Electronic Prescribing – Workflow Modeling and Analysis Method

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Background

Clinicians are beginning to use electronic medical records (EMRs) in offices. A key workflow change will be the use of computers for prescribing i.e. ePrescribing. The transition to ePrescribing is not a single-step process. The stages of ePrescribing (right) are derived from the 5-Stage EMR Adoption Model developed by the eHealth Observatory, which is based on HIMSS' "EMR Adoption Model for Physician Clinics and Expected Benefits for Each Stage" (2008)). To evaluate the use of EMRs for prescribing, we developed a workflow modeling and analysis method (see below).

A foundational part of this method is the generic workflow model. This model was turned into a series of colour-coded versions, representing increasing levels of computer-use for activities in prescribing.

At first glance, the concept of outpatient prescribing is simple: a clinician writes a prescription, a pharmacist fills it, and then a patient takes it. In the real world though, the workflow is often not so straightforward. One individual might act in more than one role, one role might be taken on by multiple individuals, activities might be done by multiple individuals or providers, and the workflow can change depending on how a patient's medical status changes over time. Our view of prescribing is presented here as a workflow diagram along with some comparisons to components of other prescribing models.

5-Stages of ePrescribing

Stage 0: Reflects a paper-based prescribing environment; phone or fax are used as well, but written prescriptions are done by hand. Pharmaceutical coverage requests are completed by hand.

Stage 1: Medication information captured in free text and stored digitally. Prescriptions are still written by hand. Pharmaceutical coverage requests are done on-computer and then printed.

Stage 2: Medication lists and renewals are generated from the EMR for most patients. Prescriptions are generated by the EMR, but still printed or faxed.

Stage 3: The EMR maintains a medication list for all patients. System supports some decision support capability. Prescription generation and renewal requests are supported by the EMR, but still printed, phoned or faxed. Pharmaceutical coverage requests are completed within the EMR, but still sent by fax.

Stage 4: EMR includes enhanced patient-specific alerts, allows clinician to access a list of favourite medications, and offers assistance re dosing based on patient-specific criteria. Insurer coverage criteria are embedded within the EMR. Forms can be generated and sent within the EMR and approval/rejection is automatically linked back to the patient.

Stage 5: Full circle e-prescribing without paper in between, including prescription generation, renewal of requests from pharmacists and syncing of medication lists with regional repositories to better support clinical decision support. The pharmaceutical coverage process is linked within the EMR as part of a region-wide ePrescribe system.

Overall Method

The overall method can be employed by a physician office practice as a quality improvement exercise or used by analysts in formal evaluation studies. The tools would typically be used during interviews with physicians and office staff. It is targeted to specifically describe and facilitate the assessment of those elements of ePrescribing encountered in the outpatient office setting of clinicians and does not suggest or describe HL7 message formats, define EMR usability criteria, or list implementation specifications for an ePrescribing system

1. ePrescribing Workflow Analysis Handbook

The handbook is the main document to guide a workflow analysis. It includes:
- Background information on ePrescribing and the stages
- Introduction to all the tools
- Details of the generic prescribing workflow
- A series of workflow diagrams for each stage

The Workflow Scenarios tool provides four examples of prescribing scenarios and questions which touch on all parts of the prescribing workflow. It can be used in addition to the Workflow Assessment Spreadsheet.

Workflow Walk-through

Workflow Scenarios

2. Workflow Assessment Spreadsheet

The Workflow Walk-through tool provides a simple walkthrough of the prescribing process with questions for how each activity is done. It can be used in addition to the Workflow Assessment Spreadsheet.

The Workflow Assessment Spreadsheet tool is the main tool used to perform an analysis. It includes descriptions of how activities are typically done at each stage. The tool allows practices to identify gaps between the current stage of workflow and known current potential stage.

3. Workflow Analysis Data Sheet

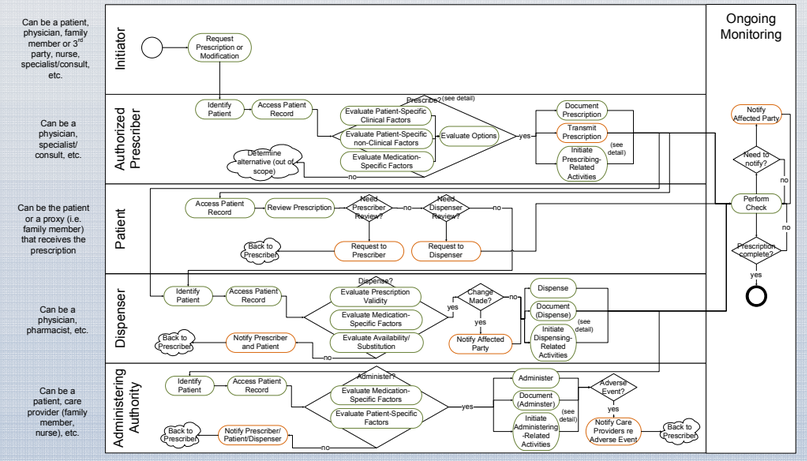
The Workflow Analysis Data Sheet is used to record the results of the Workflow Assessment to generate average stage scores for parts of the prescribing workflow.

4. Workflow Assessment Summary

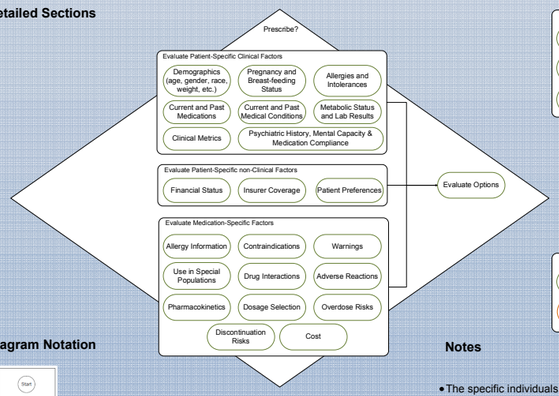
The Workflow Assessment Summary is used to present the results of the workflow analysis for the practice along with any comments collected during the evaluation.

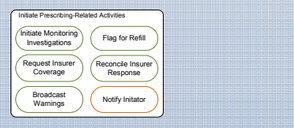
Generic Prescribing Workflow

The workflow diagram is primarily based on clinician experience with respect to physician office prescribing and includes some components discussed in Bell et al. (2004), Wang et al. (2005) as well as clinical factors from the Compendium of Pharmaceuticals and Specialities (Repchinsky, C. (Ed. in Chief), 2009).



Detailed Sections





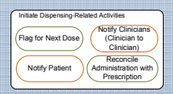


Diagram Notation

Start: start of workflow
End: end of workflow
Process/Activity: task that occurs in the workflow
Message: message sent between roles (parties)
Decision: next direction of flow is dependent on a decision or outcome
Flow: indicates direction of workflow
Note: special note

Notes

- The specific individuals carrying out tasks for a role can change e.g. The physician may be the prescriber, dispenser and administering authority.
- Not all activities shown in the diagram may be completed in all situations – the diagram represents a complete view of the prescribing workflow.
- In diagrams for each stage, the processes/activities are filled with shades of green representing the level of computer use for that process/activity i.e. darker shades at higher levels. Similarly messages are filled with shades of orange.
- Expanded sections of the main workflow are shown in detail below where indicated.

Comparisons

As mentioned in the background, prescribing is a complex process. Our generic workflow diagram represents our view of prescribing. However prescribing can be represented in different ways for different reasons. To show how our model compares to other representations, we present a four-way comparison of our generic workflow model to three other models about prescribing.

	Generic Prescribing Workflow by the eHealth Observatory (2010)	Pan-Canadian Clinical Drug Messaging Standard Business Model by Canada Health Infoway (2009)	Process Model of Medication Management by Bell et al. (2004)	Activity Diagrams for Integrating Electronic Prescribing Tools into Clinical Workflow by Johnson and FitzHenry (2006)
Purpose	To develop a model of outpatient prescribing activities for use in evaluating levels of advancing automation	To define scope of a messaging standard for transmitting prescribing, dispensing, and clinical message information	To develop a process model to assess prescribing in the clinical environment at baseline for evaluating e-prescribing systems	To model prescription management processes in a specific primary care setting for ePrescribing system development
Intended Audience	Physician practices; researchers/evaluators	Organizations implementing message specifications; technical and business audiences to develop implementations and validate for conformance to specifications	Physician practices; evaluators	ePrescribing system development team at Vanderbilt
Development Method	Led by physician/analyst team members with reviews from other physician team members; being distributed widely for external review and validation	Stakeholders/reviewers; part of Canada Health Infoway's larger implementation guide which provides implementation, compliance and conformance guidelines for developing software that conforms to pharmacy message specifications	Literature review which identified two models that have been used for analyzing failures of medication management processes; formed a process flow model that integrated steps of the two models	Convenience sample interviews of 19 providers at a hospital and clinic-based facility; evolved based on questionnaire feedback from convenience sample of 10 outpatient practices
Setting/ Applicability	Outpatient clinician practice (for in-office workflow but can apply outside as well); applicable to manual prescribing practices	Ambulatory pharmacy setting (but should apply to institutional pharmacy settings as well)	Outpatient clinical practice (principles should also apply to inpatient); applicable to manual prescribing practices	Hospital-based, and clinic-based outpatient prescribing (including before, after, and during clinic visits); applicable to manual prescribing practices
Diagram Format	Workflow model based on flowchart (swim lanes, activities, decision points, start/end states, process flow arrows)	Static model (person, organization, process, process/data flow arrows)	Function model (based on Integrated Definition for Functional Modeling (IDEF0) – activity inputs, outputs, information inputs, resources)	Activity diagram (swim lanes, activities, decision points, start/end states, process flow arrows)
Roles/Individuals	1. Initiator 2. Authorized Prescriber 3. Patient 4. Dispenser 5. Administering authority	1. Patient 2. Other health care professional 3. Prescriber 4. Dispenser 5. Drug administrator	1. Clinician 2. Patient 3. Pharmacist 4. Clinical staff	1. Patient 2. Prescriber 3. Nurse 4. Clerk/Technician 5. Pharmacist
Main in-scope processes	1. Request prescription or modification 2. Prescribe? 3. Initiate prescribing-related activities 4. Ongoing monitoring 5. Review Prescription 6. Ongoing monitoring 7. Dispense? 8. Initiate dispensing-related activities 9. Ongoing monitoring 10. Administer? 11. Initiate administration-related activities 12. Ongoing monitoring	1. Assess patient 2. Prescribe 3. Dispense Processing 4. Dispense Pickup 5. Professional Service 6. Medication Given/Taken	1. Prescribe 2. Transmit 3. Dispense 4. Administer 5. Monitor	Before or after visit: 1. Identify need for prescription or refill 2. Determine if appointment needed If needed, go to during visit diagram. If visit not needed: 3. Create prescription 4. Transmit prescription to pharmacy 5. Notify patient During visit: 1. Identify need for prescription or refill 2. Gather medication history 3. Create prescription (may be verbal) 4. Transmit prescription to pharmacy 5. Notify patient
Out of scope	1. Prescriber deciding to not prescribe	1. Invoicing 2. Ordering tests 3. Reporting of controlled substances 4. Drug recall notices 5. Narcotic dispensing reporting		1. In-office dispensing 2. Some classes of medications e.g. samples
Start Points	1. New prescription 2. Refill 3. Medication change	1. New prescription 2. Refill	1. Prescription needs assessment	1. New prescription 2. Refill
End Points	1. Ongoing Monitoring 2. Prescription Complete	1. Messaging can terminate at any point	1. Monitoring	Before or after visit: 1. Schedule appointment 2. Generate prescription 3. Medication dispensing During visit: 1. Medication dispensing
Prescribing Factors Considered	1. Patient-specific Clinical Factors 2. Patient-specific Non-clinical Factors 3. Medication-specific Factors (see detailed diagram at left)	1. Drug selection 2. Drug interactions 3. Allergies 4. Patient medical history	1. Clinician's assessment about the need for prescription 2. Patient preferences 3. Drug information 4. Patient history 5. Drug formulary restrictions 6. Need for prescription change	1. Current medications 2. Medication history 3. Health problem This model focuses on the intra and inter-office communications necessary in deciding whether a medication should be prescribed, who should prescribe it, and how the messages are transmitted.
ePrescribing	Not represented in the workflow itself but described for assessment of how activities are done	A line representing prescription sent electronically to a repository of prescriptions or electronically to a specific pharmacy; whole model is for the messaging standard	Represented in model as electronic resources the activities may use	Not represented in the workflow itself but will be implemented to support the manual processes
Accompanying Material	Has accompanying scenarios and assessment spreadsheet for performing an evaluation	Has accompanying interaction diagrams and storyboards for scenarios to demonstrate implementation	Has accompanying list of ePrescribing functional capabilities for each activity	
Identification of Key Parts	Activities/processes have a green outline	Green box indicates all items in scope for the messaging standard	Mandatory elements for elements shown by black shading or bold lettering	Most common pathways for prescribing in bold

Acknowledgements

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We welcome any questions or feedback for the generic workflow and method presented here. Version 1.0 of the workflow handbook and tools is available on the eHealth Observatory website: www.ehealth.uvic.ca.

References

Bell, D.S., Cretin, S., Marken, R.S., Landman, A.B. (2004) A conceptual framework for evaluating outpatient electronic prescribing systems based on their functional capabilities. *Journal of the American Medical Informatics Association*, 11(1), 60-70.

Canada Health Infoway. (2009) *HL7 v3 pan-Canadian Messaging Standards Implementation Guide Volume 8 – Pharmacy*. Toronto, ON.

HIMSS and HIMSS Analytics. (2008). Electronic Medical Record Capabilities and Expected Benefits in US Non-federal Hospitals and Physician Clinics. In *A Call for Action Enabling Healthcare Reform Using Information Technology Recommendations for the Obama Administration and 111th Congress*. Retrieved from http://www.himss.org/2009callforaction/HIMSSCallToActionDec2008.pdf

Johnson, K.B, FitzHenry, F. (2006). Case report: Activity diagrams for integrating electronic prescribing tools into clinical workflow. *Journal of the American Medical Informatics Association*, 13(4), 391–395.

Partridge, C. & Bassi, J. (2010). *Electronic Prescribing Workflow Analysis Handbook v1.0*. Retrieved from http://ehealth.uvic.ca/resources/tools/WorkflowModeling/WorkflowModeling.php

Repchinsky, C. (Ed. in Chief). (2009). CPS 2009: Compendium of Pharmaceuticals and Specialties 2009 (CPS) English. Toronto: Canadian Pharmacists Association.

Wang, C.J., Marken, R.S., Meili, R.C., Straus, J.B., Landman, A.B., & Bell, D.S. (2005). Functional Characteristics of a Commercial Ambulatory Electronic Prescribing Systems: A Field Study. Journal of the American Medical Informatics Association, 12, 346-356.