

Reference Workflow Taxonomy

Workflow	Phase	Task	Action	Sub-action(s)	Actor(s)	Alerts/ Reminders	Order sets	Info Buttons	Data display	Documentation templates
<i>Patient centric</i>										
Outpatient encounter ¹	Intake and Nurse assessment	Check in	Document	1.16 (Access patient demographic data), 7.6 (Document date of birth), 7.9-12 (Document ethnicity, gender, growth chart, height), 7.14 (Document insurance type), 7.25 (Document preferred language), 7.28 (Document race), 7.34(Document smoking status), 7.8(Document encounter)	Registration Clerk	x				x
		Measure, record vital signs	Document	7.40(document vital signs); 7.41(document weight)	Medical Assistant; Nursing	x				x
		Med review	Review	1.10-12(Access medication allergy history, medication history, active medication list)	Medical Assistant; Nursing				x	
		Handoff	Notify	2.2(acknowledge receipt of clinical summary), 19.5(transmit clinical summary), 12.13(receive patient summary allergy record from other providers)	Medical Assistant; Nursing; Physician		x			x
	Clinician* assessment	Review charts	Review	1.1-28 (Access - all information in medical record) 17.13 (Review quality measure results)	Physician				x	
		Interview patient	Perform		Physician; Nursing; Medical Assistant	x				x
		Take history	Document	7.1(Document a progress note for each encounter)	Physician; Nursing; Medical Assistant					x
		Diagnose and plan	Perform		Physician			x		x
		Review prior test results		17.1-2(review all information for a lab test report, clinical lab tests received with LOINC codes)						x
		Order lab test	Order	10.4(order lab study)	Physician	x	x	x	x	x

¹ (1) Textbook: Fundamentals of clinical practice (2nd Edition) by Mark B. Mengel, Warren L. Holleman and Scott A. Fields, 2002; (2) Apply direct observation to model workflow and assess adoption, Kim M. Unertl BS et al., AMIA 2006.

* Douglas Bell: Note, we use "clinician" to mean any practitioner authorized to create orders: MD, DO, NP, PA, etc.

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Patient centric										
Outpatient encounter ¹ (continued)	Clinician* assessment (continued)	Prescribe	Order	10.1(Order medication), 10.5-7 (Order medication generic-, new), 19.6 (transmit prescription)	Physician	x	x	x	x	x
		Make a referral	Order	10.10 (Order provider referral)	Physician		x			x
		Treatment	Perform		Physician; Nursing					
		Patient counseling	Perform		Physician; Nursing	x				x
	Check out	Give out instructions	Document	2.1(Acknowledge education receipt)	Medical Assistant; Nursing	x			x	x
		Schedule next appointment	Create	15.1-2 (Remind patient per patient preference for follow-up, preventive care)	Registration Clerk					
Emergency room encounter	Patient arrival for emergency care (High intensity care)**	Inform ambulance	Notify	12.13(Receive patient summary record from other providers), 2.2(Acknowledge receipt of clinical summary), 19.5(Transmit clinical summary)	Nursing					x
		Measure, record vital signs	Document	7.40(document vital signs); 7.41(document weight)	EMS paramedics	x				x
		Handoff	Document	7.1(Document a progress note for each encounter)	Nursing		x			x
		Interview patient	Perform		Physician; Nursing	x				x
		Take history	Document	7.1(Document a progress note for each encounter)	Physician					x
	Patient arrival for unscheduled urgent care / Safety net care (Low intensity care)	Interview patient	Perform		Physician; Nursing	x				x

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** Seriously ill and injured pts; referral of pts with emergency

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Patient centric										
Emergency room encounter (continued)	Patient arrival for unscheduled urgent care / Safety net care (Low intensity care) (continued)	Take history	Document	7.1(Document a progress note for each encounter)	Physician					x
		Referral	Order	10.10(Order provider referral)	Physician		x			x
		Document transfer	Transmit	12.13(Receive patient summary record from other providers), 2.2(Acknowledge receipt of clinical summary), 19.5(Transmit clinical summary)	Nursing; Medical Assistant					
	ED treatment (Clinician assessment)	Review of referral	Review	2.2(Acknowledge receipt of clinical summary)	Physician; Nursing	x			x	x
		Order lab tests	Order	10.4(Order lab study), 10.2(diagnostic imaging procedure), 10.8(procedure), 12.2(Receive clinical lab test result), 17.2(Review clinical lab tests received with LOINC codes), 20.13(Update patients record based on lab test result)	Physician	x	x	x	x	x
		Diagnosis	Document	7.1(Document a progress note for each encounter)	Physician					
		Prescribe	Review, Order	10.5-7(Order medication), 13.1(Recommend care modifications based on clinical decision support rules), 19.6 (Transmit electronic permissible medication order (prescription))	Physician	x	x	x	x	x

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Patient centric										
Emergency room encounter (continued)	Patient disposition (Medical assistant)	Disposition patients	Perform	9.1-2(Notify patients for follow-up care and preventive care), 10.10(Order provider referral)	Nursing; Medical Assistant		x			x
(Ambulatory) surgical procedure ²	Pre-operative phase	Registration	Document	1.16(Access patient demographic data), 7.6(Document date of birth), 7.9-12(Document ethnicity, gender, growth chart), 7.14(Document insurance type), 7.25(Document preferred language), 7.28(Document race), 7.34(Document smoking status)	Registration Clerk					x
		Measure, record vital signs	Document	7.40(Document vital signs); 7.41(Document weight)	Medical Assistant; Nursing	x			x	x
		Match patient to procedure	Perform		Medical Assistant; Nursing; Physician					
		Nursing preop assessment/exam	Order, Perform		Nursing; Medical Assistant	x			x	x
		Premedication	Order	10.5-7(Order medication), 13.1(Recommend care modications based on clinical decision support rules), 17.9(Review education provided)	Physician	x	x	x	x	x
		Transport to OR area	Notify		Nursing; Medical Assistant					
		Handoff	Notify	2.2(Acknowledge receipt of clinical summary), 19.5(Transmit clinical summary), 12.13(receive patient summary allergy record from other providers)	Nursing; Medical Assistant		x			x

²Surgical workflow: Clinical expectations to the research field, Leonard Berliner,TIBM 2009 VL Surgical Workflow

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Patient centric										
(Ambulatory) surgical procedure ² (continued)	Operating room phase (Surgeon, anesthesiologist, nurses)	Set up instruments & devices	Perform							
		Identify patient	Acknowledge							
		Anesthesia procedures	Perform							
		Operate	Perform							
		Create surgical record	Create	7.1(Document a progress note for each encounter)	Physician	x		x	x	x
		Write orders	Order	10.1-10(Order--all types)	Physician	x	x	x	x	x
		Handoff	Notify	12.13(Receive patient summary record from other providers), 2.2(Acknowledge receipt of clinical summary), 19.5(Transmit clinical summary)	Nursing; Medical Assistant		x			x
	Postop Period (Medical assistant)	Transport to recovery area	Notify							
		Post-op labs/tests	Order	10.4(Order lab study), 10.8(Order order set), 10.9(Order procedure)		x			x	
		Pain management	Perform			x	x	x	x	x
		Discharge from recovery area	Create	9.1-2(Notify patient for follow-up care and preventive care), 10.10(Order provider referral), 2.1(Acknowledge education receipt)	Medical Assistant; Nursing; Physician					
Inpatient hospitalization ³	Admit (Nurse assessment)	Measure, record vital signs	Document	7.40(Document vital signs), 7.41(Document weight)	Medical Assistant; Nursing	x			x	x
		Transport the patient	Notify							

²Surgical workflow: Clinical expectations to the research field, Leonard Berliner, TIBM 2009 VL Surgical Workflow

³ An ontological knowledge framework for adaptive medical workflow, Jiangbo Dang et al., Journal of biomedical informatics 41 (2008) 829-836

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Patient centric										
Inpatient hospitalization ³ (continued)	Admit (Nurse assessment) (continued)	Handoff	Notify	12.13(Receive patient summary record from other providers), 2.2(Acknowledge receipt of clinical summary), 19.5(Transmit clinical summary)	Medical Assistant; Nursing; Physician		x			x
	Detect & Treat	History / Physical	Review	1.1-28(Access--all information in medical record)	Physician	x			x	x
		Interview patient	Perform							
		Take history	Document	7.1(Document a progress note for each encounter)	Physician; Nursing; Medical Assistant				x	x
		Order lab tests	Order	10.4(Order lab study)	Physician					
		Imaging	Order	10.2(Order diagnostic imaging procedure)	Physician	x			x	x
		Review results	Review	2.3(Acknowledge receipt of diagnostic test results from other providers), 12.2(Receive clinical lab test result), 17.11-12(Review lab results electronically in human readable format, incorporated as codified data)	Physician; Nursing					
		Diagnose	Perform							
		Prescribe	Review, Order	10.5-7(Order medication, as generic, new medication), 13.1(Recommend care modifications based on clinical decision support rules)	Physician	x	x	x	x	x
		Treat	Perform							
		Administer medication	Perform							
		Handoff	Notify	12.13(Receive patient summary record from other providers), 2.2(Acknowledge receipt of clinical summary), 19.5(Transmit clinical summary)	Medical Assistant; Nursing; Physician		x			x

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<i>Patient centric</i>										
Inpatient hospitalization ³ (continued)	Transfer (Medical assistant)	Transfer to ICU or higher care unit	Notify							
		Handoff	Notify	12.13(Receive patient summary record from other providers), 2.2(Acknowledge receipt of clinical summary), 19.5(Transmit clinical summary)	Medical Assistant; Nursing; Physician		x			x
	Discharge (medical assistant)	Give out discharge instructions	Create	2.1(Acknowledge education receipt), 9.1-2(Notify patients for follow-up care and preventive care)	Medical Assistant; Nursing					
		Transport the patient	Notify							
Inpatient surgical procedure	See ambulatory surgical procedure									

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Workflow	Phase	Task	Action	Sub-action(s)	Actor(s)	Alerts/ Reminders	Order sets	Info Buttons	Data display	Documentation templates
<i>Message centric</i>										
Patient request for appointment		Check patient eligibility	Review	1.16 (Access patient demographic data), 17.3 (Review display of patients' insurance eligibility)	Registration Clerk	x				
		Order pre-visit tests	Order	10.4(order lab study)	Physician	x	x			
		Make appointment	Perform		Registration Clerk					
		Refer patient to another provider	Order	10.10 (Order provider referral)	Physician		x			
		Refer to telephone consultation or secure messaging	Perform		Physician, nursing					
Emergency room information flow ⁶		Notify ED of Incoming arrival	Notify		EMS Paramedics					
		Transfers notes onto ambulance run sheet	Create	7.1(Document a progress note on each encounter)	Nurse					
		Verbally reports case to ER	Notify		EMS Paramedics					
		Quick registration and verify patient identity	Create	7.8(Document encounter)	Nurse					x
		Writes report	Create	7.40(document vital signs); 7.41(document weight)	EMS Paramedics					
		Transfer report to ER providers	Transmit	19.5(Transmit clinical summary)	EMS Paramedics					
Pharmacy message handling, patient request for renewal	Intake	Take message	Perform		Registration Clerk					

⁶ Improving access to clinical information in an Emergency Department: a Qualitative Study, Boonchai Kijsanayotin and et al.

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Message centric										
Pharmacy message handling, patient request for renewal (continued)	Intake (continued)	Check Rx	Review	1.10-14(Access medication allergy history over multiple visit, history over multiple visits, active medication list and supplements, medication order, non-medication allergy history over multiple visits), 10.10(Order provider referral), 20.4-11(Update medication allergy, medication list, medication order,non-medication allergy, order for medication), 17.3-9(Review display of patients' insurance eligibility, received clinical lab test results for user interface, changes in diastolic blood pressure/height/ systolic blood pressure/weight, education provided)	Nursing; Medical Assistant	x		x	x	
		Check formulary	Review	17.10(Review electronically formulary or preferred drug list)	Nursing; Medical Assistant	x			x	
		Prior authorization Check	Review	19.10-13(Transmit insurance eligibility check to private/public payers, eligibility queries to private/public payers)	Physician	x			x	
	Routing to prescriber	Check DDI	Review	3.2(Alert for drug-drug contraindications(real time))	Nursing; Physician	x			x	
		Change medication	Create	10.1(Order(prescribe) medication), 10.5-7(Order medication as generic, new medication), 20.6(Update medication list)	Physician	x	x	x	x	x
		Change instruction	Document	7.1(Document a progress note for each encounter)	Nursing				x	x
		Obtain prior authorization	Receive	12.8-9(Receive insurance eligibility check electronically from private payers/public payers)	Nursing; Medical Assistant					x

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Message centric										
Pharmacy message handling, patient request for renewal (continued)	Routing back	Contact pharmacy	Notify	19.6(Transmit electronic permissible medication order(prescription))						x
		Contact patient	Notify	9.1-2(Notify patients for follow-up care and preventive care)	Medical Assistant, Nursing, Physician					x
		Transmit prescription	Transmit	19.18-24(Transmit to other provider diagnostic test results/immunizations/ medication allergy list/medication list/ problem list/procedures performed, transmit to patient summary record from other providers)	Physician, Nursing					x
Messaging with other clinicians		Msg. intake or outreach to other clinician	Transmit	19.18-24(Transmit to other provider diagnostic test results/immunizations/ medication allergy list/medication list/ problem list/procedures performed, transmit to patient summary record from other providers)	Physician, Nursing				x	x
		Negotiate on patient's case	Perform		Physician, Nursing				x	x
		Make an agreement	Document	7.1(Document a progress note for each encounter)	Physician, Nursing				x	x
Preop phase of surgery		Remind patient of surgery beforehand	Remind	9.1-2(Notify patients for follow-up care and preventive care)	Physician, Nursing				x	x

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<i>Message centric</i>										
Pre-op phase of surgery (continued)		Contact nursing group	Notify	19.18-24(Transmit to other provider diagnostic test results/immunizations/ medication allergy list/medication list/ problem list/procedures performed, transmit to patient summary record from other providers)	Physician, Nursing				x	x
		Contact anesthesia group	Notify	19.18-24(Transmit to other provider diagnostic test results/immunizations/ medication allergy list/medication list/ problem list/procedures performed, transmit to patient summary record from other providers)	Physician, Nursing				x	x
		Confirmatory phone call	Notify	19.18-24(Transmit to other provider diagnostic test results/immunizations/ medication allergy list/medication list/ problem list/procedures performed, transmit to patient summary record from other providers)	Physician, Nursing				x	x
		Contact Surgeon	Notify	19.18-24(Transmit to other provider diagnostic test results/immunizations/ medication allergy list/medication list/ problem list/procedures performed, transmit to patient summary record from other providers)	Physician, Nursing				x	x
Scheduling procedures	Schedule an appointment/ surgery	Answer phone call from pt	Perform		Nursing, Medical Assistant				x	x
		Check available slot	Review		Registration Clerk				x	x
		Confirm with pt	Create	9.1-2(Notify patients for follow-up care and preventive care)	Registration Clerk				x	x

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<i>Message centric</i>										
Scheduling procedures (continued)	Schedule an appointment/surgery (continued)	Remind before schedule	Remind	9.1-2(Notify patients for follow-up care and preventive care)	Registration Clerk				x	x
	Schedule staff	Review historical patient visits	Review							
		Check staff's availability	Review							
		Assign time schedule	Document							

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Population management										
Clinician review of feedback report		Review report	Review	17.5-13(Review displayed changes in diastolic blood pressure, height, systolic blood pressure, weight, education provided, electronically formulary or preferred drug list, lab results electronically in human readable format, lab results incorporated as codified data, quality measure results)	Physician, Nursing, Medical Assistant	x		x	x	x
		Track	Review		Physician, Nursing, Medical Assistant	x		x	x	x
		Analyze & Stratify	Perform	18.1-5(Stratify notifications by patient preference, patients by condition, reports by demographic information, by provider type, by provider role)	Physician, Nursing, Medical Assistant	x		x	x	x
		Report	Report	17.13(Review quality measure results)	Physician, Nursing, Medical Assistant	x		x	x	x
		Alert	Alert	13.1(Recommend care modifications based on clinical decision support rules)	Physician, Nursing, Medical Assistant	x			x	x
		Educate patients	Recommend		Physician, Nursing, Medical Assistant	x		x	x	x
		Follow up	Notify	9.1-2(Notify patients for follow-up care and preventive care)	Physician, Nursing, Medical Assistant					x
		Contact patient (may include order, ask patient to come in for appointment)	Perform		Physician, Nursing, Medical Assistant					x
Case management session ⁷	Case finding	Review report to identify potential eligible people	Review	17.13(Review quality measure results)	Physician, Nursing, Medical Assistant		x			

⁷ Case management in health care, Health and Social work, 13:3(1988: Summer) p.219, Loomis, James F.

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Population management										
Case management session ⁷ (continued)	Case finding (continued)	Screen	Perform		Physician, Nursing, Medical Assistant					
		Registration	Document	7.26(Document problem on problem list)	Physician, Nursing, Medical Assistant					x
	Assessment	Interview clients	Perform		Physician, Nursing, Medical Assistant					
		Determine needs	Document	7.24(Document performance result)	Physician, Nursing, Medical Assistant					x
	Goal setting and service planning	Collaborative decision making with patients	Document	7.22(Document patient preference)	Physician, Nursing, Medical Assistant					x
		Expert consultation support	Transmit	19.5(Transmit clinical summary)	Physician, Nursing, Medical Assistant					
		Guidelines institutionalization and prompts	Perform	7.2(Document advanced directive), 7.3(Document alert provided to clients)	Physician, Nursing, Medical Assistant					x
		Provider Education	Perform		Physician, Nursing, Medical Assistant					
	Care plan implementation	Educate patient	Perform		Physician, Nursing, Medical Assistant					
		Patient activation/ psychological support	Perform		Physician, Nursing, Medical Assistant					
		Guidelines available to patients	Notify	9.1-2(Notify patients for follow-up care and preventive care)	Physician, Nursing, Medical Assistant				x	x

⁷ Case management in health care, Health and Social work, 13:3(1988: Summer) p.219, Loomis, James F.

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Population management										
Case management session ⁷ (continued)	Care plan implementation (continued)	Implement the plans	Remind	15.1-2(Remind patients per patient preference for follow-up care and preventive care)	Physician, Nursing, Medical Assistant	x			x	
	Monitoring and evaluation	Reviewing services delivered	Review	17.9(Review education provided) 17.13(Review quality measure results)	Physician, Nursing, Medical Assistant				x	
		Feedback of performance data	Review	17.5-13(Review displayed changes in diastolic blood pressure, height, systolic blood pressure, weight, education provided, electronically formulary or preferred drug list, lab results electronically in human readable format, lab results incorporated as codified data, quality measure results)	Physician, Nursing, Medical Assistant	x		x	x	x

⁷ Case management in health care, Health and Social work, 13:3(1988: Summer) p.219, Loomis, James F.