

# REALIZING THE FULL OPERATIONAL AND COST BENEFITS OF DIRECT DIGITAL RADIOGRAPHY

**Transitioning from CR to ddR Can Net Imaging Providers Significant Gains in Throughput, Revenue Potential and Cost Savings**



A Frost & Sullivan White Paper

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## INTRODUCTION

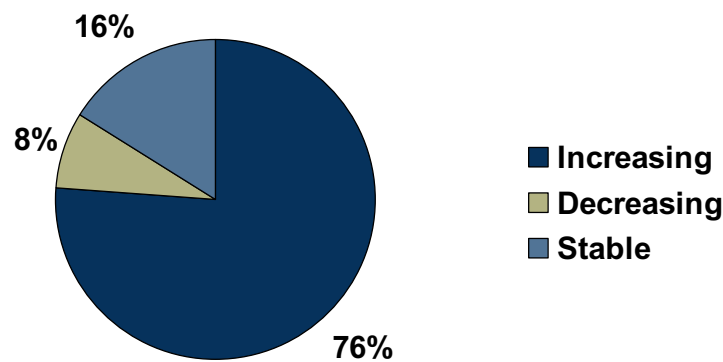
The transition from computed radiography (CR) to direct digital radiography (ddR) has changed the paradigm of x-ray with the introduction of an automated, fully digital solution. The processing speed ddR makes possible has improved patient care and lowered hospital operating costs by offering increased throughput and enhanced productivity. However, the introduction of high-technology, software-dependent equipment has also generated training needs for technicians to properly use it. Ease of use has become a crucial selection criterion for ddR solutions, since more user-friendly solutions have a better chance of being used to their full potential. As these technological advances occur, diagnostic imaging case loads continue to grow putting greater pressure on radiology administrators to optimize their workflow. Frost & Sullivan believes approximately 90 percent of hospitals with 250 beds or more have already converted to digital radiography, whether CR or DR. Approximately 55-70 percent of all images taken in a hospital setting are radiographs. With X-ray expected to continue to be the most common diagnostic imaging modality, the way in which the workflow of that modality is managed has significant repercussions on the facility as a whole.

**Figure 1: Swissray ddRFormula Plus**



Many facilities have become accustomed to the clinical benefits of digital image analysis and storage, but are still not reaping the full benefits that the technology can have on their workflow. Those facilities which have invested in the conversion from CR to ddR in the last decade have been able to reap both the clinical and operational benefits of digital radiography, such as improved throughput, higher revenues and lowered costs over the long-term. While the negative impact of the Deficit Reduction Act (DRA) of 2005 on imaging study reimbursement primarily impacted MR, CT and PET, the net effect on imaging providers in all settings has been an increased focus on improving workflow and lowering costs to make up for reimbursement shortfalls. Case volumes of radiology providers are expected to continue to grow in the future putting increasing pressure on the productivity of these departments.

**Figure 2: More than three-fourths of radiologists surveyed reported that the number of radiology studies completed by their practices was increasing**



Source: Frost & Sullivan survey of 100 U.S. radiologists across a wide variety of practice settings 2007

As a technology leader in the market, Swissray's technology and the experience of its customers serve as an excellent foundation from which to understand the full economic and operational benefits of ddR. The strengths of Swissray's ddR solutions lie not only in the essential criteria of speed and ease of use but also in the flexibility of use that its proprietary software creates. The low system price and installation costs and requirements for Swissray ddR systems make them one of the most competitive alternatives to CR in the ddR marketplace. Swissray is also the only ddR company that provides customers with a choice of detector technology to match their budgets. Providing these low capital costs are important to Swissray as it works to help customers fully appreciate the benefits of digital radiography on their workflow and bottom line. Furthermore, Swissray's dedication to providing this high quality solution and a superior level of service at a competitive price point has put Swissray on the map as a major contender in the ddR market.

Frost & Sullivan conducted interviews in several hospitals which had implemented Swissray ddR solutions to understand why they had decided to invest in ddR, and why they had chosen Swissray as the vendor for that investment. Each of these institutions chose Swissray as their vendor when they upgraded their radiology suites to ddR because of the systems' unique features, which have increased throughput and improved patient care, with an easy to use and cost-effective system.

Frost & Sullivan

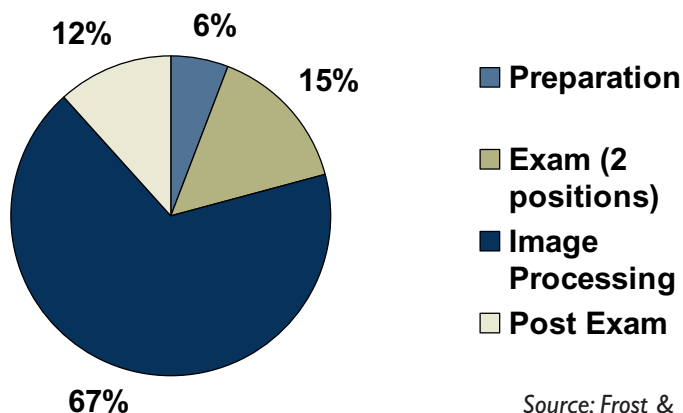
## THROUGHPUT

Throughput is crucial for high volume radiography departments and for patients which are sensitive to long examinations. Examples of such departments are orthopedic facilities and pediatric care units. In Nationwide Children's sports medicine facility, "rapid patient throughput was a must due to orthopedic facilities having a high volume of patients. We needed the ability to get the patient in, the exam completed, and the results sent through the PACS for analysis to the orthopedic specialist," explains Jerry Moody, Radiology Director at Nationwide Children's.

Paul Dubiel, Director of Imaging Services for Dell Children's Hospital and Seton Williamson County Hospital, which concurs regarding improvement of throughput in their pediatrics unit, where patients easily get distracted or impatient, "The kids are in and out much faster now."

In addition, physicians have come to expect radiographic images to be available for analysis in a matter of seconds. For Nationwide Children's, this was one of the drivers to upgrade from CR to ddR in the first place. Says Moody, "CR is still a good process but it is slow. In today's world, doctors want images now, and they interpret 'now' as one click or less than a second."

**Figure 3: Where is Time Savings Realized Comparing ddR to CR?**



Source: Frost & Sullivan and Swissray

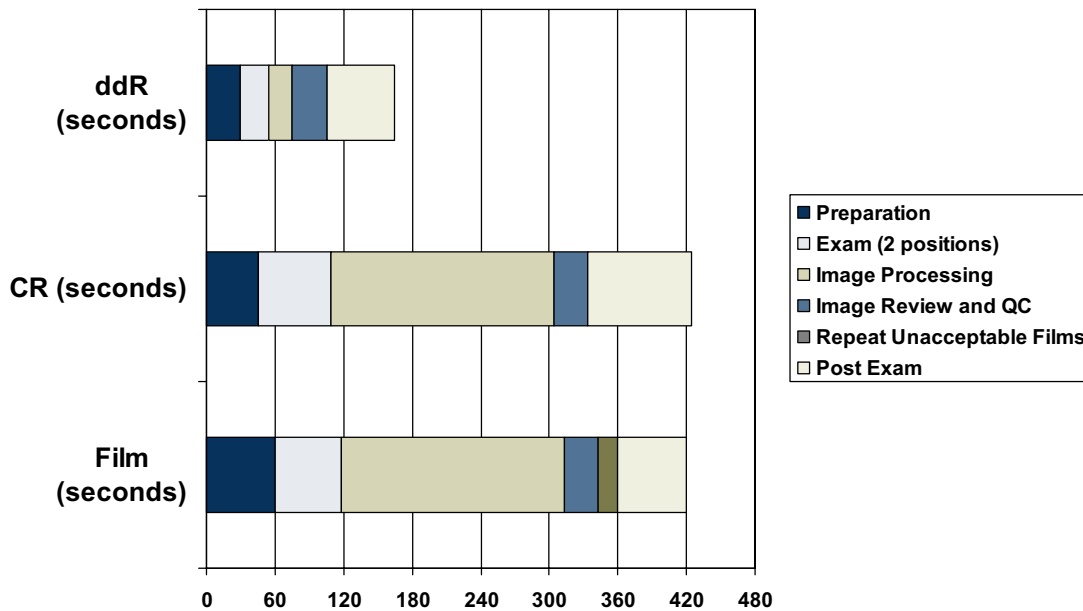
*Note: Times may vary based on DR/CR configuration, case types and other variables. Assumes use of a mid-to-low end CR and RIS/PACS system where cassettes are not associated with patient demographics that does not allow automated population of demographic file compared to the Swissray ddRFormula.*

Installing Swissray's ddR systems has helped Nationwide Children's dramatically increase their productivity. Moody noted, "If you're looking at it from the theoretical side of things, ddR vs. CR, ddR is much more efficient in the fact that you take your exposure and within seconds the technologist has an image. Then they decide if the image is adequate. If so, they hit a button and it goes to PACS and they're done. For CR, it takes a minute just to identify the plate in the CR system. Common sense just tells you that you're gaining in productivity."

According to Kim Elzey, Radiology Manager at Dorchester General Hospital, “the throughput has been great [with ddR]. Patients are done in a timely manner. Things will go even faster when there are two people working together, but the system is already fast with one tech working.”

Frost & Sullivan estimates approximately 67 percent of the time efficiencies realized by ddR compared to CR are thanks to the elimination of manual image processing. Considering a standard two-position/ two-exposure chest X-ray, Frost & Sullivan estimates that use of a Swissray ddR system could shave almost five minutes off the same procedure if done by a low to mid-grade CR system. Since ddR systems do not require technicians to carry exposed cassettes to a processing area, inserting the film in the cassette handler, waiting for the processing cycle to take place and then carrying the cassettes back to the procedure room, patient throughput can be accelerated significantly. Time is also saved during the exam itself since technicians are not required to place unexposed film in cassette trays prior to exposures or retrieve the exposed film between repositioning of the patient. Technicians are also able to save time on data entry at the beginning of cases since the necessary electronic patient demographic information can automatically transfer from the master patient record. At the end of a case, images are digitally stored for viewing by physicians, eliminating the time technicians spend carrying and posting film for review.

**Figure 4: Average Length of Procedure Time**



Source: Frost & Sullivan and Swissray

Note: Times may vary based on DR/CR configuration, case types and other variables. Assumes use of a mid-to-low end CR and RIS/PACS system where cassettes are not associated with patient demographics that does not allow automated population of demographic file compared to the Swissray ddRFormula.

**Figure 5: Average Length of Procedure Time**

Process Steps	Film (seconds)	CR (seconds)	ddR (seconds)
Preparation	60	45	30
Exam (2 positions)	58	64	25
Image Processing	195	195	20
Image Review and QC	30	30	30
Repeat Unacceptable Films	17	0	0
Post Exam	60	90	60
Total Exam Cycle Time (Seconds):	420	424	165
Total Exam Cycle Time (Minutes):	7.5	7.6	2.9

Source: Frost & Sullivan and Swissray

Note: Times may vary based on DR/CR configuration, case types and other variables. Assumes use of a mid-to-low end CR and RIS/PACS system where cassettes are not associated with patient demographics that does not allow automated population of demographic file compared to the Swissray ddRFormula.

While the actual difference in time savings per procedure between CR and ddR may seem small, when considered as a percentage of total procedure time and compounded across the thousands of X-ray procedures that a hospital, imaging center or office practice performs every year, the total time savings a facility can realize can be profound. Frost & Sullivan recently surveyed 100 U.S. radiologists in a variety of different practice settings. Eighty-two respondents were either hospital staff or part of a group practice affiliated with a hospital. On average, these respondents reported their hospitals supported approximately 494 licensed beds and the hospital performed on average 165 X-ray procedures every 24 hours. Considering a scenario with a hospital of this profile, Frost & Sullivan estimates that the facility could save almost 5,000 procedural hours over the course of a year. That same facility could achieve sufficient time efficiencies that it could perform in one ddR procedure room the same volume of cases as in approximately 2.5 CR procedure rooms. This expansion in capacity would allow the facility to better manage growing case loads and also reduce labor costs by using fewer technicians to image more cases.

**Figure 6: Annualized Time Savings of ddR Compared to CR**

Variable	CR	ddR
# X-Ray Cases for Average Year	60,225	60,225
Average Time Spent per Case (Minutes)	7.6	2.9
Total Time Spent on X-Ray Cases (Minutes) for Full Year	457,710	175,656
Total Time Spent on X-Ray Cases (Hours) for Full Year	7,629	2,928

Source: Frost & Sullivan and Swissray

Notes: Assumes an average 500 bed hospital doing 165 X-ray cases per day over one year (24/7, 365)

**Figure 7: Annualized Revenue Generation Potential of ddR Compared to CR**

Variable	CR	ddR
Number of Rad Rooms	4	4
10-Hour Shift (# Minutes)	600	600
Average Procedure Length (Minutes)	7.6	2.9
Maximum X-Ray Cases per Day per Room	63	190
Maximum X-Ray Cases per Day for Hospital	252	760
Maximum X-Ray Cases per Year for Hospital	91,980	277,400
Average Reimbursement per Procedure	\$40.0	\$40.0
Potential Revenue (\$US Mil)	\$3.7	\$11.1

Source: Frost & Sullivan and Swissray

Notes: Assumes 10-hour shifts, 365 days per year.



**Figure 8: Annualized Cost Savings Potential of ddR Compared to CR**

Variable	CR	ddR
Revenues		
X-ray Procedure Volume per Year (1 rad room in 500 bed hospital)	22,995	69,350
X-ray Revenues per Year (@ \$40 Each Procedure)	\$919,800	\$2,774,000
Costs		
Radiographic System*	\$14,285	\$40,714
RS Annual Maintenance	\$8,000	\$28,000
CR System*	\$14,285	\$0
CR Annual Maintenance	\$10,000	\$0
CR Imaging Plates	\$5,000	\$0
Film	\$0	\$0
Chemistry	\$0	\$0
Folders & Other Supplies	\$0	\$0
Transport/Storage	\$0	\$0
Image Retrieval	\$0	\$0
Scan & Send	\$0	\$0
Laser Referral Copies	\$8,738	\$26,353
Technologist Labor & Benefits	\$114,400	\$57,200
Total Annual Costs*	\$174,708	\$152,267
Cost Per Exam*	\$7.60	\$2.20
Net Revenues	\$745,092	\$2,621,733

Source: Frost & Sullivan and Swissray

Notes: Assumes 10-hour shifts, 365 days per year. Shows costs associated with upgrading one analog rad room to digital with the respective technology and operating for the first year. Assumes CR staffing requirement of 2 FTEs per year per room, and DR staffing requirement of 1 FTE per year per room. \*Amortization period for capital equipment at 7 years.

By improving throughput, ddR enables a facility to take on greater case volumes thereby boosting revenues. In a scenario comparing a 500 bed hospital with 4 CR rooms to an equivalent hospital with a ddR room, the potential net revenues that could be generated are almost five times higher for the ddR-enabled facility.

## **COST SAVINGS AND REVENUE GENERATION**

Even in the first year of use, a ddR system has the potential to quickly demonstrate a clear financial ROI with the ability to eliminate the costs of film, processing chemicals and other consumables as well as transportation and storage costs for film. In addition, the ability to increase the productivity of technologists allows for the reduction of labor costs. A 500-bed hospital converting its analog rad room to ddR instead of CR and maxing out capacity could expect to generate approximately \$1.9 million more in net revenues its first year in operation. In addition, per exam costs could be approximately 29 percent of the per exam costs for a CR system placed in the same room, contributing significantly to profit margins.

To serve hospitals wishing to upgrade their radiology suite to ddR without the higher investment costs associated with a dual detector system, Swissray provides a single-detector option. They offer a fully automated ddR system with the same functionality as a dual detector system at a much lower cost. For Elzey, Swissray was competitive “due to their price and the fact that they offered a single detector.” Confirms Dubiel, “Swissray provided all we needed with one detector versus two, and the pricing was very aggressive.”

## **EASE OF USE**

The more intuitive a software system, the faster its users will adopt and use it to its full capabilities. Excellent software will actually make the system enjoyable to use, and this is the case for Swissray’s solution. Swissray’s software powers intuitive yet sophisticated automation features to ensure technicians keep their physical effort to a minimum while enhancing patient care.

Dubiel considers this to be the main differentiator of Swissray’s ddR systems: “It’s the simplicity. It’s just easy to use. The techs like using it. Sometimes when you have a one detector system, it can be cumbersome to use and hard to maneuver, but we don’t have that problem at all with the techs. They’re very comfortable and very happy with the system. I think it’s a good system for our needs.”

As Dubiel mentions, maneuverability is key in ensuring technician satisfaction with the system. Automation limits the physical efforts technicians undertake to position patients and the equipment to prepare for the procedure. The ability to position the equipment via a remote control enhances this and Swissray’s ddR systems incorporate a unique positioning system.

Tammy Viggiano, Clinical Operations Director of Nationwide Children’s, agrees, “It’s all automated via the remote control. The X-ray tube and the detector move in unison. So it just takes the techs getting comfortable with that and letting the equipment do all the work. Ergonomically, from that perspective, it’s better on the techs and they actually love that because they’re not pushing or pulling.”

For multiple examinations of the same patient, for instance to monitor the healing of a broken bone, Swissray's solution provides the added functionality of memorizing the settings for a specific patient and reproducing them for subsequent examinations, thereby making side-by-side comparisons more exact. This also makes the technician's job easier and more efficient than if he had to reposition the instrument to the exact settings himself for every scan. "We like the Automated Positioning System, where the memory of a casting position is stored for the specific child for future follow-up visits. It also helps with true side-by-side comparisons for physicians to evaluate healing," comments Viggiano. From a patient perspective, this also reduces the preparation and positioning time needed before the procedure, as well as reducing the need for unnecessary repeat X-rays because of inadequate positioning.

Swissray's ddR equipment can also accommodate patients who cannot easily be moved onto a table, which is crucial in cases when any movement can potentially harm a patient. According to Moody, "the ability to bring in more complex patients, in particular patients on stretchers, is working out really well. Swissray's system is definitely better than an X-ray room with a table and a wall stand."

Pediatric facilities also appreciate the flexibility of Swissray's solutions, which can image all shapes and sizes of patients, even the smallest. Swissray's personalization with child-friendly characters creates a more welcoming environment and diverts attention away from the machine itself. A calmer patient is easier to image. For Moody, "on the backlit panel you can choose different logos or cartoon characters to make the machine more kid friendly, more welcoming."

Moody concludes, "Swissray appears to have put a lot of thought into what are the real needs of the users of this equipment. They've put that into practice with these tools to enhance patient care, and make the equipment incredibly user friendly."

## **DOSE REDUCTION**

The ALARA (As Low As Reasonably Achievable) concept is the key tenet to safety in modern radiology, especially since medical radiation exposure has become an issue of public awareness. For pediatric facilities, the issue is even more pressing as children are much more vulnerable to the harmful effects of radiation than adults. "Obviously, pediatrics is unique and has some needs that not all equipment fit, so the pediatric technologists have to figure out how to make it fit. We chose a ddR system based on ease of use, flexibility, low dose, one size fits all. We have pediatric patients ranging from a pound to 500 pounds", notes Moody. Viggiano adds that "dose to the patient was crucial."

Swissray's software functionalities help technicians keep radiation exposure to a minimum by automatically adjusting dose to the patient's age. Elzey confirms that the staff at Dorchester General Hospital "also likes the fact that the system will recognize the patients' age and decrease the dose for the younger patients. While speed is the biggest strength of Swissray's ddR system, dose reduction is a great benefit as well."

Also, a camera allows the technician to see the patient during the procedure. Viggiano explains, “If the child moves, the tech will see that on the camera and can stop and reposition so that he doesn’t have to redo the X-ray.” This reduces the number of unnecessary procedures and the accompanying radiation.

## **SERVICE AND IMPLEMENTATION**

Swissray is dedicated to ensuring a smooth implementation of their ddR solutions. There is a risk of encountering implementation problems for any equipment involving software, and Swissray has made a conscious effort to facilitate this process. For Dubiel, “one of their strengths is Swissray’s sales force’s responsiveness and service. My sales rep is very responsive, very respectful. If you need help he’ll get you to the right people. They are upfront all the way up to management.”

Swissray users commend the company on the solution’s ease of use and intuitiveness, which greatly simplify training requirements and accelerate the technicians’ learning curves. Dubiel adds, “The technologists took to the machine and how easy it was to use. They had never done ddR before but it was very quick for them to learn the machine and use it. The level of support that we received from our sales rep and the trainers was fantastic. We were very surprised compared to other vendors. We got really good training from Swissray. There wasn’t a long learning curve.”

## **CONCLUSION**

Swissray’s ddR solution helps hospitals improve patient care and productivity with its faster patient throughput, ease of use, and flexible, patient-friendly software functionalities including automatic dose reduction. A conversion from CR to ddR for some or all rad rooms can streamline a facility’s workflow, allowing for more cases and, therefore, higher revenue potential. Facilities using ddR also see significant cost savings over time with the ability to reduce staff and eliminate film, chemicals and other consumables. With the ability of ddR to perform the workload of several conventional x-ray rooms, extremely valuable healthcare real estate can be allocated to other revenue producing activities.

Swissray’s innovation and dedication to quality DR solutions establishes them as an industry benchmark. In addition to providing the clinical and operational benefits of DR, Swissray customers are also appreciative of the company’s commitment to providing a superior level of service at flexible, competitive prices.

“When you have technologists working with state-of-the-art, top-of-the-line equipment which at the same time makes their jobs easier, you have a very satisfied staff,” concludes Viggiano.

## ACKNOWLEDGEMENTS

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Paul Dubiel, the Director of Imaging Services for Dell Children's Hospital and Seton Williamson County Hospital. The Seton Family of Hospitals, a not-for-profit organization, is the leading provider of healthcare services in Central Texas, serving an 11-county population of 1.7 million.

Kim Elzey, the Radiology Manager of Dorchester General Hospital, in Cambridge, MD, which is part of Shore Health System. The Shore Health System combines two private, not for profit hospitals with a combined 236 licensed beds offering a complete range of inpatient and outpatient services to over 100,000 people throughout the Mid-Shore of Maryland.

Jerry Moody, Radiology Director, and Tammy Viggiano, Clinical Operations Director, for Nationwide Children's Hospital in Columbus, OH. Nationwide Children's is the fifth largest children's hospital in the U.S. and one of the top ten in National Institutes of Health-funded freestanding pediatric research centers. Nationwide Children's is also home to The Ohio State University College of Medicine Department of Pediatrics.

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### ABOUT SWISSRAY

For over ten years Swissray (East Brunswick, NJ) has been recognized as the industry's true pioneer in the design, manufacture and marketing of proprietary state-of-the-art direct digital Radiography ddR technology. Delivering high quality radiographic images in just seconds, Swissray's world-leading single detector technology dramatically improves overall productivity, and significantly lowers the cost of general radiography in comparison to conventional or computed radiography.

Swissray offers cutting-edge solutions for any application in the field of general radiography. Specifically designed packages for advanced imaging applications such as orthopedic, pediatric, bone mineral density and chest radiography are available. With years of extensive clinical experience, Swissray has collaborated with leading radiography professionals and renowned health care facilities across the globe to deliver the world's best digital radiography solutions. For more information, visit <http://www.swissray.com>

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