Advances in X-ray dose reduction techniques

Annalia De Venezia
Image Guided Therapy Systems, Italy
October 24, Torino

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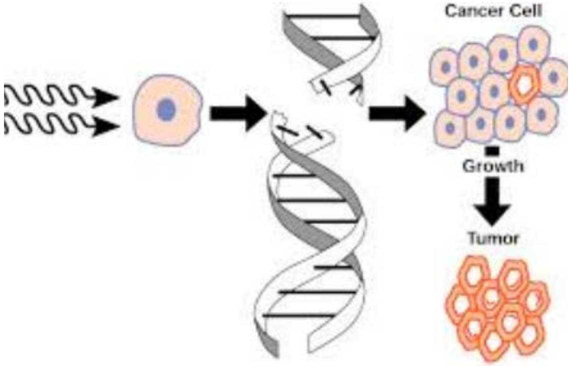
Effects of radiation dose

Patient and staff

Patient: Skin effects and cancer



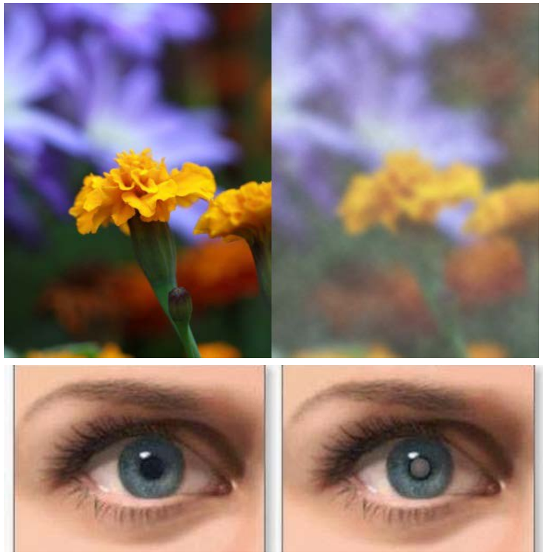
Staff: Cancer and cataracts


CLINICAL RESEARCH

Brain tumours among interventional cardiologists: a cause for alarm?

Report of four new cases from two cities and a review of the literature

Abstract



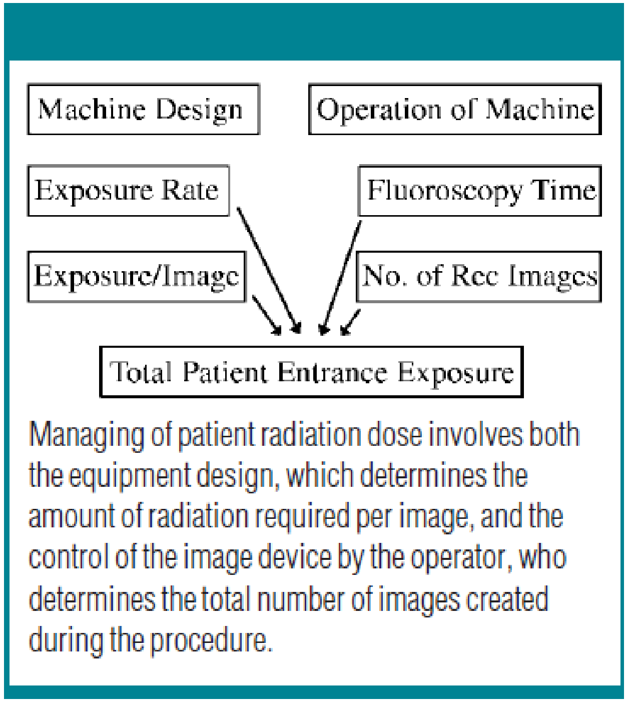
Patient radiation dose management

- ALARA principle -

The **most effective ALARA step**:
whenever possible, use an alternative imaging modality without ionizing radiation!

If this is not possible, two aspects need to be considered to achieve ALARA patient doses

Design of imaging equipment is optimized to reduce radiation dose



Correct operation of the equipment

Strauss KJ, Kaste SC. The ALARA (as low as reasonably achievable) concept in pediatricinterventional and fluoroscopic imaging: striving to keepradiation doses as low as possible during fluoroscopy of pediatricpatients—a white paper executive summary. PediatrRadiol. 2006; 36 (Suppl 2): 110–112

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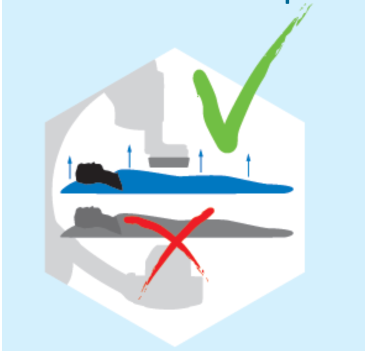
Reducing patient dose

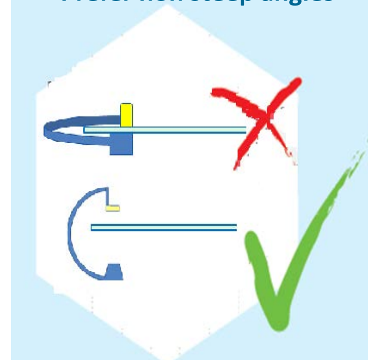
The ALARA principle

Increase distance tube-patient



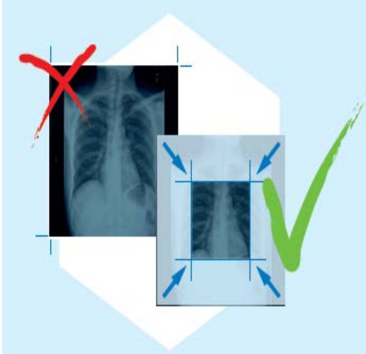
Lower SID

Prefer non steep angles

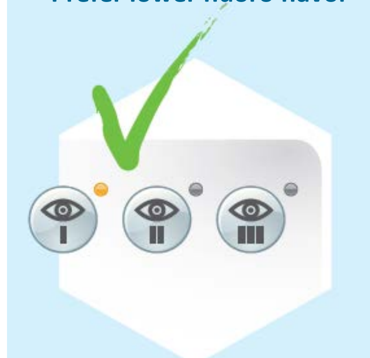


Store fluoro

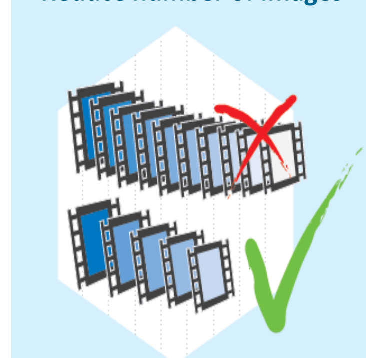
Use collimation



Prefer lower fluoro flavor



Reduce number of images



Reduce fluoro time

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Reducing staff dose

Beside reducing patient dose,

Use lead shielding.

Keep distance if possible during acquisition.

If possible, step out of the examination room during acquisition.

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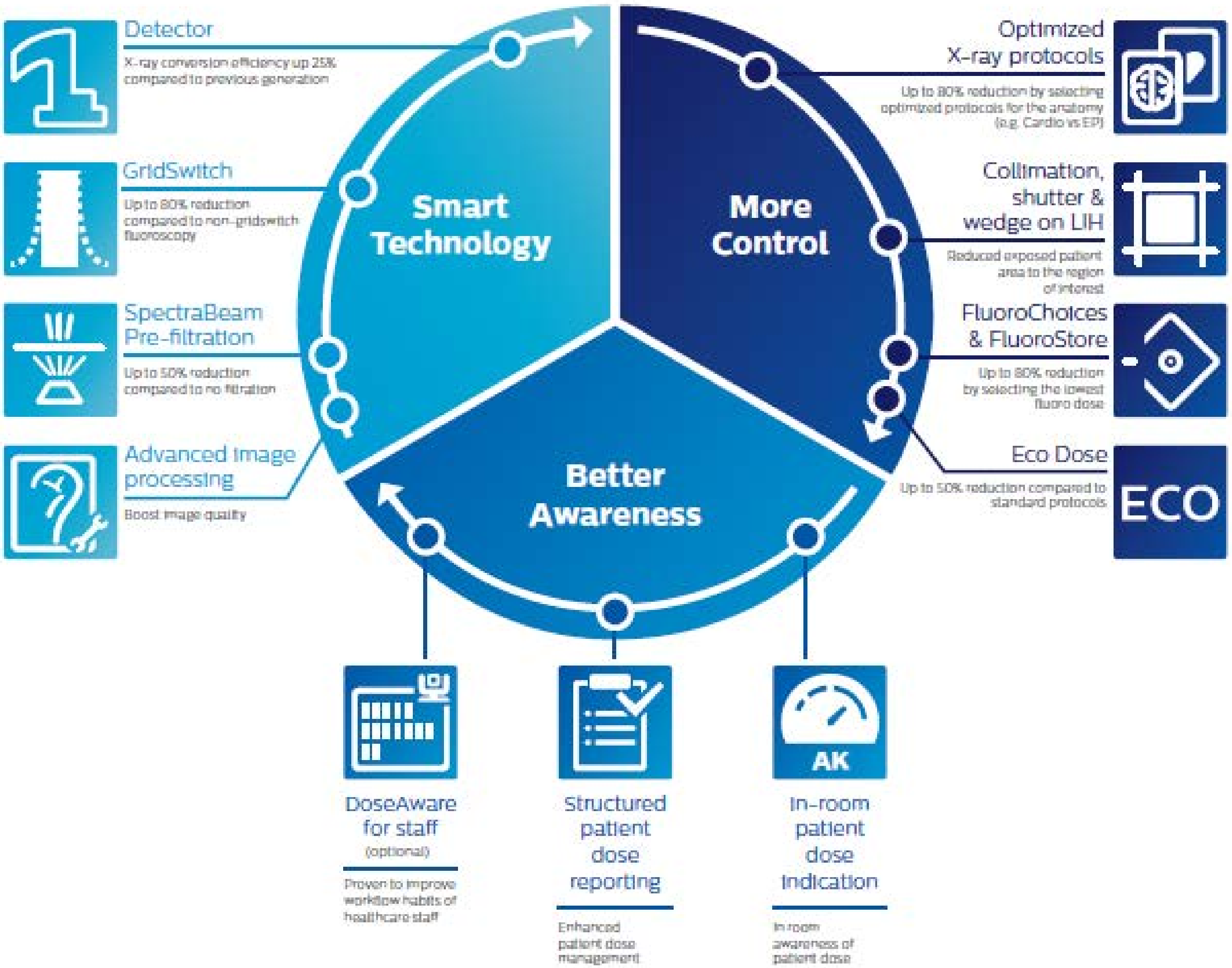
The DoseWise program



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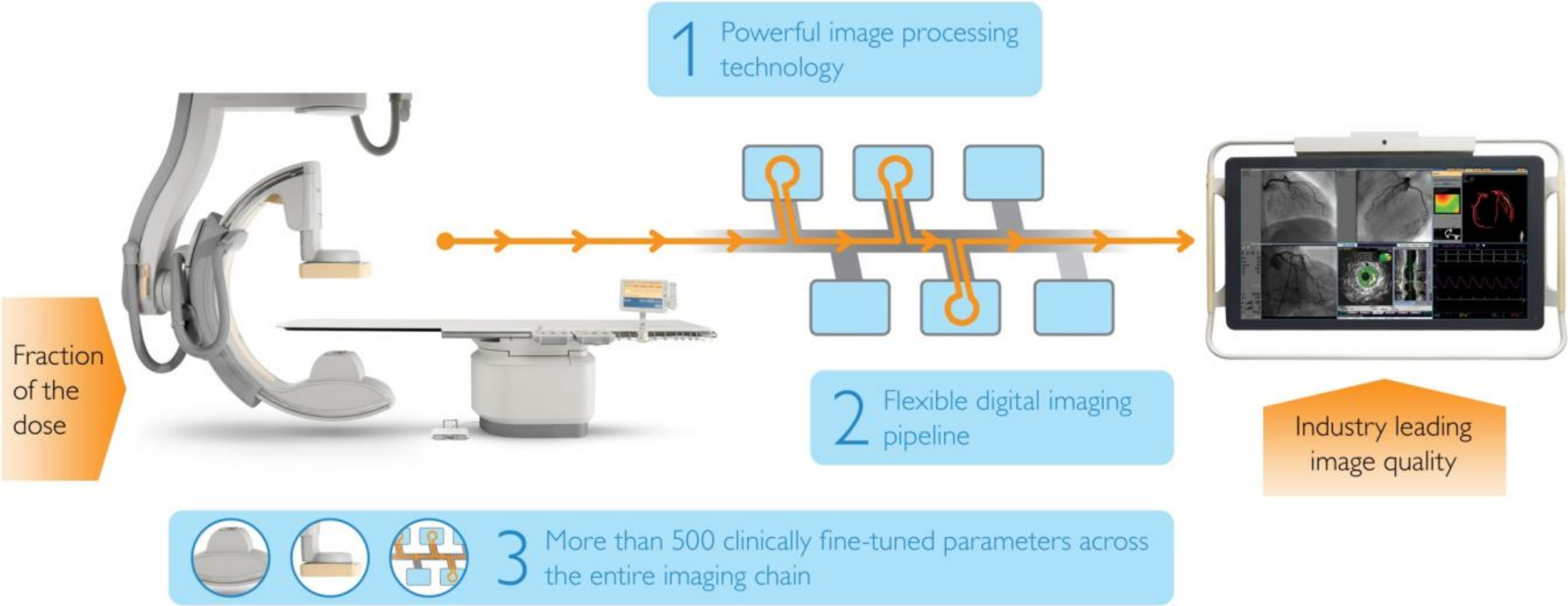
ClarityIQ: the foundation of AlluraClarity family

Unique ClarityIQ technology: touches every part of the AlluraClarity system from tube to display



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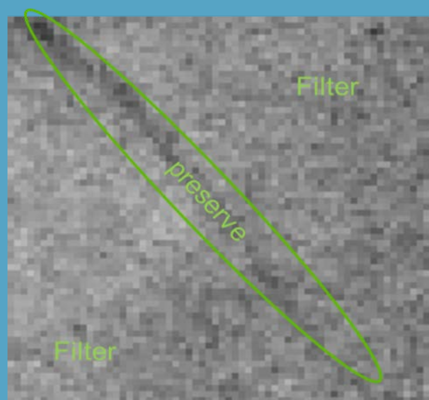
ClarityIQ: image processing building blocks

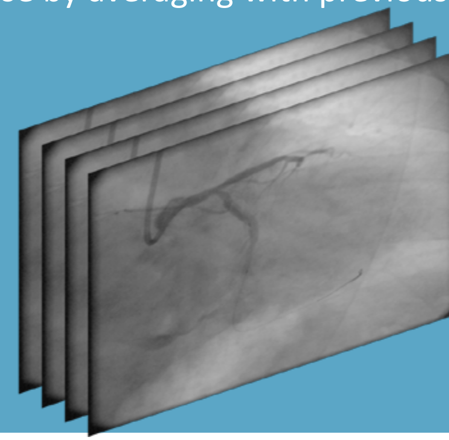
Spatial noise reduction

Reduce noise by averaging with neighboring pixels



Temporal noise reduction

Reduce noise by averaging with previous frames



Automatic live motion compensation

Reduce effect of motion in subtraction imaging

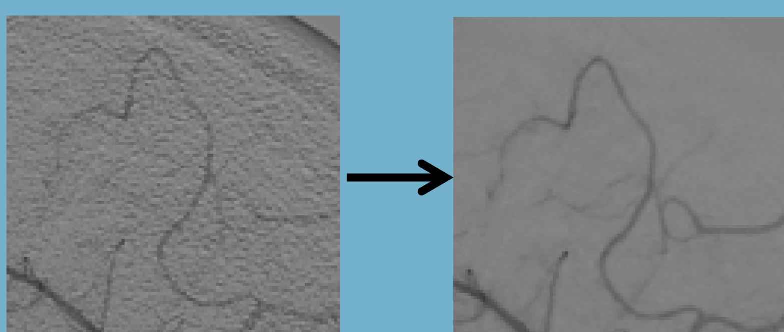
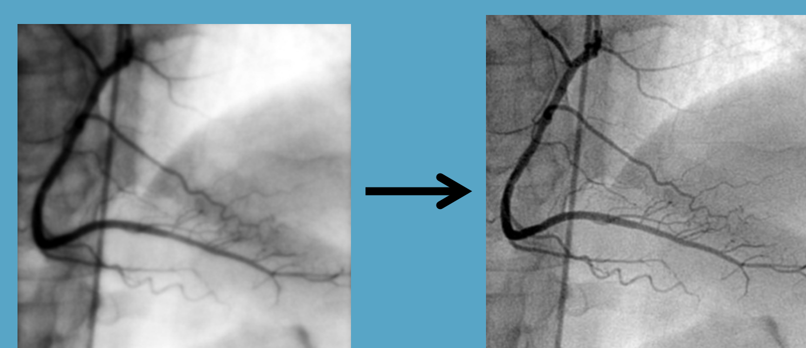


Image Enhancement

Optimize clinical visibility/utilize all clinical information



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Clinical evidence

- List of published studies -

Manuscripts

Hospital, Country	Principal Investigator	Clinical Area	Title	Journal, Month/Year	Study Design	Results summary
Karolinska, Stockholm (S)	Dr. M. Söderman	Neuro	Image Noise Reduction Algorithm for Digital Subtraction Angiography: Clinical Results.	Radiology, Nov 2013	Prospective patient dose comparison between (randomized) Clarity and Xper DSA run on 20 patients (double injection), plus DSA IQ assessment	Patient entrance dose reduction in DSA of 75%, without loss of image quality. https://www.clinicaltrials.gov/ct2/show/NCT01381952?term=ClarityIQ&rank=3 http://pubs.rsna.org/doi/pdf/10.1148/radiol.13121262
Karolinska, Stockholm (S)	Dr. M. Söderman	Neuro	Radiation dose in neuroangiography using image noise reduction technology: a population study based on 614 patients.	Neuroradiology, Aug 2013	Retrospective procedural patient dose comparison between Clarity (312 patients) and Xper (302 patients)	Procedural patient dose reduction of 65% (33% and 75% reduction in DAP fluoro and DAP exposure, respectively) on 614 patients. Comparable demographics and procedure complexity http://link.springer.com/article/10.1007%2Fs00234-013-1276-0
Catharina, Eindhoven (NL)	Dr. LRC Dekker	EP	New image processing and noise reduction technology allows reduction of radiation exposure in complex …	HRS, Aug 2013	Randomized prospective procedural patient dose comparison between Clarity (68 patients) and Xper (68 …	Median procedural patient and staff dose reduction of 43% and 50%, respectively. Comparable demographics and procedure complexity …
CCHMC, Cincinnati (USA)						
MUMC, Maastricht (NL)*						

Manuscripts

Hospital, Country	Principal Investigator	Clinical Area	Title	Journal, Month/Year	Study Design	Results summary
Radiologická klinika LF UK a FN, Hradec Králové (Cz)*	Dr. M. Rek	Neuro/ Vascular	Reducing the radiation burden of angiographic performance using the ClarityIQ technology (*Snížení radiační zátěže při angiografických výkonech s využitím systému ClarityIQ*)	Ces Radiol, Apr 2014	Retrospective effective dose comparison between Clarity (100 patients) and Xper (50 patients) for TIPS, stentgrafts for AAA, and neuro procedures	The effective dose decrease ranged from 50% to 70% and was proved be statistically significant. http://www.cesradiol.cz/dwnld/CesRad_148_152.pdf
HDZ, Bad Oeynhausen (D)	Dr. N. Haas	Ped Cardio	Substantial radiation …	JC Heart & …	Retrospective procedural …	Total DAP reduction: a) 57%, b) 71%, c) 5…
St Antonius, Nieuwegein (NL)						
UZ Gent, Ge… (B)*						
Kyoto Katsu… Hospital, Japan						

* Not BI…

Manuscripts

Hospital, Country	Principal Investigator	Clinical Area	Title	Journal, Month/Year	Study Design	Results summary
CCHMC, Cincinnati (USA)	Dr. J. Racadio	Ped IR	Estimates of diagnostic reference levels for pediatric peripheral and abdominal fluoroscopically-guided procedures	American Journal of Roentgenology, May 2015	RDSR retrospectively collected for Clarity (175 pts) and Xper (180 pts) to quantify patient dose reduction	Pediatric abdominal IQ/ Dose reduction ra… from 55% to 82% http://www.ajronline.org/doi/abs/10.2214/…14.13630
John Hopkins, (USA)	Dr RE. Schernthaner, JH Geschwind	TACE	A new angiographic imaging platform reduces radiation exposure for patients with liver cancer treated with transarterial chemoembolization	European Journal of Radiology, May 2015	Patient radiation dose comparison between Clarity (52 pts) and Xper (26 pts), plus DSA IQ assessment on a five-rank-scale in randomized and blinded fashion	Significant dose reduction with Clarity in cumulative DAP of 66% compared to Xper. No significant differences in DSA image quality were found between the two imaging platforms (p=0.49). http://link.springer.com/article/10.1007%2Fs00330-015-3717-0
VA North Texas Health Care System, Dallas, TX, USA *	G. Christopoulos	PCI/phantom	Comparison of Radiation Dose Between Different Fluoroscopy Systems in the Modern Catheterization Laboratory: Results From Bench Testing Using an Anthropomorphic Phantom	CCI 2015	Phantom radiation dose evaluated on 15 sec of cine with 4 commonly used X-ray systems: GE Innova IGS, Integris Allura FD20, Allura Clarity and SMS Artis one	Order in terms of lower dose: 1. Clarity, Integris Allura Xper FD20, GE Innova, SMS Artis One, with Clarity showing 60% lower AirKerma than Artis One. http://www.ncbi.nlm.nih.gov/pubmed/26010374
CCHMC, Cincinnati (USA)	Strauss, Racadio	Ped IR/piglets	Comparison of pediatric radiation dose and vessel visibility on angiographic systems using piglets as a surrogate: antiscatter grid removal vs. lower detector air kerma settings with a grid — a preclinical investigation	Journal Of Applied Clinical Medical Physics, Aug 2015	Three piglets (5, 14, and 20 kg) imaged using six different selectable detector air kerma (Kair) per frame values (100%, 70%, 50%, 35%, 25%, 17.5%) with and without the grid. Five pediatric interventional radiologists evaluated all images.	Grid removal reduces both dose and image quality score. Image quality scores can be maintained with less dose to subject with the grid in the beam as opposed to removed. Grid removal reduced both dose to subject and imaging quality by 26%. Third order branches could only be visualized with the grid present; Second order branches could be visualized with grid at 17.5% detector Kair for all three pig sizes. Without the grid, 50%, 35%, and 35% detector Kair were required for smallest to largest pig, respectively.

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Abstracts

Hospital, Country	Principal Investigator	Clinical Area	Title	Congress	Study Design	Results summary
UCSF, San Francisco (USA)	Dr RK Kerlan	TACE	Radiation Dose Reduction in Body Interventional Radiology: Clinical Results Utilizing a New Imaging Acquisition and Processing Platform	AAPM 2014	Retrospective procedure patient dose comparison between Clarity (25 patients) and Xper (85 patients)	Procedural dose (DAP) reduction of 43%. Mean total fluoroscopy time not significantly different between the two cohorts http://www.aapm.org/meetings/2014AM
UCSF, San Francisco (USA)						
John Hopkins, (USA)						
MUMC, Maastricht (NL)*						
Jefferson University Hospital, Philadelphia (USA)*						

* Not BIU dri…

Abstracts

Hospital, Country	Principal Investigator	Clinical Area	Title	Congress	Study Design	Results summary
St Antonius, Nieuwegein (NL)	Dr MJL van Strijen	IR	New Angiographic Imaging Technology Enables Substantial Dose Reduction without Compromise to Image Quality	RSNA 2013	Prospective patient dose comparison between (randomized) Clarity and Xper DSA run on 51 patients (double injection), plus DSA IQ assessment	Patient entrance dose reduction in DSA by 83%, without loss of image quality. https://www.clinicaltrials.gov/ct2/show/NCT01599741?term=ClarityIQ&rank=2
St Antonius, Nieuwegein (NL)	Dr MJL van …	IR	Evaluation of staff dose reduction …	ICMP 2013	Prospective scatter dose …	Scatter dose reduction in DSA by 70% …
CCHMC, Cincinnati (USA)						
CCHMC, Cincinnati (USA)						
CCHMC, Cincinnati (USA)						

Abstracts

Hospital, Country	Principal Investigator	Clinical Area	Title	Congress	Study Design	Results summary
St Radboud, Nijmegen (NL)	Dr T. Ten Cate	PCI	Automated image enhancement to reduce radiation dosage without loss of image quality	SCAI 2013	Prospective patient dose comparison between (randomized) Clarity and Xper cine run on 39 patients (double injection), plus DSA IQ assessment	Patient entrance dose reduction in cine by 50%, without loss of image quality. https://www.clinicaltrials.gov/ct2/show/NCT01684826?term=ClarityIQ&rank=1
UZ Gent, Gent (B)	Prof Y. Taeymans	PCI	Patient And Occupational Dose Reduction Enabled By A Novel X-ray Imaging Technology For Interventional Cardiology: First Results	TCT 2014	Randomized prospective procedural patient and staff dose comparison between Clarity (31 patients) and Xper (17 patients)	Total, fluoroscopy and exposure DAP decreased with 68%, 33% and 75%, respectively. Scatter dose rate at the C-arm decreased with 67%. Comparable demographic and procedure complexity http://content.onlinejacc.org/article.aspx?articleid=1903633
Leeds General Infirmary, Leeds	Dr M. Lupton	PCI	Does new image enhancement technology provide a substantial …	RSNA 2014	Retrospective procedure patient dose comparison between Clarity (130 …	Total, fluoroscopy and exposure DAP decreased with 64%, 75% and 50%, …
Leeds General Infirmary, Leeds						
VA No… Texas Health System, Dallas, USA *						

Abstracts

Hospital, Country	Principal Investigator	Clinical Area	Title	Congress	Study Design	Results summary
MCVI, USA	Dr Pena	Visceral embolization	The Effect of Radiation Dose Reduction Technology on Endovascular Visceral Embolization Procedures	SIR 2015	Retrospective comparison between Clarity (n=100 pts) vs Xper (n=139 pts). Patients divided in groups according BMI (BMI <25 kg/m2, BMI >25 and <30 kg/m2, BMI >30 kg/M2)	AK was 1342.9 ±1080.1 versus 2214.8 ± 1826.8 (p<.001) for Clarity vs Xper. http://www.jvir.org/article/S1051-0443(14)01550-4/pdf
Mt Sinai, USA	Dr Lookstein	UFE	Radiation dose reduction using image noise reduction technology during uterine artery embolization: a pilot study	SIR 2015	Clarity (n=22) vs Xper (n=28) dose comaprison	Approximately 60% radiation dose reduction, without affecting the operating habits of the physician. http://www.jvir.org/article/S1051-0443(14)01549-8/pdf
Umass, USA	Dr Wakhloo	Neuro	Novel imaging platform reduces patient radiation exposure during diagnostic and interventional X-ray angiography	ASNR 2015	DAP, FT and contrast collected for patients who underwent diagnostic angiography (group 1) or received aneurysm treatment by either coil embolization (group 2) or flow diverter placement (group 3). Patients treated with Clarity (60 pts) or Xper (60 pts), 20 pts per group per platform	For diagnostic, coil embolization, and flow diverter groups Allura Clarity achieved dose reductions of 69.5%, 55.0%, and 47.5%, respectively (all p<0.001). http://ww4.aievolution.com/asn1501/index.cfm?do=abs.viewAbs&abs=2053
NYP, USA	Dr. Balter	CAG, CTO	Improved imaging technology reduces radiation dose and facilitates complex procedures	SCAI 2015	Comparison between FD20 Clarity (previously FD20 Eco) and FD10 as reference for all procedures, diagnostic and CTO	ALL procedures: 50% reduction with Clarity compared to reference even though contrast and fluoro time increased. CTOs: no dose reduction with Clarity, even though 70% increase in fluoro time. http://www.scai.org/SCAI2015/detail.aspx?cid=c7782141-8a20-4303-a507-876ff99db8ed (nr 196)

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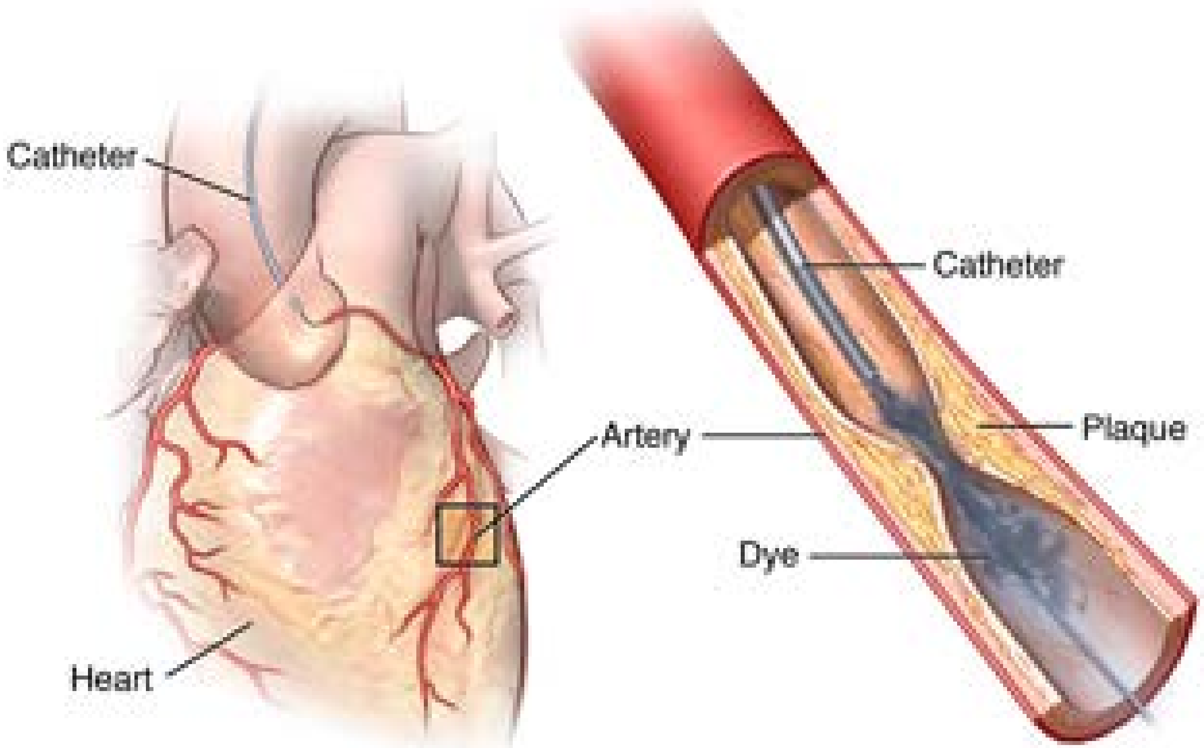
CARDIO - PCI



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Optimized cardio X-ray acquisition chain

Fluoroscopy:

			
AlluraXper EDL [R/min]	5	10	10
AlluraClarity EDL [R/min]	2.5	5	9

Exposure (cine acquisition):

AlluraXper			Coronary 15 fr/s
AlluraClarity	Coro 15 fr/s **25%**	Coro 15 fr/s **50%**	Coro 15 fr/s **100%**

Procedural patient dose reduction & IQ assessment

- UZ Gent -

Principal Investigator: Prof Yves Taeymans
Medical Physics Department: dr Klaus Bacher
Universitair Ziekenhuis, Gent, B

Study accepted in CCI, Feb 2015

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Procedural patient dose reduction & IQ assessment

- Study Design -

Prospective randomized enrollment, coronary angiography (diagnostic and intervention), informed consent

Room A: FD2010 AlluraClarity

Room B (reference): FD10 Allura Xper

Two cine runs selected from each patient (PA of LCA and Lateral of RCA)

4 interventional cardiologists graded the diagnostic quality of each run independently on a scale 0-5

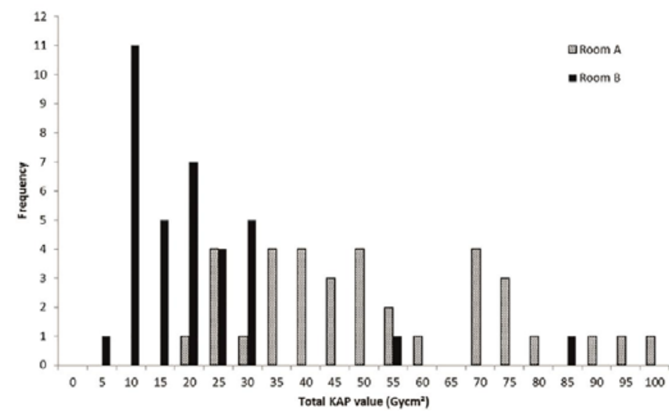
Criterion	Description	Question
1	Rating of image resolution	How would you judge the sharpness of delineation?
2	Rating of image contrast	How would you judge the contrast with the background?
3	Rating of image noise	How would you judge the noise content?
4	General image quality score	How would you judge the overall image quality?

Procedural patient dose reduction & IQ assessment

- Results on radiation dose -

75% total DAP reduction

DAP values for fluoroscopy and cine decreased with 30% and 77%, respectively, compared to the Allura Xper system.



KAP* for total procedure, Gycm²	47.4 (33.6 - 66.5)	12.0 (7.59 - 20.1)	<0.001
KAP total CA†, Gycm²	41.7 (29.6 - 60.3)	8.77 (6.33 - 17.6)	<0.001
KAP fluoro, Gycm²	4.62 (3.02 – 9.18)	3.22 (2.00 – 6.62)	0.064
KAP cineangiography, Gycm²	41.5 (28.8 – 55.3)	9.48 (5.68 - 14.0)	<0.001
Cine runs, n	11 (10 - 12)	11 (10 - 12)	0.468
Fluoroscopy time, s	114 (72 - 196)	172 (114 - 301)	0.015
CMC‡, mL	115 (104 - 130)	119 (99.7 - 136)	0.492
KAP LCA Lao0° Cran0°, Gycm²	1.57 (1.25 – 1.96)	0.260 (0.169- 0.435)	<0.001
KAP LCA Lao90° Cran0°, Gycm²	2.99 (1.88 – 5.21)	0.617 (0.379 - 1.16)	<0.001
KAP RCA Lao90° Cran0°, Gycm²	2.65 (1.92 – 4.48)	0.733 (0.492 – 1.23)	<0.001
KAP LV Rao35° Cran0°, Gycm²	4.37 (3.11 - 5.95)	2.57 (1.55 - 3.31)	<0.001

*KAP: kerma-area product; †CA: coronary angiography – here without the left ventriculogram;

The operator switched to the 50% dose setting to improve image quality for the posterior-anterior view in 1 case (patient BMI of 35 kg/m²) and for the lateral view in 2 cases (patient BMI of 35 and 34 kg/m²).

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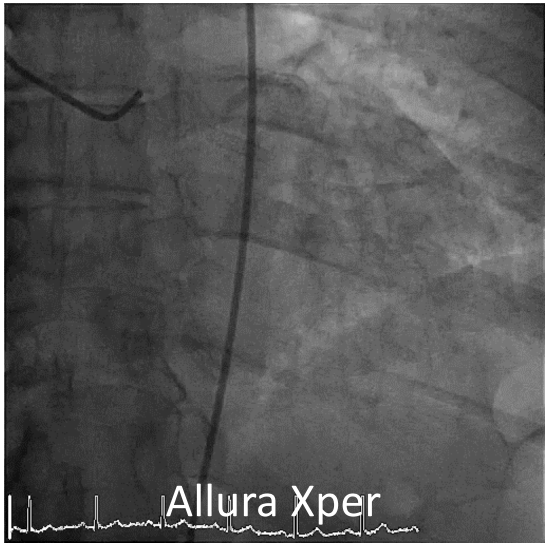
Procedural patient dose reduction & IQ assessment

- Example of cine acquisitions and IQ Results



Equivalent general IQ

	Room A	Room B	P-value
LCA, n	35	35	
Q1: image resolution	78 ± 7	75 ± 10	0.168
Q2: image contrast	82 ± 7	80 ± 9	0.512
Q3: image noise	84 ± 7	64 ± 9	<0.001
Q4: general IQ score	80 ± 8	76 ± 11	0.172
RCA, n	35	35	
Q1: image resolution	78 ± 9	75 ± 12	0.180
Q2: image contrast	78 ± 8	80 ± 10	0.293
Q3: image noise	83 ± 7	64 ± 11	<0.001
Q4: general IQ score	76 ± 11	76 ± 12	0.877

tems, Italy

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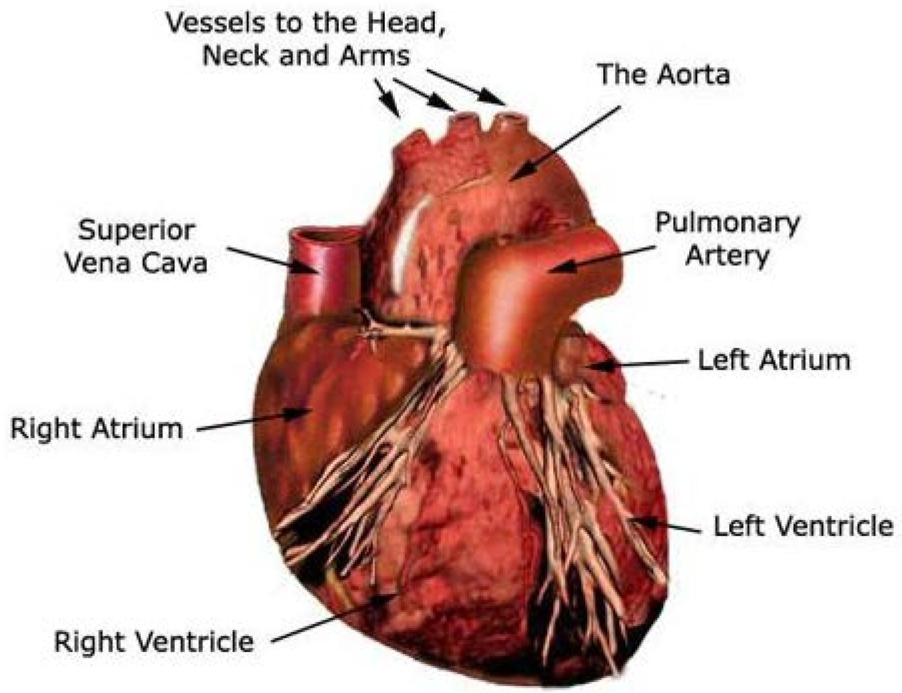
CARDIO – SHD/CHD



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Optimized Pediatric Cardio X-ray acquisition chain

Pediatric < 40 kg

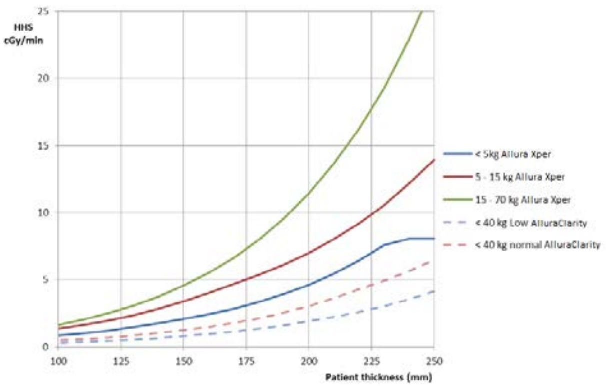
Fluoroscopy:

AlluraXper EDL [R/min]	2	5	5
AlluraClarity EDL [R/min]	0.8	1	2.5

Exposure (cine acquisition):

AlluraXper — Ped 15 fps

AlluraClarity — Ped <40kg 15fps, Low | Ped <40kg 15fps, Norm



Pediatric > 40 kg

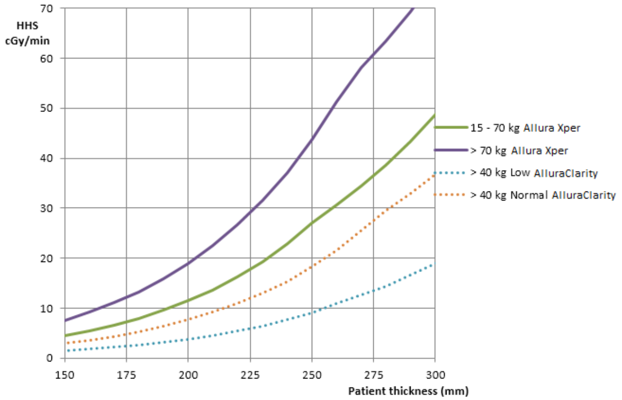
Fluoroscopy:

AlluraXper EDL [R/min]	2	5	5
AlluraClarity EDL [R/min]	2.5	5	10

Exposure (cine acquisition):

AlluraXper — Ped 15 fps

AlluraClarity — Ped >40kg 15fps, Low | Ped >40kg 15fps, Norm



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Retrospective procedural patient dose reduction

- HDZ -

HDZ NRW

UK RUB

Principal Investigator: dr N. Haas
HDZ, Bad Oeynhausen, D

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Retrospective procedural patient dose reduction

- Study design -

649 patients, congenital heart disease procedures

Room 1 (reference):
FD2010 Allura Xper
July 2012-Feb 2013
328 patients

Room 1 (upgraded):
FD2010 AlluraClarity
March-October 2013
321 patients

Procedures divided into Diagnostic and Intervention (subgroups ASD)
Analysis in 3 weight groups (<10kg, 10-40kg, >40kg)

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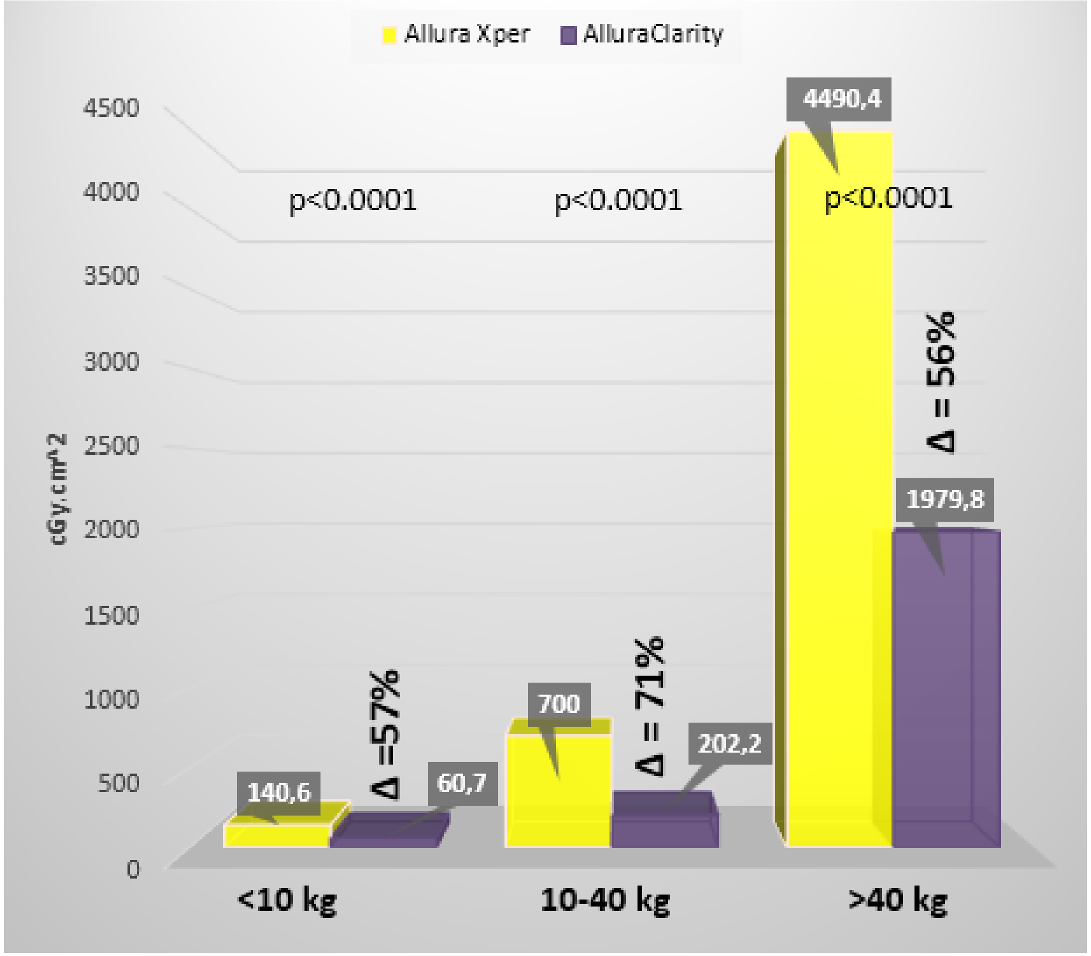
Up to 71% procedural patient dose reduction

Retrospective patient dose comparison



No statistical significant difference for patient demographics and procedure characteristics (fluoro time and volume of contrast medium)

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Retrospective procedural patient dose reduction

- Publication -

IJC Heart & Vasculature 6 (2015) 101–109

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journal homepage: http://www.journals.elsevier.com/ijc-heart-and-vasculature

ELSEVIER

Substantial radiation reduction in pediatric and adult congenital heart disease interventions with a novel X-ray imaging technology

CrossMark

Nikolaus A. Haas [a,*], Christoph M. Happel [a], Maria Mauti [b], Cherif Sahyoun [b], Lea Z. Tebart [a], Deniz Kececioglu [a], Kai Thorsten Laser [a]

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A R T I C L E   I N F O

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Dose reduction
Congenital heart disease
DAP
Radiation exposure
Interventional therapy

A B S T R A C T

Background: Pediatric catheterization exposes patients to varying radiation doses. Concerns over the effects of X-ray radiation dose on the patient population have increased in recent years. This study aims at quantifying the patient radiation dose reduction after the introduction of an X-ray imaging technology using advanced real time image noise reduction algorithms and optimized acquisition chain for fluoroscopy and exposure in a pediatric and adult population with congenital heart disease.

Methods: Patient and radiation dose data was retrospectively collected (July 2012–February 2013) for 338 consecutive patients treated with a system using state of the art image processing and reference acquisition chain (referred as "reference system"). The same data was collected (March–October 2013) for 329 consecutive patients treated with the new imaging technology (Philips AlluraClarity, referred as "new system"). Patients were divided into three weight groups: A) below 10 kg, B) 10–40 kg, and C) over 40 kg. Radiation dose was quantified using dose area product (DAP), while procedure complexity using fluoroscopy time, procedure duration and volume of contrast medium.

Results: The new system provides significant patient dose reduction compared to the reference system. Median DAP values were reduced in group A) from 140.6 cGy·cm² to 60.7 cGy·cm², in group B) from 700.0 cGy·cm² to 202.2 cGy·cm² and in group C) from 4490.4 cGy·cm² to 1979.8 cGy·cm² with reduction of 57%, 71% and 56% respectively ($p < 0.0001$ for all groups).

Conclusions: Despite no other changes in procedural approach, the novel X-ray imaging technology provided substantial radiation dose reduction of 56% or higher.

1. Introduction

Patients with congenital heart defects frequently undergo numerous and repeated diagnostic and interventional catheterization procedures, in addition to other imaging studies such as chest-X-rays and CT studies. The growing number and complexity of interventional cardiology procedures have been significant in the past years as a result of advances made in transcatheter techniques and the armamentarium available (i.e. devices, stents, percutaneous valves, miniaturized balloons, coils, etc.) [1,2]. While their benefits to the patients are undisputable, all these procedures contribute to high accumulated radiation doses to the patient population [3–5]. This is particularly relevant for infants and children and even if the long term consequences of this exposure are not well understood and extremely difficult to estimate, there is now for many decades considerable concern about the possible stochastic effects, such as the incidence of solid tumors and leukemia [6–11]. In fact, growing tissue in children is more radiosensitive than that in adults and, due to their small size, larger body parts are irradiated during cardiac catheterization including radiosensitive organs such as thyroid and eyes which are closer to the heart [12,13]. Moreover, children with complex heart defects often need to undergo increasingly complex procedures many times during their lifetime, resulting in a high cumulative dose acquired [14–16]. Minimizing radiation dose is therefore crucial for this vulnerable population, as children are likely to survive long enough through a possible latent period and develop or manifest late effects of early radiation exposure.

Successful patient radiation dose management can only be achieved by optimization of medical imaging technology together with best control of the equipment by the operator [17,18]. In this respect, best practices are applied in our lab using "ALARA" radiation reduction

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DoseWise Portal

Take control of dose management for your entire organization

Expected release January 2016

innovation you

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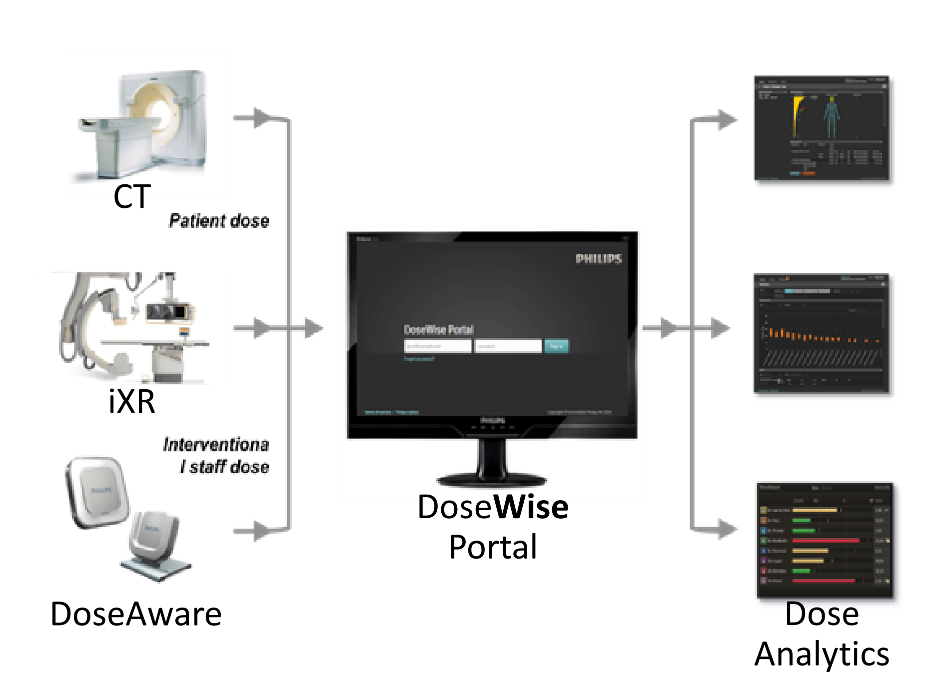
The Dose**Wise** Portal is a comprehensive dose management system that streamlines patient and staff* radiation exposure data collection and analytics for radiation safety and regulatory compliance programs.



* DoseAware Xtend integration required

The Importance of Dose Management is Rising

Growing awareness for dose tracking and optimization

To provide patients with the best image quality possible at the lowest dose possible, clinicians not only want to track radiation exposure data, but also look for solutions to optimize patient dose through exam protocol management and data-informed decision making.

Industry commitment to reducing radiation exposure

Professional associations including European Society of Radiology, American College of Radiology, and Radiological Society of North America have formed steering committees and guidelines to improve radiation safety at hospitals.

New legislation and industry standards around the corner

Dose management systems facilitate compliance with the Joint Commission new standards in the US (effective July 1, 2015) and state regulations. European regulation is expected to be implemented in 2018.

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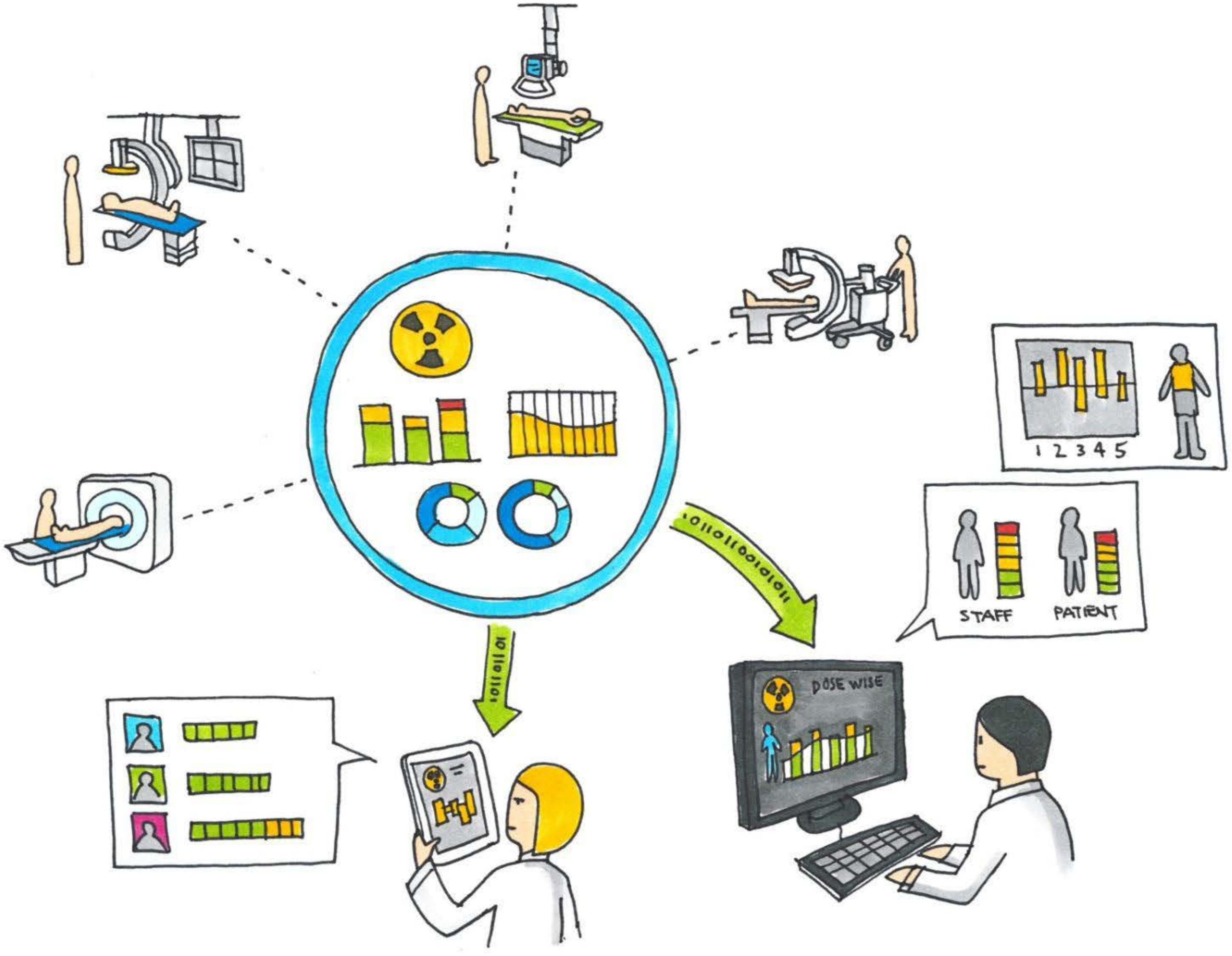
DoseWise Portal Is the Core Component in Your Radiation Dose Management Program



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Make Data-informed Decisions to Improve the Quality of Patient Care

Dose**Wise** Portal provides data to help you optimize patient dose through exam protocol management.

Key features:

- Historical patient dose data across imaging modalities
- Reconciliation of patient information through DICOM Modality Worklist (MWL)
- Size-specific dose estimates (using AAPM TG Report 220) based on water-equivalent diameter calculation
- Custom internal calibration factor capability for fluoroscopic dose
- Role-based user accounts (medical physicist, site administrator, radiologist)
- Interactive charting tools for creating bar charts, scatter plots, line graphs, and tables, including display of key dose metrics. Analysis based on exam, body part, technologist, imaging unit.
- Multiple charts can be saved to dashboards for easy review
- Dashboards can be exported as PDF and sent as email
- Offers optional tailored report creation training

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Streamline Imaging Workflow and Maximize System Utilization

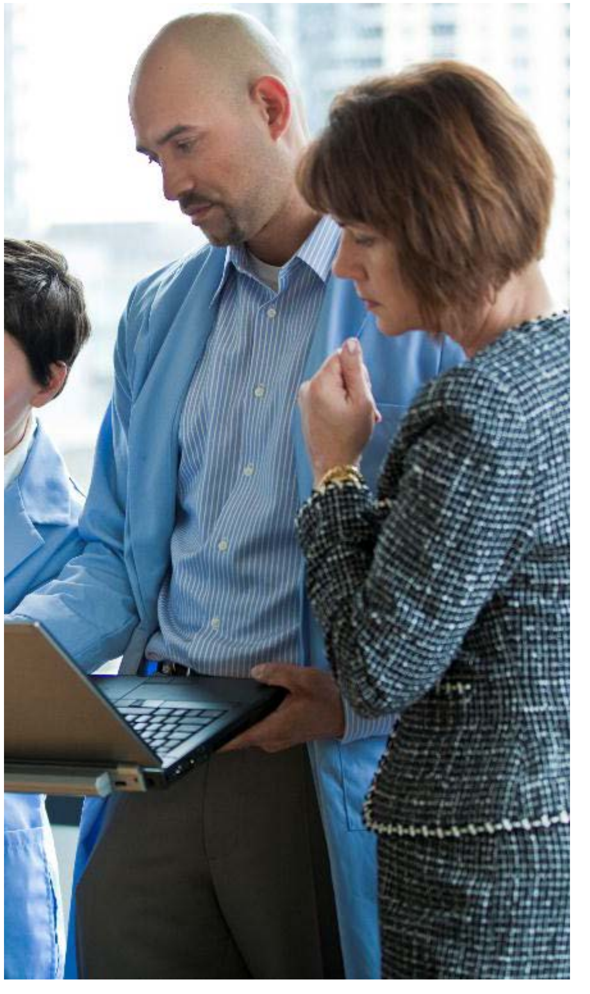
Dose**Wise** Portal connects multi-vendor systems and helps managing imaging workflow costs while improving efficiency and mitigating risk.

Key features:

- Staff exposure from interventional procedures through proprietary interface with Philips DoseAware Xtend *(Philips exclusive feature!)*
- CT overview page, showing median CTDI and DLP, trends, and threshold alerts, by exam and individual scanners
- Configurable mapping between scanner names and institutional lexicons
- Works with all X-ray modalities: CT, fluoroscopy / angiography, CR/DR, mammography
- Dose alert levels and thresholds set by exam and by site with optional email notifications
- Cloud based or local installation (virtual or physical machine)

Demonstrate Your Commitment to Quality, Satisfaction, and Safety

Dose**Wise** Portal facilitates regulatory compliance with software that securely integrates with medical information systems



Key features:

- Executes the new Joint Commission standards
- Extraction of dose data from DICOM-SR, DICOM-SC (for OCR), MPPS, image headers
- May receive data directly from the modality or from PACS
- Dose**Wise** Portal is part of Dose**Wise** Solutions, a comprehensive dose management program that integrates tools, training, and advanced product technologies for diagnostic images quality at lower dose.
- The Dose**Wise** Portal improves radiology quality programs through data-rich analytics in a clean and streamlined user interface.

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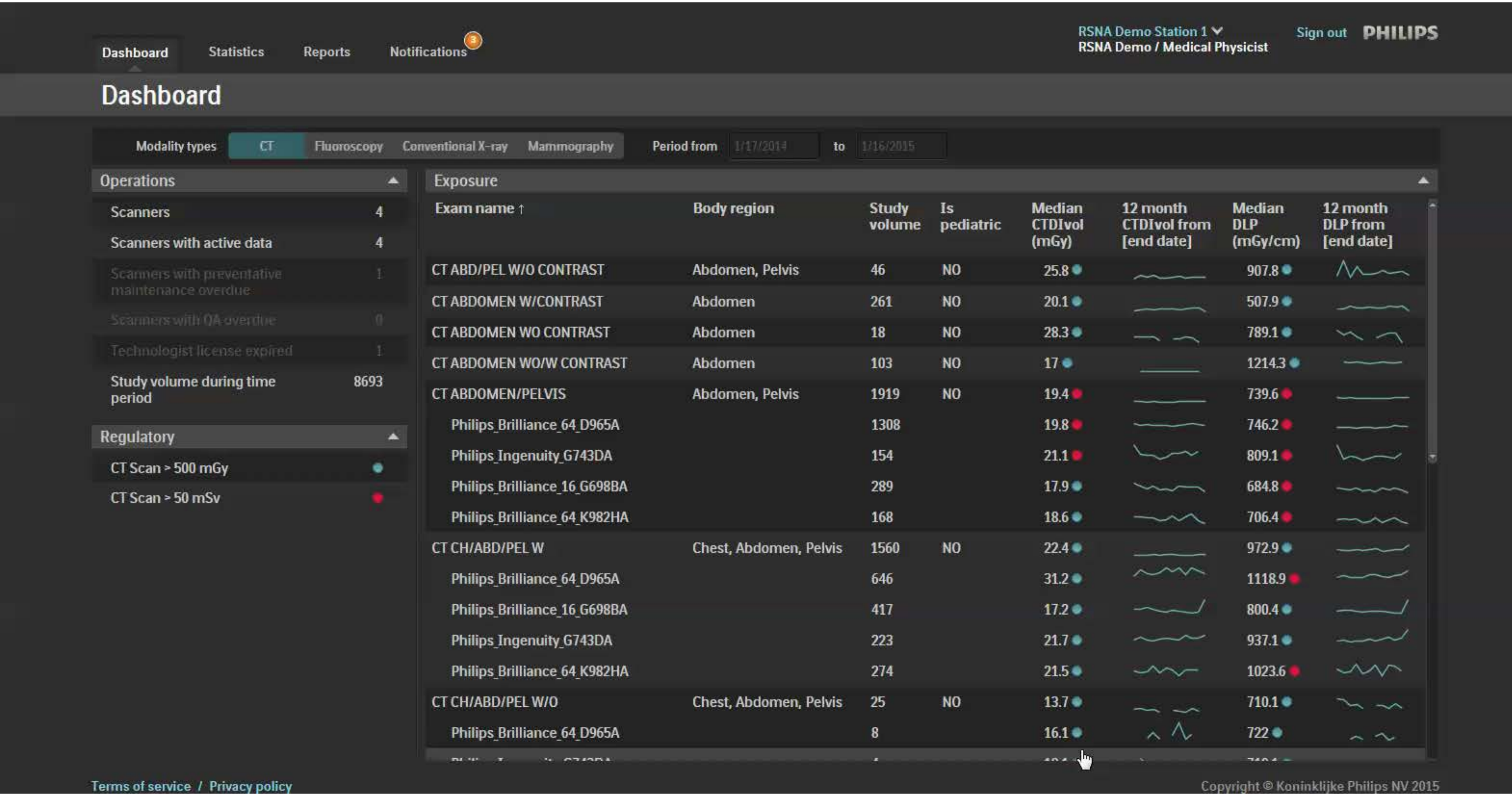
DoseWise Portal demo video!—Click play



Dashboard | Statistics | Reports | Notifications 3

RSNA Demo Station 1
RSNA Demo / Medical Physicist
Sign out PHILIPS

Dashboard

Modality types: CT | Fluoroscopy | Conventional X-ray | Mammography — Period from 1/17/2014 to 1/16/2015

Operations

Scanners	4
Scanners with active data	4
Scanners with preventative maintenance overdue	1
Scanners with QA overdue	0
Technologist license expired	1
Study volume during time period	8693

Regulatory

- CT Scan > 500 mGy
- CT Scan > 50 mSv

Exposure

Exam name ↑	Body region	Study volume	Is pediatric	Median CTDIvol (mGy)	12 month CTDIvol from [end date]	Median DLP (mGy/cm)	12 month DLP from [end date]
CT ABD/PEL W/O CONTRAST	Abdomen, Pelvis	46	NO	25.8		907.8	
CT ABDOMEN W/CONTRAST	Abdomen	261	NO	20.1		507.9	
CT ABDOMEN WO CONTRAST	Abdomen	18	NO	28.3		789.1	
CT ABDOMEN WO/W CONTRAST	Abdomen	103	NO	17		1214.3	
CT ABDOMEN/PELVIS	Abdomen, Pelvis	1919	NO	19.4		739.6	
Philips_Brilliance_64_D965A		1308		19.8		746.2	
Philips_Ingenuity_G743DA		154		21.1		809.1	
Philips_Brilliance_16_G698BA		289		17.9		684.8	
Philips_Brilliance_64_K982HA		168		18.6		706.4	
CT CH/ABD/PEL W	Chest, Abdomen, Pelvis	1560	NO	22.4		972.9	
Philips_Brilliance_64_D965A		646		31.2		1118.9	
Philips_Brilliance_16_G698BA		417		17.2		800.4	
Philips_Ingenuity_G743DA		223		21.7		937.1	
Philips_Brilliance_64_K982HA		274		21.5		1023.6	
CT CH/ABD/PEL W/O	Chest, Abdomen, Pelvis	25	NO	13.7		710.1	
Philips_Brilliance_64_D965A		8		16.1		722	

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