

Healthcare IoT and Wearable Devices

IoT and Disruptive Technologies in Healthcare

Jim Beinlich

**Associate Vice-President
Corporate Information Services**



Penn Medicine

What is innovation?

in·no·va·tion

/ˌɪnəˈvāSH(ə)n/

noun

the action or process of innovating.

synonyms: change, alteration, revolution, upheaval, transformation, metamorphosis, breakthrough; new measures, new methods, modernization, novelty, newness; creativity, originality, ingenuity, inspiration, inventiveness; *informal* a shake up

dis·rup·tion

/disˈrəpSH(ə)n/

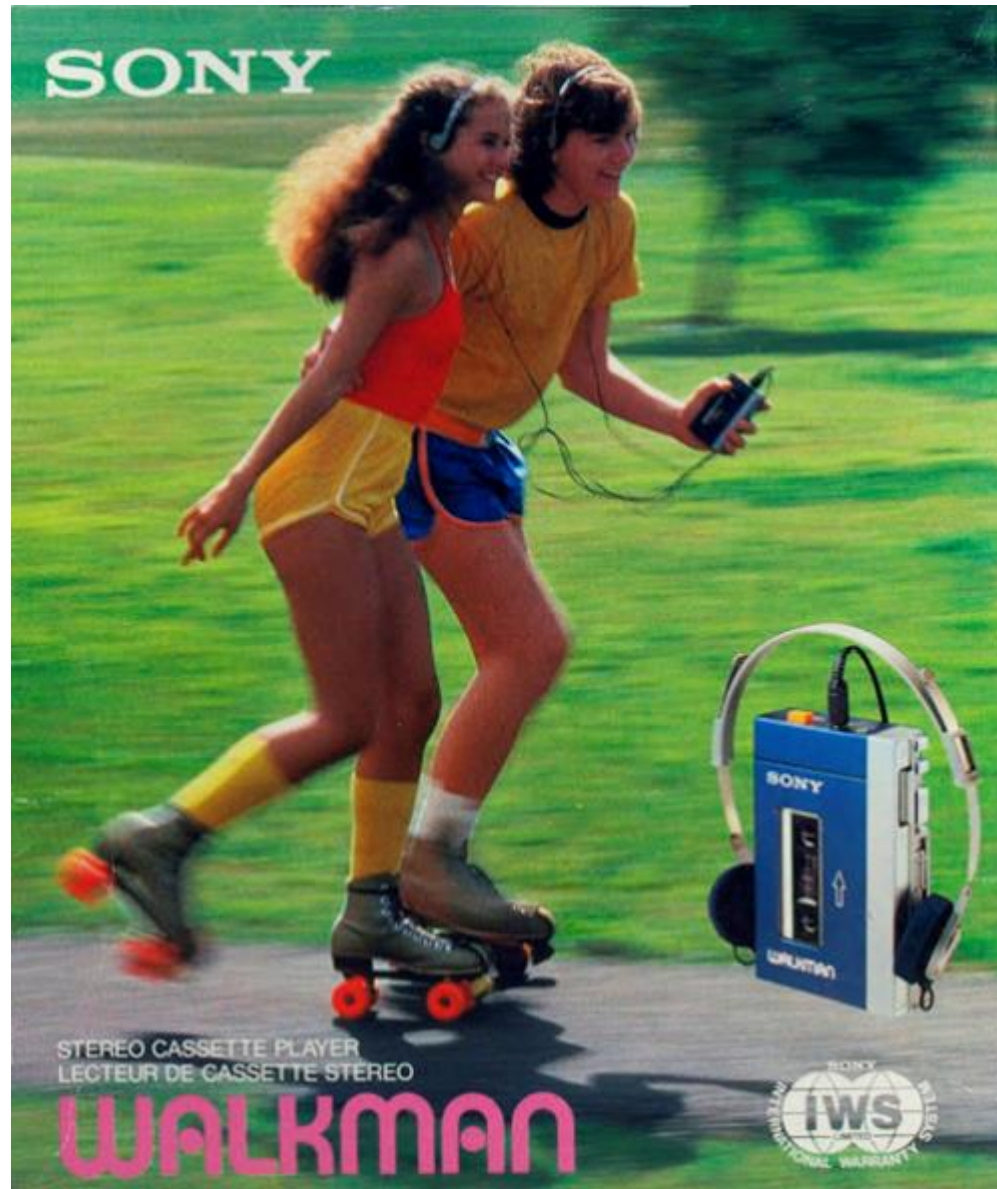
noun

disturbance or problems that interrupt an event, activity, or process.

“Innovation distinguishes between a leader and a follower.”

- Steve Jobs

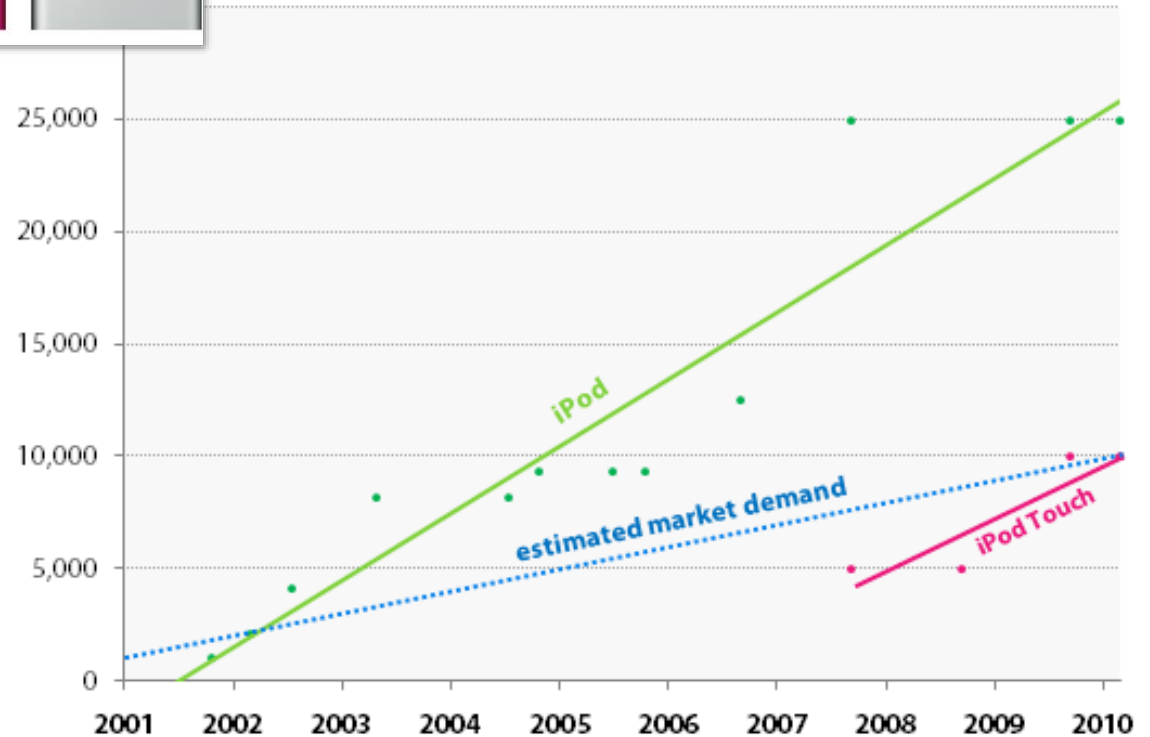
The beginning of...



...Disruption



Song Capacity



Fear of disruption



3-D Coating technology

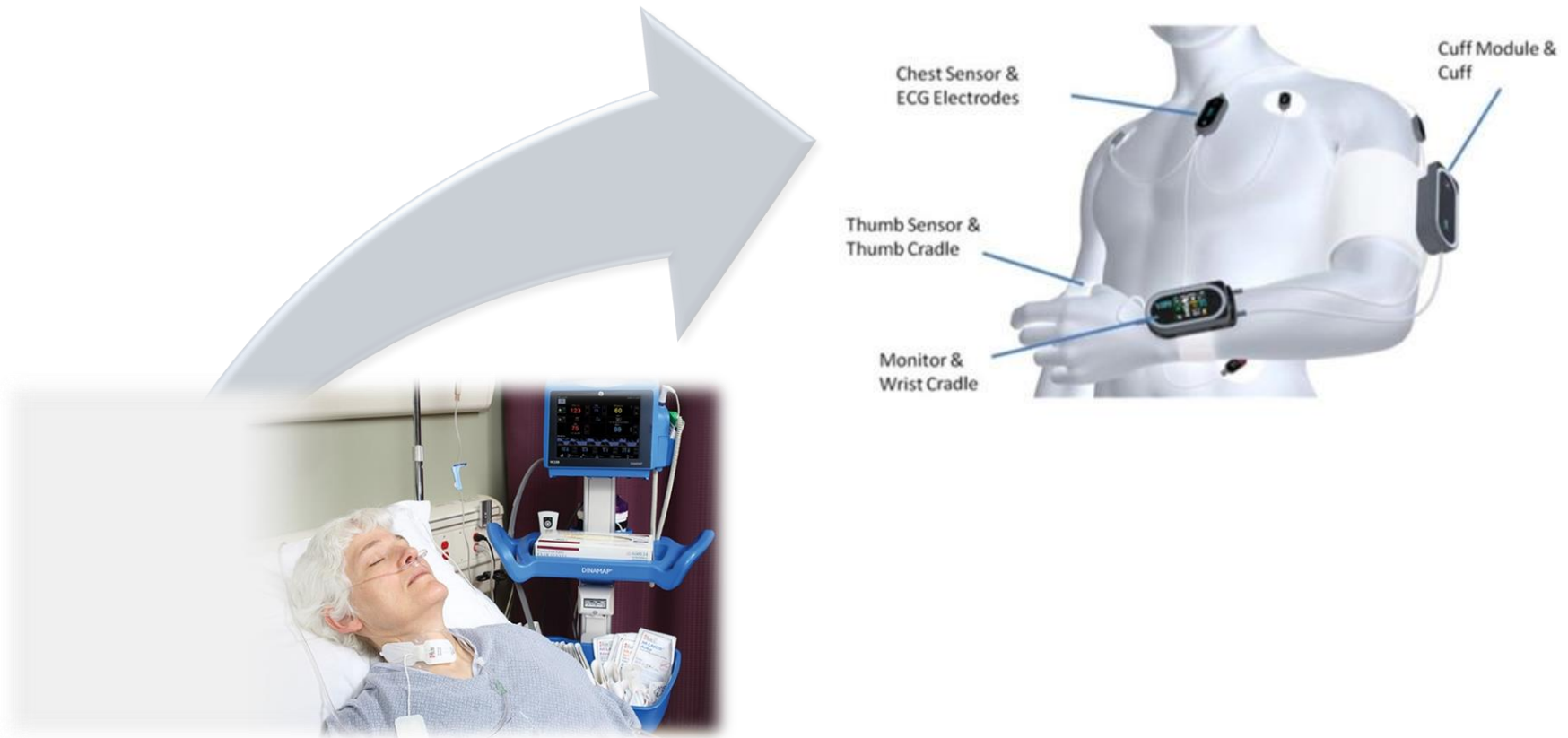
Digital Camera

“Neither RedBox nor Netflix are even on the radar screen in terms of competition,”
- CEO Jim Keyes

Could have purchase Netflix for
\$50m...2016 value ~ \$33b (65900% gain)



Are we about to see the same in Patient Monitoring Technology?



Military development translating to commercial use

Light weighting critical warfighter components while maintaining proper functionality requires novel materials and processing technologies



What IS a patient monitor?

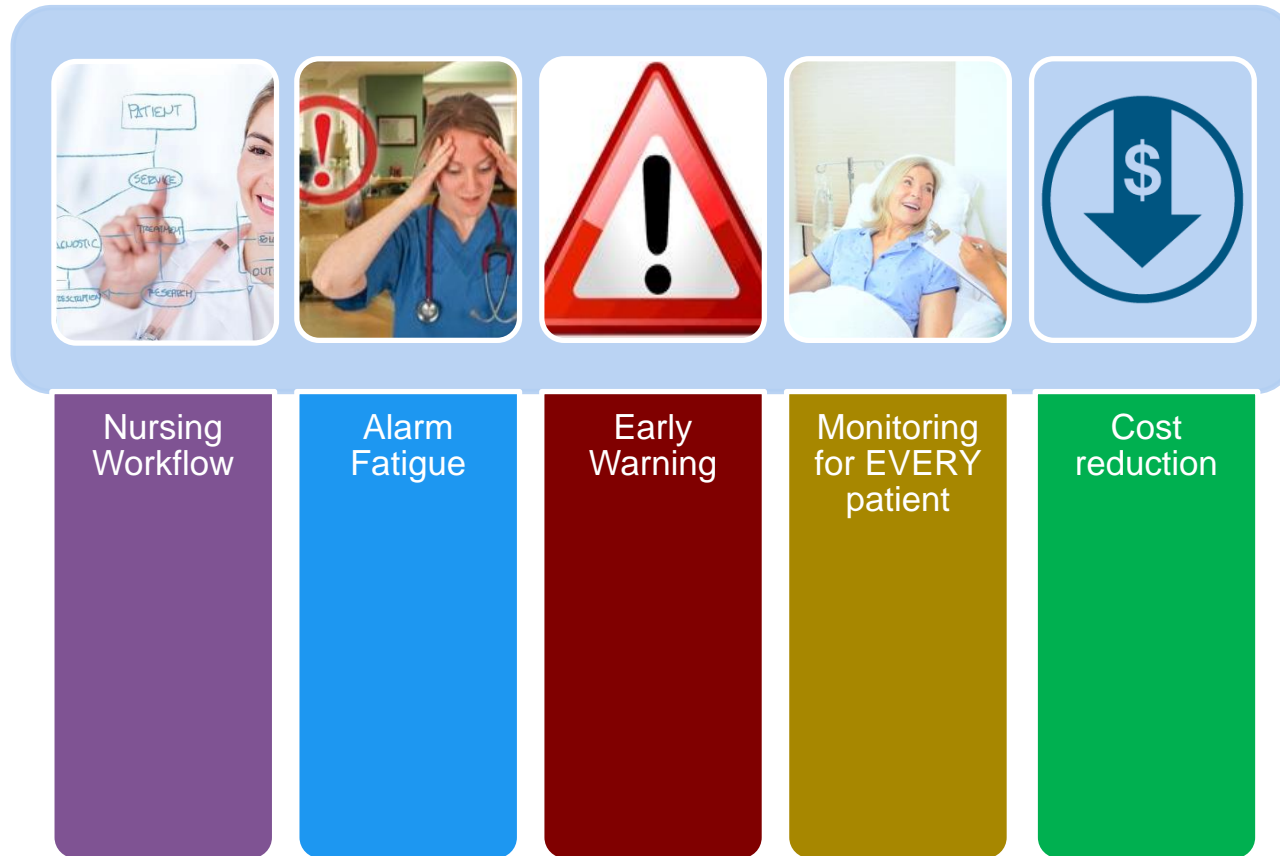


Things we should consider

- ◆ What will the 'norm' be in 2020?
- ◆ Do we believe we are on the verge of a major technology shift?
- ◆ Are we ready to pursue continuous monitoring via wearable technology?



Wearable, Wireless, Continuous Monitoring



disruptive technology driving change

Pilot Outcomes

1.79 physiological
alarms/pt/day

76% required clinician
acknowledgement



52% required immediate
clinical intervention

National average = **69**
alarms/pt/day (standard
monitoring)

Biomed Instrum Technol. 2011 Spring;Suppl:29-36. doi: 10.2345/0899-8205-45.s1.29.
Physiologic monitoring alarm load on medical/surgical floors of a community hospital.
- Gross B1, Dahl D, Nielsen L.

Cancer Patient Unit Experience

Alarm: High Heart Rate

- HR=177 while ambulating with Physical Therapist
- Patient was out of network so the device sounded at the wrist. Patient admitted to feeling lightheaded, was returned to her room and a 12-lead ECG was obtained



"I liked having constant accessibility to vital signs while performing functional tasks." - Physical Therapist

Alarm: Low SpO2

- SpO2=83%. Patient was in bed and sleepy
- ABG revealed low O2 and elevated CO2; BiPAP applied
- Despite multiple pulmonary interventions, the patient was eventually transferred to MICU later that evening for progressive respiratory failure



"Having the vital signs available real-time was invaluable in the care of this patient." – RN

Cancer Patient Unit Experience



Low BP Trend

- Patient was receiving first dose of Atgam prior to BMT
- The nurse noted the BP to be trending downward and assessed the patient
- The BP was validated to be low and was given an IVF bolus
- The BP stabilized-no further intervention was necessary

“If I had solely been using the Dynamap, this would not have been picked up until much later.” --RN

Final thoughts

Exploit technology



Get comfortable disrupting

Challenge our vendors
Challenge ourselves

to be
better