of all prescribed, dispensed, purchased medications and would seamlessly connect patients and providers to medication data from multiple sources. While it is ideal to capture every aspect of medication management, in reality a *Best-Possible Medication History (BPMH)* has been identified as a more achievable goal. In an effort to realize a BPMH and to facilitate the goals of the Office of Health Strategy's Medication Reconciliation and Polypharmacy Committee (MRPC), we engaged stakeholders (patients, clinicians, advocates) in focus-groups and interviews to solicit feedback on the user interface requirements for a BPMH. Feedback was obtained via facilitated discussions that occurred in-person, via virtual WebEx meetings, and through online surveys.

Background

Many stakeholders have vested interests in the accuracy and currency of medication lists. For example, a patient has a health emergency and presents to the emergency department. This individual is incapacitated and therefore unable to share their medication history. The clinicians would benefit from knowing what medications this patient is prescribed. Unfortunately, often times healthcare systems and pharmacies use different programs to track and provide medications lists for patients. The inability to capture all of the patients' prescriptions, over the counter (OTC) medications, and supplements can lead to gaps in the medication history. Clinical decisions based off erroneous medication reconciliation can lead to drug-drug interactions, adverse events, and other medication-related problems.

A BPMH should encompass a real-time, up-to-date list of medications that can be accessed and updated by patients and providers across healthcare networks. Such tools should source information from disparate data sources and include both discrete and non-discrete prescription data fields. This could be data from electronic health records (EHR), data across different healthcare networks, community pharmacy prescription dispense history data, and patient-entered data on purchased OTC medications.

To help envision how a BPMH could be graphically represented, two students from UConn's Computer Science and Engineering School used Figma to create a wireframe tool. They created two prototypes, a patient-facing prototype and a clinician-facing prototype. Figma allows for interactive screen shots thereby providing the end-user a simulated experience of how the wireframe tool might operate. Through this platform, we were able to showcase mock-ups to participants, collect feedback and via rapid-cycle design and testing, display new features.

Previous Work

The process of developing our mock-ups began with a prototype created in Flutter (features listed in Appendix VII) with the intention of displaying some basic features that a real working application might provide. Our intention was to design the wireframe in such a way that it kept the basic features provided in the prototype, while building on top of those ideas to improve the usability and functionality of the mock-up. Another source of ideas was the 2019 Medication Reconciliation Hackathon²⁷ (features listed in Appendix VII), where members of the medical community came together to discuss the current problems with the way that medications are managed in Connecticut, and possible solutions to these problems. Ideas about both functionality and user interface were pulled from the report created as a result of the hackathon. This report was especially useful because it came from people who have real-world experience with the issues we are attempting to solve, so their thoughts on design choices and ideas for features can be used to get a better understanding about what end-users would need. Finally, a list of business and functional requirements was developed for this project, outlining various features that a working application would eventually need. These requirements gave us basic guidelines to follow, and served as a baseline for features that were absolutely necessary to include in our

²⁷ https://portal.ct.gov/-/media/OHS/Health-IT-Advisory-Council/Presentations/Report-on-Medication-Reconciliation-Hackathon_10_June_19_v1_0-FINAL.pdf

wireframe. Using a combination of these three sources, we had a wealth of inspiration and ideas to pull from when designing the first version of the mock-up.

Methods

Patient Facing Prototype

(This portion of the work was provided by UConn Storrs Health Research Program)



Figure 1 Sign-in Screen

The goals of the patient-facing version of our application are to show patients the most accurate version of their medication list which they can modify and allow them to further collaborate with their physician/pharmacist. The patient-facing prototype begins with a sign-in screen (figure 1), created using a simple logo and a button allowing the user to sign into the app. Because Figma does not allow any real functionality to be added, there is no actual sign-in system in place here. Due to Figma's easy-to-use design tools, this screen was simple to create and connect to the rest of the mock-up.

One of the most important screens regarding both functionality and design is the reconciled med list screen. The reconciled med list screen (figure 2) was created using a more complex variety of shapes and tools in Figma, and we needed to make multiple decisions throughout the design process. For example, we needed to decide how much information to provide about each medication on the initial list. Figma allows the developer to use text with many fonts and sizes, so it was easy to make the name of each medication relatively large, while some medication properties could be displayed in the block but in a smaller size, allowing more information to be shown. This screen also shows how Figma can easily implement imported pictures and designs, for example the "alert" symbol. This symbol was not created in Figma and was instead imported.

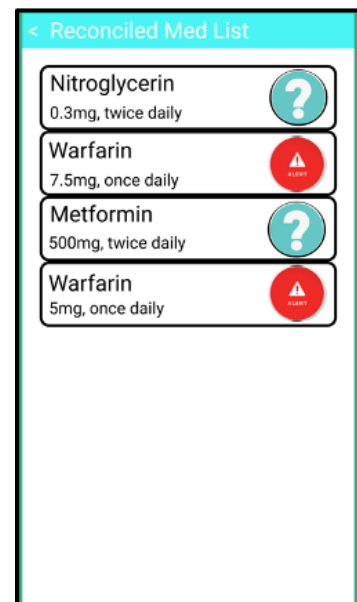


Figure 2 Reconciled Med List Screen



Figure 3 Medication History Screen

A good example of Figma's ability to mock functionality can be found in the "Medication History" screen (figure 3), which shows a calendar, allowing the user to click a date and see which medications they were taking at that date. This was created using mostly simple squares and rectangles within Figma, showing how using the simple shapes Figma provides can lead to more complex designs. In reality, only two dates are selectable in this mock-up, highlighting yellow when they are clicked. However, this does the job of showing people how this feature might work in the final application, and it was relatively easy to do so once the screen was created. Other

screens of this version of the application are just a mixture of shapes and text, using these simple elements to build more complex designs. This version also shares a lot in common with the clinician facing prototype, and Figma makes it easy to transfer those common elements between files.

Clinician Facing Prototype



Figure 4 Patient List Screen

The goals of the clinician-facing version are to provide clinicians with an easy way to see and edit their patients' medications. Similar to the patient facing prototype, the clinician facing version also has a sign in screen which is not yet functional. The sign in button on the first screen is connected to a personal menu screen. Figma makes it easy to connect shapes, screens, and all types of design elements together. Connections between design elements in Figma are called interactions and these interactions are easy to delete and modify. The patient list screen (figure 4) was difficult to make initially because each patient name had to be given its own rectangle and no space was supposed to be left in between the rectangles. Although it was difficult to position all rectangles together, the Figma tool itself was able to automatically position rectangles together when two rectangles were brought close together which made it easier to create the patient list. After the rectangles with all the patients' names were in position, we were able to add all of them into one group, making it much easier to move all the design elements together. The search bar at the top of the patient

list was not in the initial design but it was very easy to add because we could select the group of all rectangles with patient names and move them in sync. The magnifying glass icon at the left corner of the search bar was not created by us. The icon was imported from an open-source file in the Figma community. There are many open-source files available in the Figma community that offer various types of UI design elements that can be copied into your own file.

The frames in Figma usually have a standard size, but you are also given the option to create your own frame with its own dimensions. For our design purpose we chose to use standard android phone sized frames. This frame had a fixed height which was not enough for the patient list, but in Figma it is possible to alter the dimensions of the frame. We increased the height of the frame to include all patients and an add button at the bottom of the list. The patient menu screen was relatively easy to design, it only required four rectangles with text boxes that were evenly spaced across the screen. The patient details screen was designed similarly, by adding rectangles and using text boxes to add information inside them. In the reconciled medication list screen (figure 5), we were able to create an alert by adding an imported image inside a circle. The medication details screen has a design similar to the patient details screen. The review changes screen was

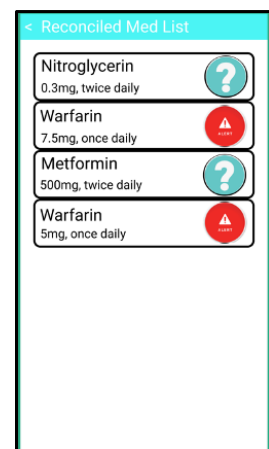


Figure 5 Reconciled Med List Screen

created so that a clinician could review any past changes that had been made and accept/deny new changes.

Since we were including past changes, we also wanted the clinicians to be able to see the date the change was made. Since Figma allows you to format the text by changing its size, font, color, etc. we were able to differentiate between the date and the medication name. We were also able to create circular design buttons on the submit changes screen by modifying the corner radius of the rectangles.



Figure 2 Confirm Change Pop Up

We also created a pop up (figure 6) that appears when you click on the remove button in the submit changes screen. This pop up was created by modifying the interaction of the button to open an overlay. Figma has provided us with a wide variety of features that allow us to make app-like models out of frames, rectangles and text boxes and has been a great tool for our initial design phase.

The User Interface Development Process

In total, we created 66 screens for the clinician facing version of our app and 60 screens for the patient facing version of our app. Initially, we started by recreating the designs from the hackathon report (figure 7) and our prototype (figure 8). We also created an iPad version of our

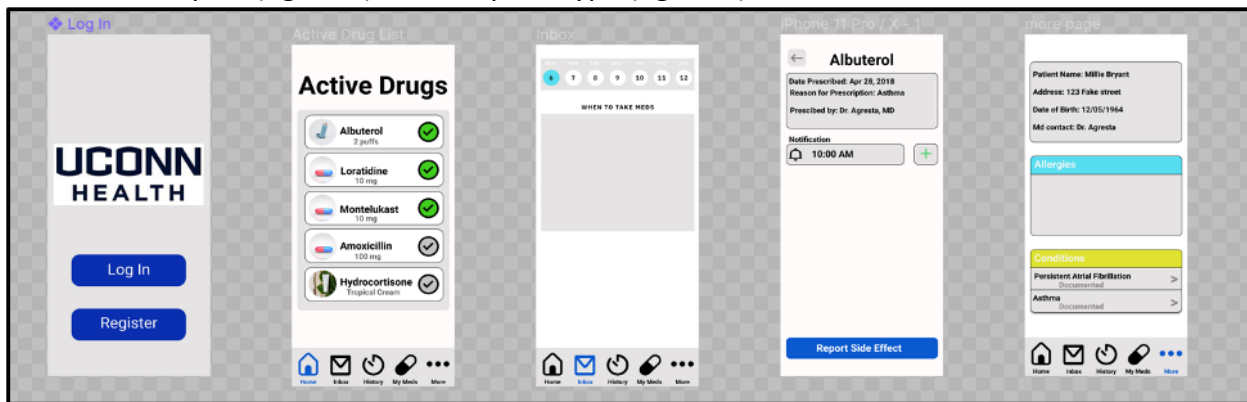


Figure 7 Hackathon Design Prototype

Figma designs to be used to show our prototype on an iPad to focus groups. There isn't an option in Figma to convert one size of a frame into another so to create an iPad version of our designs we had to resize our design elements to fit the iPad frame (figure 9).

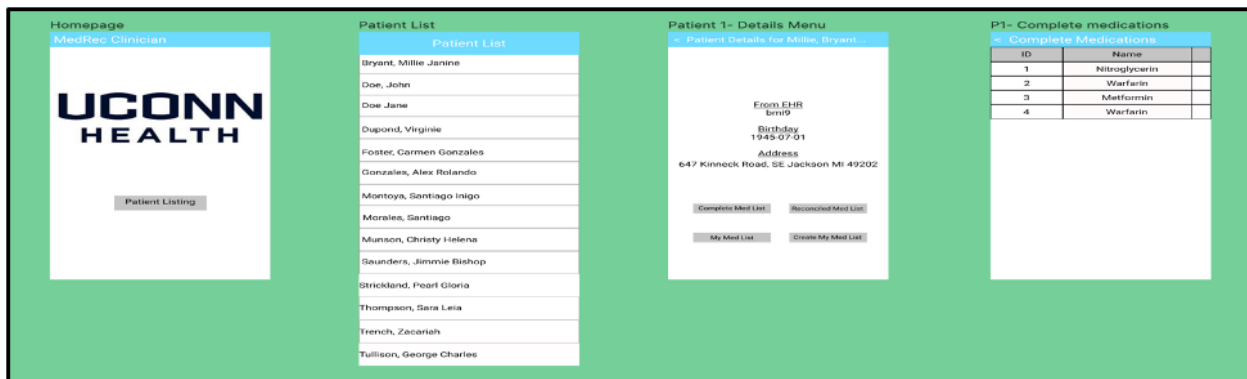


Figure 8 Prototypes Created in Figma Based on Hackathon Designs

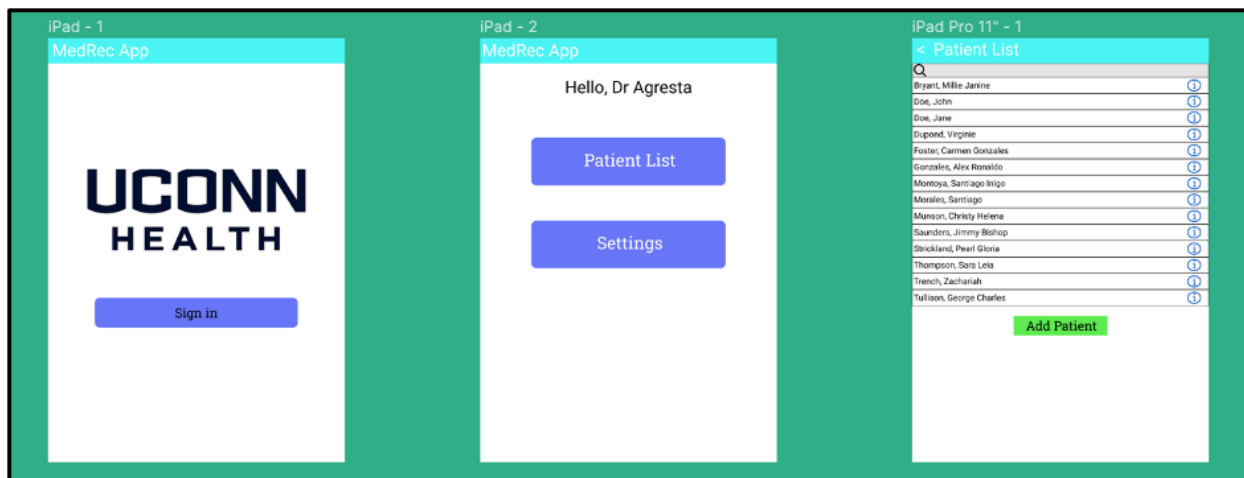


Figure 9 iPad Frame Figma Designs

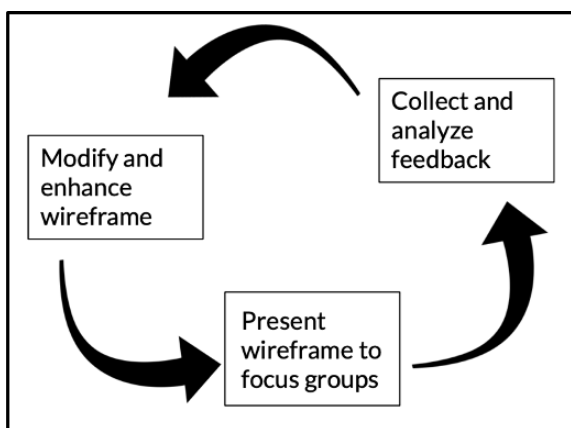


Figure 10 Process to Incorporate Design Feedback

To improve the user interface design of our application we presented a mock-up of our Figma designs to focus groups comprised of patients and clinicians. In our focus group sessions, we shared with end users the Figma mock-ups of our application and then took their feedback. We then analyzed that feedback and made changes to our designs

Feedback Session Design

(This portion of the work was provided by a sub-award through UConn Health from OHS)

Participants were identified through a convenience sample consisting of clinicians, patients, and MRPC members. Qualitative feedback from focus groups and individual sessions were collated to inform BPMH wireframe designers on key features and functionality of the BPMH user interface.

A script (Appendix I) was formulated which presents the current gaps existing with medication reconciliation and introduces the purpose of this project. A set of 10 questions (Appendix II) regarding wireframe feedback was prepared for clinicians, MRPC members, and patients. The script and questions were prepared by the researchers, five pharmacy students, and two pharmacy residents. They underwent several iterations with guidance from a public health research associate with over ten years of experience in quantitative and qualitative research methods.

Clinician sessions were held either in-person or virtually through WebEx video conference. Clinicians included representatives from Hartford HealthCare, Asylum Hill Family Medicine, Yale

New Haven Hospital, a retail pharmacy chain, and a managed care organization. MRPC member sessions were held virtually through WebEx video conference. Patient sessions were conducted in-person at two outpatient clinics: Asylum Hill Family Practice (Family Medicine Residency practice center) and Cornell Scott - Hill Health Center (Patient-Centered Medical Home).

Each session followed the same agenda and format. It began with providing the participants an overview of the project using the prepared script. This was followed by a demonstration which entailed showcasing a series of simulated screenshots from the wireframe's clinician-facing prototype and/or patient-facing prototype. This was displayed either on a large projector screen or a computer screen. If desired, participants could then explore further with individual iPads. The set of 10 questions were used to facilitate the discussion and collect feedback about the user interface requirements. Feedback was hand-written or typed by the facilitator and/or facilitator's assistant (pharmacy student). Clinician sessions were recorded by WebEx to allow for accurate transcription of feedback and to validate report details.

Feedback sessions for clinicians and MRPC members ranged from 30 to 60 minutes. Feedback sessions with patients were about 15 to 60 minutes. MRPC members and patients who were unable to attend a live session had the option of watching a video demonstration and providing feedback via an online Qualtrics survey (Appendix III).

After the interviews were conducted, researchers used thematic analysis to identify and define key themes present in the transcripts. The research associate (mentioned above) led this process. After the first round of individual coding was completed, coders met to compare themes present in the data. Coding discrepancies were resolved using consensus and by an iterative process of refining and merging codes. To demonstrate the data-driven nature of the qualitative findings, feedback (including quotes) supporting each theme was extracted from the transcripts and are presented in the appendices section.

Results

Feedback from a total of 70 participants was collected (Table 1). Of the 70 participants, there were 34 clinicians, 6 MRPC members, and 30 patients. Among clinicians, there were 7 focus groups and 5 individual interview sessions. The feedback from MRPC members were obtained via 3 WebEx video conferences. Feedback from the patients were obtained either in-person (15) or via online Qualtrics survey (15). The patient population was intentionally recruited from a diverse population and included patients on Medicaid and Medicare.

Over half of the clinicians identified as physicians (17.6%) or medical residents (38%) (Table 2). The physicians' area of practice included internal medicine, family medicine, primary care, and hospice/palliative care. Most of the physicians hold leadership positions, and some also identified themselves as academicians. About a quarter of the clinicians identified as home care nurses (14.7%), primary care nurses 5.8%, or nurse care managers (5.8%). Four of the clinicians were pharmacists practicing in managed care, community pharmacy, pharmacy operations, or pharmacy informatics. There was also one medical student (2.9%), and one medical assistant (2.9%).

Table 1: Participant Breakdown

Type of Participant (n=70)	Number	%
Clinicians	34	49%
MRPC Members	6	9%
Patients (in-person)	15	21%
Patients (survey)	15	21%

Table 2: Clinician Breakdown (includes other members of health care team)

Type of Clinician (n=34)	Number	%
Physicians	6	17.6%
Medical Residents	13	38%
Pharmacists	4	12.5%
Home Care Nurses	5	14.7%
Primary Care Nurses	2	5.8%
Nurse Care Managers	2	5.8%
Medical Students	1	2.9%
Medical Assistants	1	2.9%

Appendix IV lists the feedback from clinicians and MRPC members. Appendix V lists the feedback from patients.

Overall the feedback was positive. Participants provided important considerations regarding the user interface requirements, safety/workflow barriers, and applicability.

Feedback was broken down into the following themes and sub-themes:

- Existing Gaps
- User Interface Optimization
 - Features
 - Visual Appearance
- Safety Considerations
 - Potential Hazards
 - Workflow Considerations
 - Patient Control
 - Patient Safety
- Data
- Best Use Considerations
- Value Proposition

The following key points emerged from the feedback sessions:

Existing Gaps: Currently it is challenging to accurately perform medication reconciliation given the gaps that exist in medication data. There is also a lack of communication between providers/EHRs.

User Interface Optimization: Participants recognized the wireframe mockups are prototypes. They were able to appreciate the intent and provided recommendations to enhance the user experience. For example, simplifying the collaboration code process, adding a hamburger menu of options on the home screen, and having the ability to filter medications in different ways (alphabetically, chronologically, by medication class, etc.). There were suggestions to optimize the Medication History calendar by enabling reminder alerts. Recommendations to enhance visual appearance included adjusting the font size and color and adding pictures of medications.

Safety Considerations: Both clinicians and patients expressed concerns regarding patient autonomy over prescription medications. Most felt patients should be able to modify OTC medications only (not prescriptions), and that they should be able to add comments on *all* medications. Clinicians raised concerns regarding alert fatigue since they might be alerted to real-time updates made to their patients' medication list. Also, it was suggested to simplify the language in order to accommodate patients with low literacy levels.

Data: A reoccurring theme was the need to seamlessly incorporate data from many sources including electronic medical records, insurance dispense records, health systems, pharmacies and other data banks. Clinicians felt this should be integrated into their EHR as well.

Best Use Considerations: This could be valuable for health systems, pharmacies, and health plans. Clinicians recognized the expanding capabilities of already existing EHRs pulling data from multiple sources, and questioned what this could add. Patients felt this could facilitate bidirectional communication with their providers, and enhance their autonomy.

Value Proposition: Many felt this would improve patient care across the healthcare landscape, and would facilitate patient autonomy over their medications. This could also be used in population health to close gaps in care such as adherence gaps, which could ultimately improve plans' star ratings.

Incorporation of Feedback

On the medication details screen (figure 11) we were asked to add images of the medication a patient was taking to allow patients to identify and cross check their medications. On the clinician side of the screen, we also added a view refill option which would allow clinicians to monitor their patient's medication usage. We also added a dismiss button to the clinician side in the potential errors box. This was done because clinicians said that there might be a potential situation where a patient is taking two doses of the same medication. In that situation, a clinician could use the dismiss button to dismiss the false alert. We also deleted the potential errors box from the medication details screen on the patient facing side entirely because clinicians expressed the concern that if patients were shown an error in their medication list, they would stop taking their medications entirely which would be an undesirable situation.

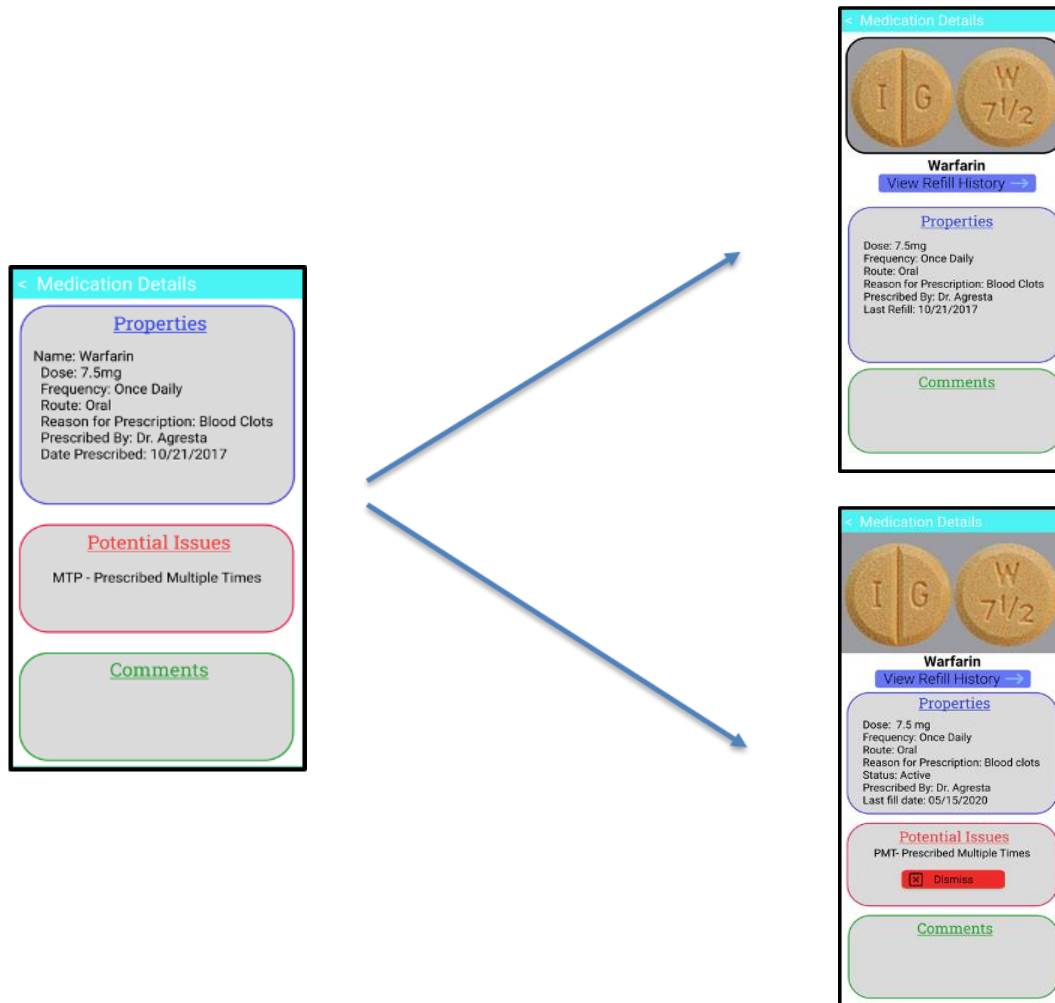


Figure 11 Update of Medication Details Screen

We also made changes to the patient list screen (figure 12) on the clinician facing version of the app. We sorted the patients in alphabetical order and added a toggle button to the right-hand corner to allow clinicians to switch between a normal view of all their patients and a changes view in which they can only see patients with changes in their medication list. On the medication list screen (figure 13), we added pictures next to the medication names to make it easier for patients to identify their medications. While not all feedback from participants is represented, it is clear that they provided great comments and notes, which can inform the development of future tools.

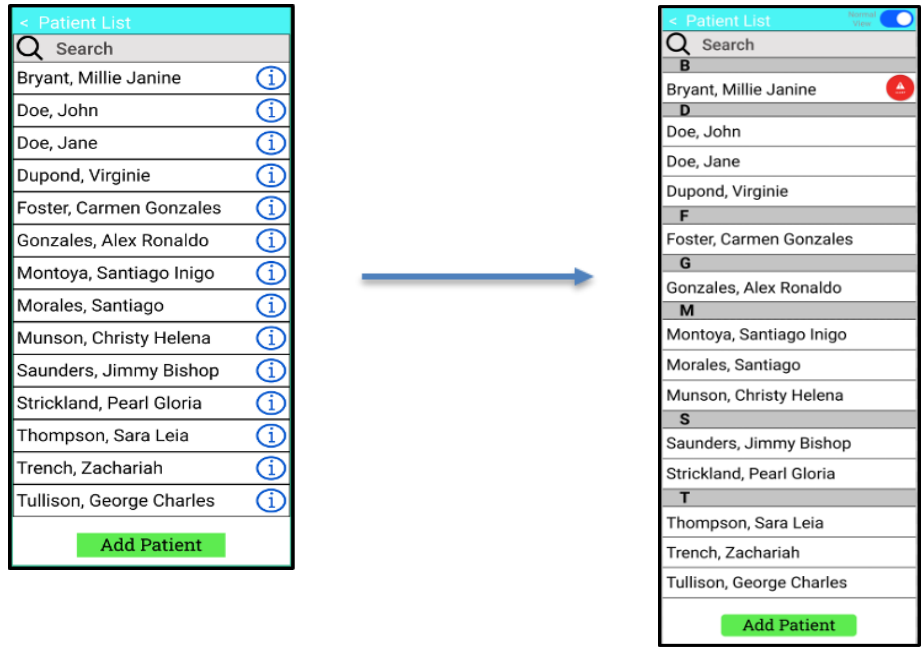


Figure 12 Update of Patient List Screen

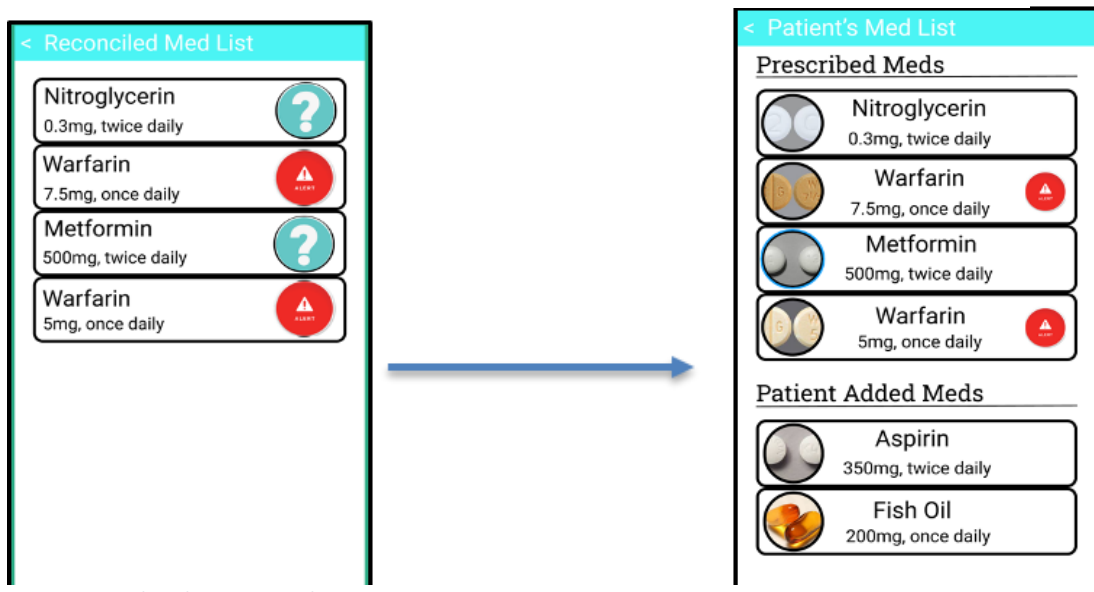


Figure 13 Updated Patient Med List Screen

Limitations

While most sessions were in-person or by video conference, there were 15 participants who responded via an online survey. Therefore, individuals who only responded to the survey did not have an opportunity to ask clarifying questions. Also, because this was a convenience sample, it is not representative of all stakeholders. However, although the findings may not be generalizable, they can still be useful for identifying changes and improvements.

Recommendations

In order to address the suggestions and concerns provided by the participants, organizations designing BPMH user cases such as Connecticut's Health Information Exchange (Connie) can consider the below recommendations.

VISUALIZATION: To optimize the user interface, it would be helpful to engage graphic designers who could enhance and streamline the visual appearance. They could assist with customizing features such as alerts, notifications, and displaying/filtering data in multiple ways. It would be wise to engage health literacy experts to assure readability for the appropriate literacy levels.

DATA PRIVACY: While Figma required a collaboration code to visualize the interface, future versions will require industry-standard approaches to data security, encryption, and log-in credentialing. Would explore alternate methods for patient-authorization of data sharing, or streamline this process by globally authorizing data sharing when signing in for the first time.

PATIENT AUTONOMY: Suggest future iterations allow patients to add comments to any medication, and to add/modify only OTC medications (not prescriptions).

DATA PROVENANCE: To enhance accuracy and completeness of medication data, ensure the data is from disparate sources including both discrete and non-discrete prescription data fields. This should include but not be limited to data from EHR, data across different healthcare networks, Prescription Drug Monitoring Program, community pharmacy prescription dispense history data (including cash and coupon transactions), mail order companies, and patient-entered data on purchased OTC medications.

INTEROPERABILITY: Designing for interoperability is important. Would collaborate with informatic technologists to ensure seamless integration with EHR and other platforms. Suggest comparing vendors that provide commercially available medication databases to allow for pre-populating of medications during manual data entry. As an example, Medi-Span drug data is integrated into EPIC. These drug database files provide prescription and OTC data including drug name, strength, therapeutic class, etc.

PLATFORM EXPANSION: Suggest exploring opportunities to sync refill/renewal requests with pharmacies to facilitate "one stop shopping" for patients. To address trust concerns with the data, consider using a confidence score to help allay clinician fears of erroneous data. For example, in EPIC a confidence score for a prescription's Proportion of Days Covered calculation is typically provided. Can expand other platform offerings such as being able to order a prescription within the platform or pend the prescription to the EHR, or cancel a prescription through CancelRx technology. Any functionalities must first be vetted for potential liability before implementation can occur.

Recommend speaking with health plans regarding the business use-case for improving medication-related star measures such as adherence to antidiabetic medications,

antihypertensives, and statins. This could have implications on broader population health quality measures such as hemoglobin A1c, hypertension control, and atherosclerotic cardiovascular disease reduction.

Acknowledgements

Funding for this project was from two major sources. The Computer Science Engineering students in this project were funded through UConn summer research internships. The project and these feedback sessions were also funded through contracts with UConn Health supported from the Office of Health Strategy. A set of additional funding was provided to carry out the qualitative research using funding already available.

Appendices

Appendix I: Scripts

Appendix II: Focus Group/Interview Questions

Appendix III: Online Qualtrics Survey

Appendix IV: Clinician and MRPC Member Sessions Analysis Themes and Feedback

Appendix V: Patient Sessions/Surveys Analysis Themes and Feedback

Appendix VI: Mock-up Screens Map

Appendix VII: List of Features in Prototypes

Appendix I: Scripts

Script for Clinicians and MRPC Members

Healthcare systems and pharmacies use different programs to track all the medications your patients may be taking. However, they typically do not communicate with each other, and may not be able to see other medications patients are taking like over-the-counter medications or medications prescribed by other providers or health systems.

We have created a mock-up tool which aims to maintain an up-to-date real time view of your medications that you and all of your patients' healthcare providers would be able to see.

You would be able to view your patients' profiles, add/change/stop medications, and review potential concerns. Patients would also be able to make modifications to this list, like adding over-the-counter medications and supplements, and remove any medications that they have stopped taking.

We are asking for [___] minutes of your time to preview a series of interactive screenshots and provide feedback. Your feedback will help inform Connecticut's Office of Health Strategy and CONNIE (Connecticut's HIE) on possible solutions for medication reconciliation.

Some questions we would like you to keep in mind are:

- If we were to take this and build this into an actual application, how would you improve it?
- What did you like about it and what is it missing?
- What ways could this be more user-friendly?

Funding for this project was from 2 sources. The Computer Science Engineering students in this project were funded through UConn summer research internships. The project and these feedback sessions were also funded through contracts with UConn Health supported from the Office of Health Strategy.

Thank you for your time and assistance. We will begin with the demonstration and then will ask you for feedback.

Script for Patients

Healthcare systems and pharmacies use different programs to track all the medications you may be taking. However, they typically do not communicate with each other, and may not be able to see other medications you are taking like over-the-counter medications or medications prescribed by other providers or health systems.

We have created a mock-up tool which aims to maintain an up-to-date real time view of your medications that you and all of your healthcare providers would be able to see.

Providers would be able to view your profile, add/change/stop medications, and review potential concerns. You would also be able to make modifications to this list, like adding over-the-counter medications and supplements, and remove any medications that you have stopped taking.

We are asking for [___] minutes of your time to preview a series of interactive screenshots and provide feedback on how you would like to view and interact with your medication list. Your feedback on the design features will help inform Connecticut's Office of Health Strategy on possible solutions for maintaining an accurate medication list.

Some questions we would like you to keep in mind are:

- If we were to take this and build this into an actual application, how would you improve it?
- What did you like about it and what is it missing?
- What ways could this be more user-friendly?

Thank you for your time and assistance. We will begin with the overview of the tool and then will ask you for feedback.

Appendix II: Focus Group/Interview Questions

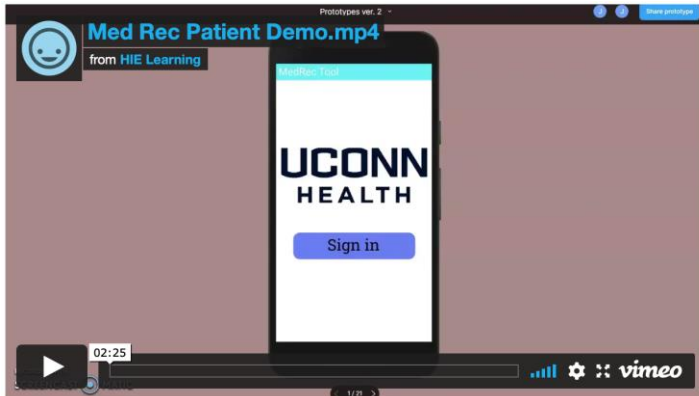
Clinician and MRPC Member-Facing Questions

- 1) What did you like about the tool?
- 2) What features is it missing?
- 3) Was each screen, button, and menu easy to navigate?
- 4) What ways could this mock-up tool be more user friendly and visually appealing?
- 5) Was it intuitive/easy to perform the different actions, like adding/removing medications?
- 6) Is “potential issues” the right phrase on the Medication Details screen? What might be a better word for problems that the reconciliation algorithm catches?
- 7) If we were to build this into an actual application, how would you improve it?
- 8) What barriers do you foresee preventing you from using this tool?
- 9) Do you think your patients would use this tool? What editing privileges should the patient have?
- 10) Would you trust the information in this tool? Do you think it would improve the care you provide?

Patient-Facing Questions

- 1) What did you like about the tool?
- 2) What features are missing?
- 3) Was each screen, button, and menu easy to navigate?
- 4) What ways could this mock-up tool be more user friendly and visually appealing?
- 5) Was it intuitive/easy to perform the different actions, like adding/removing medications?
- 6) How do you feel about the “potential issues” alert on the Medication Details Screen?
- 7) If we were to build this into an actual application, how would you improve it?
- 8) What barriers do you foresee preventing you from using this tool?
- 9) How do you feel about editing your medication list? Would you prefer to only comment instead?
- 10) Would you trust the information in this tool? Do you think it would improve the care you receive?

Appendix III: Online Qualtrics Survey

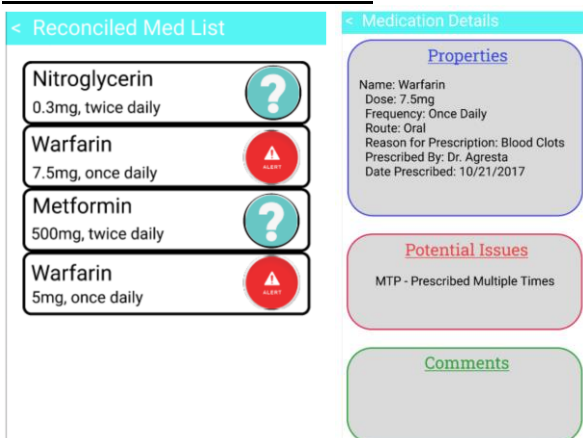


Main Menu Screen:



- Was it intuitive and easy to understand the main menu screen options? Should there be more features included?

Reconciled Med List Screen:



- Was it intuitive/easy to access the information/errors starting from the home screen?
- What other information would you like to see about a medication in addition to the information provided in the prototype?
- Is “potential issues” the right phrase here? What might be a better word for problems that the reconciliation algorithm catches?

Profile Screen:

< Profile Information

Basic Information
 Name: Millie Bryant
 Address: 123 Fake Drive
 Date of Birth: 06/12/1964
 MD Contact: Dr Agresta

Allergies

Conditions
 • Diabetes
 • High Blood Pressure

- Is there any other information that should be included in this section?

Medication History Screen:

< Medication History

< June 2021 >

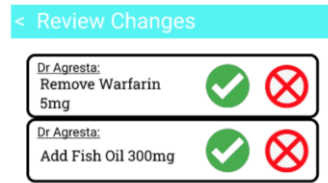
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

Active Drugs

Nitroglycerin 0.3mg
Warfarin 7.5mg
Metformin 500mg
Warfarin 5mg
Fish Oil 300mg

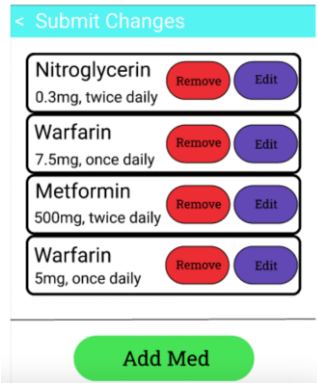
- Was it intuitive/easy to understand this screen? Would you prefer a different layout or ways to view this information?
- Is there any other information that should be included?

Review Changes Screen:



- Is it easy to understand what is happening in the review changes screen? Would you like to see more information than currently provided if you were to accept a change made to a medication list?

Submit Changes Screen:



- Is it clear what every button of the submit changes screen does, and how it would affect the med list?
- Was it intuitive/easy to perform the different actions, like adding/removing medications?
- How do you feel about editing your medication list? Would you prefer to only comment instead?

Change History Screen:



- Is there any other information that should be included on this screen?

General Questions:

- Are there any missing features that you would consider essential?
- Would you trust the information in this tool? Do you think it would improve the care you receive?
- What barriers do you foresee preventing you from using this tool?
- Is there anything confusing or unclear about this design?

Appendix IV: Clinician and MRPC Member Sessions Analysis Themes and Feedback

Themes	Sub-Themes	Feedback
Existing Gaps		<ul style="list-style-type: none"> • Home care nurses stated they do not receive medication dispense data from home care, long-term care, or skilled nursing facility settings. These medications come from independent pharmacies and are billed to the facility, so are not captured through claim data • Med recs can be difficult. Getting the doctor to call back is time consuming so hopefully this would cut down on time waiting for doctor to get back to them. • Sometimes providers have issues communicating with each other. We need a tool to better facilitate those conversations.
User Interface Optimization	<i>Features</i>	<ul style="list-style-type: none"> • Should be linked/integrated with EHR (including EPIC) for ease of use • Need to reconfigure the collaboration code into a more use friendly and accessible feature • Would be helpful for the pharmacy to see if a medication was discontinued so they know not to fill it • Should include the date the prescription was dispensed • Provider updates need to be optimized for workflow without adding to alert fatigue • Medication History calendar needs to have notifications built in • Language should be easy to read at a low literacy level • Should include brand and generic name for each medication • Make this more user-friendly for patients • Recommend that the first or home screen be the actual medication list itself with a hamburger menu on the side to open other options such as medication history, obtain shareable code, etc. <ul style="list-style-type: none"> ○ Including multiple languages ○ Patient literacy – using simple language, including more visuals ○ Option to increase text size ○ Bold certain information (ex. Drug name and indication)

Themes	Sub-Themes	Feedback
		<ul style="list-style-type: none"> • Refills should be added to the prescription information • Having a medication list vs. a prescription medication list <ul style="list-style-type: none"> ○ Have different sections for prescriptions and OTC meds ○ Show different section for reviewed medications • Would be helpful to see historical info (vs. current) in a separate view (archive old info) • Errors and notifications on the tool should be actionable instead of needing to go back and use another screen • Comments section should not be included <ul style="list-style-type: none"> ○ “I do not want to have comments with the patient because then I need to maintain a separate medical record” • Would be useful to add a filter that would arrange the medication list in the order of your choosing. For example, alphabetically, but disease state/indication, or by chronological order with the most recent meds at the top. • “For the patient facing side, it would be good to have quick facts about their medications such as what common side effects they could expect. This could even be a separate link in the tool to take the patient to some sort of interface for more information about their medication.”
	<i>Visual Appearance</i>	<ul style="list-style-type: none"> • Difficult to read font on some buttons because dark colored font is on dark colored background, or light font on light background <ul style="list-style-type: none"> ○ Examples on Submit Changes screen: “Submit Changes” is currently on white font on light blue background. Suggest making black font. • Adding images for the medications would be beneficial for patients but could be complicated since there are multiple manufacturers for a medication • Prescriptions should have administration directions and precautions. For example: <ul style="list-style-type: none"> ○ “Don’t take with alcohol” ○ “Keep refrigerated”
Safety Considerations		
	<i>Potential Hazards</i>	<ul style="list-style-type: none"> • Providers may worry about liability issues <ul style="list-style-type: none"> ○ “If patient makes a potentially dangerous change to their medication profile and the provider does not acknowledge it, they may be held accountable”

Themes	Sub-Themes	Feedback
		<ul style="list-style-type: none"> • Worried about patients going to different specialists who don't know them and bringing their medication list <ul style="list-style-type: none"> ○ "Patient taking medication differently than prescribed" • Redundancy in information could be a potential hazard • Sometimes there are 2 prescriptions for the same medication at different strengths (common with warfarin and other med classes where the strength desired is not available so must combine 2 strengths). In these cases, should not be listed as "Potential Issue". • Most clinicians like the idea of being able to pend a Rx from here to the EHR. One person strongly advised against having this transmit a Rx to the pharmacy or having this pend to EHR stating "I would not let this be an approach for Rx changes, that's begging for a lot of hurt. There needs to be another safety check."
	<i>Workflow Considerations</i>	<ul style="list-style-type: none"> • A few clinicians stated they would like this to be similar to the CT PDPM • Original prescriber should be informed automatically for any changes made to the original prescription • "Synchronization for started and discontinued medications through EHR/pharmacy directly with the app will be key. Ideally you would get to a point where no changes to prescribed meds are made through the app at all, with it essentially serving as view-only access. Would be best if all changes were made via EHR to reduce risk of redundancy and confusion" • Would like the application to have a ledger feature where we can track the reason behind why a medication was stopped or added. <ul style="list-style-type: none"> ○ "For example, the cardiologist stopped a cardiac medication because the patient had many falls, or the patient flagged a medication as not taking because it was causing them to fall. I would like an area to see this information. This information should go in the comments section. I should be able to click into the medications from the review changes screen and take a deeper dive into this information from there."
	<i>Patient Control</i>	<ul style="list-style-type: none"> • Most patients like the autonomy in being able to interact with their medication list and to add OTC meds. However, many patients feel

Themes	Sub-Themes	Feedback
		<p>intimidated to make changes to their prescriptions. Instead, they would prefer to only have the ability to comment on how they are taking the prescription differently than prescribed etc.</p>
	<i>Patient Safety</i>	<ul style="list-style-type: none"> • Patient privacy: this would need to comply with current protection laws • Patients can now ask for their data, and legally we must provide this information.
Data		
		<ul style="list-style-type: none"> • Data sources should be all inclusive and integrated into EHR (e.g. EPIC) • Pharmacy data should be included to have a more accurate medication history, including prescription pick-up date data • Have medication name data be accessible (so that it pre-populates once start typing) so the patient will not have to type out the medication name when adding a new medication • Under patient information with the prescriber information: add the phone number of the prescriber and be able to click on it to call them. • The source of the prescription and information should be listed somewhere. Should be easy to see (e.g. is the source EHR, Surescripts, patient reported, etc.) • Pharmacy dispensing data should be integrated • Having a full prescription history that dates as far as possible would be useful. "My current EHR only shows 3 years back."
Best Use Considerations		<ul style="list-style-type: none"> • The tool being an online/mobile access only could be a barrier to use for patients who cannot afford a cell phone etc. • Not sure how many people would be interested to have this. • Clinician side—would probably use more at the computer. Not as much on the mobile device • "Providers/clinicians have trouble dealing with updating medications and making corrections within EPIC, they will be unlikely to use another system to update the information" • "Health plans would be able to push information to the patient with this tool. This tool could be used as a data repository to keep track of everyone."

Themes	Sub-Themes	Feedback
		<ul style="list-style-type: none"> • Having a reward system in place. Example: Health plans and closing care gaps. Possibly a gift card? • There are many companies already working on applications such as this one, it may be beneficial to collaborate with them to be able to pull in larger amounts of data. • “As far as the mode of the delivery, one argument for having it on a different platform (e.g. my phone) is that it would be nice to do a side-by-side comparison while I have the patient’s meds listed on my EHR screen. This would allow me to have a separate screen on my phone rather than having to open another window in the computer and toggle between the EHR and web browser” • “Elderly population would benefit from this the most because they are on many meds. By default, this would help caregivers. This could also be an educational tool for patients.” • This may be good for a provider that has an EMR with limited functionality, but for a large healthcare system we have a robust EMR that provides us with many features already and pulls in a large amount of data. • “This would be ideal for someone without an EHR or with an EHR that does not have much functionality, but unless this fed into data that is already in our medication list to help us reconcile outside meds in a more streamlined way, there may not be much benefit.”
Value Proposition		
		<ul style="list-style-type: none"> • “I think this is fantastic. From a health plan perspective there is a lot of value in this information. There is a lot you can do with this in collaboration with the health plans. You guys are on to something here, not only making it easier on members but healthcare side as well” • Could serve as a database for all health systems to pull information from, would be ideal to have that as a med rec source • The value of the tool is to have full buy in by everyone. All groups and data sources would have to have a stake in the project for it to work. SNFs, home, hospital, etc. • The ability to add OTC meds/supplements would be helpful. “Patients adding OTCs would be tremendously helpful especially for retail pharmacists because there are a ton of drug-drug interactions with OTCs meds and

Themes	Sub-Themes	Feedback
		<p>supplements. We don't have the ability to see those meds"</p> <ul style="list-style-type: none"> • This would be useful on the business side for any initiatives or projects when you would like to access this information. • Could be used in population health. • If you utilize this tool if the way it is supposed to be used, it could help bring provider ratings up and improve star ratings for the health system. Maybe increase reimbursement?

Appendix V: Patient Sessions/Surveys Analysis Themes and Feedback

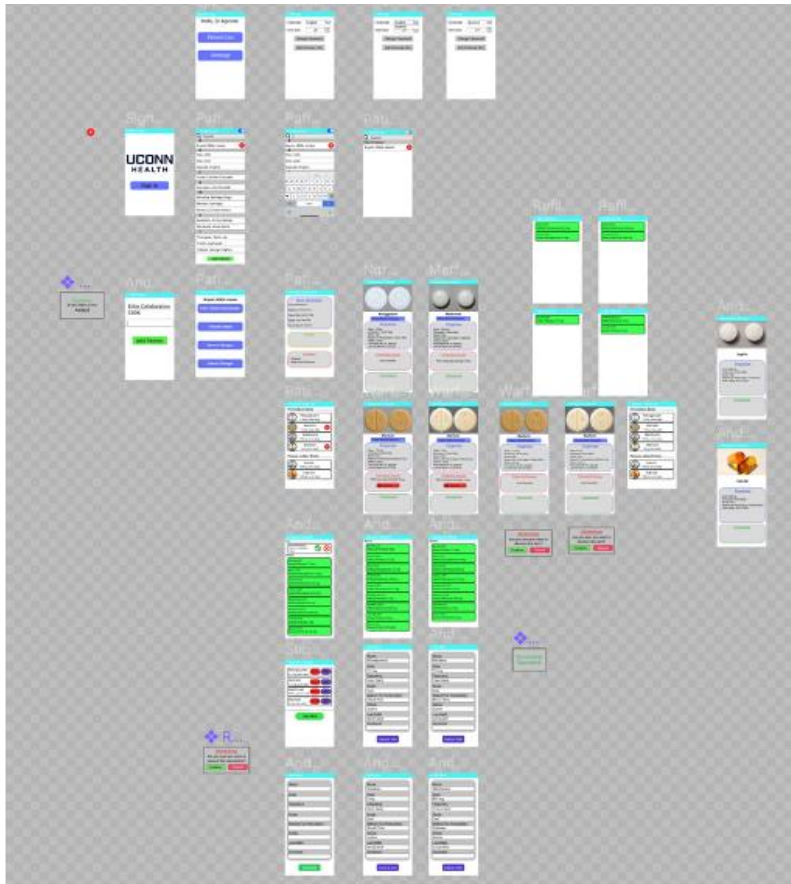
Themes	Sub-Themes	Feedback
Existing Gaps		<ul style="list-style-type: none"> Sometimes they must create their own tools to organize their medication lists which is often time consuming and difficult to upkeep.
User Interface Optimization	<i>Features</i>	<ul style="list-style-type: none"> It would be nice to have pictures of the medication or just the color of the pill or liquid Electronic signatures trailing the last editor into the information would be useful. "It's not entirely clear who is going to be seeing this screen. Assuming it's the patient, yes, it's adequate. Although I wonder if it's worth adding a "last seen by" and "last seen on" - to indicate when the last interaction with a health professional was." Having a history of a particular prescription and being able to see a previous prescription dose would be helpful Patients had mixed views on the medication calendar. Some thought it was useful or others felt that it was hard to understand or that it would not be useful for patients taking only a few meds. One patient suggested it could be useful for patients taking alternating medication regimens (e.g. take a Rx several days per week, or take Vitamin D weekly) One patient suggested a ring tone to alert at time a med is due, and then have the option for a prompt that asks if med was taken, if not why Collaboration code should be simple to use. Most patients liked this collaboration code because it helps maintain privacy, but in current state it may be too burdensome to type or relay if too many characters. Being able to request refills/renewals here would be helpful, as well as being able to see when meds are due for refill/renewal The "Review Changes" screen seems confusing. Define the symbols and the intention. In the "Change History" screen, patients would like to see who made the changes "There should be a help button somewhere if people get confused."

Themes	Sub-Themes	Feedback
	<i>Visual Appearance</i>	<ul style="list-style-type: none"> • Patients thought the tool was very easy to use and understand. “This was very easy to understand and seems like a very useful tool” • Some patients expressed concern over some of the wording in the tool. Wording change considerations included: <ul style="list-style-type: none"> ○ “Reconciled Med List” may be confusing ○ “Patient won’t know what MTP means. Take that out. You’ve already said prescribed multiple times” ○ Use <i>Please Note</i>: rather than <i>Potential Issues</i> • Medication names should include both generic and brand names • Patients liked the ability to comment, but should be able to be deleted • “MD contact” should be changed to primary care provider contact • Suggest adding not just primary care provider, but also other specialists • Consider including emergency contact
Safety Considerations		
	<i>Potential Hazards</i>	<ul style="list-style-type: none"> • Most patients felt the “Potential Issues” section is too frightening and that it should only be visible to providers. One patient stated that you may actually have 2 strengths of the Rx which should not flag as a potential issue if prescribed that way. However a few patients like seeing “Potential Issues” and would like to be aware of side effects, drug interactions, and when to take with food
	<i>Workflow Considerations</i>	<ul style="list-style-type: none"> • A few patients felt this could help facilitate communication with providers and increase response speed
	<i>Patient Control</i>	<ul style="list-style-type: none"> • Most patients expressed concern over having the ability to alter their medication list, particularly Rx medications. One patient stated “I don’t want to be given the power of authority to remove meds.” • Most patients felt intimidated with altering their Rx’s, but comfortable with the ability to add/modify/remove OTC meds. • “I have a concern about actually editing. If the user makes an error or spells a drug name incorrectly it may lead to problems. There are several drugs that have ‘almost’ the same spelling.”
	<i>Patient Safety</i>	<ul style="list-style-type: none"> • Patients thought that medication lists were too complicated for a regular patient and could be a source for error in medication use

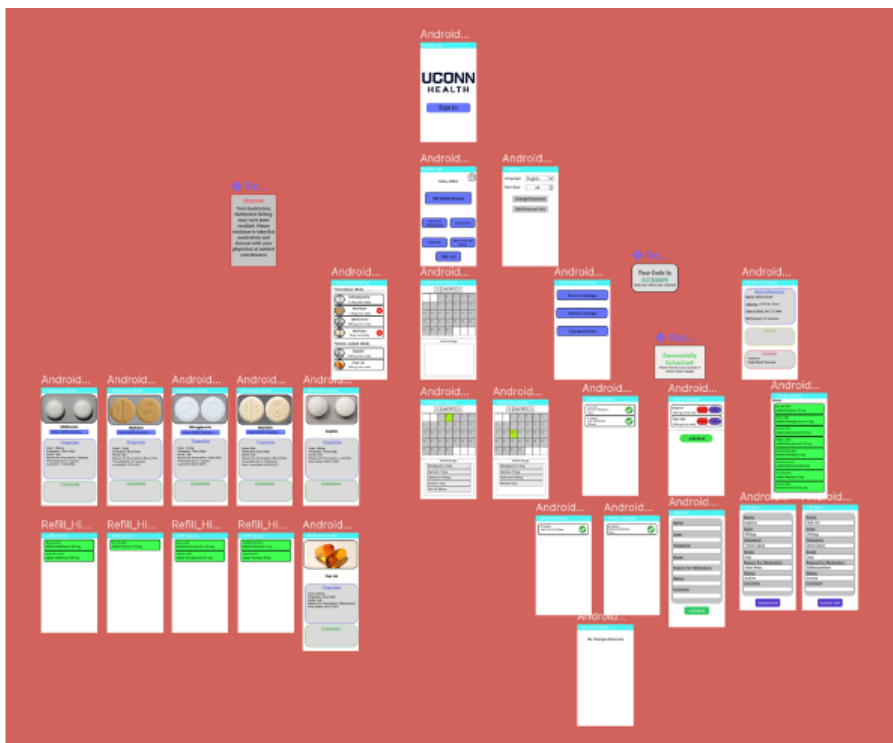
Themes	Sub-Themes	Feedback
		<ul style="list-style-type: none"> Some patients felt it would be helpful to be able to view the side effects of the medication, while others felt that would be “too much information and scary”
Data		
		<ul style="list-style-type: none"> Would like themed list organized by group – heart meds, arthritis meds, etc. One patient expressed that they don’t mind sharing their medication data This should display insurance coverage More information on allergies would not be useful Patients should be able to add allergy or remove an allergy if not accurate
Best Use Considerations		<ul style="list-style-type: none"> Most patients felt this could be useful in multiple settings, such as hospital visits and doctor visits. “Would make it easy to share accurate info with a new doctor if the information is updated frequently by a clinician” One patient stated this would be especially helpful for people with memory issues. One patient expressed that this is timely during the pandemic when patients are hesitant to come into clinics, and that this could help increase interaction and collaboration. One patient felt that their retail pharmacy already takes care of their needs, and this tool would not be beneficial A few patients stated they are “too old” for this type of technology and would rather pick of the phone and call their doctor
Value Proposition		
		<ul style="list-style-type: none"> Patients felt that the tool had many benefits compared to MyChart, and that it could augment MyChart “MyChart & EPIC doesn’t tell me what this med is for, whereas this does” “This here puts it all in one to be shared with everyone globally but is already in MyChart. But this program offers the ability to change my med & communicate – that’s a longer process in MyChart & have to wait a few days but this is more direct” “This tool is a help to caregivers but puts another barrier between the patient and physician. It is sometimes hard to actually talk to your provider. You have to go through the front office, medical tech, medical assistant

Themes	Sub-Themes	Feedback
		<p>and now a phone app. Just like Telemedicine it has a place in today's world but can be hard on older patients and distance them from asking important questions with a one on one with their provider.”</p>

Appendix VI: Mock-up Screens Map



Screenshot of all screens in the patient facing version



Screenshot of all screens in the clinician facing version

Appendix VII: List of Features in Prototypes
Flutter prototype

Screen	Features
Patient List	<ul style="list-style-type: none"> -A list of all patients -Scroll and find the name of a patient
Patient Details Screen	<ul style="list-style-type: none"> -Shows the patient's date of birth and address -Provides 4 options to view a patient's reconciled med list, complete med list, create a med list, and view the med list.
Complete Med list/Quick medications	<ul style="list-style-type: none"> -Shows a list of all the patient's medications (including duplicate medications) -Shows details of the medication like ID, name, dose, frequency, indication, and route.
Reconciled Med list	<ul style="list-style-type: none"> -Shows a list of all the patient's medications (with no errors) -Shows details of the medication like ID, name, dose, frequency, indication, and route.
Create my med list	<ul style="list-style-type: none"> -Shows you a table with your reconciled medications and another table that lists your medications
My med list	

Screens from the hackathon report

Screen	Features
Active Drug list	<ul style="list-style-type: none">-List of all drugs a patient is taking-circles next to the name of a medication indicating it status (active/inactive)
More page	<ul style="list-style-type: none">-Provides patient details like name, address, date of birth and md contact.-Shows conditions and allergies the patient has
Inbox	<ul style="list-style-type: none">-Displays a calendar in which the days can be clicked on to view medications to be taken that day

Wireframe v2 (Clinician-facing)

Screen	Feature
Clinician Menu	<ul style="list-style-type: none">-Navigate to patient list-Navigate to settings
Settings	<ul style="list-style-type: none">-Change language-Change password-Change personal info
Patient List	<ul style="list-style-type: none">-List of all patients-Navigate to add patient-Scroll down to find patient

Add Patient	-Enter patient's collaboration code to add them to the patient list
Patient Menu	-Navigate to patient information -Navigate to reconciled med list -Navigate to review changes -Navigate to submit changes
Patient Information	-See a patient's basic information, including allergies and any conditions a patient may have
Reconciled Med List	-Overview of all the medications a patient is taking -Navigate to information for each medication -Displays medication name, dose, and frequency -Alert displayed next to medication if reconciliation issue is detected
Medication Details	-Shows various properties of a medication -Shows potential issues picked up by the reconciliation algorithm about the medication -Shows any comments submitted by clinician or patient about medication
Review Changes	-Review changes submitted by Patient -View a history of accepted changes -Accept/Deny any changes
Submit changes	-Menu of all medications, with options to remove or edit -Option to add medication -Upon removing a medication, user is prompted with a pop-up ensuring they want to remove it

Edit Med	-Gives a menu of all properties of a med, allowing user to edit any property -Space to add comments on the med
Add Med	-Gives a menu of all blank properties of a medication, user must submit text for each property to add med

Wireframe v2 (Patient-facing)

Screen	Features
Main Menu	-Navigate to Reconciled Med list -Navigate to medication history -Navigate to clinician collaboration -Navigate to profile information -Navigate to settings -Sign out
Settings	-Change language -Change password -Change personal information
Reconciled Med list	-Overview of all the medications a patient is taking -Navigate to information for each medication -Displays medication name, dose, and frequency -Alert displayed next to medication if reconciliation issue is detected
Medication details	-Shows various properties of a medication -Shows potential issues picked up by

	<p>the reconciliation algorithm about the medication</p> <ul style="list-style-type: none"> -Shows any comments submitted by clinician or patient about medication
Medication History	<ul style="list-style-type: none"> -Displays an interactive calendar -Displays a list of active drugs a patient is taking on any particular day
Clinician collaboration menu	<ul style="list-style-type: none"> -Navigate to generate collaboration code -Navigate to review changes -Navigate to submit changes -Navigate change history
Review changes	<ul style="list-style-type: none"> -Review changes submitted by Clinician -Accept/Deny any changes
Submit changes	<ul style="list-style-type: none"> -Menu of all medications, with options to remove or edit -Option to add medication -Upon removing a medication, user is prompted with a pop-up ensuring they want to remove it
Edit Med	<ul style="list-style-type: none"> -Displays all the properties of a med and allows the user to edit any property
Add Med	<ul style="list-style-type: none"> -Gives a menu of all blank properties of a medication, user must submit text for each property to add med
Change history	<ul style="list-style-type: none"> -View a history of all changes made to the medication list
Profile information	<ul style="list-style-type: none"> -Patients can view their basic information, including allergies and any conditions they may have