Flow Disruptions as a Result of Personal Electronic Devices in Orthopedic Surgery

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Introduction

- Orthopedic surgery is physically demanding and, like many surgeries, is highly technical. Two of the most common orthopedic surgeries, which include a great deal of temporal demand for the surgeon and the surgical team, are hip and knee arthroplasty.
- From a workload standpoint, these surgeries place a great deal of mental and physical demand on the surgeon and surgical team, which requires that all parties maintain a high level of attentiveness in order to ensure the safety of both the patient and the surgical team.
- The proliferation of personal electronic devices has resulted in divided attention of the user, increasing distraction, and creating situations for the occurrence of errors and accidents.
- **Flow Disruptions:** Characterized as 'deviations in a set task' and pose a significant threat to patient safety and operating team efficiency (Wiegmann et al., 2007). Flow disruptions that take the player's attention away from the surgery are synonymous with taking mental attention away from watching a movie. Key pieces of information are missed that add up to a more well-rounded understanding of the plot.

This investigation overall aims to assess the use of PEDs during orthopedic surgery and its potential for distracting members of the surgical team.

Methods

A total of twenty elective orthopedic surgery cases (knee replacements and hip replacements) were observed over a four-month period in 2017. The disruptions were coded to reflect PED use, as defined by the use of personal cell phones and tablets, and length of flow disruptions, as well as players involved using a real-time, custom data collection tool designed in Microsoft Excel. Each case was consensus coded by a team of four human factors researchers from Embry-Riddle Aeronautical University (ERAU).

Reports with too little detail to determine human error were excluded from analyses. Analyses were completed using Microsoft Excel.

A total of 741 flow disruptions were collected throughout 20 orthopedic surgeries. 242 were the result of PED use, pulling one or more players out of the game at a time and putting their most updated mental model seconds to minutes behind the real-time surgical progress.

Abstract

The operating room (OR) is a complex environment in which highly trained individuals perform cognitively demanding tasks. Distractions in this environment may lead to deleterious effects, as a loss of situational awareness can interfere with surgical procedures. The present study aims to quantify the frequency and nature of distracting events associated with personal electronic devices (PEDs) during twenty elective orthopedic surgery cases. PED use was coded using a real-time, custom data collection tool beginning in the pre-operative area and terminating at the time of handoff with the post-anesthesia care team. PED use accounted for 242 flow disruptions in the OR. The vendor showed the highest frequency of flow disruptions (73), followed by the circulating nurse (52) and the certified registered nurse anesthetist (CRNA) (52). Thus, taking a proactive safety approach to account for intraoperative distractions associated with PEDs among OR team members will be critical to ensure high-quality patient care.

Figures

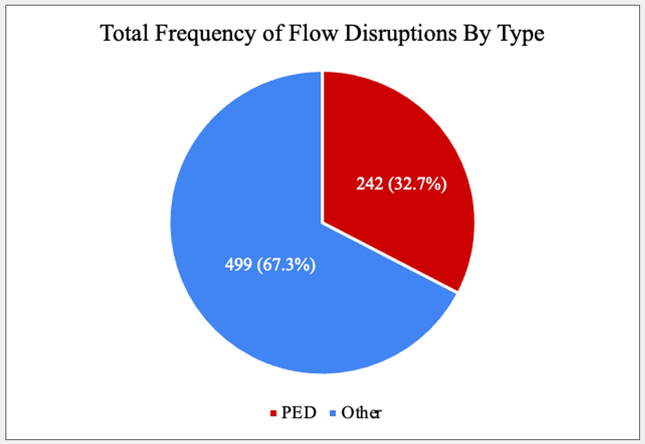

Figure 1. Total Frequency of Flow Disruptions by Type

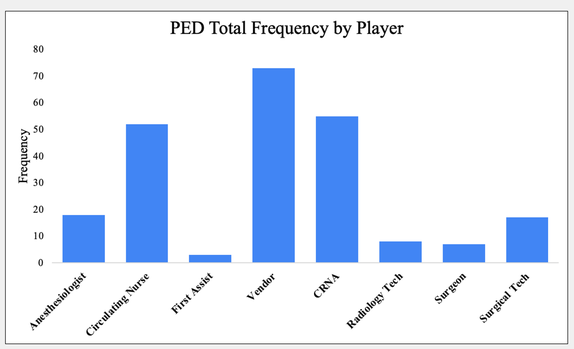

Figure 2. Total Frequency of PED Disruptions by Player

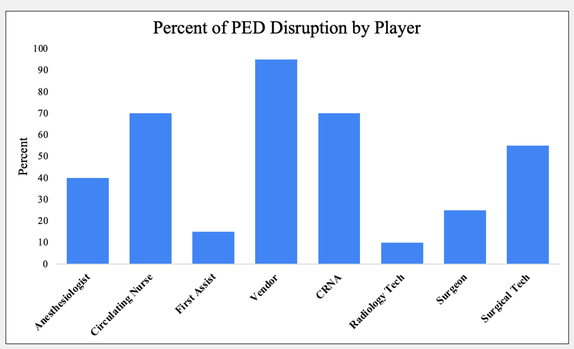

Figure 3. Percent of PED Disruptions by Player

Results

- The highest frequencies of PED usage distracting from the surgery come from the vendor, circulating nurse, and certified registered nurse anesthetist (CRNA). The vendor accounted for 73 flow disruptions, the circulating nurse accounted for 52, and CRNA accounted for 55 of the total 242 disruptions regarding PED use.
- Analyzing each individual case indicates that the vendor used a personal electronic device in 95% of the surgeries and both CRNA and circulating nurse in 70% of the surgeries. Moreover, the surgeon was disrupted by PED use during the surgical process in one-fourth of the 20 orthopedic surgeries.
- Overall, all 20 orthopedic surgeries encountered at least one instance with PED use. On average, each surgery case included over 15 minutes of PED disruptions.

Examples of PED Flow Disruptions

Player	Flow Disruption
Vendor	CT Tech trying to hand scan to Vendor, takes a moment to get attention since he was on phone.
	Vendor on cell texting.
Anesthetist	Anesthetist is alerted about the patient lifting her arm because he was on PED. Operating team stops the operation to tell him.
	Anesthetist on PED texting.
Circulating Nurse	Circulating Nurse on phone (Facebook).
	The Circulating Nurse shows the surgical assistant pictures of her family on her phone. Surgical assistant still suturing.
CRNA	CRNA on cell, holds up phone to ear to listen to different videos, anesthesia equipment starts to quietly alarm, but CRNA doesn't look or do anything for quite some time. Can't hear because of loud music, and is not paying attention due to phone. Eventually stops beeping and flashing.
	Circulating Nurse asks CRNA something, no response; she's on PED.

Discussion

- PED use has increased in the OR, adding a new level of distraction to the surgical team leading to downstream failures.
- Aggregate flow disruptions present larger threat windows and increased likelihood of negative outcomes.
- Maintaining SA in the OR is critical to the safety of patients and practitioners in the OR, allowing us to capture errors and omissions prior to them becoming accidents.

Recommendations: "sterile cockpit" mentality, updated policies and procedures