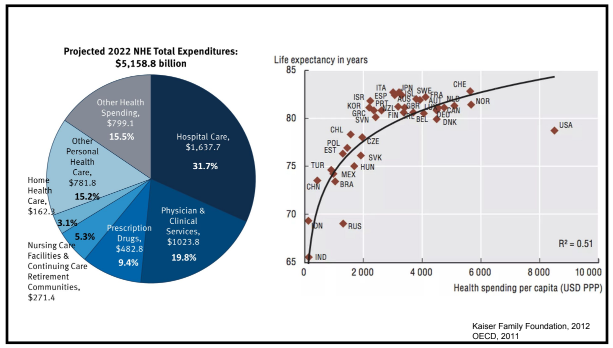
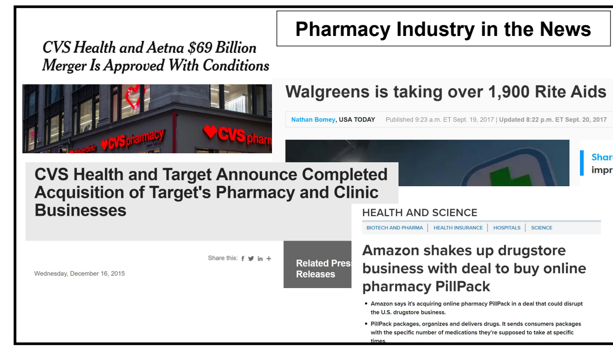
Objectives

- Discuss the current landscape of pharmacy and medication in US healthcare
- Introduce human factors and cognitive engineering models provide examples in pharmacy practice
- Describe current and future research focused on pharmacist work and medication safety





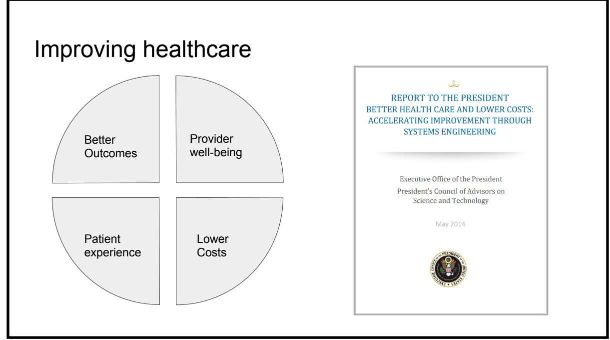
Scope of Medication Safety

- World Health Organization (WHO) estimates $42 billion in annual costs
- Nearly 700,000 ED visits and 100,000 hospitalizations each year in US
- Progress has been painstakingly slow

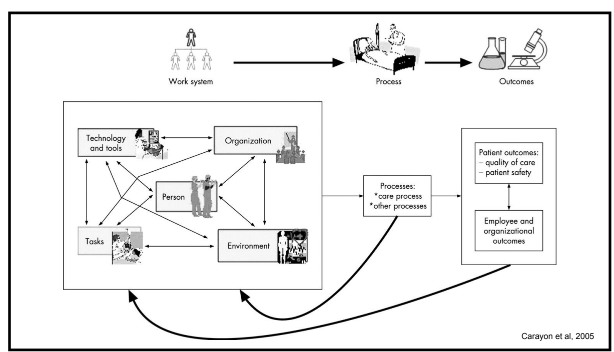
Medication Without Harm

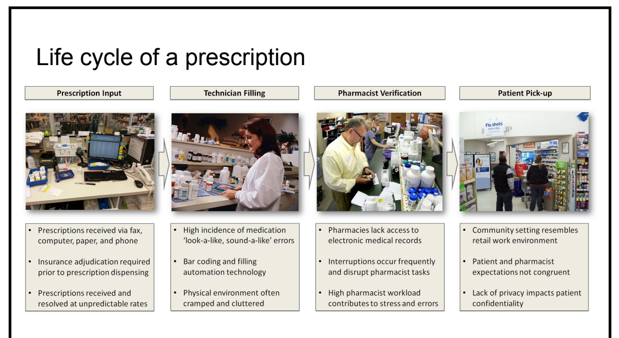
WHO Global Patient Safety Challenge

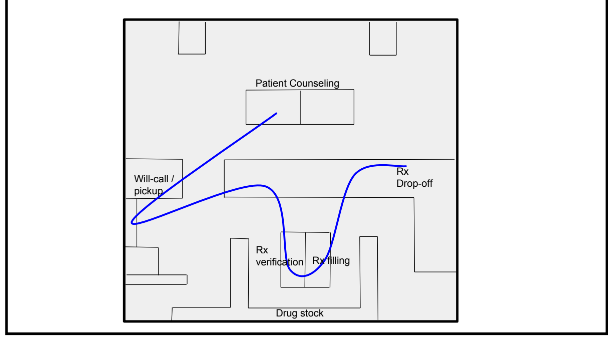
AHRQ, 2015
Bates DW, 2018

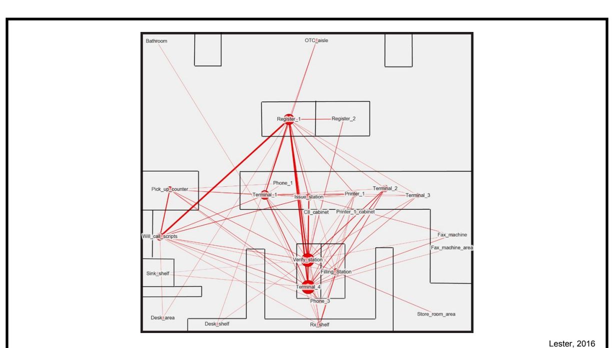


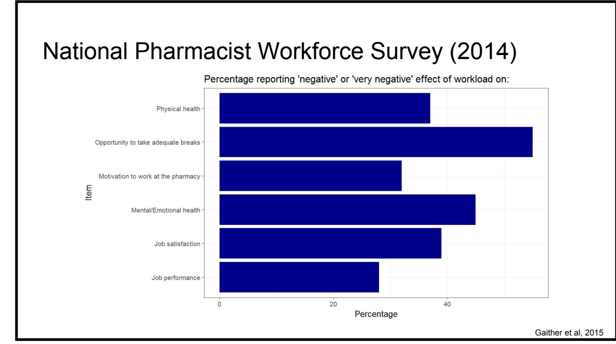
Pharmacy as a work system

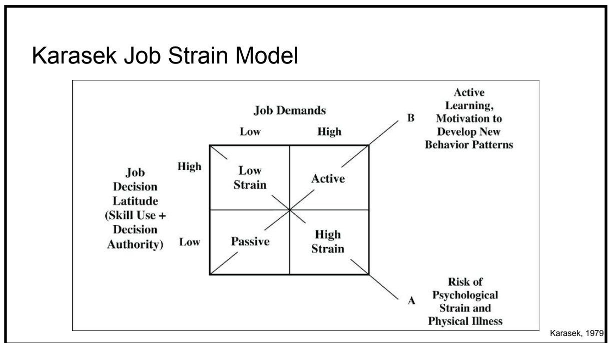




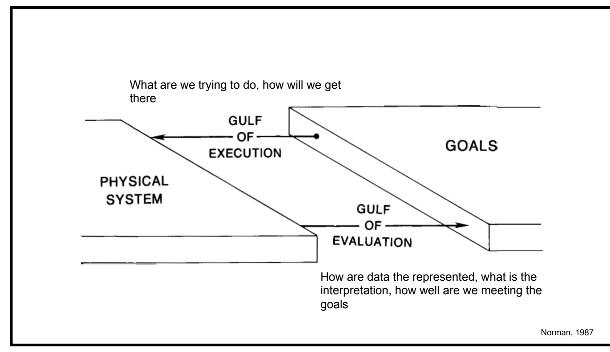


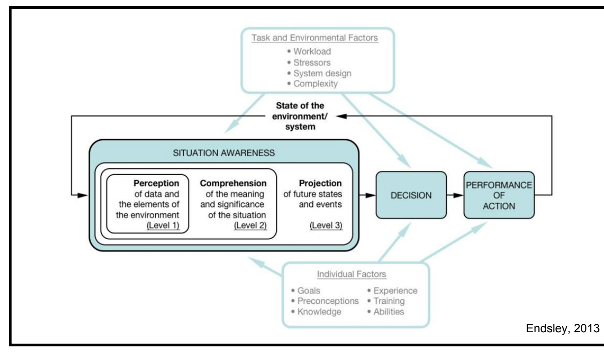


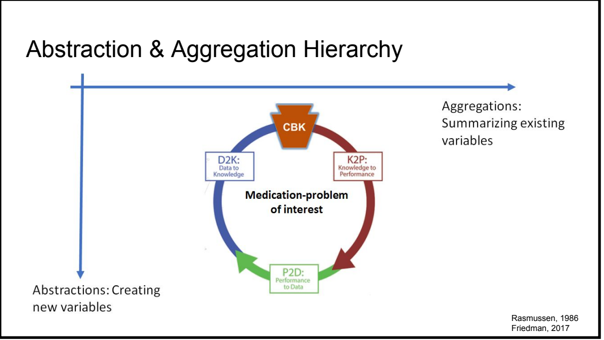




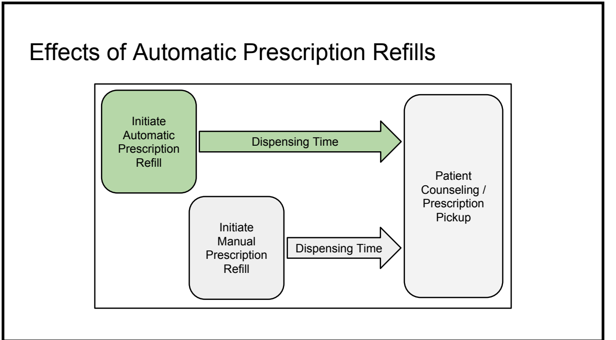
Cognitive engineering approach to data science







Application in prescription processing and medication adherence



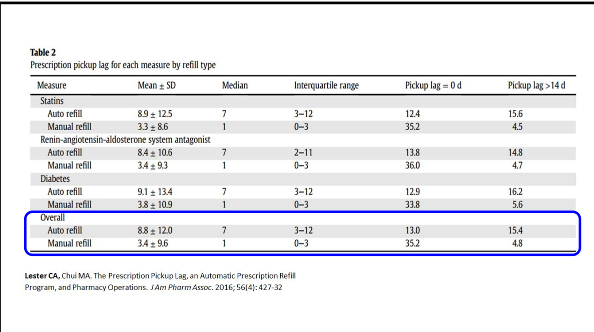
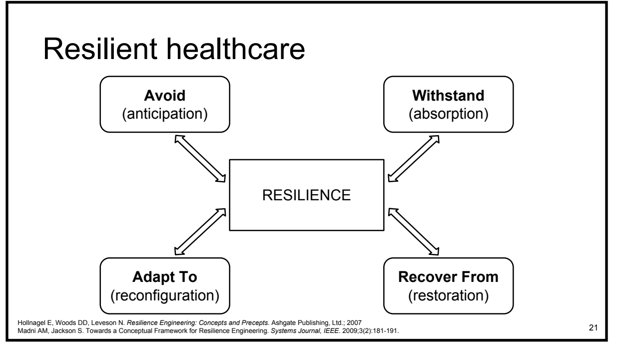


Table 2
Prescription pickup lag for each measure by refill type

Measure	Mean ± SD	Median	Interquartile range	Pickup lag = 0 d	Pickup lag >14 d
Statins					
Auto refill	8.9 ± 12.5	7	3–12	12.4	15.6
Manual refill	3.3 ± 8.6	1	0–3	35.2	4.5
Renin-angiotensin-aldosterone system antagonist					
Auto refill	8.4 ± 10.6	7	2–11	13.8	14.8
Manual refill	3.4 ± 9.3	1	0–3	36.0	4.7
Diabetes					
Auto refill	9.1 ± 13.4	7	3–12	12.9	16.2
Manual refill	3.8 ± 10.9	1	0–3	33.8	5.6
Overall					
Auto refill	8.8 ± 12.0	7	3–12	13.0	15.4
Manual refill	3.4 ± 9.6	1	0–3	35.2	4.8

Lester CA, Chui MA. The Prescription Pickup Lag, an Automatic Prescription Refill Program, and Pharmacy Operations. *J Am Pharm Assoc.* 2016; 56(4): 427-32



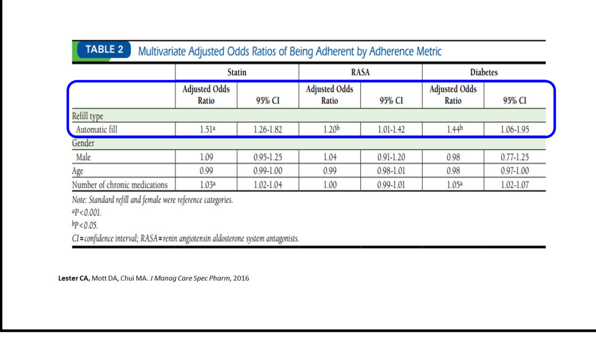
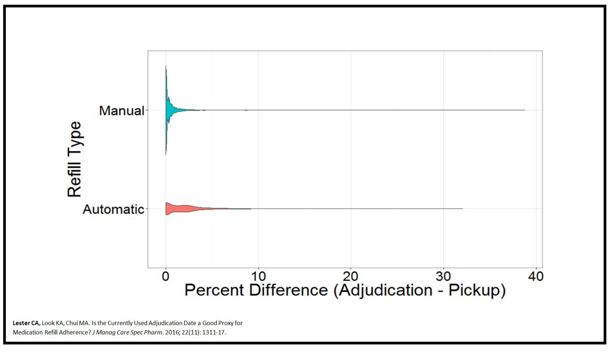


TABLE 2 Multivariate Adjusted Odds Ratios of Being Adherent by Adherence Metric

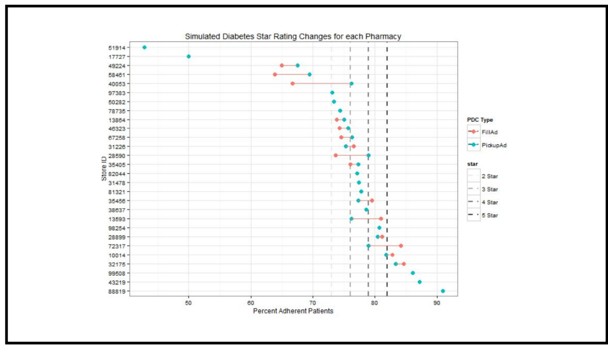
	Statin		RASA		Diabetes	
	Adjusted Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Refill type						
Automatic fill	1.51[a]	1.26-1.82	1.20[b]	1.01-1.42	1.44[b]	1.06-1.95
Gender						
Male	1.09	0.95-1.25	1.04	0.91-1.20	0.98	0.77-1.25
Age	0.99	0.99-1.00	0.99	0.98-1.01	0.98	0.97-1.00
Number of chronic medications	1.03[a]	1.02-1.04	1.00	0.99-1.01	1.05[a]	1.02-1.07

Note: Standard refill and female were reference categories.
[a]$P < 0.001$.
[b]$P < 0.05$.
CI = confidence interval; RASA = renin angiotensin aldosterone system antagonists.

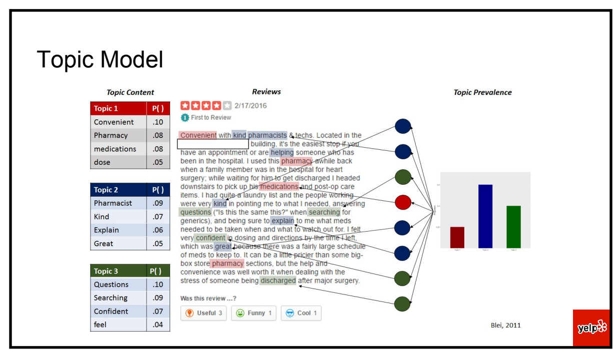
Lester CA, Mott DA, Chui MA. *J Manag Care Spec Pharm*, 2016

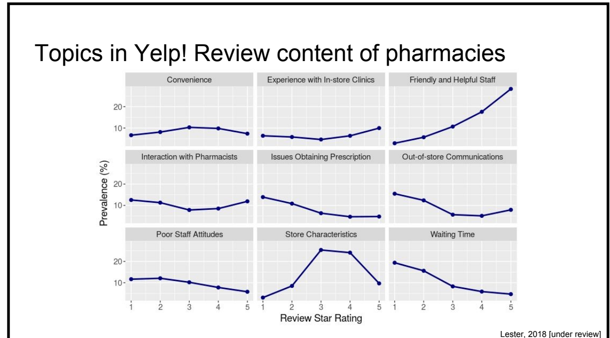


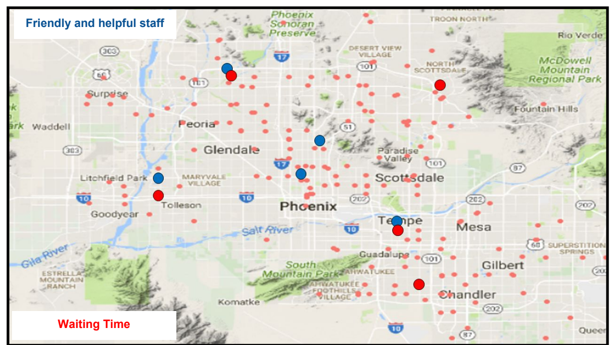
Lester CA, Look KA, Chui MA. Is the Currently Used Adjudication Date a Good Proxy for Medication Refill Adherence? *J Manag Care Spec Pharm*. 2016; 22(11): 1311-17.



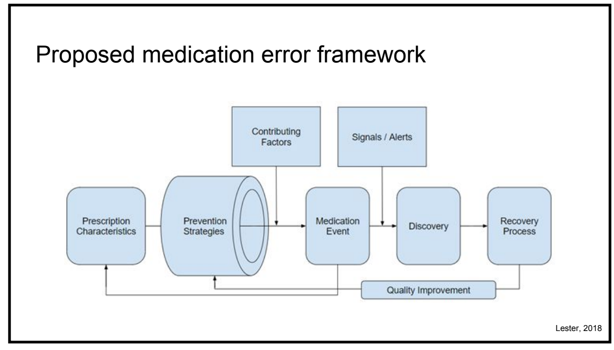
Application in patient experience

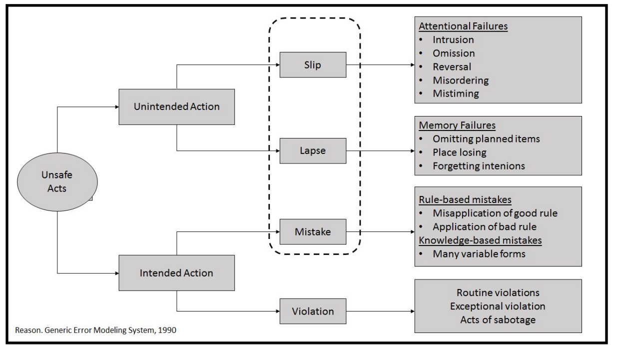




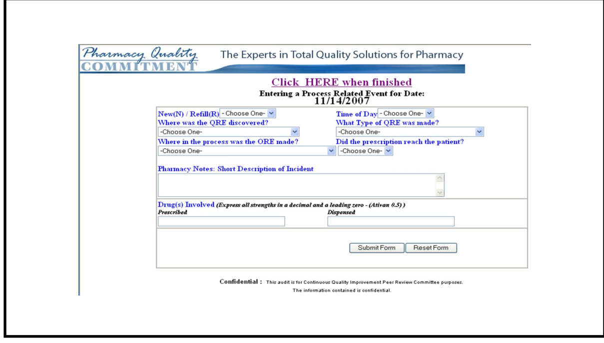


Application in medication errors

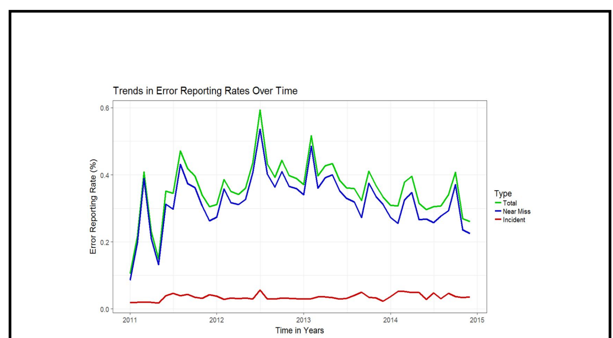




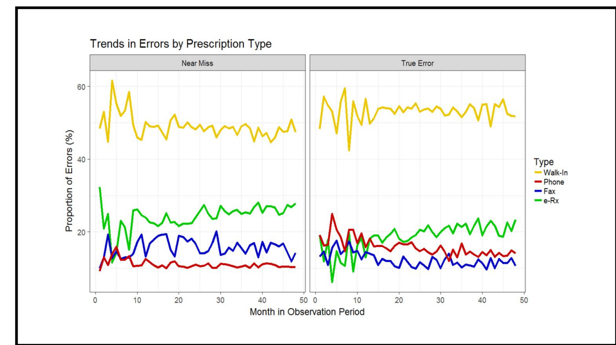
Unsafe Acts
Unintended Action
Intended Action
Slip
Lapse
Mistake
Violation
Attentional Failures
• Intrusion
• Omission
• Reversal
• Misordering
• Mistiming
Memory Failures
• Omitting planned items
• Place losing
• Forgetting intenions
Rule-based mistakes
• Misapplication of good rule
• Application of bad rule
Knowledge-based mistakes
• Many variable forms
Routine violations
Exceptional violation
Acts of sabotage
Reason. Generic Error Modeling System, 1990



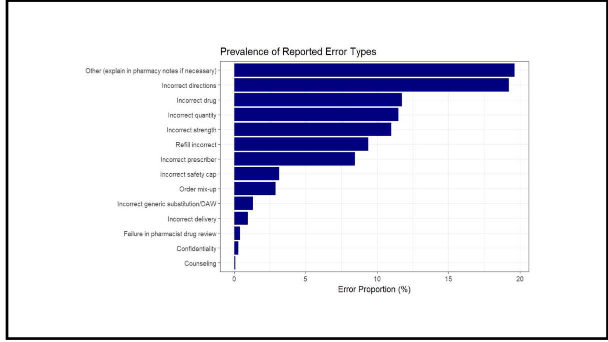
Pharmacy Quality COMMITMENT
The Experts in Total Quality Solutions for Pharmacy
Click HERE when finished
Entering a Process Related Event for Date:
11/14/2007
New(N) / Refill(R)
Time of Day
Where was the QRE discovered?
What Type of QRE was made?
Where in the process was the QRE made?
Did the prescription reach the patient?
Pharmacy Notes: Short Description of Incident
Drug(s) Involved (Express all strengths in a decimal and a leading zero - (Ativan 0.5))
Prescribed
Dispensed
Submit Form
Reset Form
Confidential :



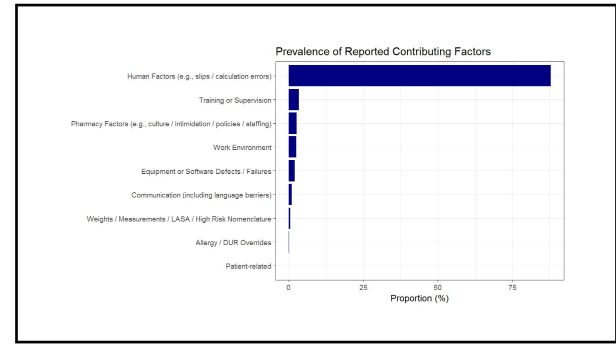
Trends in Error Reporting Rates Over Time
Error Reporting Rate (%)
0.0
0.2
0.4
0.6
2011
2012
2013
2014
2015
Time in Years
Type
Total
Near Miss
Incident



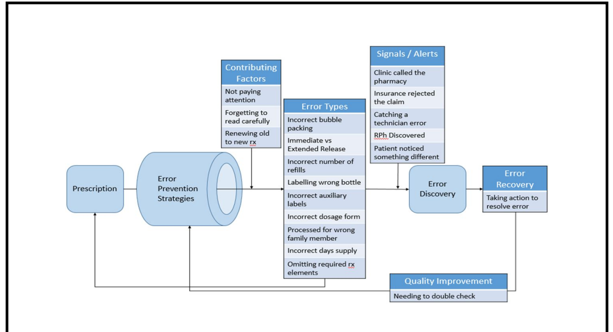
Trends in Errors by Prescription Type
Near Miss
True Error
Proportion of Errors (%)
20
40
60
0
10
20
30
40
50
Month in Observation Period
Type
Walk-In
Phone
Fax
e-Rx



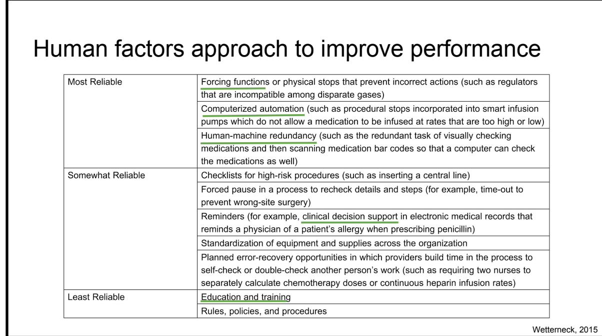
Prevalence of Reported Error Types
Other (explain in pharmacy notes if necessary)
Incorrect directions
Incorrect drug
Incorrect quantity
Incorrect strength
Refill incorrect
Incorrect prescriber
Incorrect safety cap
Order mix-up
Incorrect generic substitution/DAW
Incorrect delivery
Failure in pharmacist drug review
Confidentiality
Counseling
0
5
10
15
20
Error Proportion (%)



Prevalence of Reported Contributing Factors
Human Factors (e.g., slips / calculation errors)
Training or Supervision
Pharmacy Factors (e.g., culture / intimidation / policies / staffing)
Work Environment
Equipment or Software Defects / Failures
Communication (including language barriers)
Weights / Measurements / LASA / High Risk Nomenclature
Allergy / DUR Overrides
Patient-related
0
25
50
75
Proportion (%)



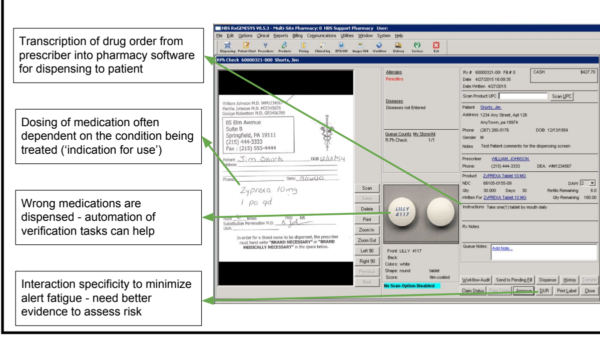
The future of pharmacists' work

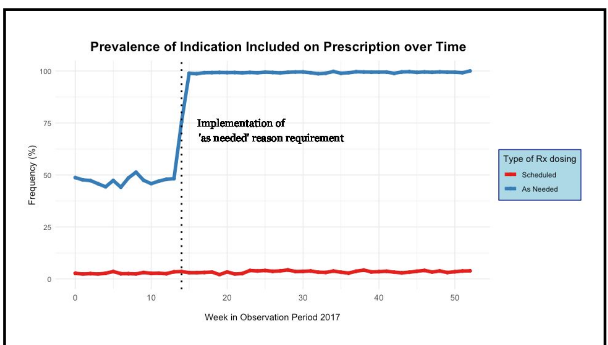


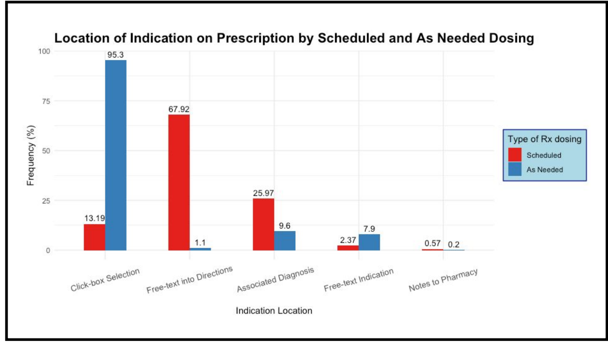
Human factors approach to improve performance

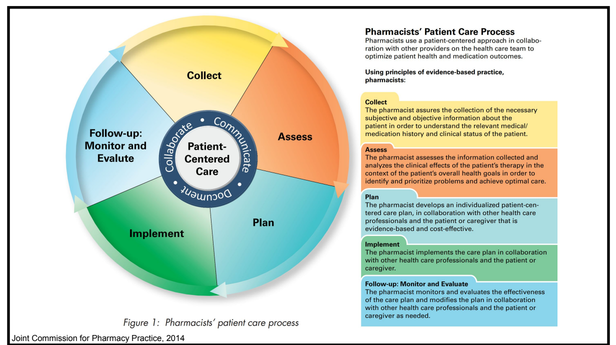
Most Reliable	Forcing functions or physical stops that prevent incorrect actions (such as regulators that are incompatible among disparate gases)
	Computerized automation (such as procedural stops incorporated into smart infusion pumps which do not allow a medication to be infused at rates that are too high or low)
	Human-machine redundancy (such as the redundant task of visually checking medications and then scanning medication bar codes so that a computer can check the medications as well)
Somewhat Reliable	Checklists for high-risk procedures (such as inserting a central line)
	Forced pause in a process to recheck details and steps (for example, time-out to prevent wrong-site surgery)
	Reminders (for example, clinical decision support in electronic medical records that reminds a physician of a patient's allergy when prescribing penicillin)
	Standardization of equipment and supplies across the organization
	Planned error-recovery opportunities in which providers build time in the process to self-check or double-check another person's work (such as requiring two nurses to separately calculate chemotherapy doses or continuous heparin infusion rates)
Least Reliable	Education and training
	Rules, policies, and procedures

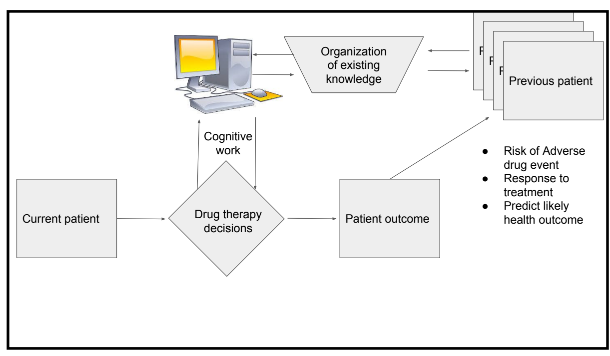
Wetterneck, 2015








Collect
Assess
Plan
Implement
Follow-up: Monitor and Evalute
Patient-Centered Care
Collaborate • Communicate • Document
Pharmacists' Patient Care Process
Pharmacists use a patient-centered approach in collaboration with other providers on the health care team to optimize patient health and medication outcomes.
Using principles of evidence-based practice, pharmacists:
Collect
The pharmacist assures the collection of the necessary subjective and objective information about the patient in order to understand the relevant medical/medication history and clinical status of the patient.
Assess
The pharmacist assesses the information collected and analyzes the clinical effects of the patient's therapy in the context of the patient's overall health goals in order to identify and prioritize problems and achieve optimal care.
Plan
The pharmacist develops an individualized patient-centered care plan, in collaboration with other health care professionals and the patient or caregiver that is evidence-based and cost-effective.
Implement
The pharmacist implements the care plan in collaboration with other health care professionals and the patient or caregiver.
Follow-up: Monitor and Evaluate
The pharmacist monitors and evaluates the effectiveness of the care plan and modifies the plan in collaboration with other health care professionals and the patient or caregiver as needed.
Figure 1: Pharmacists' patient care process
Joint Commission for Pharmacy Practice, 2014


Organization of existing knowledge
Previous patient
Cognitive work
Current patient
Drug therapy decisions
Patient outcome
• Risk of Adverse drug event
• Response to treatment
• Predict likely health outcome

Thank you
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