Determining the Benefits of Proactive Digital Service for Computed Tomography Scanners

Background

Diagnostic imaging, especially computed tomography, has emerged as a valued tool in the diagnostic workup of patients with traumatic as well as non-traumatic emergencies.[1] Market surveys performed between 2010 and 2012 have demonstrated that patient convenience and satisfaction are the primary concerns of customers when a system experiences a malfunction.[2] Unplanned downtime from medical imaging devices can have a significant negative effect on every aspect of healthcare delivery ranging from patient anxiety, added stress for department staff, hospital reputation, to financial implications.[3]

To address these concerns, GE Healthcare launched 'OnWatch', a solution that remotely monitors the performance of the equipment and proactively performs service. This technology has been deployed on various GE devices including computed tomography systems. 'OnWatch' monitors specific system components using data-driven prediction tools and alerts GE engineers in case any variations in the performance of specific components and also forecasts the need for maintenance to enable minimum disruption to operations.[3]

The objective of this paper is to evaluate the user impact of OnWatch proactive digital services solution for GE computed tomography systems.

Methods

One hundred and thirty-six computed tomography devices that were monitored using OnWatch services in the European Union[4] were included in the analysis. Any device that was compatible with OnWatch technology was included in the analysis. Service data were collected between October 2011 and October 2013 to facilitate a comparison of the periods before and after activation of the OnWatch services. The pre-OnWatch period was defined as October 1, 2011, or install date to activation date, while the post-OnWatch period was defined as activation date plus 2 weeks to October 31, 2013. The total number of service events analyzed was 2783. Service performance including number of disruptions, average time to service, and average downtime per system were compared between the pre-OnWatch and the post-OnWatch periods. All user-initiated service events as well as proactive service events that were opened and closed during the measurement period were included in the analysis. Manual and connectivity-related service events were excluded as they were not influenced by OnWatch deployment. Service events occurring within the 2-week period after OnWatch installation were excluded as activation triggers an unusual number of events and could skew the results. Service events that were opened before and closed after the beginning of the measurement period were excluded. Furthermore, service events opened before the end and closed after the end of the period were excluded. Event rates (number of events per month) and downtime rates (downtime per month) were calculated to adjust for differences in period durations before and after OnWatch deployment.

Metrics

Service performances were compared over the pre-OnWatch and the post-OnWatch period using the following metrics: unplanned downtime, number of service events and average time to service.

Unplanned Downtime: Unplanned downtime is the total time elapsed between a user-initiated request for service and the time of work completion, over a specific period. It describes the total unplanned time elapsed over a given period during which the equipment requires servicing. Service events that do not impact device functionality were not included in the analysis.

Number of Service Events: The number of service events is the count of service actions needed to maintain the system at optimal performance, regardless of their duration. In this study, user-initiated requests, as well as proactive events generated automatically by the OnWatch back office, were taken into consideration. A user-initiated request is disruptive due to the uncertainty and the impact it can have on a hospital department. A proactive event is less disruptive since it triggers a service action that can be planned when it is less disruptive to the users.

Average Time to Service: The average time to service is the time elapsed between a user-initiated request for service and the completion of work for a given service event. The time to service of a proactive event is the

time elapsed between the start of work and its completion. Owing to the planned aspect of proactive service events, the response time and travel time do not impact the users. The average time to service is calculated by averaging the times to repair over a specified period. This is a good assessment of time over which the equipment requires servicing.

Results

Equipment Unplanned Downtime

The average downtime (cumulated service time) per month for emergency calls was reduced by 32% (from 7.97 h to 5.42 h) after the adoption of OnWatch (p=0.007). The median and standard deviation also were reduced by 55% and 14%, respectively, indicating an improved and consistent service (see Table 1).

An improvement in downtime (cumulated service time) per month was noted in 89 out of 136 devices monitored. For the 89 devices showing improvement, average downtime (cumulated service time) per month was reduced by 69% for user-initiated service calls. At the time of the study, the average downtime per monthof proactive calls was observed to be 6.6.[5]

Time to Service

The time elapsed to service (user-initiated calls and predictive events) was almost constant before and after adoption of OnWatch (see Table 2). Overall, the average time to service was reduced by 3%, median reduced by 22% and standard deviation by 8%. For user-initiated calls, the time to service was reduced by 21% from 11.7 hours to 9.2 hours (p=0.02) after adoption of OnWatch. Median and standard deviation were reduced by 33% and 19%, respectively, (see Table 3) indicating an improvement and consistency in response to service events.

Disruption Rate

After the adoption of OnWatch, the average user-initiated calls (disruptive events) per month was decreased by 13% (p=0.02) from 0.76 to 0.66. The median and standard deviation also were decreased by 5% (from 0.63 to 0.59) and 3% (from 0.44 to 0.43), respectively (see Fig. 1).

The overall average disruption rate was increased by 19% (from 0.76 to 0.90) due to the proactive service events (see Fig. 2). The planned aspect of the proactive events because they are planned in advance, may be undertaken with other planned service events, which could reduce the service event rate.

Table 1: Downtime analysis for emergency calls

	Pre-OnWatch	Adoption	Post-OnWatch	V%
Mean	7.97	6.44	5.42	32%
Median	6.95	0.00	3.13	55%
SD	6.81	24.47	5.87	14%

Table 2: Average time to repair (all service events)

	Pre-OnWatch	Adoption	Post-OnWatch	V%
Mean	11.71	14.25	11.40	3%
Median	2.82	3.99	2.20	22%
SD	25.34	21.55	23.43	8%

Table 3: Average time to repair emergency events

	Pre-OnWatch	Adoption	Post-OnWatch	V%
Mean	11.71	8.76	9.24	21%
Median	2.82	2.59	1.90	33%
SD	25.34	18.46	20.40	19%

Fig. 1: Emergency dispatches/month.

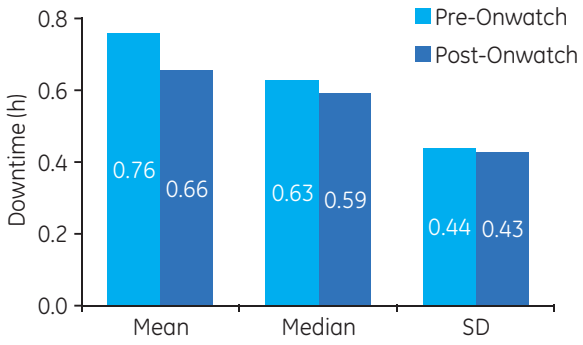
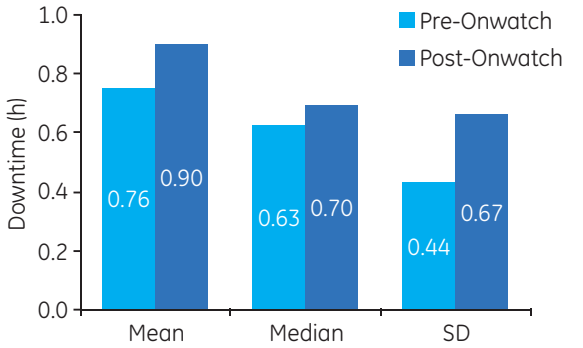


Fig. 2: All dispatches/month.



Discussion

OnWatch is a visionary technology designed to predict and limit disruptions of devices resulting in a less stressful experience for healthcare providers. OnWatch is fully automated and powered by Insite Remote Platform. It is equipped with a 24/7 automated technical data push and analysis, automated fault recognition algorithms, and automated service request with traceability.

OnWatch is a creative way to consider service. OnWatch is equipped with a proactive and predictive technology combined with remote support that shifts the risk of unplanned downtime to planned corrective intervention and minimizes patient rescheduling. It continuously monitors system parameters and signals potential errors and malfunctions even before users are aware of them. On detection of an error, a status message is automatically sent to GE online experts, who initiate due actions. After the evaluation, an email notification is sent to the user regarding the status of the system as well as service actions performed or to be performed. Proactive identification of the service need allows service experts to accelerate maintenance, such as ordering of parts in advance. Proactive replacement of parts and additional service actions further improve system reliability. Service actions can be scheduled to accommodate user requirements, without affecting exam schedules. OnWatch also features periodic reports depending on products. These reports serve as an effective tool to evaluate system usage and overall performance.

Adoption of OnWatch offers the following advantages:

- Reduces yearly unplanned downtime and thus minimizes unplanned workflow disruptions that impact daily operations.
- Limits unscheduled disrupting events and thereby ensures that the devices are operating at optimal performance.
- Notifies users regarding potential problems and facilitates proactive solutions.

In this study, all service events were considered to have equal priority. No sorting was performed to differentiate the level of service needed. Customer surveys and internal data show that due to workflow needs regarding computed tomography, any type of disruptionis impactful because it means you cannot perform scans as scheduled.

Instead of comparing two separate sets of systems, the study compared the same group of systems before and after OnWatch adoption to limit system-to-system variability, as well as service delivery process variability.

Limitations of the Study

OnWatch does not monitor all technical issues occurring in a specific device. Therefore, measuring the OnWatch performance over all set of devices randomly selected dilutes the performance. A closer analysis of devices that were not operating at optimal performance may reveal more consistent metrics on the intrinsic performance of OnWatch. This study was based on an assumption of uptime covering 24 hours per day, 7 days a week.

Conclusions

Computed tomography users value the ability to reduce the number of service events since operational disruptions and lost revenue due to downtime are genuine concerns. The findings of this study suggest that OnWatch allows computed tomography users to maintain workflow efficiency by turning unplanned downtime into more predictable service events. Furthermore, for user-initiated requests, the time to service is more predictable. The adoption of OnWatch is estimated to reduce unplanned downtime by 32% and the number of disruptions by 13% on average. OnWatch also produces a 33% reduction in downtime for 50% disruptive cases. On a theoretical basis, for a system operating 24 hours and 7 days a week, these improvements would translate into more than 55 hours of increased system availability per year.

References

1. Nuñez DB Jr, Ledbetter MS, Farrell L. Dedicated CT scanner in an emergency department: quantification of factors that contribute to lack of use. *AJR Am J Roentgenol*. 2002;179(4):859–862.
2. Predictive and proactive monitoring research, ITG Market Research, Inc., GE Healthcare 2012.
3. GE Healthcare introduces InSiteOnWatch to its AssurePoint Services, Helping Enable Greater Efficiencies in Nuclear Medicine and PET/CT [press release][cited 2014, Feb 04]. Available from: http://www.genewscenter.com/Content/Detail.aspx?ReleaseID=10425&NewsAreaID=2&ClientID=12
4. Devices were installed in Germany, United Kingdom, Spain and Scandinavian countries.
5. This number could be reasonably expected to decline as service delivery improves with the experience.