The anatomy and physiology of a medication order/prescription

Prinivil / lisinopril, 10 mg tablet, P.O., daily, for hypertension. Prescribed by Phil Smith, MD

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TRADE / generic name, dose-strength with units of measure, form, Route, Frequency, indication, prescriber.

Other data: Quantity prescribed, Pharmacy filling, Number of refills. Start date, Stop date, Drug class (ACE-inhibitor), Duration, Do Not Substitute indicator, Controlled-substance indicator, Over-the-Counter (OTC) indicator. Cost data, price data, RxNorm, NDC, priority code

Item	Structure	Function	Comment
Trade name of medication	Text, Usually capitalized	Identifies a medication produced as a Brand, typically from one manufacturer	Standard format is first letter capitalized. May be one or more Trade names for every generic name. Essentially works as a familiar "alias" to the generic name.
Generic name of medication	Text, usually all lower-case	Identifies a specific medication as its FDA approved chemical name.	Generic name is specific. It may have one or more aliases of Trade names.
NDC (National Drug Code	10-digit/character*, 3-segment numeric identifier assigned by FDA to each product. **Segment 1**: is 4-5 digits long and represents the "Labeler code" A labeler is any firm that manufactures, repacks or distributes a drug product. **Segment 2:** is 3-4 digits long and identifies a specific strength, dosage form and formulation of a particular firm/manufacturer. **Segment 3**: is 1-2 characters long and identifies the package forms and sizes. This segment may contain numbers and/or letters.	FDA assigns to each medication in the U.S. intended for human use. It contains 3 segments that identifies the vendor, product and trade package of the drug. https://www.fda.gov/Drugs/InformationOnDrugs/ucm142438.htm	NDC's have been historically reused from time to time. ****CMS has created an 11-digit NDC derivative to create a fixed 5-4-2 segment length with a leading zero as needed in each segment.*** Some applications use a 9-digit code with a 5-4 representation of first two segments (whenever packaging is irrelevant.).

Item	Structure	Function	Comment
DIN (Drug Identification Number)	8-digit. Randomly assigned to all medication sold in Canada.	Identifies all prescription and OTC meds in Canada and are displayed on the label. A DIN uniquely identifies the following product characteristics: manufacturer; product name; active ingredient(s); strength(s) of active ingredient(s); pharmaceutical form; route of administration	DIN is used for Canadian drugs, while NDC is used for U.S.A. drugs.
RxNorm	https://www.nlm.nih.gov/research/umls/rxnorm/	RxNorm provides standard names for clinical drugs (active ingredient + strength + dose form) and for dose forms as administered to a patient. It provides links from clinical drugs, both branded and generic, to their active ingredients, drug components (active ingredient + strength), and related brand names. Updated weekly as new drugs are released in the U.S. for human use.	Maintained by the National Library of Medicine (NLM) as part of the Unified Medical Language System (UMLS). Updated quarterly and free to use in U.S. Developed for interoperability across clinical systems.

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Therapeutic class	A grouping of medications with similar structure and function. There are classes and subclasses. For example: Cardiovascular agents Antihypertensives Alpha Blockers Beta Blockers Highly-selective Calcium Channel Blockers Dihydropyridines Phenylalkylamines ACE Inhibitors (ACE-I) Angiotension Receptor Blockers (ARBs)	Used mainly for clinical decision support rules to allow duplicate checking by class or sub-class. However, this can also lead to nuisance alerts as there are legitimate reasons to have a patient on two or more drugs in the same class. (for example, prescribing both long and short acting insulin is best practice)	Drugs are often used for their action outside of their class. For example, alpha blockers may be used for both hypertension and/or for men with enlarged prostate glands.
Strength and/or volume	Typically numeric. Always requires a "unit of measure" to follow to provide meaning. Some medications are prescribed by volume of dose (e.g. 5 mL or 1 tablet) rather than by strength (e.g. 7 mg). **Leading zero is ALWAYS** used if any value exists right of the decimal point (for example 0.088 mg). **A trailing zero is NEVER** used if no value to the right of the decimal point. (for example 1 mg should never be written as 1.0 mg).	To avoid mis-dosing errors on the order of a magnitude (for example confusing 1.0 as 10 mg and thus over-dosing 10x or one order of magnitude of intended dose.)	The Leading Zero and Trailing Zero rules are national standards in the US originally set by The Joint Commission
Units of Measure	Typically a defined code-set in the EMR and never free text. Alpha characters. Examples: mg, Gm, units, mg/dL, tablet(s), mL	The same UoM codeset is used for lab reporting as well as pharmacy and important	

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Duration	Typical has two components in the EMR. First component is the multiplier and the second is the unit of measure. Example: 3, day(s); where 3 is the multiplier and day(s) is the unit of measure.	Drives tasks in the EMR such as on the electronic medication administration record (eMAR) or on staff Tasks Lists. Used on both medications and lab tests.	Some acute medications (e.g. antibiotics) are prescribed for a defined interval and discontinue once duration is met. Chronic medications (e.g. for hypertension) do not have a duration and therefore stay continuously as an active medication, even if the patient has quit it or refills have expired.
Dose Form	Tablet, Capsule, Extended-release capsule, vial, syringe, injection, liquid, suspension, solution. Typically driven by a code set, not free text.	To indicate how the product is dispensed. Used in machine logic to limit the available routes (For instance, a tablet cannot be given as an injection, and a long-acting tablet cannot be crushed (since that would make it an immediate release do	Important for two reasons: 1. Dispensing from a automatic cabinet 2. Delayed release system. The drug Cardizem/diltiazem comes in immediate release capsule, extended release capsules (Cardizem CD) and long acting tablets (Cardzem LA). This is usually managed as a dose form, but could be managed as a product.
Sig: (instructions)	Typically the collection of prescribing instructions on a medication order to clarify at least four requirements: 1. Dose and unit of measure 2. Route 3. Frequency 4. Duration	To provide requirements for proper use of the medication for the indicated patient. NOTE: Nursing refers to the Five Rights of Medication Management: 1. Right patient 2. Right dose 3. Right route 4. Right time (and frequency) 5. For the Right duration.	Sig is abbreviation for latin word signetur, or “let it be labelled”. Prescriptions may also allow “special instructions” or “Order Comments” to the patient and/or to the pharmacist.

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Quantity Dispensed	Numeric value of the number of units (volume, tablet(s), capsule(s) dispensed by the pharmacy	To ensure the number of units the patient should receive in fulfilling a prescription.	Some drugs, such as opioids may be limited to a few days at a time. Many chronic medications may be dispensed with one month to 3 month intervals.
Refills	Numeric value indicating the number of times the Quantity Dispensed can be re-dispensed (i.e. refilled)	To limit the number of times a prescription can be refilled until a new prescription is issued	Some systems limit the window during which a prescription can be refilled. This may be on the low side (e.g. cannot refill a 90-day prescription earlier than 75 days passed the prior dispensing) or long side (cannot refill a prescription older than one year.
Pre-authorization	Indicates that a payor is willing to reimburse the pharmacy for the prescription at a maximum amount. Usually stored as an authorization code, date, and payor information with notes.	To limit risk for the pharmacy benefit manager and the dispensing pharmacy when a medication insurance plan exists	Especially important for high cost agents such as monoclonal antibody drugs used for autoimmune diseases and malignancies.
Indication	Usually defined from one or two code sets in the EHR 1. Problem list in SNOMED-CT 2. Diagnosis in ICD-10 3. Rarely for a procedure in CPT-x	To indicate a disease or condition for which a medication has been prescribed.	Especially important when a medication is used for a rare or off-label indication to prevent inadvertent discontinuation by another provider
Patient Data	Factors that impact choice of medications, dosages and routes. Includes: 1. Allergies 2. Intolerances 3. Idiosyncratic reactions 4. Weight (typically in kg.) 5. Height (typically in cm.) 6. Body-surface area (BSA in M^2) 7. Body mass index (BMI in kg/M^2) 8. Age 9. Renal function (GFR of CrClearance) 10. Liver Function	**Allergies** are reactions to medications that are often generalized to classes and create immune-mediated reactions including anaphylaxis. **Intolerances** are common side effects that preclude the patient successfully taking the medication (example: Nausea and vomiting from codeine)	``This data typically comes from clinical data sets in the EHR and not be easily accessible to the pharmacist.

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Patient Data (continued)		**Idiosyncratic reactions –** are rare reactions associated with certain medications that would preclude use of that medication or similar meds in the future. (Example: Stevens-Johnson Syndrome which is a life threatening reaction to drugs such as Sulfa and some diuretics) **Wt/Ht/BSA/BMI** impact dosage adjustments that are recommended of some medications of for infants and children. **Age** –some drugs may not be administered to all ages. **Renal and Liver Function** – May require dose reduction or avoidance of certain medications.	
Prescriber (or ordering provider)	Usually defined in a personnel table or freetext (which can cause duplicates). Prescribers are ideally associated to a Unique Provider Identification Number (UPIN)	The provider who has authorized or ordered the medication last.	This is confusing during medication reconciliation in which the prescribing physician/provider may not be known.
DEA Number	Unique Alphanumeric code provided by the Drug Enforcement Agency to allow providers to prescribe controlled substances.	Serves as authorization and authority that a prescriber can legally prescribe a controlled substance.	Not all physicians / providers have a DEA number.
Dispensing Pharmacy	Name of a pharmacy, usually in a codeset (such as from SureScripts), from where the current medication was dispensed. Metadata includes address, phone and fax number for the pharmacy.	Allows identification of where a medication was last obtained.	Not always available and there are other sources of medications (spouses, samples, mail order, Canada, street drugs, etc.)
CancelRx	A specific SureScripts communication to indicate the specific intention that a specific medication is to be discontinued for a specific patient at this time.	Communicates that a medication is to be moved from ACTIVE to Inactive/historical status.	Functionality is often overlooked and sometimes unavailable.

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eHx - Electronic prescribing history	An active query from SureScripts to the EHR showing active medications and refill histories.	Allows person doing query to see medications that the patient has been taking and may still be taking.	Is not a source of truth since it may be incomplete and/or inaccurate due to many factors.
SureScripts	A service that manages data transfer between prescriber, pharmacies and pharmacy benefit managers (PBMs).	Is the backbone for electronic prescribing in the United States. May include electronic prescribing of controlled substances (EPCS) transactions.	Note: PBMs typically store dispense quantities and refill history but rarely include specific instructions.
Medication Reconciliation	The process of comparing multiple sources of patient medication lists and agreeing on a current medication treatment list.	To ensure the patient, provider and all care givers know a current list of medications that is accurate. Then apply START, STOP, CONTINUE decision-making to determine a true and accurate current list.	The act of reconciliation has two major steps: 1. Compiling a complete list of medications that the patient is currently on. 2. Determining which of these should be **Stopped**, which should be **Continued**, and what new meds should be **Started.**
Admission / Discharge / Transfer Med Rec	Represents 3 distinct times that medication reconciliation is documents during an inpatient/hospital encounter 1. Upon Admission 2. Upon Transfer from one level of care to another (e.g. ICU to med/surg unit) 3. At time of Discharge from hospital.	Current day EMR's provide each of these three functions in their med rec module. At discharge, new prescriptions need to be produced and transmitted or printed.	

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CDS – Clinical Decision Support	Rules based on Boolean logic using IF, THEN, AND, OR, ELSE Statements	CDS rules are used in various manners in the medication management process: - Drug-drug interactions - Drug-allergy interactions - Drug-food interactions - Drug duplicates - Weight-dosing and Age-dosing mismatches More complex rules also look at clinical-drug interactions such as involving lab values and other clinical data.	Varies by each EMR and by each provider.

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