

Best Practices in Medical AI Development

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1. From Concept to Clinic: Understanding the AI Development Journey

- Start with real clinical problems, not technology hype. Clinical problems are similar worldwide, though workflows and administrative processes differ between institutions. Use design thinking: interview and observe stakeholders to thoroughly understand the real problem before developing solutions.
- Validate the problem before seeking technological solutions. Example: What appeared to be a hospitalist-physician communication issue was discovered to be specifically about discharge processes. Creating follow-up appointments from the hospital to outpatient services led to 93% patient attendance and 12% reduction in readmissions.
- Consider the appropriate technology approach. Early AI applications focused on imaging as data was already digital. Before generative AI (pre-2023), machine learning required thousands of data points to prove a single algorithm. Generative AI has transformed healthcare technology implementation, requiring less data and offering more flexibility.
- Build minimum viable products by adapting existing technologies when possible. Example: Defense industry image analysis technology designed to detect changes in maps was successfully adapted for mammogram analysis to identify year-over-year changes, flagging differences for physician review rather than attempting specific diagnoses.
- Test thoroughly before implementation. Always obtain IRB approval and conduct comparative studies with and without the technology. Successful integration depends on embedding tools directly into clinical workflow, such as AI algorithms for brain hemorrhage detection that prioritize abnormal CT scans with color-coding.
- Focus on user adoption and workflow integration. Technology should integrate smoothly into existing clinical processes. Success is evident when clinicians actively request the technology, as happened when radiologists wanted the AI tool installed on their personal computers after seeing its value.

2. The Clinician's Role in a Health Tech Team

- Physicians are essential for meaningful healthcare technology development. Technology specialists often don't understand the complexity of medical care, ethical considerations, and patient relationships. Example: A CEO without healthcare background assumed a UTI consultation could be reduced to under one minute, not understanding that even simple cases involve complex patient contexts.
- Clinicians serve multiple critical roles in technology development: domain experts for clinical functionality, gatekeepers for patient safety, evaluators of technology fit, and advocates for ethical implementation. Their insight is crucial from concept through deployment for successful integration.
- Create effective multidisciplinary teams by bringing together medical specialists, data scientists, engineers, and IT experts. Develop structured evaluation systems to assess technologies from multiple perspectives (clinical value, integration feasibility, workflow impact).
- Bridge the gap between startup speed and healthcare institution caution by identifying and modifying bureaucratic barriers. Example: Reducing contract length from 60+ pages to 3 pages facilitated startup relationships and reduced legal costs. Provide project managers to help companies navigate hospital systems and regulatory processes.
- Clinicians must be assertive about their value in technology development. Companies that fail to incorporate physician perspectives often struggle to create successful healthcare solutions. Physician involvement is essential for understanding clinical thinking and workflow integration.

3. Ensuring Safety, Ethics, and Trust

- Patient safety is non-negotiable. Always follow proper regulatory processes (IRB, FDA) for any technology involving patient care. Run comparative studies to demonstrate effectiveness and safety. Example: AI tools for detecting lung nodules in ER chest X-rays reduced missed diagnoses and related lawsuits by automatically flagging concerning images.
- Maintain the human-in-the-loop approach where AI makes suggestions but clinicians maintain control and oversight. Physicians must remain responsible for final decisions in all patient care situations. Key evaluation question: "Would I use this AI tool for a family

member? If not, it's not ready for implementation."

- **Ensure transparency and explainability in AI systems.** Understand what data was used to train algorithms and be alert to "black box" solutions that can't be explained. Technology must be continuously monitored for algorithmic drift (when algorithms change behavior over time) and bias.
- **Address accountability considerations.** AI can both reduce liability (by catching issues humans might miss) and create new concerns. Technology must be continuously monitored, and institutions should establish clear lines of responsibility for AI-assisted decisions.
- **Design for equity and ethical implementation** by vigilantly monitoring for biases in data and algorithms, ensuring technology works for diverse populations, and implementing proper data handling and privacy protections.

Future Directions

- **Medical education must evolve** to include technology evaluation skills for future healthcare professionals. The goal is not to teach every technology (impossible given rapid changes) but to develop critical thinking about technology implementation.
- **AI can enhance patient-centered care** by reducing administrative documentation burden, transcribing and summarizing information, enabling pre-visit symptom checking, and supporting personalized medicine approaches through better data analysis.

Conclusion

AI in medicine is not something being done to clinicians but must be built with their active involvement. Healthcare professional expertise, caution, and vision are critical for ensuring these technologies enhance patient care rather than compromise it. The successful integration of AI into healthcare requires ongoing clinician involvement, careful validation, and a commitment to maintaining human judgment and oversight throughout the process.