



In Search of Common Ground in Handoff Documentation in an Intensive Care Unit

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Introduction

- Handoff
 - Frequent
 - Multiple points for potential communication break-down
 - Multiple disciplines
- Purpose of the handoff
 - To establish common ground
 - Conversations
 - Shared handoff documentation tools

Dayton, E, Henriksen, K. Communication failure: basic components, contributing factors, and the call for structure. Joint Commission Journal of Quality and Patient Safety 2007; 33:34-47

Horwitz, LI, Moin, T, Krumholz, HM, et al. What are covering doctors told about their patients? Analysis of sign-out among internal medicine house staff. Quality & Safety in Health Care 2009; 18:248-55

Problem

- Handoff in critical care
 - Intra-disciplinary process...but...critical information flow spans
 - Multiple disciplines and handoff documentation tools/artifacts
(Benham-Hutchins, 2010)
 - Information complexity increases potential for communication breakdown and errors
- Proposed solutions within literature
 - Standardization
 - Unclear definition for handoff
 - Computer-based tools to support collaborative work
 - Should embed functionalities and infrastructure of paper they replaced (Xiao, 2005)
 - Standards based

Aim

- To understand the structure, functionality, and content of nurses' and physicians' ICU handoff artifacts to inform development of standards-based EHR handoff tools

Interdisciplinary Handoff Information Coding (IHIC) framework

- IHIC coding framework
 - Systematic Review of 36 nurse and physician handoff studies
 - 95 handoff information elements categorized in lists:
 - Interdisciplinary (46%)
 - Nursing (36%)
 - Physician (18%)
 - Continuity of Care Document (CCD) standard
 - Covered 80% of elements
 - Remaining 20% - we developed “Hospital Handoff” Sections

Collins, SA, Stein, DM, Vawdrey, DK, et al. Content overlap in nurse and physician handoff artifacts and the potential role of electronic health records: A systematic review. Journal of Biomedical Informatics 2011

IHIC Code Examples

CCD Section	Nurse only data	Physician only data	Interdisciplinary data
Functional Status	<ul style="list-style-type: none"> • Neurological status • Cardiovascular status • Respiratory status • Gastrointestinal status • Skin integrity • Activities of Daily Living 	<ul style="list-style-type: none"> • Physical exam findings • Baseline status 	<ul style="list-style-type: none"> • Patient's condition • Plan of care trend • Specialty specific key physiologic parameters (e.g., critical care measurements, sepsis status, APACHE risk scale)

Methods

- Setting
 - 21 bed Cardiothoracic Intensive Care Unit (CTICU)
 - Large urban medical center
 - Used EHR for clinical documentation, not for handoff
- Data Collection
 - Observations
 - Handoff artifacts used by nurses, resident physicians and physician assistants' (PAs)
 - Purposive sampling – maximize variability by patient type/clinical status
- Data Analysis - two-steps
 - Artifact analysis (Nemeth 2005; Nemeth 2004; Hutchins 1995)
 - Structure and function
 - Semantic coding using IHIC
 - Inter-coder reliability with physician informatician (30% of artifacts)

Results

- Observed a total of 9 changes of shifts
- 22 artifacts collected
 - 6 nurse admission Kardex
 - 8 nurse personal handoff sheets
 - 8 resident/PA handoff print-outs

Nurse Kardex

Events during surgery: Time spent on bypass, medications and blood products given, complications and necessary interventions

Date and type of surgery; surgeon and cardiologist

Allergies and reactions

Past medical/surgical history

Test result after surgery

Medications prior to surgery

Lines and invasive devices; date of insertion

Family contact information, advance directive, and code status

Cardiothoracic ICU Nurses' admission "Kardex" used during handoff

Date: [redacted] **AICD EXPLANT SURGERY S/P OHT & LVAD-Duraheart EXPLANT** SURGEON: [redacted] CARDIOLOGIST: [redacted]

ALLERGIES	MEDICATION/REACTION	X-CLAMP TIME	CPB TIME	ISCHEMIC TIME	CIRC. ARREST TIME	ISOLATION PRECAUTION				
<input type="checkbox"/> NKDA <input checked="" type="checkbox"/> YES	? HIT tape.	1° 23"	2° 09"	2° 16"		Date	Site	Org.		
HPI: SYMPTOMS - ONSET - DURATION / PMI		Hi	Wt	Pre-op immunosuppression	Steroid dose/time					
40 y/o M, NIDDM, EF 12-20%, NYHA class IV CHF, s/p Duraheart LVAD, Polyastatic kidney disease, acute chronic A-fib, s/p PPM/AICD, recurrent problems & PRC hist, recurrent UTI. S/p OHT.		180cm	106kg	Methylenediamine 600mg @ 1254 pm						
TEE Post: op LVEF >55%, Nrmal LV, Mildly dilated RV, A dissection.		TRANSFUSIONS	PRBCs		Units	FFPs	Units			
		Platelets	12 Units	NSS	750ml	LRS	1500ml	Hexend	ml	
		Cell Saver	360 ml	Albumin	ml	Cryo	-10units	FENTANYL	-1250mcg	
						40-430ml	Midazolam	10mg	Hydroxyzine	3mg
		OR COMPLICATIONS	INTERVENTIONS							
		① IS Cordis placement	- difficulty passing dilator. site Abandoned and went 1cm proximal. - oozing blood products given.							
		Hct =	CO/CI =	CVP =	PAP =	K+ =	Cr =	IT =		
		Pre incision antibiotic/time last given:	TEE RESULT: EF %							
PRE-OP MEDS: Bacrim DS, Nexium, Coumadin, Lisinopril, Aspirin, Allopurinol, Amiodaron, Cytalopram, and Digoxin.		CTICU MANAGEMENT								
Arrived from OR @ [redacted] on Levo 6mg/ASO 4, Epi 4mcg, Milrinone 0.375mcg, Insulin 6units, Propofol 25mcg, and Precedex 0.7mcg.		- Bleeding from ① IS cordis site. Suture placed.								
		- 1 liter Albumin given								
		- 4 PRBC given								
		- 500Ks given								
		- Acidotic. - BE -12 given fluid as Above.								
INVASIVE LINES		IN	OUT	Procedures	Date	Tests	Date			
Swan @ 58cu				Reintubation		EEG				
Cordis ① IS				Trache		CTScan				
IABP				Duotube		TEE				
Pacing Wires A/V				PEG		TTE				
Chest Tubes x4				PICC		Bronch				
Pens @ wrist						MRI				
Foley @ A/P						Doppler				
Arterial Line (Dred)										
FAMILY INFORMATION:		INTUBATION # 8 - 22cm						Patient name, MRN, date of birth, date of admission, attending physician		
EMERGENCY CONTACT #: [redacted] - Mother		<input type="checkbox"/> Easy <input type="checkbox"/> Hard <input type="checkbox"/> Fiberoptic								
ADVANCE DIRECTIVE <input type="checkbox"/> HCP <input type="checkbox"/> LIVING WILL		Date Extubated: [redacted]								
NAME OF HCP: Cell: [redacted]		PRIMARY RN: [redacted]								
HCP's Phone # [redacted] - Wife		ASSOCIATE RN:								
CODE STATUS: <input type="checkbox"/> FULL CODE <input type="checkbox"/> DNR Cell [redacted]										

Date 11. off. Subsequent Wounds; Propofol to assist for nausea status. Attempts to open eyes. Abandoned pt on Othra. Precedex drip. AC & rate to B according to Abi results. W/d to 20 mcph. VAS cath placed to @ femoral. CVH started & diaphragm flow rate at 180ml. Graft May maintenance. PRBC 2units; FFP 2 units given for L&A MAP; Hct 25.3 Family updated on status.

Date NIGHTS
CVH goal net even. pt net @ 71.71
↓ in flows @ A MAP 130's - pt grimacing & eye opening
↓ sedation restarted fentanyl @ 50mcg commands of withdrawal from pain
• propofol @ 25mcg
• pt loose scheduled for chest closure

Date 7A-11A back to OR for chest closure, no events, Pts 12u given, no other products. New Lt Pleural CT. Fluorocath tube 18+ rifampin 600 @ 8:30AM. 4ADS @ same RPM + flows. P ECHO trace TR, trace HR, @ PI, @ AI.

Date NIGHTS
PRBC x1 platelets x1
Blue port vasovath flushing - TPA x2
CVH off @ 8p - 5A restarted
↓ fentanyl @ 25mcg
echo done

Date -day
- CT head - partial infarct - 1 unit RBC's - ENT + Frank
- Echo done - Albumin x1 - L side cath
- 2 ECG on - Echo done - Plunkie ur. mch. subseq

Back of nurses' admission "Kardex":
Updates of significant events written by each nurse at end of shift

Intubation; Primary nurse

Patient's clinical state on admission to CTICU from surgery, may include update within hours

Nurse Personal Handoff Sheet

Laboratory results Hourly fluid output Blood glucose every 2 hours, and insulin infusion adjustments

- Date and type of surgery
- Allergies and past medical/surgical history
- Body systems assessment:
 - Neurological status
 - Respiratory status
 - Cardiovascular status
 - Gastrointestinal status
 - Genitourinary status
 - Skin integrity
- Intravenous drips:
 - Type of medication, dose, and concentration
- Plan
- Lines and invasive devices
- Significant events: assessments, interventions, and evaluations
- Test result

Patient identifying information and attending physician name

LABORATORY RESULTS:
 Na 128, K 4.5, Cl 91, CO2 22, BUN 45, Creat 2.6, Ca 7, IonCa 1.16, Mg 2.3, PO4 3.5, PT 16.3, PTT 48.1, WBC 13.3, Hgb 6.1, Hct 25%, Plt 176, D/La
 pH 7.40, PCO2 33, PO2 194, RR -2, HCO3 22, SaO2 94%
 SvO2 87%
 Urinary Output: 8, 9, 10, 11, 12, 1, 2, 3, 4, 5, 6, 7, 8, 9
 Flow 52, 48, 5
 SPEED 60, 80, 100, 120, 140, 160, 180, 200, 220, 240, 260, 280, 300, 320, 340, 360, 380, 400, 420, 440, 460, 480, 500
 PE 11.4, 11.5, 11.6, 11.7, 11.8, 11.9, 12.0, 12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7, 12.8, 12.9, 13.0, 13.1, 13.2, 13.3, 13.4, 13.5, 13.6, 13.7, 13.8, 13.9, 14.0, 14.1, 14.2, 14.3, 14.4, 14.5, 14.6, 14.7, 14.8, 14.9, 15.0
 PP 63, 62, 61, 60, 59, 58, 57, 56, 55, 54, 53, 52, 51, 50, 49, 48, 47, 46, 45, 44, 43, 42, 41, 40, 39, 38, 37, 36, 35, 34, 33, 32, 31, 30, 29, 28, 27, 26, 25, 24, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0

INTRAVENOUS Drips:
 > Levophed 0.5 mcg/min (8mg/D250)
 > Phenopresin 2 u/hr (100u/NS100)
 > Albuterol 2.5 mcg/min (2mg/D250) x 2pm
 > Mirinone 0.25 mcg/kg/min (20mg/D100)
 > Dobutamine 5 mcg/kg/min (250mg/D250)
 > Dopamine 5 mcg/kg/min (400mg/D250)
 > Precedex 1 mcg/kg/hr (400mcg/NS100)
 > Propofol 1 mcg/kg/min (1g/100)
 > Pentanoyl 100 mcg/hr (2mg/NS100)
 > Versed 1 mg/hr (100mg/D100)
 > Insulin 1 u/hr (100u/NS100) [20U]
 > Amiodarone 0.5 mg/min (450mg/D250)
 > Lasix 7.5mg

Lines and Invasive Devices:
 A-Line: Rad
 Swan/Cordis: IJ (50cm)
 Chest Tubes:
 TIC:
 PIV:
 Vas Cath:
 IABP:
 PICC:

Significant Events:
 -> wearing INO from S to 0.5 but Δ hematocrit still 20% → 25%
 -> MI #1NO 1 (hr early, +MAP, ↑PAP, ↓CVP)
 Intermittent diff @ 2pm → ↑INO 5 ppm @ 2pm
 Low OFF → ↑Vaso 2 (↑virginia 0.5 to 2.5) → 2.5
 -> Lasix 7.5mg
 -> TIE → EP 40-60%, LV size not a mild LVH
 -> TIE size → 4 PV FX

Test Result:
 TIE → EP 40-60%, LV size not a mild LVH
 -> TIE size → 4 PV FX

Front and back of nurse's personal handoff sheet

Hospital course

■ Admission Day 0 → back to OR for reentry
 ■ TEE & PV FX
 A. Fluor Rate 130-170 bpm → Monitor + Anti-coagulations per
 Agitation → A. Keenid

Hourly events

20:30 → 20:30 → 20:30 → 20:30
 19:00 → 4PM 9:20 → 10:00 → 10:00 → 10:00
 ↑ Lasix 10mg/hr as per MD
 ↓ Vaso 1
 OFF Vaso
 2940 Divil 500mg ✓ Chlorzoxazole 500mg ✓ Zogan 4.5g ✓ Sildenafil 25mg
 Labs Spmt
 MV reflecte EPI 2, INO 3ppm, K-1.0-2.5
 ↓ PE < 4, PAP < 30, IRBS → 18 interactions
 ↑ Vaso 2
 ↓ Vaso 1
 AM Care
 Vaso OFF
 Saravel 12.5mg

Medication times

HEDS
 Iloprost 8pm ☐ 12 AM ☐ 4AM ☐
 Zogan 12AM ☐
 Butorphanol 12.5mg 3PM ☐
 Sildenafil 25mg 12 AM ☐

Antibiotics
 ID → Zogan 7.5h
 Vaso 7.5h → trough 31 → held today

Tasks and to-dos;
 Assessment of response to medication
 Dignin level ☐
 2 Saravel PE drops to 32
 Lasix 7.5mg
 Vaso 7.5mg

CTICU specific key physiologic parameters/interventions:
 Pulmonary and cardiac pressure monitoring; Ventricular assist device hourly parameters

Resident/PA Handoff Print-out

Patient 1

- Bed number; Patient MRN; patient name; Date and surgical procedure(s); surgeon
- Intravenous infusions
- Lines and invasive devices and date of insertion
- Active/Current problems/Diagnosis
- Past medical/surgical history; Reason for admission
- Events during surgery: Intubation; Test results before and after surgery; Time spent on bypass
- Significant events during shift

Patient 2

- Specialty specific key physiologic parameter

Patient 3

Printout Content:

- Header:** MV repair, closure of PFO Dr. [redacted] s/p Trach Dr. [redacted]
- Current Problem List:**
 - severe MR s/p repair
 - restrictive lung disease 2/2 severe dystyrophibrosis
 - respiratory failure
 - Respiratory alkalosis on ACVC
 - Hyperactive Delirium
 - anxiety
 - HTN
 - vasodilatory shock
- Recent Events:**
 - tolerate vent wean (SIMV) s/p -deat to R94, changed to A/C 400/4/500
 - TM in today's EEG (s/p Dig) -> TTE, tropoinem
 - increasing pressor requirements
 - Levo 1-->8 (MAP 63), Vaso 2
 - increasing tracheal secretions-
- Tasks and to-dos:**
 - f/u blood, urine, sputum cx
 - f/u VTE read
 - f/u troponem
- Significant updates: intravenous infusions:**
 - Levo -> 8
 - Vaso 2
- Significant events and dates:**
 - 10:30 AM
- Plan:**
 - MAP 270
 - Even/240
- Antibiotics:** Insulin 3, norepi 8, amiodarone 0.5
- Lines:** Right IJ Cordis/Swan, Right radial a-line
- Specialty specific key physiologic parameter:** MAP 270

Resident Computer-based handoff, printed and annotated during handoff and throughout shift

Results: Artifact Structure and Functionality

- Highly structured
 - Predefined structure and “norms” for organizing data
- Functionality
 - Consistent use for nurses and residents/PAs
 - Main cognitive adjuncts
 - Discarded after shift
 - Used to copy data into EHR
 - Summarization significant events
 - Highlighted temporal information

Artifact Content – IHIC coding

- 827 data elements on 22 artifacts
 - 52 unique IHIC codes
 - 92% (757/827) elements were interdisciplinary
 - Inter-coder reliability 83%
- Nurse Kardexes
 - 309 elements => 301 interdisciplinary and 8 nursing
- Nurse personal sheets
 - 261 elements => 204 interdisciplinary and 57 nursing
- Resident/PA print-outs
 - 257 elements => 252 interdisciplinary and 5 physician

Interdisciplinary Elements consistently Present in Physician and Nurse Artifacts

- **Antibiotics**
- **Intravenous infusions**
- **Lines and invasive devices**
- **Significant events during last shift/overnight**
- **Specialty specific key physiologic parameters/interventions**
- Clinicians involved in case
- Hospital course/summary/current history
- Past medical/surgical history
- Patient age
- Patient name
- Patient sex
- Patient's hospital MRN
- Plan
- Reason for admission/transfer
- Tasks/To-dos
- Test/procedure results

Mapping to CCD

- CCD sections
 - 70% (573/827) elements
- Hospital Handoff sections developed for IHIC framework
 - 30%(254/827) elements
 - Admission demographics
 - Hospital course
 - Past medical/surgical history
 - Consultations
 - Fluid Balance
 - Education
 - Updates
 - Anticoagulation status

Discussion

- Paper-based handoff artifacts
 - Non-technical, yet sophisticated and structured system
 - Physical location of data was important
 - High degree of interdisciplinary content
 - IHIC coding confirmed mapping to discipline specific lists
- Coordinate work beyond “tasks”
 - Annotations => critical thinking (Gurman, 1998; MacKay, 1999)
 - Nurses circled and annotated electrolyte and blood glucose values
 1. Acknowledgment of the critical value
 2. Unambiguous statement = medication given for that particular critical value
 3. Captured the temporal nuances of patient data
 - e.g. Potassium over-dosing errors

Discussion

- Handoff and interdisciplinary communication highly variable (Dayton, 2007)
 - Common paper structures may be leveraged to better ensure continuity of care and coordination

- Computer-based tools
 - **Further** organize and coordinate work beyond paper-based system
 - Structured narrative
 - Patient-centered
 - Role of paper-printouts and mobile devices

Limitations

- 1 setting – CTICU
- Further work is needed to determine the generalizability

Conclusions

- Management of handoff content
 - Leveraged for patient-centered care
 - Customized for specialty settings
 - Structured narrative (Johnson, 2008)
 - Transitions of care standards from other settings
- Ongoing work
 - Validate IHIC coding in other settings
 - Multidisciplinary rounds
 - Mapping to HL7vMR

Follow-up study: Multidisciplinary Rounds

Standards-Based Observational Tool

Multi-Disciplinary Rounding Tool 5/10/2012

User: Sarah Collins Patricia Dykes **Days in hospital:** **Observation id:** 36

Patient location: Shapiro 8 Shapiro 9 **Days on unit:** **Patient id:**

Notes/Comments:

Time elapsed: 00:00:00

Clinicians Shapiro 8

Plan of care	Read	Discuss	Category	Read	Discuss	Category	Read	Discuss
Patient preferences	<input type="checkbox"/>	<input type="checkbox"/>	Patient information	<input type="checkbox"/>	<input type="checkbox"/>	Pain management	<input type="checkbox"/>	<input type="checkbox"/>
Need for/urgency of review	<input type="checkbox"/>	<input type="checkbox"/>	Problems	<input type="checkbox"/>	<input type="checkbox"/>	Payers	<input type="checkbox"/>	<input type="checkbox"/>
Prognosis	<input type="checkbox"/>	<input type="checkbox"/>	Updates	<input type="checkbox"/>	<input type="checkbox"/>	Support	<input type="checkbox"/>	<input type="checkbox"/>
Rationale of primary team	<input type="checkbox"/>	<input type="checkbox"/>	Functional status	<input type="checkbox"/>	<input type="checkbox"/>	Admission demographics	<input type="checkbox"/>	<input type="checkbox"/>
Plan/Daily goals	<input type="checkbox"/>	<input type="checkbox"/>	Social history	<input type="checkbox"/>	<input type="checkbox"/>	Advance directives	<input type="checkbox"/>	<input type="checkbox"/>
Tasks/to-dos	<input type="checkbox"/>	<input type="checkbox"/>	Consultations	<input type="checkbox"/>	<input type="checkbox"/>	Past medical/surgical history	<input type="checkbox"/>	<input type="checkbox"/>
Pending results and pre-op procedures	<input type="checkbox"/>	<input type="checkbox"/>	Procedures	<input type="checkbox"/>	<input type="checkbox"/>	Hospital course	<input type="checkbox"/>	<input type="checkbox"/>
Discharge planning/disposition	<input type="checkbox"/>	<input type="checkbox"/>	Medications	<input type="checkbox"/>	<input type="checkbox"/>	Orders	<input type="checkbox"/>	<input type="checkbox"/>
Advice/anticipatory guidance	<input type="checkbox"/>	<input type="checkbox"/>	Results	<input type="checkbox"/>	<input type="checkbox"/>	Alerts	<input type="checkbox"/>	<input type="checkbox"/>
Short term concerns/clinical judgements/instincts/comments	<input type="checkbox"/>	<input type="checkbox"/>	Anticoagulation status	<input type="checkbox"/>	<input type="checkbox"/>	Patient vital signs	<input type="checkbox"/>	<input type="checkbox"/>
Goals	<input type="checkbox"/>	<input type="checkbox"/>	Fluid balance	<input type="checkbox"/>	<input type="checkbox"/>	Health care providers	<input type="checkbox"/>	<input type="checkbox"/>
Evaluation	<input type="checkbox"/>	<input type="checkbox"/>	Prophylaxis	<input type="checkbox"/>	<input type="checkbox"/>	Education	<input type="checkbox"/>	<input type="checkbox"/>
			Psychological concerns	<input type="checkbox"/>	<input type="checkbox"/>	Admission information	<input type="checkbox"/>	<input type="checkbox"/>
			Assistive devices/equipment	<input type="checkbox"/>	<input type="checkbox"/>			

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Thank you!

Questions?

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