



# **Electronic Prescribing**

## **Workflow Analysis Handbook**

Version 2.0  
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# Overview

As clinicians migrate to using electronic medical records (EMRs), one of the key workflow changes they will encounter will be the use of the computer in prescribing. This is otherwise known as electronic prescribing, or ePrescribing for short. The transition to ePrescribing is not a single-step process. There are levels of implementation ranging from baseline paper-based prescribing, all the way to advanced ePrescribing systems that include features only dreamed of today.

These advanced systems will include the ability to make patient-specific medication recommendations based on age, gender, race, stage of pregnancy, genetic information, allergy & medication history, medical history, financial status, etc. These advanced systems will also be able to integrate information from outside of the clinician's office, in order to notify a prescriber when a prescribed medication is dispensed or administered, and equally importantly, allow a prescriber to know when a prescribed medication has not been filled within a reasonable time.

The eHealth Observatory has defined stages of prescribing workflow, ranging from level 0 (paper-based prescribing), up to level 5 (advanced ePrescribing including integration of an EMR with external resources).

This document describes prescribing workflow at each of the progressively more advanced levels of ePrescribing. It also offers a detailed assessment tool to help clinicians, clinician funding programs, and governing bodies assess the level of ePrescribing as practiced in a clinician's office. The assessment tool can also assist EMR vendors evaluate the level of ePrescribing functionality offered by their products.

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# Introduction

In jurisdictions throughout the world, electronic medical records (EMRs) are becoming more and more commonplace. A significant feature of these products is the ability to generate prescriptions. Beyond merely digitizing the paper-based task of writing a prescription, the use of an EMR has the potential to improve prescribing practice. Such improvement may include:

- Simplifying prescription refills
- Improving drug selection by checking for medication interactions and medication allergies
- Better individualizing therapy for patients of a given age, race, gender, pregnancy status, renal function, medical history, financial status, etc.
- Reconciling the act of *prescribing* with the associated act of *dispensing*. Just as importantly, an advanced EMR should have the ability to notify a clinician when a patient has *not* filled a prescription within a reasonable period of time.
- Improved ability to identify and notify patients when a medication is recalled, or when prescribing precautions are changed.

Conversely, just as computerization of the prescribing process could improve quality of care, there is the potential that it might in some situations be detrimental. Some conceivable pitfalls may include:

- Simplifying prescription refills might induce a prescriber to refill a list of medications *en masse*, without taking the time to individually review the need for continuing each medication.
- Too many prescribing alerts or interaction warnings for minor interactions could induce a clinician to ignore or turn off the EMRs alert system, thus causing her to miss a significant interaction.
- Clinicians might become complacent in relying on their EMR to identify potential medications risks while simultaneously not having provided adequate information to the EMR. (E.g. by forgetting to enter the fact that a patient is pregnant, or that a patient is from a race at higher risk of complications from a given medication, the ePrescribing system might fail to warn of a potential risk).
- Depending on the sophistication of the ePrescribing system, if a medication is recalled, the EMR may not correctly identify some patients at risk. (E.g. if the medication name is misspelled, the medication is a generic brand, or if it is one component in a multi-drug formulation).

In order to assess objectively the potential risks and rewards of transitioning clinicians from paper-based prescribing to electronic prescribing it is first necessary to understand the workflow of prescribing. Further, there needs to be a clear description of what the workflow is like at each stage of advancing computerization.

Only with this information in hand, we can better identify the potential risks and benefits at each step of the prescribing process, at each level of computerization. In addition, with defined criteria for what is expected at each level of ePrescribing, clinicians can evaluate how far along the road they have traveled, and what potential benefits they can expect down the road. Vendors can assess the sophistication of their products, and assess how well clinicians are able to use their products. Funding agencies can determine whether their EMR subsidies are being effectively used. Governance agencies can better identify interoperability shortcomings that are impeding clinicians and the populace from reaping the maximum benefit from ePrescribing systems.

# Disclaimer

This document is strictly a workflow description and analysis document focused on the outpatient prescribing process. It does not suggest or describe HL7 message formats, define EMR usability criteria, or list implementation specifications for an ePrescribing system.

Yet, an astute reader can develop more robust and complete HL7 messages, data archetypes, usability criteria, and EMRs with enhanced functionality by carefully examining the workflow processes herein described.

# Scope

Though this document describes the outpatient *prescribing* workflow, it is targeted to specifically describe and facilitate the assessment of those elements of ePrescribing encountered in the outpatient office setting of clinicians. This being said, although clinicians are often thought of as being only *prescribers* of medications, their daily workflow includes frequent *dispensing* (i.e. dispensing of medication samples), and *administration* of medications (typically injectable medications including vaccinations, hormones, anti-hormonals, steroids, disease modifying anti-rheumatic drugs (DMARDs), and the like).

Thus, the majority of the workflow described herein is encountered within the outpatient office setting. The workflow descriptions, diagrams, and assessment tools are all designed to capture the fullness of “prescribing” as experienced by clinicians.

# Prescribing Workflow

## A. The Five Stages of ePrescribing

It is the expectation that quality of patient care will improve with increasing levels of computerization in the prescribing process. In order to objectively assess this hypothesis, it is important to define clear criteria by which to assess the stage of advancement of EMR use in ePrescribing in a given office setting.

HIMSS Analytics (2008) has created a five-stage model which defines levels of functionality expected with increasingly advanced levels of computerization in the outpatient clinical practice setting. The reader is referred to the HIMSS documentation for “EMR Adoption Model for Physician Clinics and Expected Benefits for Each Stage”.

The eHealth Observatory has adopted this model to subdivide ePrescribing functionality into five stages with each stage reflecting increasing computerization and functionality. Perhaps surprisingly, for the most part the *tasks* to be done in the prescribing workflow change very little despite increasing levels of computerization. It is the *means* by which the tasks are done that changes. Also advancing computerization often enriches, or facilitates the processes involved.

With increasingly sophisticated ePrescribing systems, some new processes do enter the workflow. These include functionality such as the ability of stage five systems to reconcile a prescription with the associated act of a patient actually filling the prescription.

The ePrescribing workflow description that follows later, illustrates the general scenario of outpatient prescribing.

The five ePrescribing stages are defined as follows:

0. **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 like Special Authority, Indian Affairs, and Veteran’s Affairs forms are completed by hand.
1. **Stage 1:** Medication information is captured in free text and stored digitally. Prescriptions are still written by hand. Pharmaceutical coverage requests are done on-computer and then printed.
2. **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.
3. **Stage 3:** The EMR’s ePrescribing system maintains a medication list for all patients. System supports some decision support capability (E.g. allergy checking). Prescriptions are generated by the EMR, but still printed or faxed. Renewal request is supported within the EMR, but still received by phone or fax. Pharmaceutical coverage requests are completed within the EMR, but still sent by fax.
4. **Stage 4:** As in level 3, yet also includes enhanced patient-specific alerts including checks for drug interactions, drug/disease interactions, and checks based on gender, age, weight, race, pregnancy status, breast-feeding status, financial status, etc. The system 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.
5. **Stage 5:** Full circle e-prescribing without paper in between, including writing of prescriptions, but also 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 where application, approval, and subsequent prescription generation are all part of the system.

## B. General considerations

Workflow modellers usually describe workflow in terms of roles and activities. 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. I.e. The three workflow roles are Prescriber, Dispenser, and Patient. 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.

Some examples:

- A clinician might do all four steps of initiating, prescribing, dispensing and administering a medication in-office, bypassing a pharmacist altogether.
- A medication prescribed by one clinician might be changed by another clinician covering for a colleague.
- There can be a delay between the time that a prescription is issued, and the time that it is actually filled. In the interim, which may be a matter of minutes, days, or months, a patient's medical status may have changed such that the prescription becomes inappropriate.
- Prescription starts, refills, and changes are often done by telephone via a conversation between clinicians, clinician and pharmacist, clinician and patient, pharmacist and patient, etc. – often for the most part bypassing a written record of the transaction.
- In British Columbia, pharmacists are permitted to renew some prescriptions, change some prescriptions, and substitute lower-cost alternatives for the medication actually prescribed. Pharmacists can also dispense some medications previously available by prescription only (E.g. the morning after pill). In the majority of cases, the patient's primary care clinician is not made aware of the changes.
- Patients often either don't fill their prescriptions, and if they do fill them, often don't take the medication, or take it as prescribed.

A plethora of decisions can underlie each step of the process of prescribing. Each decision can involve the consideration of multiple factors, and the interplay of multiple players.

Overarching the entire process of medication prescribing, dispensing, and administering, there is an ongoing aspect of monitoring and surveillance. This includes analysis of patient and medication issues both before and after each step of the process, and by each party involved in the process. Prescribers, patients (or their proxies), dispensers, and those who administer the medications all must make decisions about the suitability of a medication for a given individual, within the dynamic milieu of the patient's changing health status. Implicit in this is the need for communication among the parties involved, at all stages of the process.

### B.1 Generic Workflow Diagram

The prescribing roles and processes are summarized in the diagram that follows. Note that the diagram is a generic representation of prescribing workflow. A limited number of the processes may not be available, or not relevant, depending on the stage of ePrescribing in place in an office.

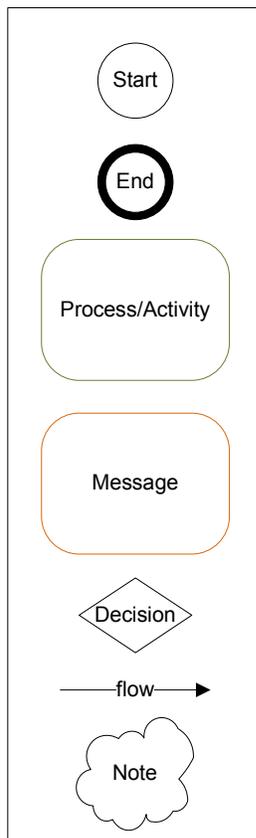
For example, in a paper-based prescribing environment, clinicians are typically not notified when a medication is dispensed to a patient. Thus, there is no convenient way of reconciling the act of *prescribing* a medication, with the act of *dispensing* it. This workflow element is however, present, and a key feature in a stage 5 ePrescribing environment.

Conversely, in a stage 5 ePrescribing system where prescriptions are transmitted electronically directly to a pharmacy system, a patient may not receive a paper copy of the prescription. Thus, an important opportunity for a patient to confirm the validity of a prescription, may be lost in a stage 5 ePrescribing scenario.

The workflow diagram is primarily based on clinician experience with respect to physician office prescribing and includes 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).

## Notation

The generic workflow diagram uses the following set of symbols to illustrate workflow components:



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

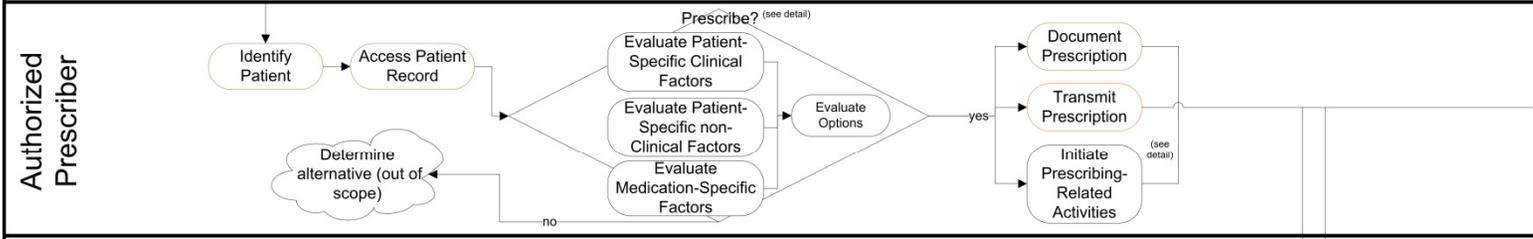
Note: special note

Expanded sections of the main workflow are shown in a detailed diagram where indicated.

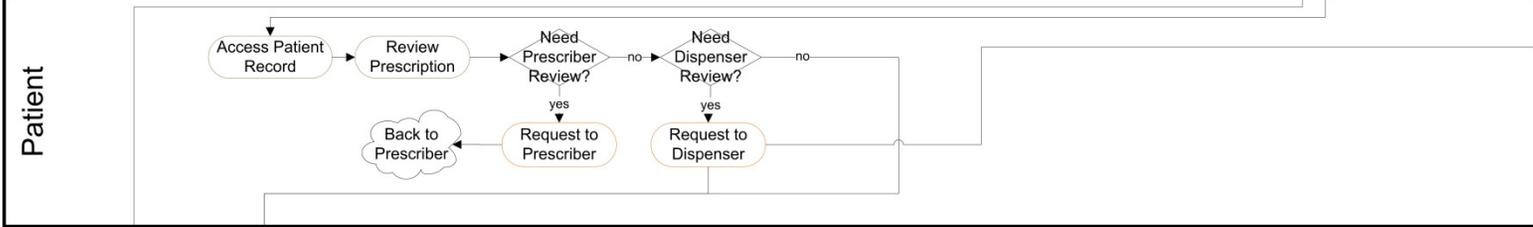
Can be a patient, physician, family member or 3<sup>rd</sup> party, nurse, specialist/consult, etc.



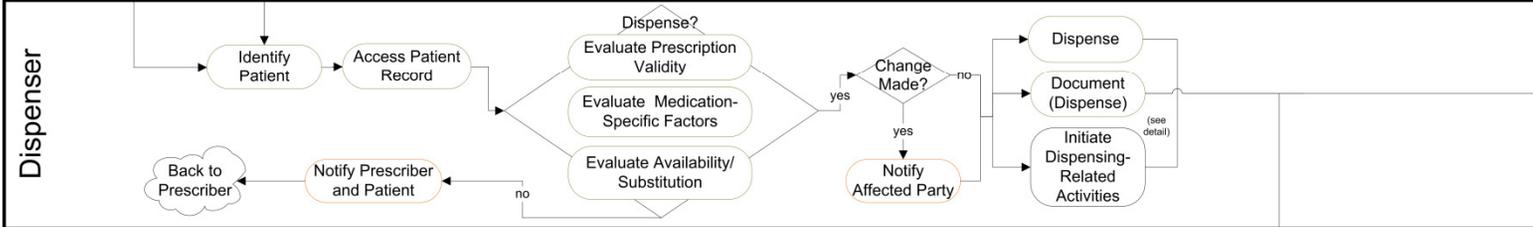
Can be a physician, specialist/consult, etc.



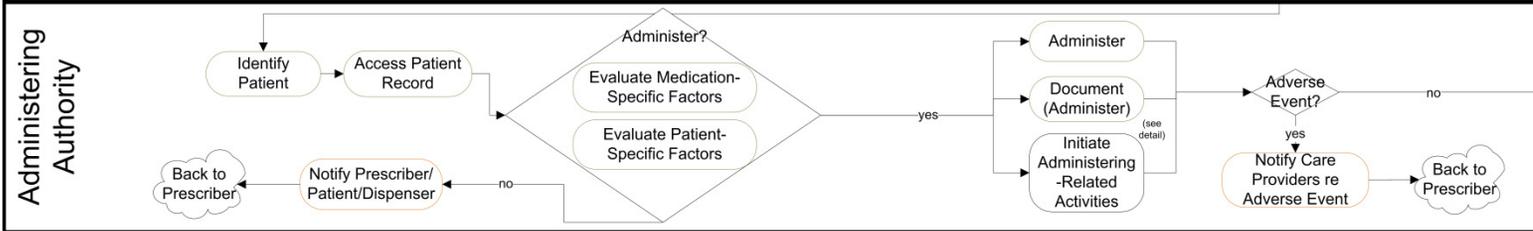
Can be the patient or a proxy (i.e. family member) that receives the prescription



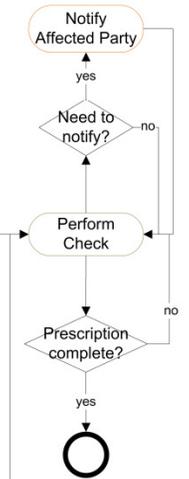
Can be a physician, pharmacist, etc.

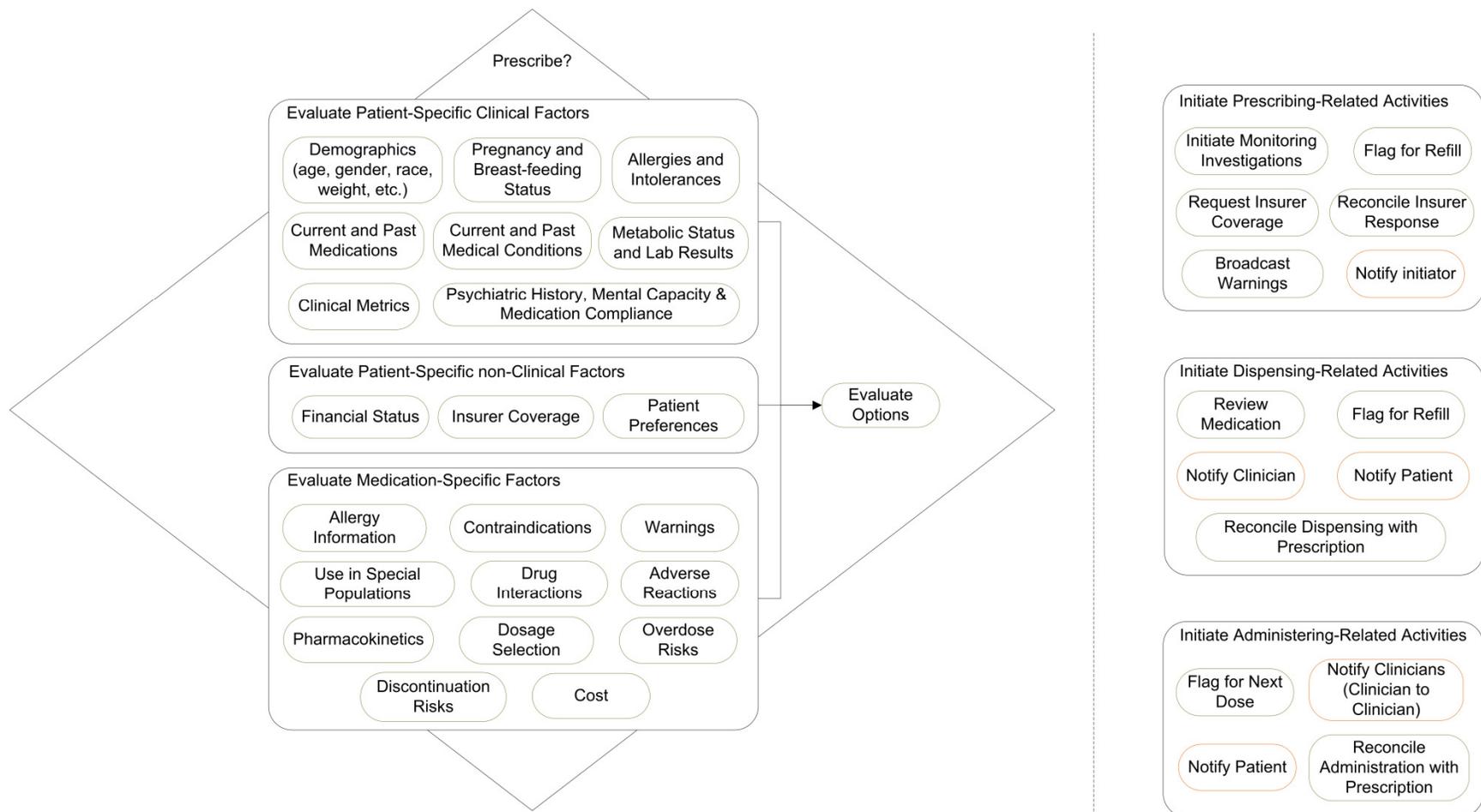


Can be a patient, care provider (family member, nurse), etc.



**Ongoing Monitoring**





## B.2 Prescribing Roles & Processes

In real-world outpatient prescribing, the individuals and processes involved in the circle of initiating, prescribing, dispensing, and administering a pharmaceutical product can be dynamic. A single individual may play multiple roles. Similarly, a single role may be assumed by multiple parties.

As noted earlier in this document, the processes involved in prescribing remain fairly static despite increasing levels of computerization. I.e. A decision is made to initiate a prescribing activity, a prescriber selects a medication and prescribes it. Then, it must be dispensed and administered. Along the entire process, there is an element of assessment and monitoring to assess the appropriateness of the selected medication at each step.

Again, what changes with increasing computerization is the *means* by which the above processes are carried out. A few processes become obsolete, and the potential for enhancements increases with advancing computerization, but in general, the steps in the process of prescribing remain the same.

This section describes roles and the processes associated with these roles as viewed from the general case.

There are five key roles in the prescribing process:

1. **Initiator** – the one who initiates a prescribing activity
2. **Prescriber** – the individual who has generated a prescription
3. **Dispenser** – the individual who dispenses the medication
4. **Administering Authority** – the individual who administers the medication
5. **Patient** - the individual who receives the medication dispensed.

### Initiator

The agent initiating a request for a prescription can be a patient, a care-giver, family member, consultant, the prescribing clinician themselves, clinical decision support tool, pharmacist, or other allied health care worker.

If the initiator is not the clinician herself, the initiator may notify an authorized prescriber by a variety of means including in-person, via telephone, fax, SMS (text message), Email, etc. A clinical decision support system may use similar electronic means, or generate a pop-up suggestion or alert within an EMR.

#### B.2.1 Processes

##### B.2.1.a Request Prescription or Modification

The initiator submits a request for a prescriber to prescribe or modify an existing prescription.

### Prescriber

This can be anyone authorized to prescribe a medication. Depending on the jurisdiction, this could include a physician, nurse practitioner, pharmacist, dentist, naturopath, etc. During the workflow process of prescribing, more than one prescriber may be involved. A prescription authored by one individual might be changed by another. E.g. the oft-encountered situation where a pharmacist needs to contact a prescribing clinician, but finds that the clinician has gone off shift or is away. In this scenario, a colleague might be giving the authorization to proceed with the prescription, or modifying the original prescription.

## B.2.2 Processes

### B.2.2.a Identify Patient

The prescriber needs to confirm that the she has correctly identified the patient for whom a prescription is being considered.

### B.2.2.b Access Patient Record

The prescriber accesses the appropriate patient record in order to obtain information needed in making a decision on whether to prescribe. The record is also necessary in order to document the decision.

### B.2.2.c Prescribe?

Following a request to prescribe or change a prescription, a clinician needs to go through a process of deciding *whether* to prescribe, and *what* to prescribe. This is not necessarily a linear process. Usually, the process is iterative.

For example, a prescriber might decide to prescribe an anti-inflammatory for a patient's arthritis. After checking for drug allergies and medical history, he might then select drug "X". After choosing drug "X", he might discover that the patient is unable to afford it. He might then elect to give samples of whatever anti-inflammatory samples he has available in-office. Finding that there are no samples available, he might decide not to prescribe an anti-inflammatory at all. The process then begins all over again; he might elect to not prescribe any medication at all, or choose to consider a different class of medication, thus restarting the medication selection process. At any point along the way, it may become clear that the patient under consideration is not the one whose chart he is viewing! (This is not an unusual situation). Thus the decision about whether and what to prescribe is a dynamic process.

The steps in the decision to prescribe, include:

**Evaluate Patient-Specific Clinical Factors** - includes reviewing a patient's medical history via a review of the chart, discussion with the patient, family members, caregivers, etc. This includes reviewing demographics, pregnancy status (including stage of pregnancy), breast-feeding status, allergies & intolerances, current & past medications, current & past medical conditions, metabolic status & lab results, clinical metrics, psychiatric history, mental capacity, and medication compliance.

Though it may seem politically incorrect, race is also an important consideration in the prescribing process. E.g. G6PD deficiency in blacks, decreased effectiveness of hepatitis B vaccine in Australian aboriginals, increased risk of adverse reactions to statins in people of South-east Asian descent, etc.

Further information about existing medications may be obtained via conversations with the patient's pharmacist, and access to the other external resources. In British Columbia, examples of the external resources include the provincial Pharmanet system, the BC Cancer Control Agency, TB control, and the HIV Centre of Excellence.

The process may also include the review of appropriate medical and prescribing resources, including books, digital resources, discussion with colleagues, decision support algorithms (both paper-based and digital), etc.

**Evaluate Patient-Specific non-Clinical Factors** – this includes considering such factors as a patient's financial status, availability of third party insurance coverage, and a patient's preferences. A patient may for example prefer liquid formulations as opposed to

tablets. Parents of a school-aged child may prefer a medication that can be given twice a day, in the morning before school, and after school.

**Evaluate Medication-Specific Factors** – drug selection involves evaluating medication-specific factors in the light of patient-specific factors. Therefore a host of medication-specific factors need to be considered: allergies, contraindications, warnings, use in special populations, drug interactions, adverse reactions, pharmacokinetics, dosage selection, overdose risks, discontinuation risks, and cost.

Examples include drug pharmacokinetics – does the medication accumulate if a person has kidney disease? With what drugs does a prospective medication interact? Are there special precautions to take if the medication is given to children or the elderly? What potential allergens are used as fillers/carrier media in the drug? – E.g. peanut oil, sulphites, gluten, lactose, or tartrazine dyes.

**Evaluate Options** – When the patient-specific and medication specific factors have been considered, a clinician will rank the available therapeutic options in deciding what medication to choose.

#### **B.2.2.d Document Prescription**

Once a decision has been made to prescribe a medication, a prescription *may* be generated for transmission to a pharmacist. It is a typical occurrence in clinical practice, that a clinician dispenses medication samples directly to a patient, completely bypassing the need for a prescription. Often, a clinician dispenses samples, and concurrently generates a prescription. Clinicians usually do not differentiate between the acts of prescribing and dispensing. In either case, a written record of the event should be maintained in the medical record.

In the traditional case, prescriptions are either written and given to a patient, telephoned, or faxed to a pharmacy. In the case of early stage EMRs, the prescription may still be in a printed form. In more advanced EMRs, they will be generated digitally.

In the case of controlled drugs like pure narcotics, under current law in jurisdictions such as in British Columbia, prescriptions **MUST** be written on a duplicate prescription pad, even if an EMR is used. The EMR of course, should still record the fact that a narcotic has been prescribed.

At the time of prescription generation, in more advanced ePrescribing environments, an associated clinical decision support system should also prompt a clinician to order baseline and monitoring investigations. For example, a new prescription for a lipid-lowering medication should cause the ePrescribing system to offer to generate a requisition for lipid levels, liver function, and CK levels, on a recurring basis as per currently-recognized best practices.

#### **B.2.2.e Transmit Prescription**

Once a prescription has been generated, it must be transmitted to a dispenser. In the classic case of paper-based prescriptions, the prescription is typically given to a patient or their proxy. A prescription may also be transmitted via fax or telephone call. In advanced EMRs, prescriptions are transmitted directly to a specific pharmacy, or to a common cyber-site. A common cyber-site allows a patient to attend *any* pharmacy, whereupon the pharmacist can download the prescription.

#### **B.2.2.f Initiate Prescribing-Related Activities**

In association with prescribing, it may also be appropriate to: initiate monitoring investigations, flag for refill, request insurer coverage, reconcile insurer response, broadcast warnings, and notify the initiator.

Even after prescribing, a prescriber may review a prescription and decide to change or discontinue it. For example, it is a standard practice among many clinicians to initially include only a brief entry in a patient's chart at the time that a patient is seen. Later in the day, or even later in the week during free time at the end of the workday, a clinician might then complete the chart entry. During this less hectic time, a clinician on further review of the chart might decide to modify their initial prescription. At this point, they might choose to contact the patient (or their proxy), their pharmacist, or both, with advice re the modification.

Similarly, a prescriber may learn that a patient is a drug-seeker or is multi-doctoring, prompting her to cancel a prescription.

In many cases, the use of a medication mandates arranging baseline and monitoring lab investigations. Use of some medications can necessitate arranging specialist referral – for example the need for regular ophthalmologic examinations with the use of hydroxychloroquine. At the time of prescribing, a clinician might also set a flag to recall the patient when the prescription is due to run out.

Prescribing can also prompt a request for a third-party insurer to subsidize the cost of the medication. Reconciliation of the insurer response is included in this workflow.

Communication with other care providers may also be triggered by the act of prescribing. For example, if a consultant had initially suggested that a specific medication be prescribed, it would be courteous to inform them that a prescription had been issued in fulfillment of their advice. If a patient is prone to over-use or medication abuse, this would also be an opportunity to broadcast a warning to other care providers that the prescription should not be refilled, or that only one clinician should be prescribing for them.

### **B.2.2.g Ongoing Monitoring**

After prescribing, it may be necessary to revise prescriptions, be able to identify unfilled prescriptions, identify delayed refills, identify patients affected by a drug recall, and identify the need for a prescription modification.

A patient may have a condition requiring only sporadic treatment (E.g. gout, or Herpes). A prescription for treating such conditions might sit unfilled, or unused for months. If a patient were to develop a change in their health status, become pregnant etc., a clinician might need to notify the patient and/or pharmacist, with advice to avoid or modify the use of the prescription. In a paper-based or early-stage EMR, it can be difficult to track these changes, and identify patients at risk.

Similarly, if a prescribed medication is not filled or refilled within an expected time period, an ePrescribing system should be able to notify the prescriber that the prescription has not been filled.

In advanced ePrescribing systems, results from monitoring investigations ordered at the prescription generation stage can trigger automated systems to issue a warning about the need to modify the dosage of a prescribed medication.

Also, a medication recall/warning may be issued on a certain batch of a medication, on a specific medication as a whole, or on an entire class of medications. Irrelevant of whether a given medication has been only prescribed, or prescribed *and* dispensed, an authorized prescriber may encounter the need to notify affected patients of the recall or warning. Again, in a stage zero or early-stage ePrescribing system this can be difficult.

## Patient (or proxy)

The role “Patient” includes not just the individual receiving a medication, but also includes their proxy. For example in the case of children or invalids, it is often a family member or care-giver who is involved in receiving a written prescription, transporting it to a pharmacist, and picking up a dispensed prescription from a pharmacist.

Further, they are the ones who will review a medication before it is swallowed/applied/etc. They are the ones who will usually report any immediate adverse reaction. Just like the prescriber role, they will also do ongoing monitoring/surveillance of future adverse reactions, and often initiate further discussion with a prescriber, dispenser, or administering authority should they have future concerns re their medications. This might for example occur should they see worrisome news about their medication, as reported in the media.

The patient (or proxy) is also the one who usually initiates the entire prescribing cascade, including refills, and often the discontinuation process.

The role of “Medication Recipient” is a subset of the “Patient (or Proxy)” role, and holds a unique role in the workflow. They are the final common pathway in the prescribing workflow, and hold the only role played by a static individual.

### B.2.3 Processes

#### B.2.3.a Access Patient Record

Patients often maintain informal health records about themselves and their medications. In the prescribing process, a patient can access the record in order to confirm their list of medications against what has been prescribed. Besides informal records, patients are now also making use of the availability of formal Personal Health Records (PHRs). No matter what kind of patient record is used, such a record is also useful in allowing a patient to document medications dispensed and administered.

#### B.2.3.b Review Prescription

Just as in the case of Authorized Providers going through the “Prescribe?” process, upon receipt of a written prescription, a patient or their proxy often review the prescription given to them. This can include noting an unexpected change in dosage of a chronic medication, inclusion of the wrong medication, absence of a medication, the wrong quantity, wrong prescribing interval, wrong patient name, lack of a signature, etc. Upon reviewing the prescription, they might then make a decision to:

- a. Request that the prescriber make a change in prescription
- b. Request that the dispenser review the prescription

In a stage 0 (paper-based) environment, and in the case of early-stage EMRs that generate paper prescriptions, this process of Reviewing Prescription is an opportunity for detecting errors or omissions before a medication or device is dispensed. This step is lacking in advanced-stage EMRs, wherein prescriptions are transmitted directly to a pharmacy system. Unless patients are given a copy of their prescription, there is a potential for increased errors in these more advanced ePrescribing systems.

#### B.2.3.c Ongoing Monitoring

Hours, days, or weeks after a medication has been dispensed, the patient is the one most likely\* to become aware of adverse drug reactions. Through the media and other means, a patient may become aware of recalls or other concerns also prompting a prescription review by their clinician or medication dispenser.

\*Note: that it is not always the case that a patient is the one to identify an ADR. It is frequently the clinician who through monitoring lab work is the one who discovers an adverse reaction to a medication).

## Dispenser

The dispenser of a medication may be a pharmacist. It may be a clinician dispensing samples of medications. It is also not unusual for a clinician to dispense samples of a medication *along with* a prescription for the medication. The patient can then try the samples, and fill the prescription should it be effective or tolerated. In compassionate cases, a patient may receive all of a given medication via samples.

Note that during the workflow processes of prescribing, more than one dispenser may be involved. E.g. the case where a pharmacist leaves a telephone message requesting clarification of a prescription, or faxes a refill request to a clinician. By the time the clinician responds to the message or fax, the pharmacist has often gone off duty, and an alternate pharmacist handles the clinician's response.

### B.2.4 Processes

#### B.2.4.a Identify Patient

Just as a prescriber needs to confirm that the she has correctly identified the patient for whom a prescription is being considered, other care providers such as pharmacists need to ensure that they have done the same, before dispensing.

#### B.2.4.b Access Patient Record

Similarly, the dispenser will need to access the appropriate patient record in order to obtain information needed in making a decision on whether to proceed with dispensing. The record is also necessary in order to document their decision.

#### B.2.4.c Dispense?

"Dispense?" is the process wherein a dispenser goes through the process of reviewing a transmitted prescription request, and deciding whether to proceed with dispensing. During the process, the pharmacist may need to contact an authorized provider, patient/proxy re necessary or suggested changes in a prescription. Such dialogue may result in the prescription being cancelled, modified, or continued with provisos attached. Examples include:

- A serious drug interaction necessitating that a prescription not be filled.
- A person's renal function necessitating a reduction in dose or frequency of a medication.
- A medication that has the *potential* to interact with another medication, or affect a person's renal, hepatic, respiratory or other function. This might prompt a clinician to initiate lab monitoring, or change the dose of a pre-existing drug. E.g. Coumadin.

The steps in the "Dispense?" process include:

**Evaluate Prescription Validity** – The dispenser needs to confirm that they have received a valid prescription. The dispenser will do a validity check to confirm that the presence of the correct patient name, provider signature/authorization, date, etc. This includes checking that the provider is authorized to dispense the given medication. The dispenser will also check whether the prescription appears to be authentic, and whether it appears to have been tampered with. Further, in the case of paper prescriptions, the dispenser will seek to confirm that the individual delivering the prescription is qualified to do so.

**Evaluate Medication-Specific Factors** – Similarly to the Authorized Prescriber's process of drug selection, the dispenser will usually also review what information they

have available about the patient's existing and past medications, drug allergies & intolerances, etc. It may also include a review of medical history, and access to electronic resources. In British Columbia, this would include regional prescribing data warehouses like the Pharmanet database.

Note that the British Columbia Pharmanet database does not provide dispensers information about medications dispensed by the BC Cancer Agency or HIV Centre of Excellence. Further, in stage 0 and low level ePrescribing systems, a dispenser would also not be aware of medications dispensed directly as samples in a clinician's office, unless the dispenser happened to be the clinician or their colleague using the same EMR. In a level 5 ePrescribing system, dispensers should have access to full information about medications previously or currently dispensed.

**Evaluate Availability/Substitution** – Once a dispenser is satisfied that a medication can safely be dispensed, comes the process of checking whether it is available. This includes checking that the medication is still manufactured, that there is stock available, checking the expiry date, checking that the medication or lot is not subject to a recall, checking whether there is adequate stock available to fill the whole prescription, checking that the patient has coverage for the prescription, or is otherwise able to afford it.

The pharmacist may also choose to select an alternative to the medication prescribed. It is the rule rather than the exception in B.C., that a lower-cost generic alternative will be substituted for a name-brand drug, unless explicitly requested otherwise by the prescriber.

#### **B.2.4.d Dispense**

Once a dispenser is satisfied that a medication can and should be dispensed, they can prepare the prescription for delivery to the patient.

#### **B.2.4.e Document (Dispense)**

Once a decision has been made to proceed with dispensing, the dispenser needs to document information about the dispensed medication, including details about the medication, quantity, the dispenser, and the like. In more advanced systems, a dispenser may be able to scan a medication package (E.g. via bar code scanner, RFID scanner and the like), to accurately capture information about the medication.

#### **B.2.4.f Initiate Dispensing-Related Activities**

The act of dispensing may trigger various ancillary processes:

**Review Medication** - Dispensers usually review the use and potential side effects of a medication or device that they are dispensing. This process includes documenting the fact that this process has occurred.

After dispensing, the patient may look at the packaging or tablet and realize that they've had it before, with a less than optimal outcome in the past. This post-dispensing review provides a further level of safety at which both the dispenser and the patient (or their proxy) can verify that an appropriate medication or device is being dispensed.

Also at this point, it is not unusual for a patient to realize that the medication or device is unaffordable, triggering a cancellation, modification, or call to the originating prescriber to request an alternative prescription.

**Flag for Refill** - Another ancillary workflow task is to flag a refill reminder for when the medication is due to run out.

**Notify Clinician** – To close the loop on the prescribe/dispense process, the prescriber should be notified that the prescription they generated has actually been dispensed. Unfortunately, this process is usually absent in paper-based and early-stage ePrescribing systems. It is important for clinicians to know whether a patient has actually filled a prescription. It is perhaps even more important for clinicians to know if a prescription has *not* been filled within a reasonable period of time.

**Notify Patient** – When a patient has a personal health record, the Dispenser has the opportunity to update the record. An advanced ePrescribing system should do this automatically.

**Reconcile Dispensing with Prescription** – The ability of stage four or five ePrescribing systems to reconcile prescriptions with the related process of dispensing a medication offers a potential significant enhancement to the quality of patient care, compared with the current paper-based environment in which most clinicians still practice.

#### **B.2.4.g Ongoing Monitoring**

Just as with prescribers, dispensers have a role in the ongoing monitoring of the safety of medications that they have dispensed. A medication recall/warning may be issued on a certain batch of a medication, on a specific medication as a whole, or on an entire class of medications. A dispenser may need to notify affected patients of the recall or warning. In level 0 and early-stage ePrescribing systems this can be difficult if not next to impossible.

## **Administering Authority**

Generally, the one administering an outpatient medication will be the patient themselves. It can also be their proxy, such as a family member or care-giver. It could also be nursing-home staff, a pharmacist, clinician, etc.

Similar to the dispensing process, there are the steps of identifying the patient, potentially accessing their medical record, a pre-activity review, an active process (administering a medication), followed by a post-activity review and ongoing monitoring.

### **B.2.5 Processes**

#### **B.2.5.a Identify Patient**

If the administering authority is other than the patient themselves, the individual involved needs to ensure that they have correctly identified the patient recipient.

#### **B.2.5.b Access Patient Record**

Similarly, if the administering authority is a care provider such as nursing home staff, pharmacist, or clinician, they will need to access the appropriate patient record in order to obtain information needed in making a decision on whether to proceed with medication administration. The record is also necessary in order to document their decision.

#### **B.2.5.c Administer?**

“Administer?” is the process wherein an administering authority evaluates the patient and the medication at hand to determine whether to proceed with medication administration. During the process, the administering authority may need to contact the prescriber, dispenser, or the patient/proxy to obtain ancillary information or clarification. Such dialogue may result in the prescription being cancelled, modified, or continued with provisos attached. For example, a

change in a person's health status may necessitate a reduction in dose or frequency of a medication.

The steps in the "Administer?" process are similar to those in the "Prescribe" process, and include:

**Evaluate Medication-Specific Factors** – Factors include confirming the intended patient, confirming the intended medication, and checking for medication expiry or recall.

It is important to review the medication about to be administered, to ensure that it is labelled as being for the correct patient. A prudent administering authority will also review the dose, expiry date, and check for recalls.

As with the equivalent work-flow step for Prescribers, an Administering Authority may need to consider attributes of the medication about to be administered. Examples include potential adverse reactions that might be expected. Are there warnings about risks of photosensitivity, or avoiding certain foods while on the drug? Does it need to be started at a certain time? – An example being the use of oral contraceptives.

**Evaluate Patient-Specific Factors** - includes checking the patient's current medical status and medication schedule.

As there can be a delay between the time that a medication is prescribed, and the time that it is administered, it is prudent to verify that the patient's *current* medical status does not mandate a dosage change or cancellation of medication administration. This includes reviewing a patient's medical history via a review of the chart, discussion with the patient, family members, caregivers, etc. for existing medical conditions, renal and liver function, current medications, allergies & intolerances, age, gender, pregnancy status, breast-feeding status, social situation, medication compliance, mental status and competency, psychiatric history, etc.

Medications like hormonal injections and vaccinations are routinely given on a scheduled basis. In these cases, it is appropriate to check that the medication is about to be administered on-schedule.

#### **B.2.5.d Administer**

Once an administering authority is satisfied that a medication can and should be administered, they can administer the dispensed medication or device.

#### **B.2.5.e Document (Administer)**

Once a decision has been made to proceed with medication administration, the administering authority may need to document information about the administered medication, including details about the medication, quantity, the dispenser, and the like. In more advanced systems, the administering authority may be able to scan a medication package (E.g. via bar code scanner, RFID scanner), to accurately capture information about the medication.

#### **B.2.5.f Initiate Administration-Related Activities**

After administering medication to a patient several ancillary workflow activities may be initiated. These include:

**Flag for Next Dose** – In cases such as those of vaccines and regularly recurring injections, it is helpful to be able to set a trigger for when the next dose will be due. If the patient does receive it as scheduled, a notification can be sent to the administering authority.

**Notify Clinicians (Clinician to Clinician)** – Such a situation would include those such as when a consultant requests that a family physician administer a patient’s injectable medication in-office. For example, injections of chemotherapy, anti-hormonal, or anti-rheumatic medications would fall into this category. Where an advanced-stage ePrescribing system is in place, the system should reconcile the consultant’s prescription for the medication, with the fact that the referring clinician has actually administered it.

**Notify Patient** – When a patient has a personal health record, the Administering Authority has the opportunity to notify the patient. This may seem to be an artifice, as in most cases the Administering Authority *is* the patient. In an advanced ePrescribing system though, technology-enabled medication-administration devices should be able to update automatically a patient’s digital Personal Health Record.

**Reconcile Administration with Prescription** – To close the loop on the prescribe/dispense/administer process, the prescriber can be notified that the prescription that they generated has actually been administered. For the most part, this process is outside the scope of ePrescribing systems as presently described. I.e. there is currently no regularly-used device that will notify a clinician each time that a patient takes their prescribed medication. There are however, situations where this can and should be done when an ePrescribing system has the capability of doing so. (Note: “SIM-enabled” medication dispensers are available. These are like pill bottles with an embedded cell-phone, that sends a message to a clinician whenever the pill bottle is opened.)

#### **B.2.5.g Notify Care Providers re Adverse Event**

Later in the prescribing process, after a medication has been dispensed, the patient or their proxy is the one most likely to become aware of an adverse drug reactions (ADRs), and the need to notify a prescriber or dispenser. This activity is captured under the role of Administering Authority when a patient administers a medication to himself.

#### **B.2.5.h Ongoing Monitoring**

Just as with prescribers and dispensers, administering authorities have a role in the ongoing monitoring of the safety of medications that they have dispensed. Adverse drug events (ADEs) can occur hours, days, weeks or even longer after a medication is administered. A patient or caregiver acting in the role of administering authority may need to contact a prescriber or dispenser well after a medication has been administered.

Further, through the media, friends, or research, a patient or caregiver acting in the role of administering authority, may become aware of concerns about continued use of medication, and seek further advice from their prescriber or medication dispenser.

In the current early days of computerization in outpatient health care, it is unlikely that lay people acting as administering authorities will be automatically notified of medication recalls. In a climate of advanced ePrescribing and EHR systems though, they may be directly notified of such recalls, again prompting them to seek advice from those who prescribe or dispense their medications.

## **C. Workflow Diagrams**

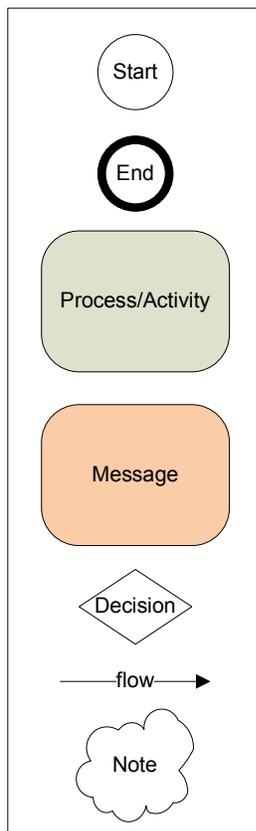
The following set of diagrams represent increasing levels of automation and ePrescribing sophistication with each stage. The basic workflow activities do not necessarily change from stage to stage, however the extent to which they are automated and methods of completing these activities do change as depicted by the colour-shading. In stage 0, most of the workflow is shaded lightly as all activities are done manually. As an office achieves stage 5 adoption, most communication and information transfer is done

through linked systems with additional decision support capabilities. This is shown by the darkest shading.

**For detailed descriptions of activities in the workflow at each stage, please refer to the Workflow Assessment Spreadsheet (Tool C) which provides justifications of colour-shading. For portions of the diagrams not shaded, please refer to the detailed diagrams that follow.**

## Notation

The workflow diagrams presented in this handbook use the following set of symbols to illustrate workflow components:



Start: start of workflow

End: end of workflow

Process/Activity: task that occurs in the workflow

Message: message sent between roles (parties)

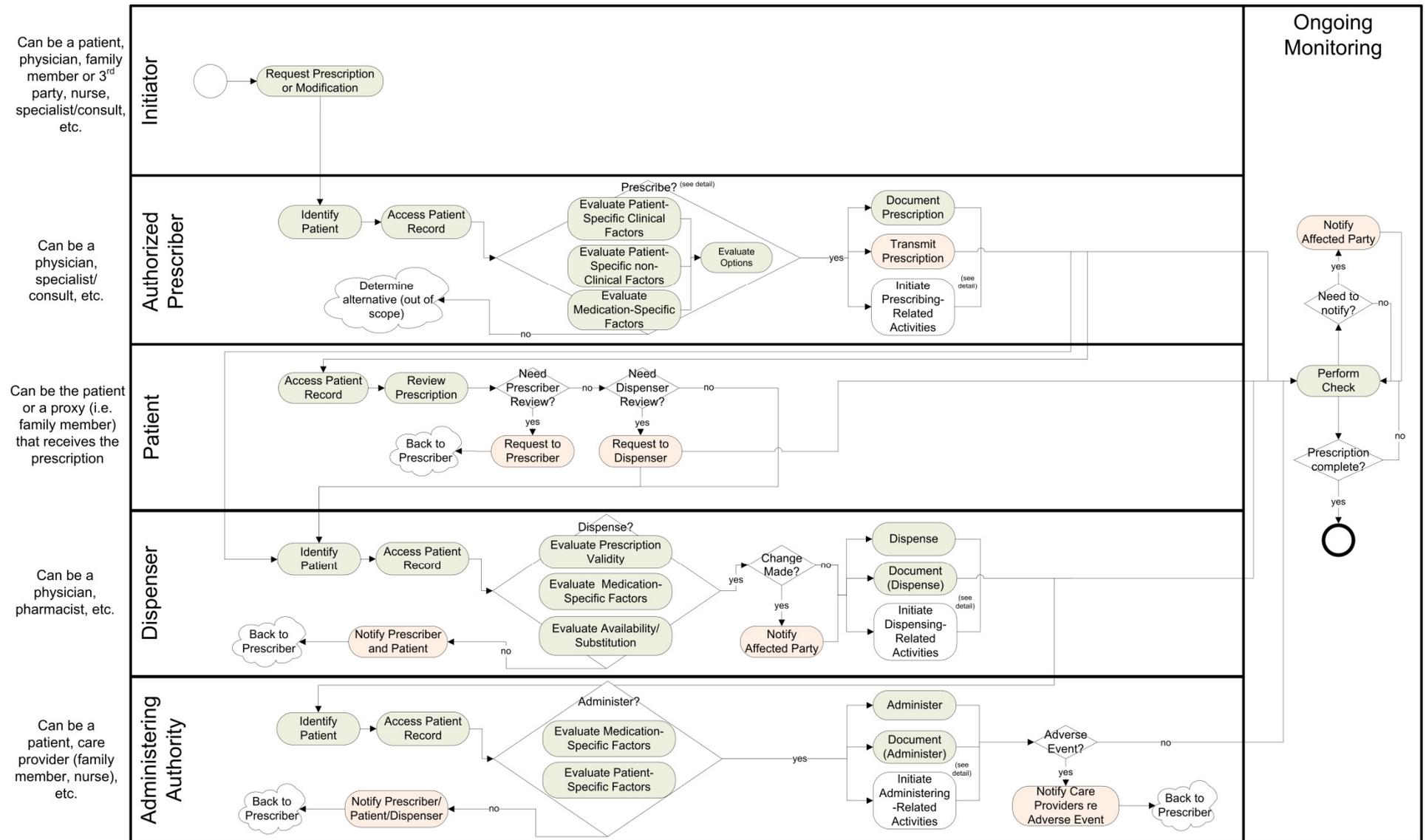
Decision: next direction of flow is dependent on a decision or outcome

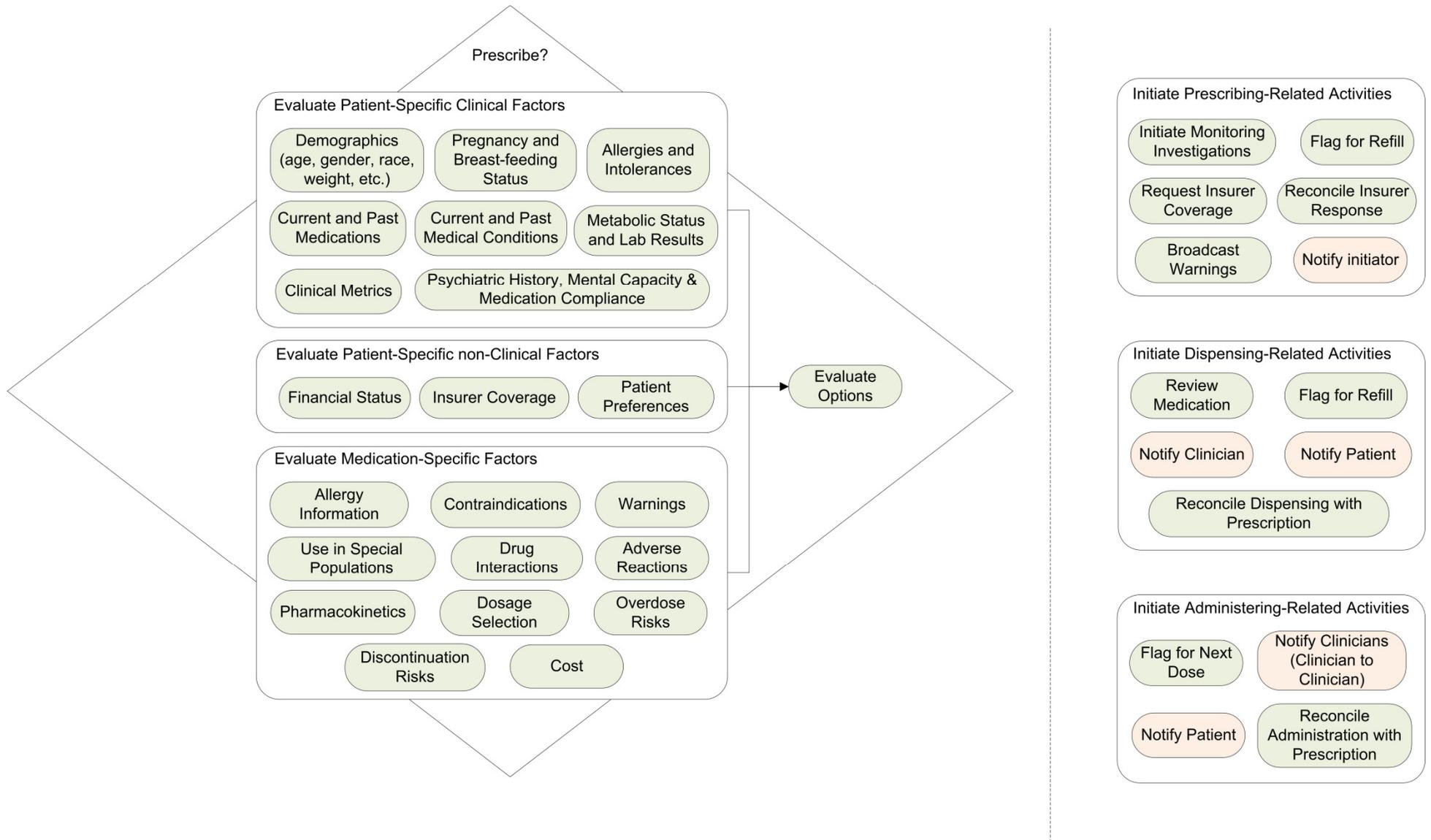
Flow: indicates direction of workflow

Note: special note

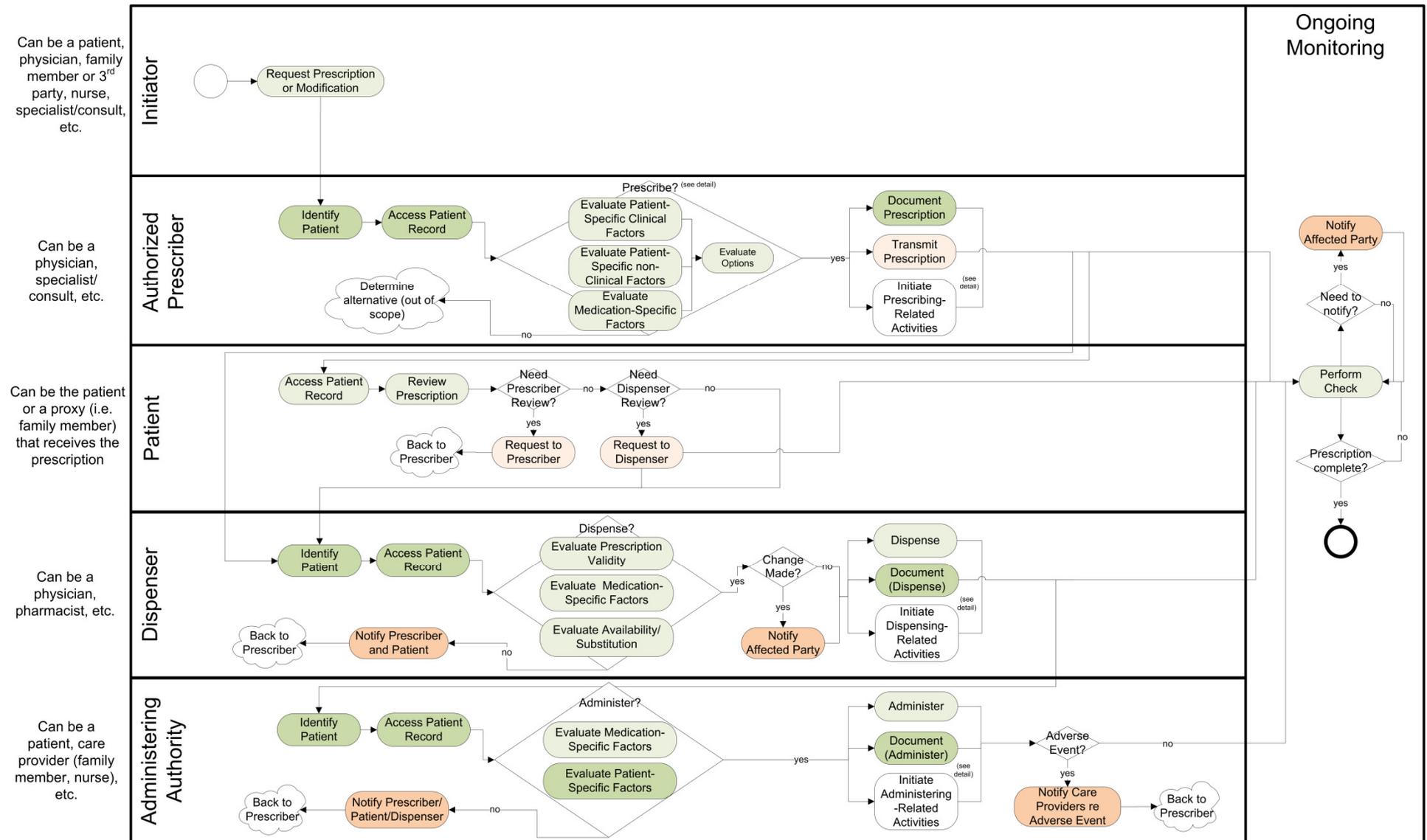
Expanded sections of the main workflow are shown in a detailed diagram where indicated.

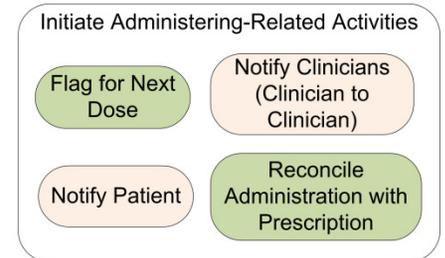
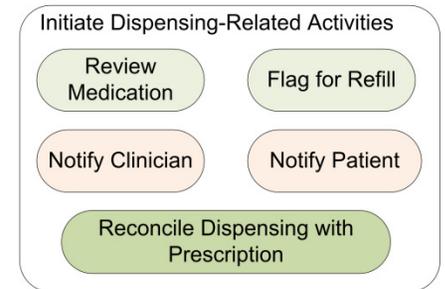
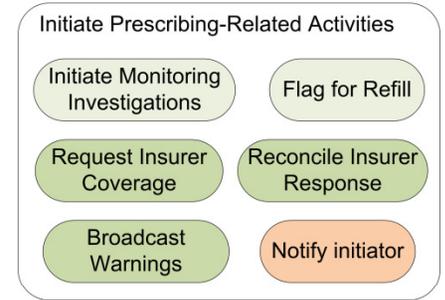
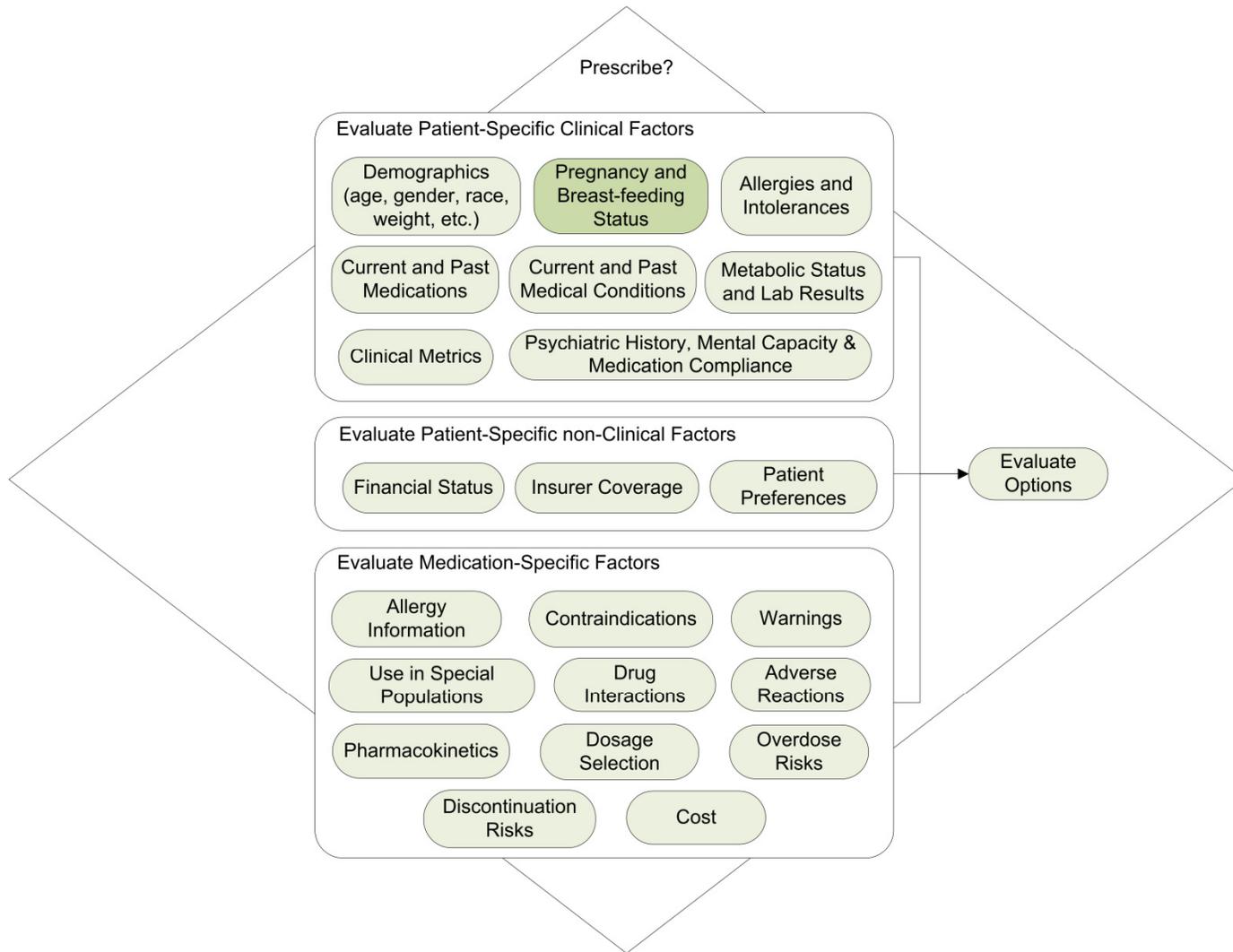
# C.1 Stage 0



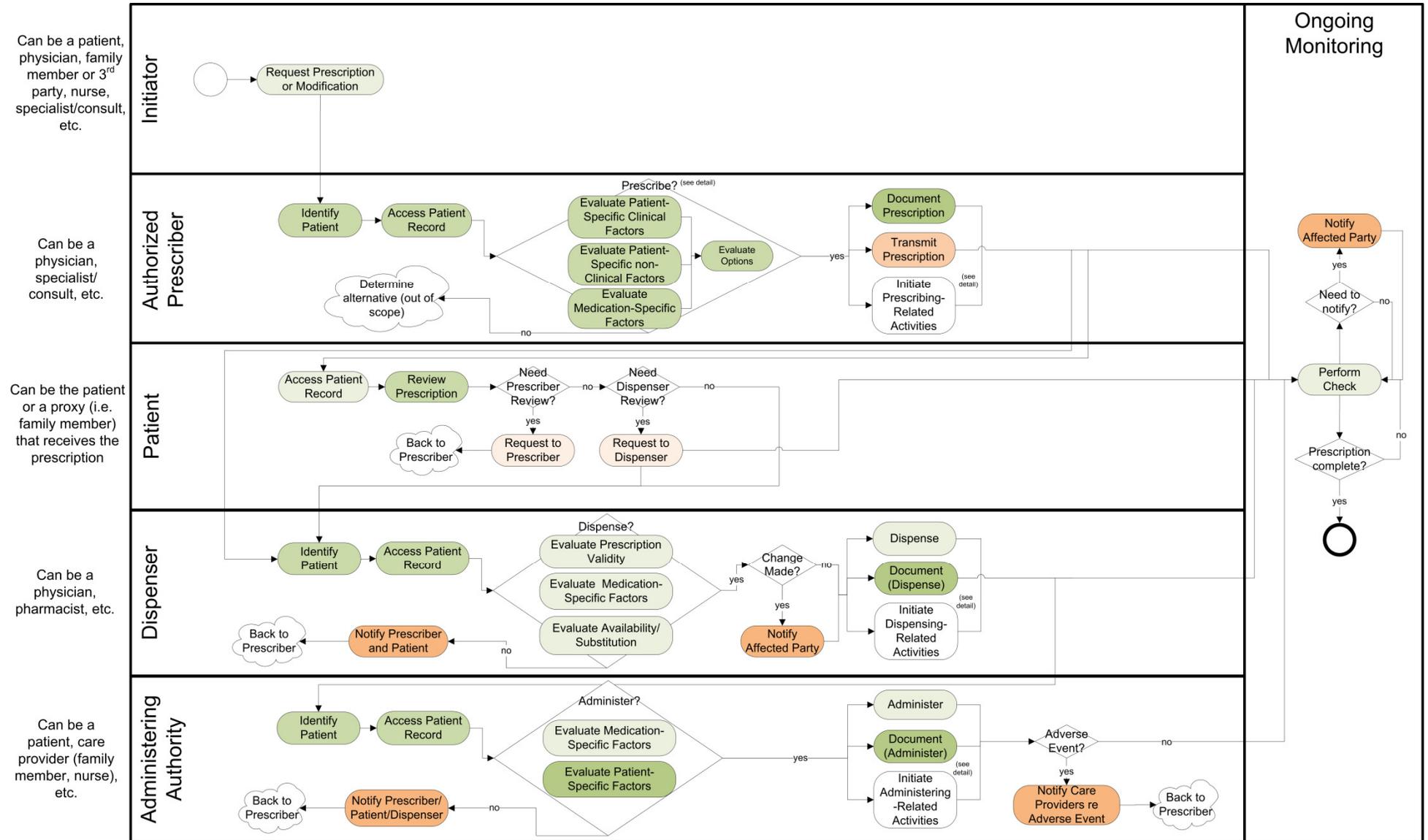


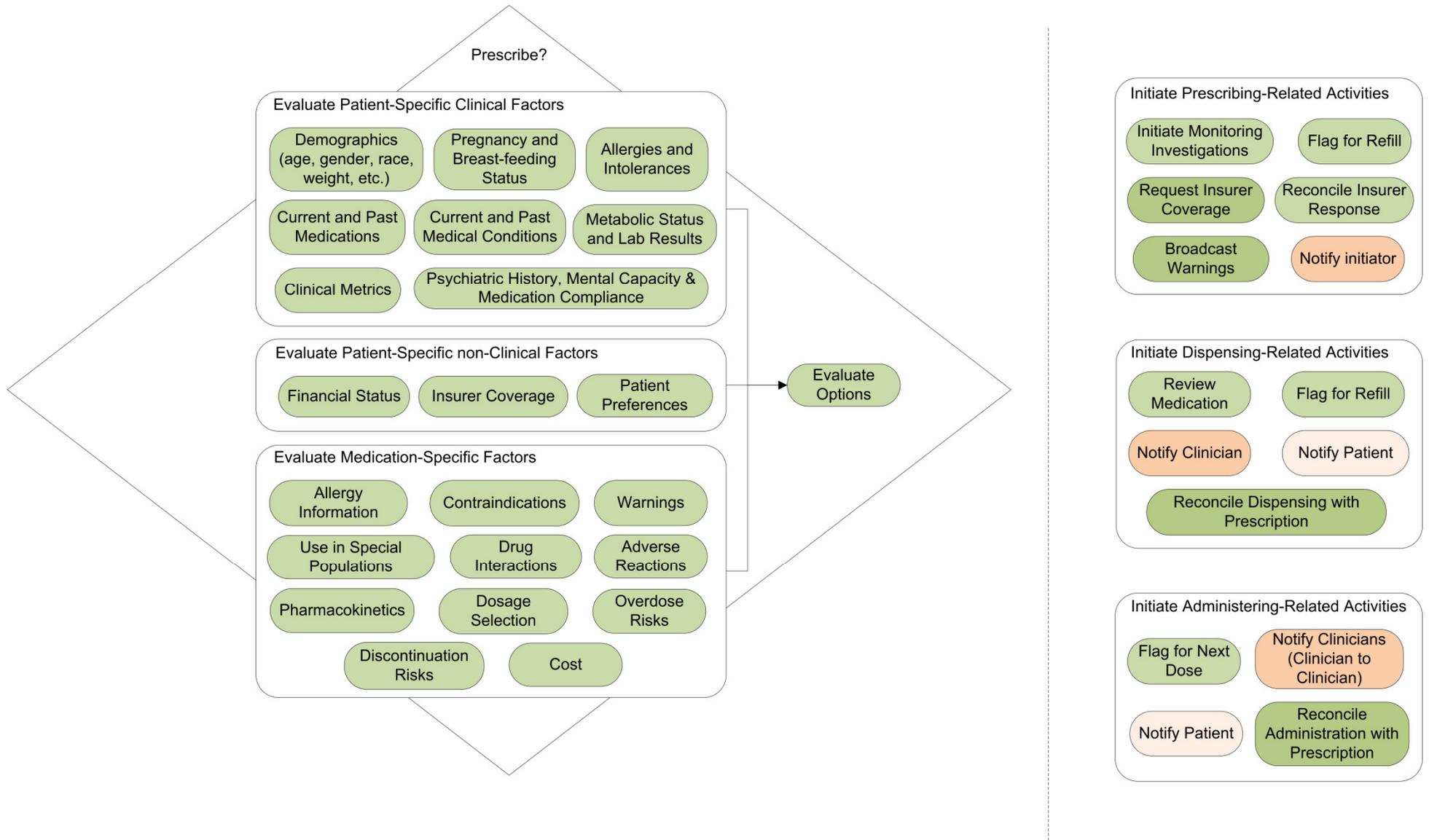
## C.2 Stage 1



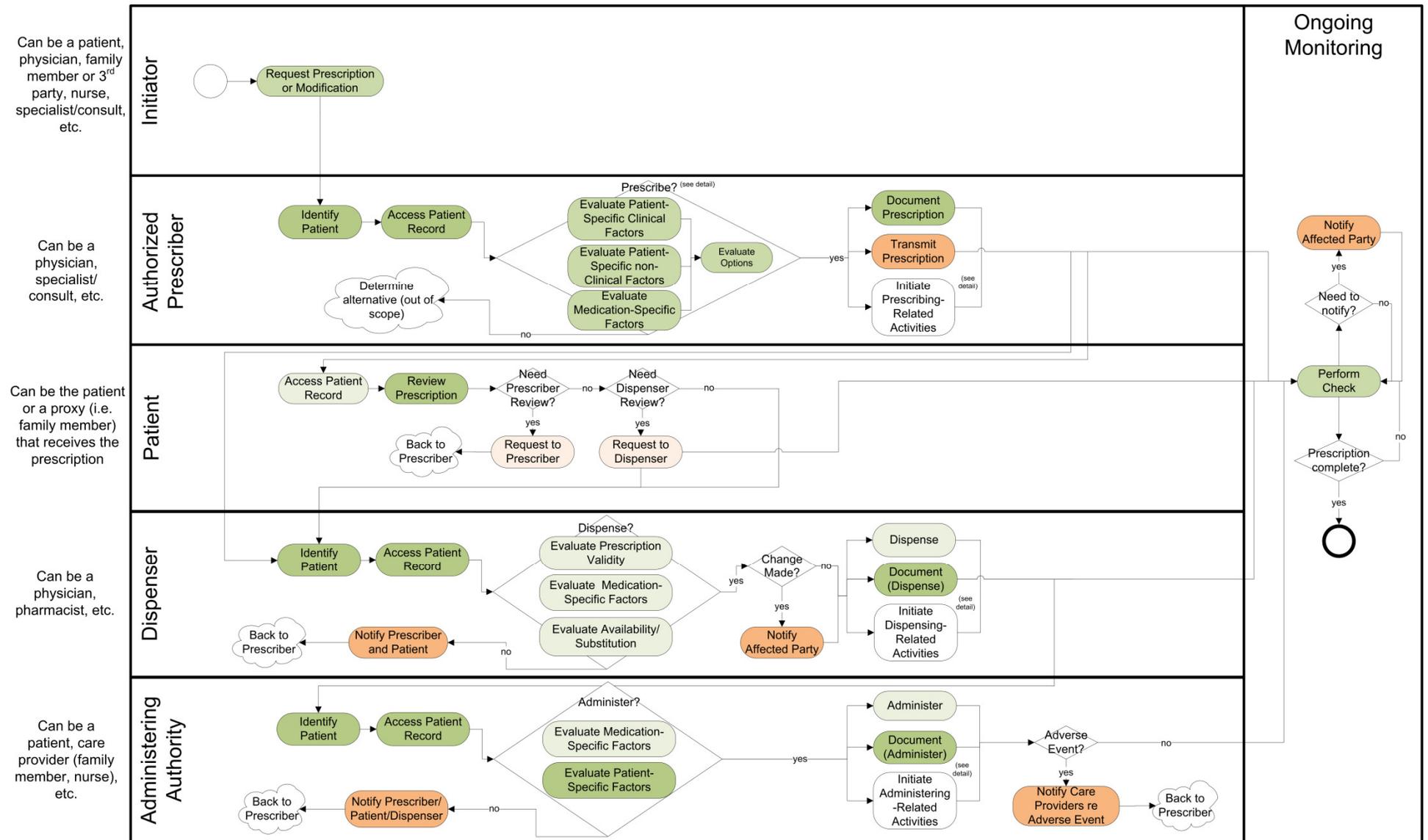


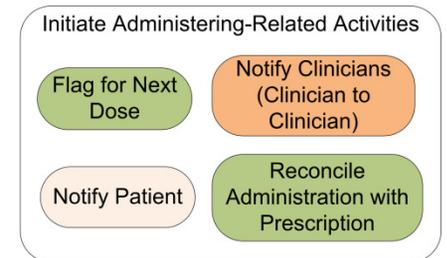
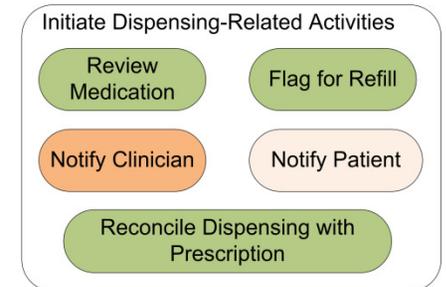
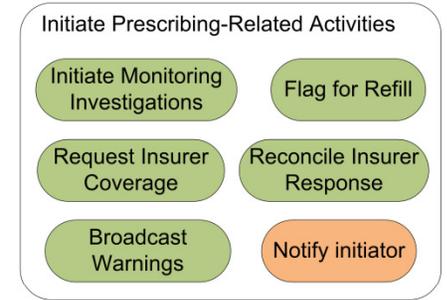
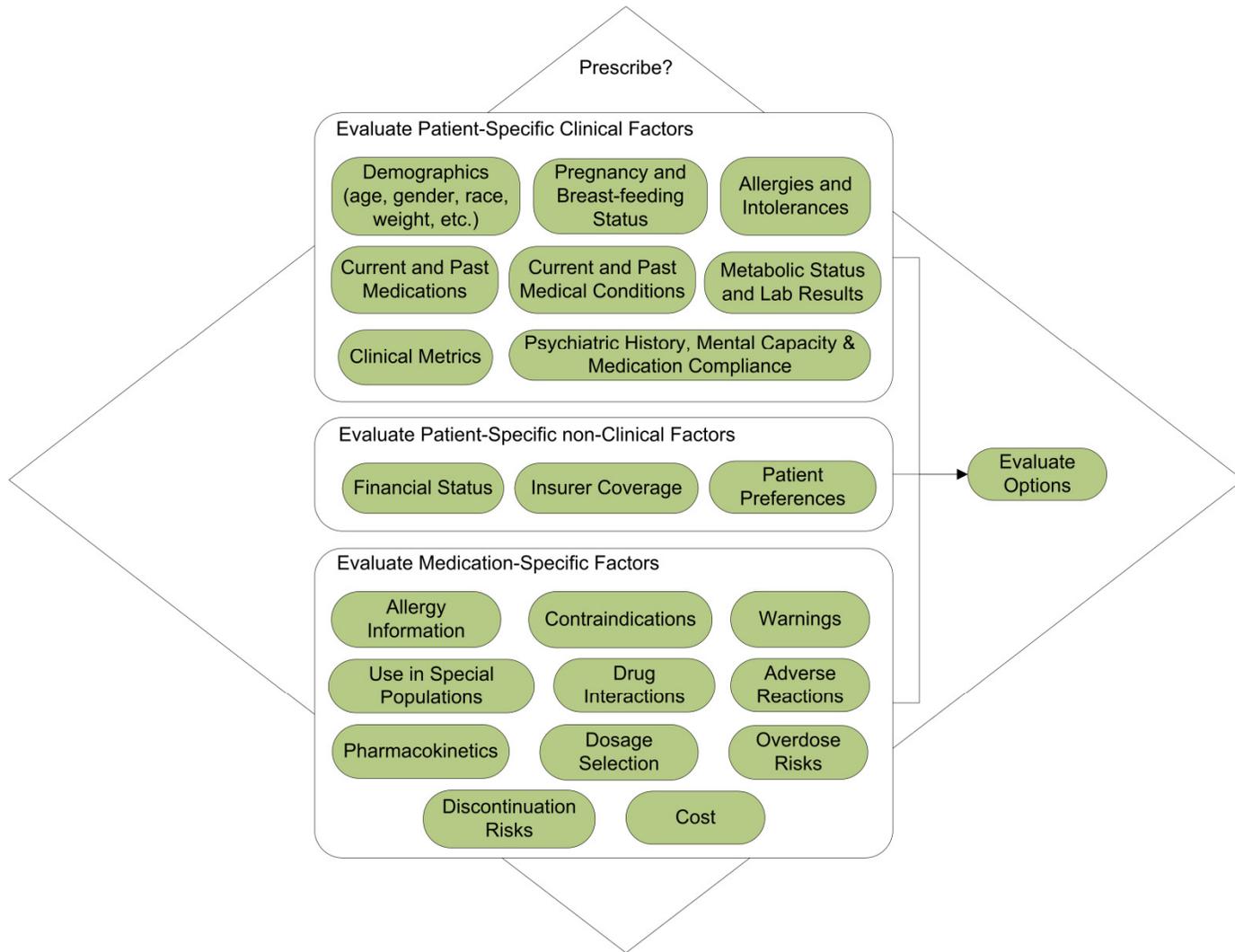
## C.3 Stage 2



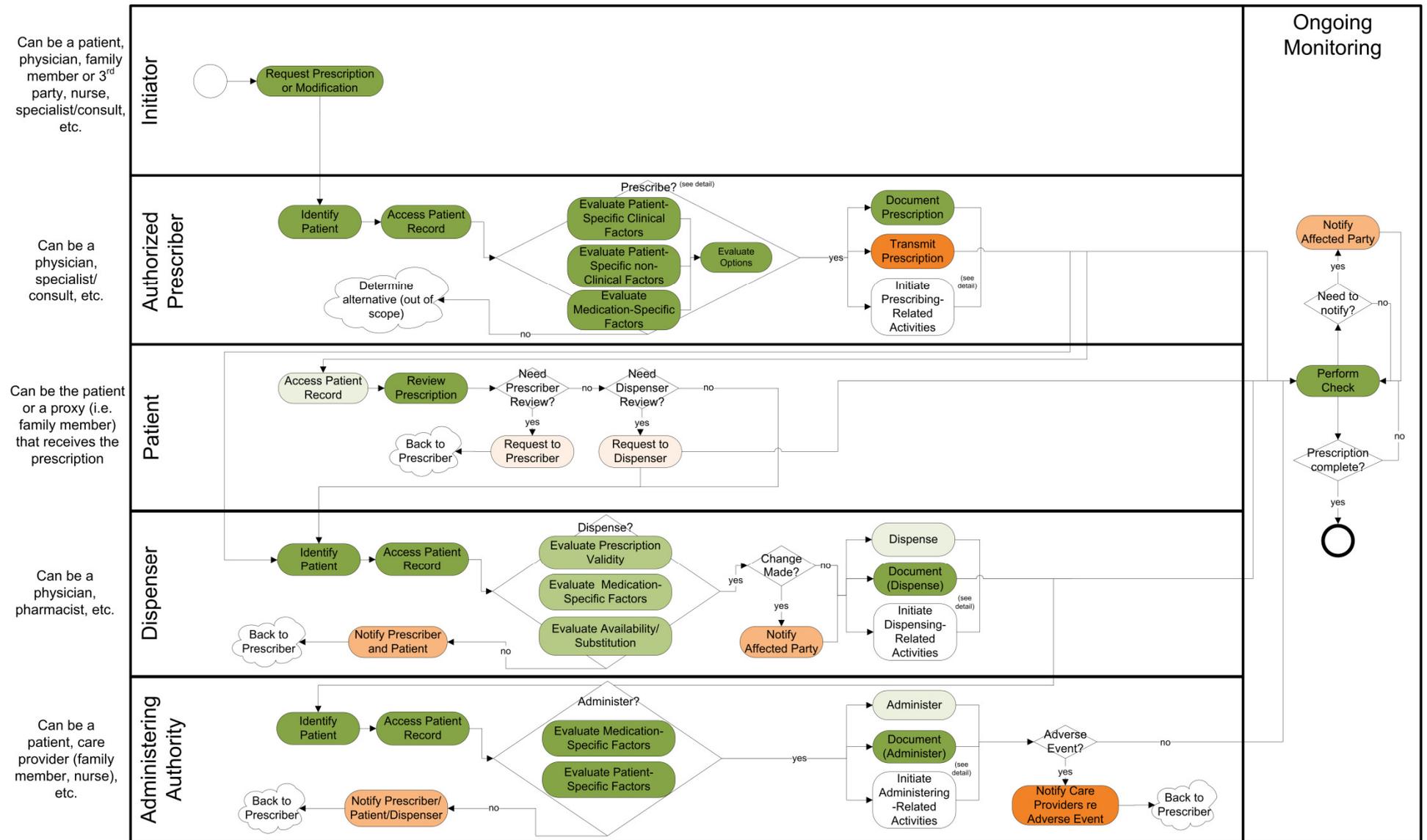


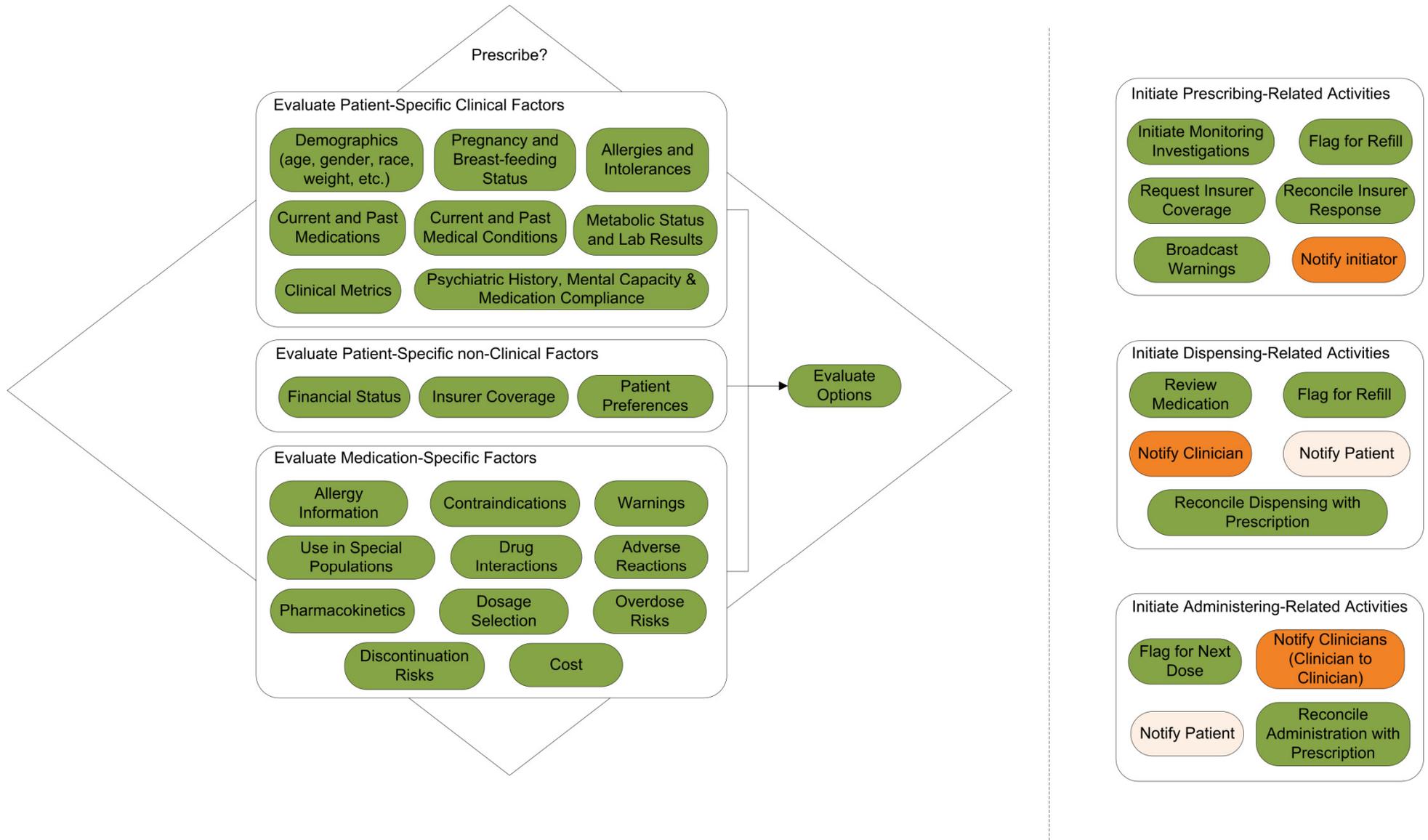
## C.4 Stage 3



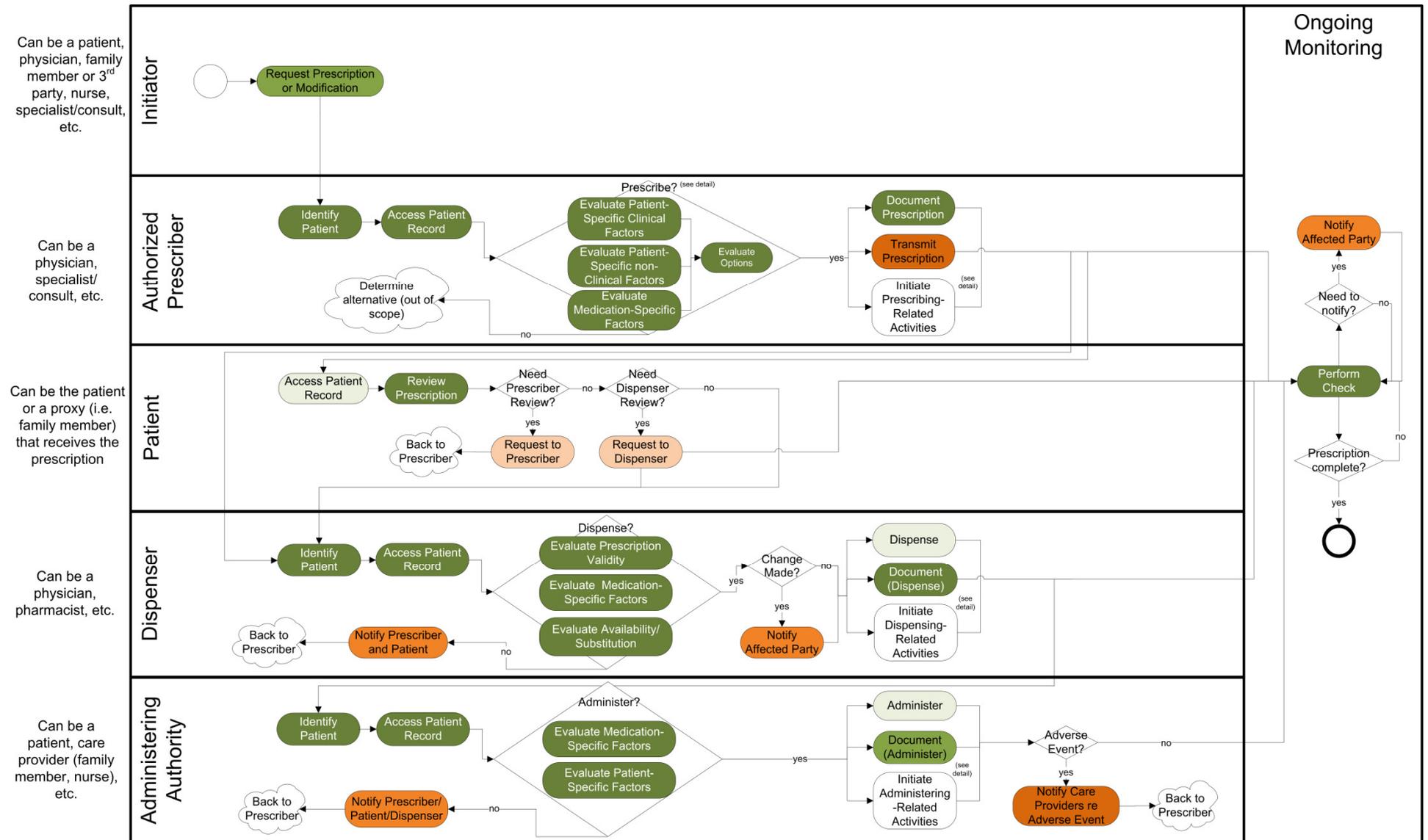


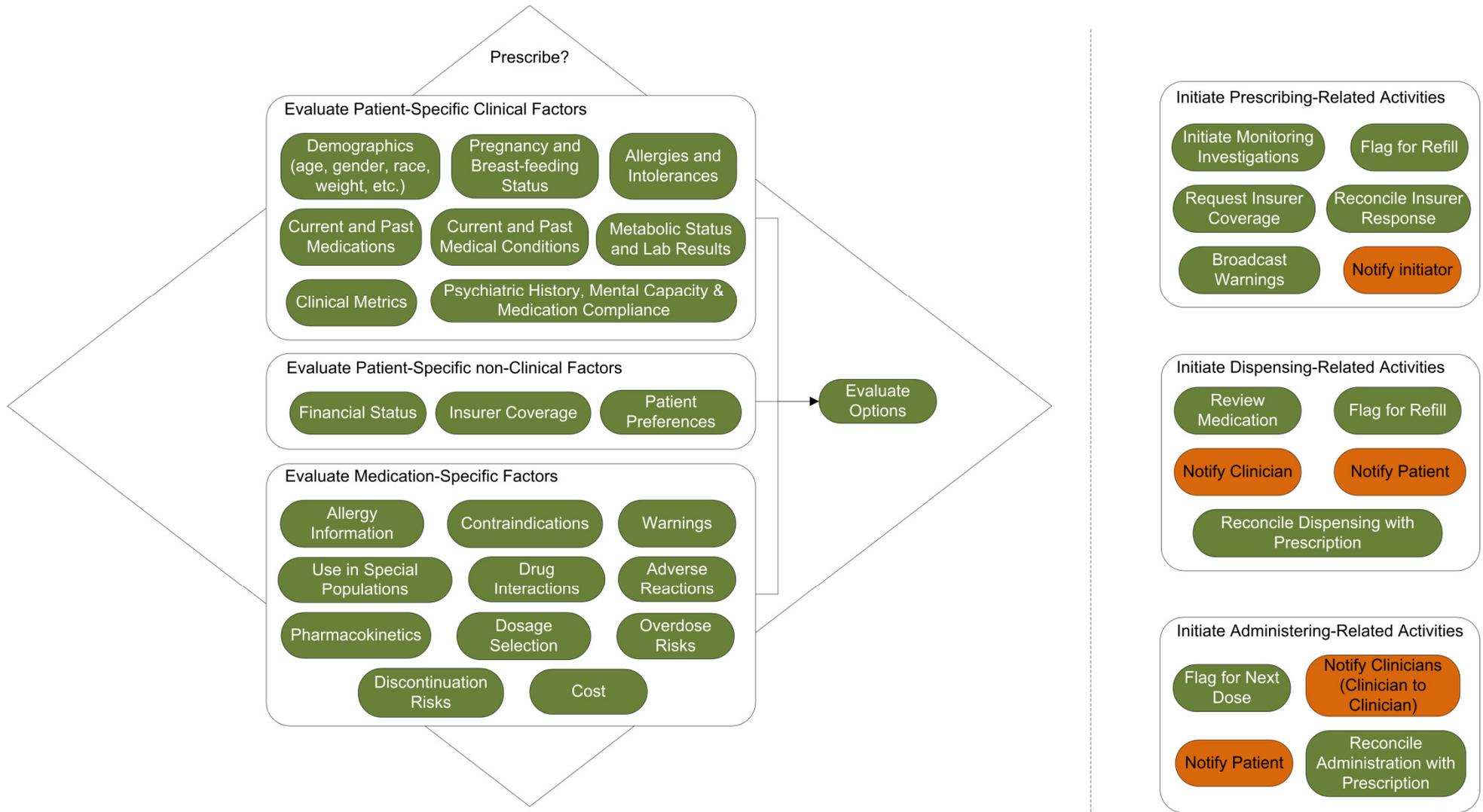
# C.5 Stage 4





## C.6 Stage 5





# Evaluation Methodology

Several tools have been developed to determine what stage of advancement an office has achieved in their migration to an ePrescribing environment. A master workflow spreadsheet describes the functionality expected for each workflow step, at advancing stages of prescribing.

## A. Target Audience

The tools can be used by researchers, evaluators, or even physician office practices themselves to determine the current stage of prescribing activities. They provide a benchmark for comparison and future implementation plans.

## B. Tools

Our overall method to determine current stage of ePrescribing consists of the following tools:

1. **Workflow Survey:** The survey tool consists of a series of multiple-choice questions for physicians to answer, corresponding to each stage of prescribing. This is the key tool to be used in an interview.
2. **Workflow Walk-through:** Provides a sequential walk-through perspective for considering the prescribing workflow. Questions address key parts of the workflow.
3. **Workflow Scenarios:** Provides a realistic scenario-based perspective for considering prescribing activities. Questions address key parts of the workflow.
4. **Workflow Analysis Data Sheet:** A data sheet to record scores and provide a summary for assessments done multiple times or across sites.

It is expected that in a typical office, for each of the workflow activities described, there will be variability in the stage of advancement reached for the different tasks.

These assessment tools can therefore be expected to produce results similar to a student's report card. Just as a student may be doing well in math, and poorly in literature, an ePrescribing system may rank high in its ability to do some tasks, and rank lower in other areas. For example, a given ePrescribing system might be quite advanced in its ability to do drug interaction checking for a medication, but quite primitive in its ability to suggest appropriate monitoring lab work for that drug.

Unlike a report card however, these tools are not meant to assess a clinician's abilities, but rather to assess the ability of an ePrescribing system to meet certain objective criteria. Of course, it is possible that an ePrescribing system has advanced functionality that a clinician is not using. If this were the case, it might be a suggestion that perhaps the user interface of the system had shortcomings, or that the users had not received adequate training in using the product.

In any case, results of these assessment tools can be used to help clinicians identify areas where they can achieve enhanced functionality from their EMR/ePrescribing system. They can also be used to help them identify potential pitfalls and solutions. Further, they can help identify areas where vendors can improve their products. Lastly, they can help funding agencies objectively assess how well their resources are being put to use.

# 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, 60-70.
- 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 111<sup>th</sup> Congress*. Retrieved from <http://www.himss.org/2009calltoaction/HIMSSCallToActionDec2008.pdf>
- 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., Meill, 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.

# Appendix A. A Comment about Detail

On reviewing the assessment tools, a reader might wonder why so much time and attention is focused on the detailed workflow steps. Why are the different clinical and medication factors individually isolated? Can't some of these be consolidated?

In response, let's step back a bit, and look at the bigger picture. These workflow tools are useful if they not only evaluate workflow, but are also used to help improve future EMR functionality and use, and thus improve healthcare. In order to do this, it is important to consider EMR adoption, the current state of EMR implementation, and improvements brought about by EMR use.

EMR adoption has been an issue frequently reviewed in the literature. Physicians have in general been slow to adopt EMRs. At least some of this hesitation is due to EMRs not including the functionality that physicians expect and desire.

The success of EMR implementations has historically been less than hoped. Even with funding support to encourage the use of EMRs, the use of clinical functions has often been less than expected.

When clinical functions of EMRs are used, studies have shown equivocal improvements in quality of care, and sometimes even weakened quality of care. EMRs also have the potential to impact the costs of healthcare both negatively and positively.

In the light of these considerations, the workflow assessment tools have a key role in helping assess what clinical factors are related to improved adoption, improved use of clinical functionality, and most importantly, what workflow factors are associated with improved quality of care. Lastly, healthcare costs may be affected by prescribing workflow, so it's important to assess workflow factors associated with reduced costs.

It is therefore important that a detailed workflow assessment be done. It is also critical to assess whether an EMR acts *actively* or *passively* in including information in decision-making. For example, an EMR may include a field for whether a patient is pregnant or not, but is this information integrated into the automated drug-selection decision support process, or is the information just a field in the database? Is the pregnancy status displayed to the clinician *at the time of prescribing*? Some medications are safe at one stage of pregnancy, but unsafe at another. Does the EMR go beyond a yes/no pregnancy flag, and include the *stage* of pregnancy? Does the EMR rely on the clinician to consider such factors? Stated differently, to what degree can a clinician rely on her EMR to give her guidance?

Are drug costs displayed when a clinician is offered the option of multiple potential drug choices? Are recent relevant lab results automatically displayed when making a medication selection? Does the prescribing workflow process facilitate the inclusion of factors like race, medication compliance, and psychiatric history, and *actively* assist the clinician in decision-making.

For the prescribing workflow assessment to make a difference to improving healthcare, detailed analysis of the workflow is critical. For the drug selection process in particular, it is not adequate to consolidate the multiple decision-point factors into a single check box.

# Appendix B. Glossary

## Authorized Prescriber

An authorized prescriber is anyone authorized to create, modify, or discontinue a medication. Examples include physicians, nurse practitioners, pharmacists, dentists. In some situations this also includes nurses (E.g. in outpost nursing stations).

Note that an authorized prescriber might delegate some of the activities of prescribing to another individual. The authorized prescriber however, retains responsibility for the actions of their delegate. Examples of these delegates include medical students, nursing students, residents, nurses, and MOAs. A medical student for example might make a tentative diagnosis, and create a prescription. Their mentor however would be responsible for signing off on the prescription. Similarly, a physician might authorize their office staff to notify a patient of a recommended change in a prescription dose.

## Electronic Medical Record (EMR)

In this handbook, an electronic medical record (EMR) refers to a system used by physicians to electronically store and manage a patient's medical information within their office or practice.

## Electronic Health Record (EHR)

In this handbook, an electronic health record (EHR) refers to a system used by health care providers that links information from several EMRs to create a longitudinal care record for a patient spanning different health care settings.

## Medication

The term "Medication" includes pharmaceutical products, and also devices such as IUDs that are only available on prescription.

## Patient

In the prescribing workflows, the term "patient" means the individual for whom a medication is about to be prescribed, or the individual already taking a medication. Where appropriate, "Patient" can also include a patient's proxy. For example, a family member may be the one to request a prescription renewal for an elderly parent, or be the one to pick-up a prescription for an ill child.

## Personal Health Record (PHR)

In this handbook, a personal health record (PHR) refers to a record used and maintained by patients to manage their own health information (independent from an EMR or EHR). For example, a PHR may be a web-based portal which allows a patient to enter and track information for a chronic condition or simply a folder of paper documents, or even a half-page medication and problem list that the patient carries in their wallet or purse.