

# Comparing Mobile Digital C-arm Systems

A time and motion study comparing workflow efficiency between the OEC Brivo™ system and a comparable competitive C-arm system



# ABSTRACT

A two-part comparison study was performed with an OEC Brivo C-arm\* imaging system from GE Healthcare and a competitive C-arm system. First, in a time and motion study supervised by a third party, 10 experienced radiology technologists were timed as they performed a series of several movements of both devices around a phantom on the surgical table. Second, the technologists were interviewed for their qualitative comments on the two systems. The impact on productivity was evaluated in terms of intra-operative time savings and workflow efficiency. The study measured productivity advantages with the OEC Brivo system. In the time and motion study, the technologists expressed strong preference for the OEC Brivo C-arm system.

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## BACKGROUND AND PROJECT SCOPE

Efficient workflow and high-quality imaging are important to hospitals and surgical centers seeking to deliver positive patient outcomes and positive economic performance in operating rooms (B. Hartmann, 2010). Characteristics of C-arm imaging systems can substantially affect both quality and productivity in image-guided procedures. In November 2014, GE Healthcare conducted a study to evaluate the productivity of the OEC Brivo digital C-arm imaging system against a comparable competitive digital C-arm system. The study, performed in a market research facility by a third party, measured the impact of specific features on workflow optimization and the ability to perform orthopedic procedure tasks quickly and in a few steps – factors that can contribute to clinical efficiency and economic performance. The features evaluated included:

- **C-arm movements** (*lateral, up and down, oblique*)
- **Smart Connect**, which enables the imaging system to be disconnected from the power source and moved during a procedure without having to shut it down and restart.
- **Auto Trak**, which automatically locates regions of interest and adjusts image brightness and contrast. The intent is to reduce the retakes required to secure a suitable clinical image.

- **Smart Metal**, which adjusts the image automatically to compensate for metal (such as prostheses) in the field of view.
- **Manual noise filtering**, designed to remove errors in the image acquisition process and enable acquisition of clear images in less time.
- **Angle Measurement Software,\*\*** which helps users make accurate measurements, such as during hip procedures for correctly positioning bones or inserting screws.

## Methodology

The time and motion study was conducted Nov. 18-20, 2014, by Healthcare Research & Analytics (HRA), an independent third-party firm based in Salt Lake City, Utah, USA. The study was organized and paid for by GE Healthcare but participants were not informed of the sponsor of the study. As study participants, 10 radiologic technologists were recruited from hospitals and participants were required to have significant experience and high familiarity with C-arm imaging systems and the surgical suite environment. None of the technologists had previous experience with the two systems used during the study.

All 10 participants were introduced to the features

of both the OEC Brivo system and the competitive C-arm by way of a video. Then they operated the systems under supervision by two professional moderators, simulating a battery of imaging procedures with a phantom on the surgical table. The examinations included:

- Antero-posterior (AP) lumbar spine (average patient)
- Lateral lumbar spine (average patient)
- Lateral lumbar spine for a large patient, simulated using two plastic blocks (approximately 15 kg each)
- AP hip without and with prosthesis

The technologists were timed in performing a number of specific maneuvers with the two C-arm systems. They moved the systems through the following sequence, as instructed at each step by a moderator:

- Set up in the AP position
- Move from AP to lateral
- Move from AP to oblique (rollover/rainbow) 30 degrees
- Move up and down the table
- Move to caudal/cephalic tilt
- Move the C-arm to the other side of the surgery table

In addition to the quantitative time measurements, technologists gave qualitative comments about their perceptions and preferences related to the two systems, responding to questions from the moderators based on a discussion guide.

## Findings of the time and motion study

### 1. Operator preference

As part of the questionnaire presented after the time and motion study, the technologists were asked which C-arm system they preferred. Specifically, they were asked two questions:

**If you were to perform a procedure right now, using a C-arm, which system would you prefer? Why?**

In response to this question, nine of the 10 participants said they would prefer the OEC Brivo system.

The key reasons given were:

- Ability to disconnect and move the system without shutting down

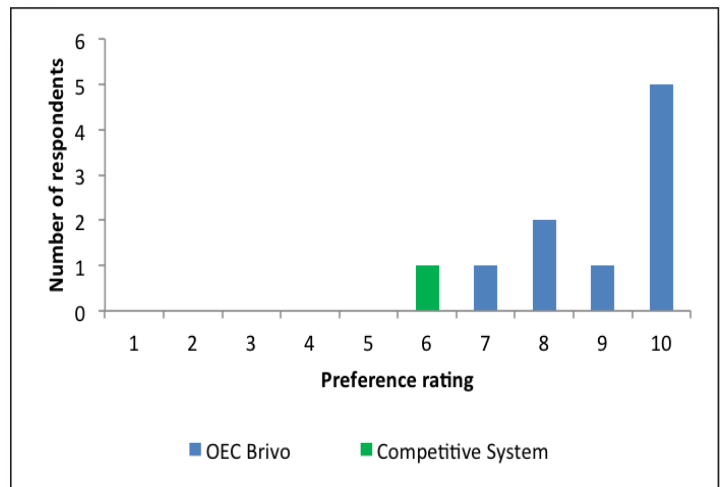
- Ease of moving the C-arm using the handle on the top of the back
- Smart Metal feature
- Ease of reading and understanding buttons and controls

One respondent expressed preference for the competitive system, citing the ability to control the system from the C-arm, the smaller size at the front end at the base of the table, and the screen height.

**On a scale from 0 to 10 [where 10 is strongest], how much do you prefer System A over System B, or System B over System A?**

On this question, the technologists who preferred OEC Brivo did so with an average 9.2 strength of preference rating. The technologist who preferred the competitive system did so with 6.5 strength of preference rating.

Figure1: Summary of Time and Motion Study participants' system preferences



### 2. Speeding up work in the operating room (OR)

Participants stated that movement of the C-arm, such as from one side of the table to the other, does not occur during all procedures. However, the study results showed that the Smart Connect feature on the OEC Brivo system can save time and allow the procedure to continue uninterrupted in the event the system had to be moved. The tests showed that the OEC Brivo system allowed users to disconnect, move and reconnect the C-arm to the workstation three times quicker than with the competitive

system. This is because the system continued to operate even after being disconnected from the power source; it did not have to be shut down and then restarted.

The OEC Brivo system allowed users to make automatic noise filtering adjustments almost four times faster (3.7 times) than with the competitive system. Noise filtering adjustments can help to produce clear images.

### 3. Optimizing workflow

The tests showed that using the OEC Brivo system could be more straightforward than using the competitive system. Users found the OEC Brivo to be a friendly system that helped them complete some tasks in a few steps. For instance, the automated Auto Trak feature allowed brightness and contrast adjustments with only a push of one button to produce images of suitable quality. The competitive system required at least four pushes of a button to produce an image of comparable quality. The majority of the technologists found the OEC Brivo system simpler and easier to operate than the competitive system.

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### 4. Other observations

In general, the technologists could easily follow the directions and perform the actions with both systems. Participants observed that the OEC Brivo system took slightly longer to boot up than the competitive system.

## CONCLUSION

The independent third-party time and motion study found productivity advantages when using the OEC Brivo C-arm that could translate to economic advantages. The OEC Brivo system allowed technologists in the time and motion study to perform a variety of technical tasks in less time. In that same study, the technologists showed a strong preference for the OEC Brivo system for its automated features and intuitive interface.

### ABOUT OEC BRIVO

The OEC Brivo digital mobile C-arm systems from GE Healthcare are used for everyday use in general surgical applications and musculoskeletal procedures. Designed as affordable and compact imaging solutions well suited for hospitals and surgery centers, it offers low-dose features, user friendly workflow and wireless connectivity. Brivo's automated features, including point-and-shoot capabilities, are designed to enhance productivity. Various smart options available on Brivo are intended to enable users to improve technique in challenging situations. The user interface is similar to that of other OEC C-arm systems.

### REFERENCES

B. Hartmann, L. N. (2010). Workflow Efficiency Comparison of a New CR System with Traditional CR and DR Systems in an Orthopedic Setting. *Journal of Digital Imaging*, pp 666Y673.

\* The OEC Brivo 865 Plus was used to conduct the study

\*\* Angle measurement software is not available on the OEC Brivo 715 Prime

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™ The OEC Brivo 865 Plus is also commercially marketed as OEC Brivo Plus.

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