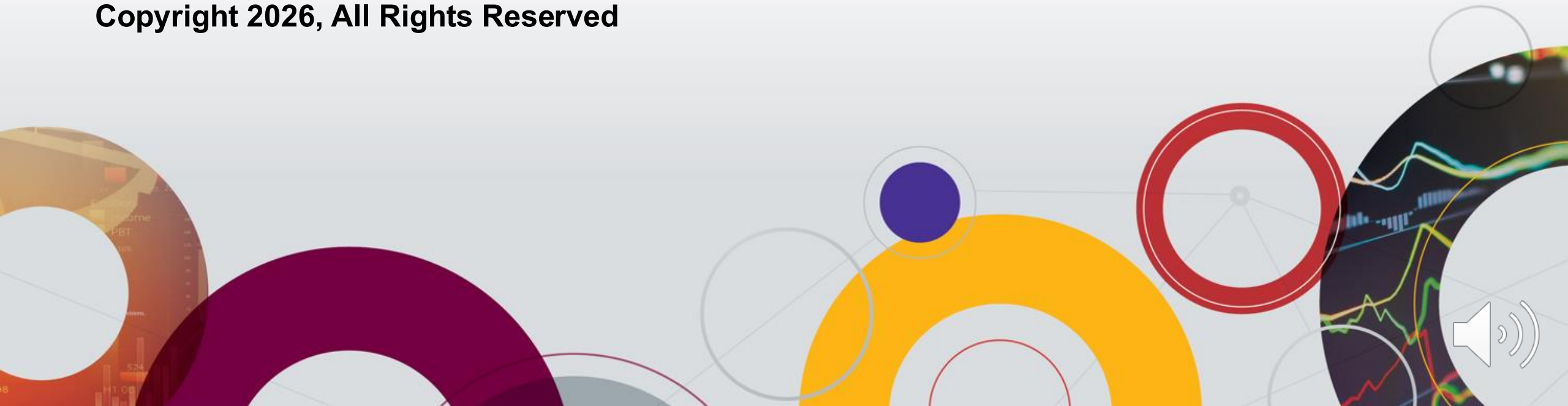


3.4 EHR Data Entry

10x10 – Introduction to Biomedical Informatics & Artificial Intelligence
William Hersh, MD, FACMI, FAMIA, FIAHSI
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Major challenge for paper or electronic records: data entry

Free-form entry

- Writing
- Dictation – also opportunity to engage patient
- Typing

Structured (menu-driven) data entry by mouse, typing, or (in past) pen

Automated speech recognition (ASR) for any of above

Scribes – people who enter data for clinicians

Ambient dictation/scribes – using artificial intelligence (AI) to generate draft notes based on patient-clinician dialogue

Data entry challenges (Toll, 2012; Toll, 2019)



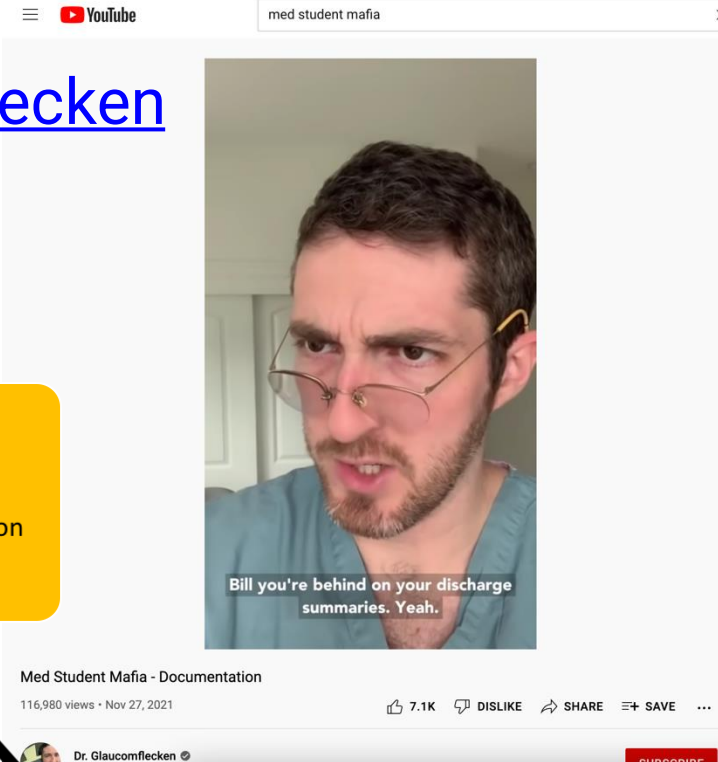
Dr. Glaucomflecken

EHR
Repository/Record of Care
Used during visit: Teaching, Decision Support, Information Review

TEAM
Front Desk, Medical Assistant, Scribe, Pharmacist, Nurse, NP, PA, Physician
ALL trained for team based care

PATIENT
Via Portal

- Updates to Insurance, History, Medical Conditions
- Complete Screenings (Mental Health, Substance Use, Social Determinants)
- Start Visit Agenda



Structured or menu-driven data entry

Many attempts from old (Greenes, 1970; Bell, 1994) to newer (Oceania; OpenSDE – Los, 2005)

Can be done via mouse or pen, with typing

Benefits

- Data codified for easier retrieval and analysis
- Reduces ambiguity if language used consistently

Drawbacks

- In general, more time-consuming
- Requires exhaustive vocabulary
- Requires dedication to use by clinicians

Automated speech recognition (ASR)

Most common use is for narration

- e.g., computer dictation of clinical notes

Improved technology and algorithms have advanced systems over time

Many established systems on the market that operate on front end (synchronously – used by clinician) or back end (asynchronously – process dictations for later editing)

Modern speech recognition systems are improved but still have challenges

- Systems have output lag behind user input, which can be distracting
- Require area with minimum of background noise and where patient privacy can be protected

Evaluation of ASR

Systematic review of all studies to date (Ng, 2025; also includes evaluation of ambient dictation, to be discussed later)

ASR applied in wide variety of settings and specialties

ASR word-error rates varied widely, from 8.7% in controlled dictation settings to over 50% in conversational or multi-speaker scenarios

F1 scores spanned 0.42 to 0.86, reflecting variability in accuracy

Some studies found reductions in documentation time and improved note completeness, but others noted increased editing burdens, inconsistent cost-effectiveness, and persistent errors with specialized terminology or accented speech

Types of errors in ASR (Goss, 2016)

Study of 100 physician notes in emergency department (ED)

- 1.3 errors per note, 14.8% critical
- 71% of notes had 1 or more errors; 15% had critical errors
- Enunciation errors most frequent (54%), followed by deleted words (18%) and added words (12%)

Error type	Description	Example ^a
Annunciation errors	Occurring due to speaker mispronunciation	<i>He will see her on reactive</i> Pupils equal round and reactive
Dictionary errors	Resulting from missing terms	<i>solo bricks</i> Celebrex
Suffix errors	Caused by misrecognition of appropriate tenses of a word	<i>markedly</i> marked
Added words	Word added	8 year old male <i>the</i> history
Deleted words	Word deleted	O2 saturation___percent
Homonym errors	Resulting from substitution of a phonetically identical word	Nares <i>or</i> two days for two days
Spelling errors	Occurred only in human- transcribed notes and not with speech- recognized notes	and <i>get</i> her sugars yet
Nonsense errors	Resulting from words or phrases whose meaning could not be understood by examining the context	<i>Patient up been admitted for stable gait</i>
Critical errors	Were deemed to be “critical” if they could potentially impact patient care	pulse 175, respiration 32, <i>temperature</i> 12.9, room air O2 saturation percent.

^a Actual examples of SR errors identified within this study with the exception of Dictionary and Suffix errors, of which our sample had none.

Other approaches to aid clinicians in data entry

Speech entry of snippets in presence of patients with processing and later editing (Payne, 2018)

- No improvement in timely availability or physician satisfaction (Payne, 2018) but still used effectively by some (Payne, 2023)

Autocomplete with structured concepts as notes typed (Gopinath, 2020)

Use of scribes

Use of another person to record information for clinical note

- Can be done virtually, i.e., virtual scribes
- Opportunity before applying to medical school

Study of 18 primary care physicians over 12 months (Mishra, 2018)

- Presence of scribes associated with
 - Less self-reported after-hours EHR documentation (<1 hour daily during week; <1 hour daily during weekend)
 - Higher likelihood of physician reporting spending >75% of visit interacting with patient and <25% on computer
 - Encounter documentation more likely to be completed by the end of next business day
- 61% of patients reported scribes had positive bearing on visit vs. 2.4% reporting negative bearing

Scribes (cont.)

Scribes associated with lower rate of record closure, i.e., completing records (Florig, 2022)

Patients and clinicians generally satisfied, especially when best practices followed (Ash, 2021)

Remote scribes associated with improvements in physician wellness and reduced EHR use (Micek, 2022)

VA study showed 30% increase in productivity in cardiology and 20% in orthopedics (Shafer, 2024)

Alternative view: do scribes represent failure of EHR data entry usability (Bates, 2018)?

Ambient dictation/scribes/listening using AI

Processing of patient-clinician dialogue to generate notes for editing and entry into record

- Growing commercial marketplace
 - [Dragon Ambient Experience \(DAX\) Copilot](#)
 - [Abridge](#)
 - [Nabla](#)

Systematic review of studies through 2024 showed mostly improvement in (Hassan, 2025)

- Engagement or uptake
- Documentation quality
- Accuracy
- Efficiency
- User satisfaction

Additional observational studies show similarly generally positive results (Wendt, 2025; Guo, 2025; Olson, 2025; Pearlman, 2025; Stults, 2025; You, 2025)

Ambient dictation randomized trials

Randomized controlled trials

- Reduced work exhaustion/interpersonal disengagement but did not significantly increase professional fulfillment; documentation time decreased around 22 minutes per day without compromising accuracy of diagnosis, billing compliance, or note quality (Afshar, 2025)
- Reduced time in notes around 1 minute per patient visit for Nabla and burnout, task load, and work exhaustion but occasional inaccuracies for Nabla and DAX (Lukac, 2025)
- Accompanying editorial noted integration with other tasks could increase productivity (Kim, 2025)

Some outliers

- In ED, AI scribes associated with more time spent in EHR notes section, more physician note contribution, and similar-to-lower quality notes than human scribes (Morey, 2025)
- Simulation comparison of 5 commercial systems found variable rates of errors within and across systems (Anderson, 2025)

Ambient dictation – implementation and challenges

Implementation

- Best practices (AMIA, 2025)

Challenges

- Visualized or other non-spoken information
- “Driving out the chit-chat” (Schiff, 2025)
- Clinicians enthusiastic but time savings modest (Aguilar, 2025)
- Risks (Topaz, 2025)

Risk Category	Examples of Potential Harm	Recommended Safeguards
Clinical Accuracy	AI Hallucinations (fabricated exams), Omissions of symptoms	Mandatory accuracy standards, Independent validation studies
Patient Privacy	Unauthorized recording, Data repurposing for AI training	Explicit consent protocols, Audit trails for data access
Legal Liability	Unclear responsibility for AI errors, Documentation discrepancies	Updated liability frameworks, Clear error attribution processes
Transparency	“Black box” algorithms, Proprietary systems	Required explainability standards, Open audit of error rates
Interprofessional Communication	Inconsistent documentation across care team, Widened information gaps	Team-based implementation protocols, Shared responsibility models

Other concerns for data entry: copy and paste

Copy and paste (Hersh, 2007)

- Current systems make it easy; occurs in up to 10-20% of charts (Weir, 2003; Embi, 2004; Thielke, 2007)
- Maybe need to re-think documentation in electronic era, e.g., annotation of data instead of copying (Cimino, 2013)?

Best practices for copy and paste (ECRI, 2017)

- Provide a mechanism to make copy and paste material easily identifiable
- Ensure that the provenance of copy and paste material is readily available
- Ensure adequate staff training and education regarding the appropriate and safe use of copy and paste
- Ensure that copy and paste practices are regularly monitored, measured, and assessed

Do we adhere too much to the paper paradigm of medical records in the era of EHR?

“Notes” an outdated paradigm (Steinkamp, 2021)

- Medical record – notes, labs, imaging, etc. – should be reconceptualized as dynamic, fully collaborative workspace organized by topic rather than time, writer, or data type
- Save time and effort seeking and synthesizing information?

Review of systems detracts time from other physician tasks such as counseling and shared decision-making (Barry, 2022)

Other paradigms for medical records?

Medical records as a wiki (Naik, 2010; Warner, 2019)?

- Appropriate edits by appropriate users, tracked and audited
- Data accessed by APIs

Use of Facebook model (McCormack, 2013)?

- About for medical history
- “Privacy Settings” and “Permissions” for controlled sharing
- Photos for images
- Tagging to involve others and track themes
- Notifications for test results, alerts, reminders, etc.
- “Check-ins” and “Events” for encounters
- “Friends” for provider relationships