Ethical and Legal Aspects of Ambient Intelligence in Hospitals

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Ambient intelligence in hospitals is an emerging form of technology characterized by a constant awareness of activity in designated physical spaces and of the use of that awareness to assist health care workers such as physicians and nurses in delivering quality care. Recently, advances in artificial intelligence (AI) and, in particular, computer vision, the domain of AI focused on machine interpretation of visual data, have propelled broad classes of ambient intelligence applications based on continuous video capture.

One important goal is for computer vision–driven ambient intelligence to serve as a constant and fatigue-free observer at the patient bedside, monitoring for deviations from intended bedside practices, such as reliable hand hygiene and central line insertions.[1] While early studies took place in single patient rooms,[2] more recent work has demonstrated ambient intelligence systems that can detect patient mobilization activities across 7 rooms in an ICU ward[3] and detect hand hygiene activity across 2 wards in 2 hospitals.[4]

As computer vision–driven ambient intelligence accelerates toward a future when its capabilities will most likely be widely adopted in hospitals, it also raises new ethical and legal questions. Although some of these concerns are familiar from other health surveillance technologies, what is distinct about ambient intelligence is that the technology not only captures video data as many surveillance systems do but does so

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by targeting the physical spaces where sensitive patient care activities take place, and furthermore *interprets* the video such that the behaviors of patients, health care workers, and visitors may be constantly analyzed. This Viewpoint focuses on 3 specific concerns: (1) privacy and reidentification risk, (2) consent, and (3) liability.

Privacy and Reidentification Risk

Most forms of ambient intelligence capture data from patients and health care workers that might encroach on privacy. The concern is easiest to see with video capture. One solution is to engage in (or indeed for hospitals to require that the systems engage in) "data minimization"—collecting the minimal amount of data necessary for the task. Yeung et al[3] and Haque et al[4] chose to capture silhouette-like images, rather than color video, to reduce risks of compromising privacy.

But while certainly better than direct video capture, these techniques may not fully protect patient or health care worker privacy. The problem is "data triangulation," such that a person may be deidentified as to one data set, but the knowledge that they are a member of another available data set may allow them to be reidentified.[5] In this example, given information easily available to hospitals regarding personnel and shift timing, reidentification is not very difficult.

If protecting health care worker (and patient) privacy is a priority in building trust, what is needed is a fleshed out, legally enforceable, model that describes when such reidentification will be permitted and penalties for unauthorized reidentification.[6] This could be achieved either through external (eg, federal or state law) or internal (eg, promises in an employment contract, protections in collective bargaining agreement) rulemaking.

Consent

Should explicit consent be required when ambient intelligence makes a recording of patients? Hospitals have been sued for their recording of and retention of videos of patients in vulnerable situations such as cesarean delivery.[7] Many initial consent documents for patients in hospitals have buried within them authorization for such recording for quality improvement and security reasons, but the more explicit and specific that consent, the better. Even if a hospital system could escape liability with opaque boilerplate language for ambient intelligence in consent forms, as with any new technology, the better course in building trust is to be as transparent with patients as possible. Far from hiding the technology, hospitals should be eager to educate patients about it, explain the anticipated benefit to patient care, and demonstrate to them the safeguards that have been taken to protect privacy.

A more challenging question has to do with health care workers, should they have to consent? The law typically treats the place of work for private employees as a public space wherein surveillance for legitimate business interests or the public interest is permitted, including video surveillance.[8] For many uses of ambient intelligence, such a business interest or public interest will be easy to articulate. Thus, employers have a strong claim of a right to record their employees without meaningful consent. For unionized workers, the scope of such recording may be a matter of collective bargaining.

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Should employers nevertheless go beyond what the law requires and seek the affirmative consent of the health care workers or even permit an opt-out?—likely not. As a practical matter given that many health care workers are operating in tandem in patient care, enabling the system to only record some but not others may not be feasible. Moreover, allowing an opt-out might frustrate the very goals of an ambient intelligence system for improving quality of care.

Hospitals may ethically use ambient intelligent systems to record health care workers without consent as long as the following conditions are met: (1) the recording is taking place in quasi-public spaces (eg, operating rooms, corridors, or patient rooms); (2) the goal is to improve patient care; (3) proper safeguards are in place to protect individual privacy; and (4) workers are informed that this will be taking place.

Ambient intelligence systems may also capture information relating to groups other than patients and health care workers, such as friends and family members visiting patients, a problem sometimes referred to as "bycatch." Although appropriate signage may help to alert visitors to the use of an ambient intelligence, it is far from a complete solution. Hospital systems may want to pay particular attention to what they do with data collected for these groups who are even less "part of the conversation" than patients or health care workers and are often likely wholly unaware of the surveillance.

Liability

The use of ambient intelligent systems may complicate liability issues for hospital systems in several ways, although this is a reason for thoughtful implementation rather than a reason to reject such systems.

First, in the case of adverse events for patients, the information recorded by the system may be sought by the plaintiffs in bringing their claims against health care workers or the hospital. This raises various implementation questions, the resolution of which will depend on local law and consultation with hospital counsel. To speak in general terms, if a hospital system were to explicitly destroy video recordings from cases in which it knew medical injury occurred, this might constitute "spoliation" of evidence, which in some states might not only be held against the hospital system in court but subject it to liability. By contrast, if the data collected by ambient intelligence systems are dealt with via an appropriate overall document retention and destruction system, and retained for a reasonable time, the hospital will likely be on safer ground.

Second, when the ambient intelligence detects repeated problems with a worker or care team, should that problem go uncorrected, the hospital may be vulnerable to a claim of liability for failing to act. Again, planning is essential. Before the first recording is taken, the hospital should plan through how it will respond if various problems are uncovered. Ideally, this can be done in a cooperative way with health care workers, but the key is to be transparent with explanations about what is planned.

Third, in some cases, ambient intelligence may record episodes that are relevant to the criminal justice system, such as illegal activities by health care workers. Before implementing these systems, hospitals should establish clear policies as to under what circumstances they will retain and share these recordings with law enforcement.

Conclusions

In the future, it is likely that ambient intelligence systems will be widely used in hospitals to improve patient care and overall efficiency. It is essential to consider the ethical and legal implications of such systems and the appropriate frameworks for implementation now.

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