

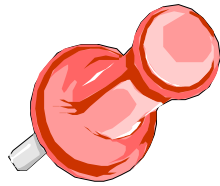


Technical and Organisational Solutions for a Nation-wide Testing Procedure for DICOM CDs

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Introduction and Background



- **The exchange of radiological images on CD is becoming increasingly popular in Germany**
 - good image quality, suitable for post-processing, therapy planning etc.
 - much cheaper than film
 - easier to implement than Teleradiology (no security issues)
- **However, there are also many problems with these “Patient CDs”**
 - not always DICOM images, not always diagnostic quality
 - many CDs rejected by PACS workstations (DICOM errors)
 - different viewing software on each CD, does not always work
 - fear of virus infections through software on the CD
- **The QA Initiative of the German Roentgen Society addresses this issue by**
 - providing a specification for a “best practice” DICOM CD
 - offering a test and validation procedure for CD producing products
 - providing guidance for the correct handling of incoming CDs

Specification of a best practice DICOM CD (1)



- Detailed specification of a DICOM CD that allows for a “plug and play” interchange of radiological images and reports
 - based on IHE “Portable Data for Imaging” specification
 - with some extensions (harmonisation in progress)
- Principles
 - medical images in DICOM format are **required**
 - other non-DICOM content is allowed: reports, discharge letters etc.
 - DICOM viewer application or IHE “web content” is allowed but optional
- Vendors are encouraged to adapt their products to this requirements specification, which is freely available
 - <http://www.dicom-cd.de/> (in German language)



Specification of a best practice DICOM CD (2)



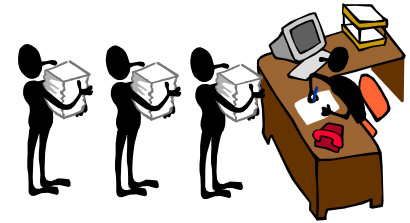
- **Storage medium and file system requirements**
 - CD-R and CD-RW with ISO 9660 file system (no packet writing)
 - multi-session allowed but may be dangerous
- **Malicious software**
 - creator must ensure absence of malicious software (viruses, spyware etc.)
 - recommendation: finalise CD and label with “tested for absence of malware”
- **Labelling of the CD required**
 - should contain patient’s name, birth date, creator, date of study and CD creation, type of content
- **DICOM viewing software (if present)**
 - shall run without installation on normal (restricted) user account
 - must be able to correctly display all DICOM content of the CD
 - recommendation: include PDF manual and printed short manual with CD
 - recommendation: don’t use “autostart” for the viewer

Specification of a best practice DICOM CD (3)



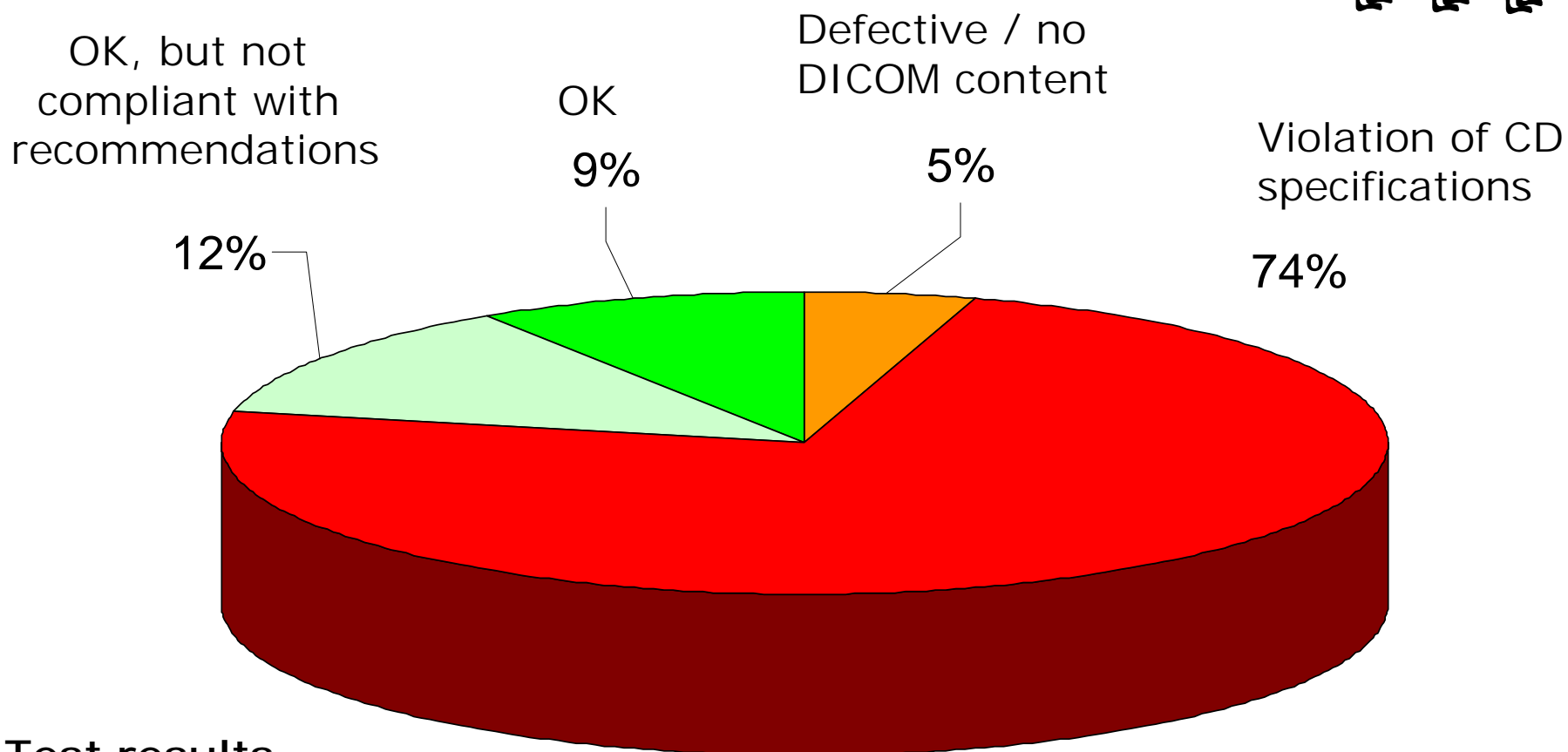
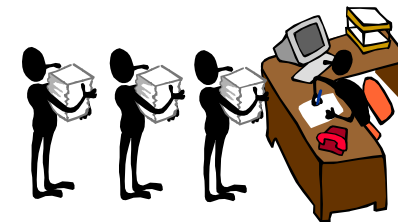
- **Strict DICOM conformance required**
 - a number of DICOM application profiles supported (extension over PDI)
 - DICOMDIR required, DICOM directory and file naming rules apply
 - all medical images must have DICOM format
- **Compression is possible**
 - lossy compression only if this is the original image format
- **CDs may contain data for one or more patients**
 - multi-patient CDs only useful for very specific purposes (QA, clinical studies)
- **Recommendation: All clinically relevant content should be DICOM**
 - With DICOM Encapsulated PDF, there is no excuse not to use DICOM

DICOM CD Tests at DRK 2006 (1)



- **At this year's German Congress of Radiology (DRK 2006), we invited Radiologists to submit DICOM-CDs for a short live test during the show**
 - intended to provide an overview of the "state of the art"
 - also, a good test run for the initial prototype of the conformance test suite
 - CDs with real patient data required explicit consent
- **In total, we received 65 CDs representing 44 different products/versions from 27 different vendors.**
 - Not 100% coverage of the market, but a good overview
- **Test procedure**
 - Automated test software for type of file system, directory structure, absence of malware and conformance of DICOMDIR (images not tested)
 - Manual test of DICOM viewer and web content (if present)
 - Visual inspection of CD labelling and manual (if present)

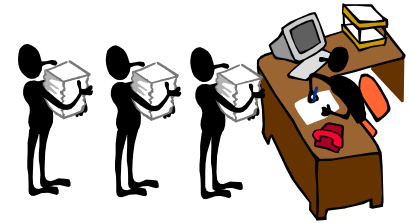
DICOM CD Tests at DRK 2006 (2)



■ Test results

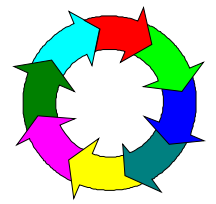
- almost 80% of the tested "real world" CDs failed!
- this clearly shows that - despite all the activities of DICOM and IHE - a quality assurance program is really needed

DICOM CD Tests at DRK 2006 (3)



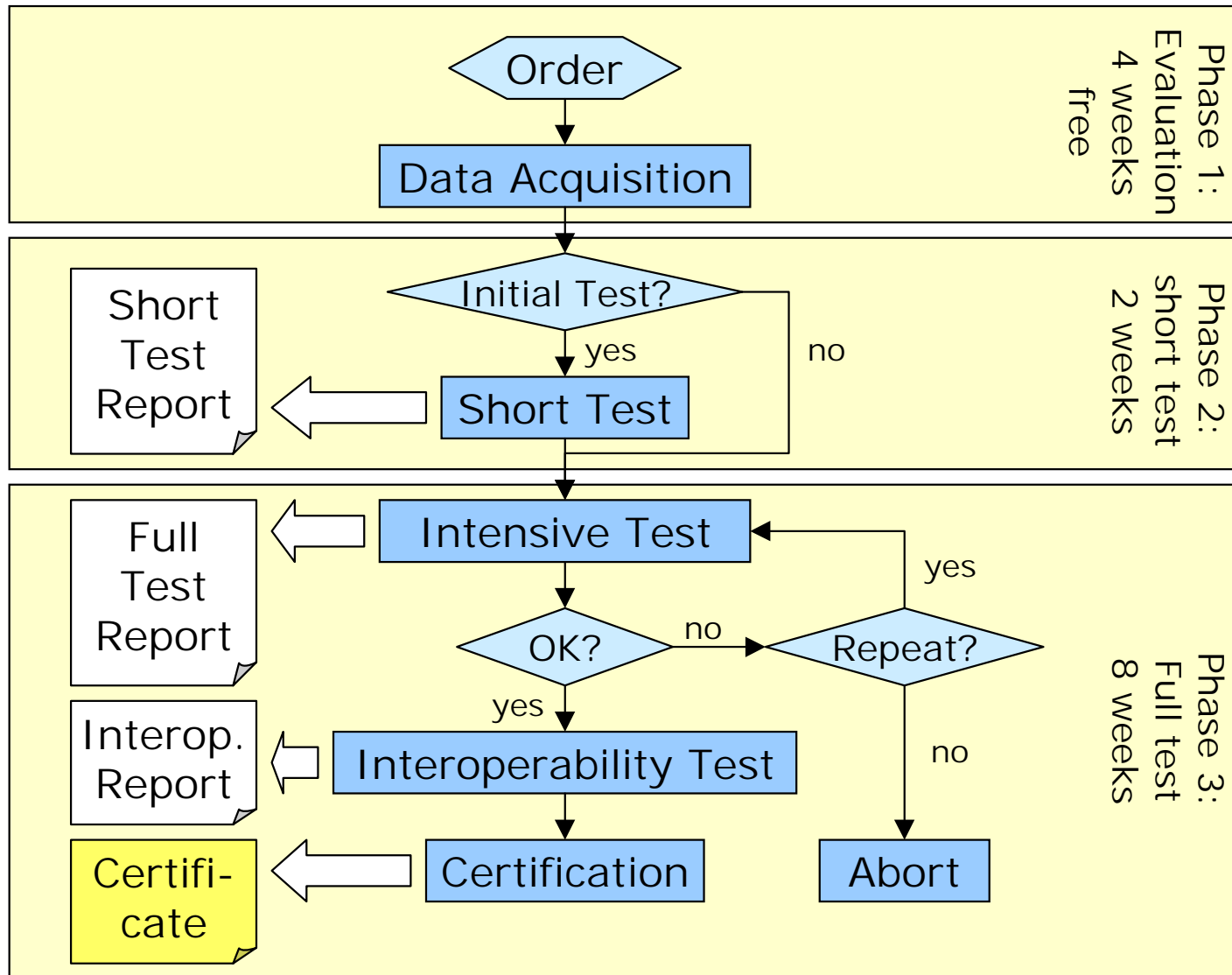
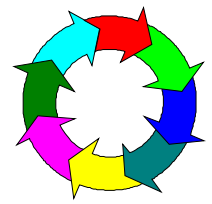
- **Typical DICOM errors**
 - DICOM rules for filenames and directory names violated (beginner's mistake!)
 - missing/empty required fields in DICOMDIR
 - syntax rules for DICOM data types violated
 - incorrect transfer syntax for DICOM images (implicit VR)
- **Typical problems with the DICOM viewer**
 - required administrator privileges or does not run at all (Windows XP)
 - tries to install software components (Java or .NET runtime)
 - tries to write in C:\WINDOWS
 - cannot display all images on the CD
 - often no documentation, no manual
- **CD labelling often missing, almost always incomplete**
- **In summary, most of these problems would be easy to avoid for the software vendor.**

The Validation Process

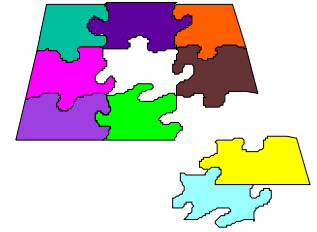


- **Vendors of products that create DICOM CDs are invited to have their product tested for conformance with the DRG specification**
 - Test involves validation of conformance with DRG spec and practical interoperability tests with most popular PACS workstations
 - If successful, certificate awarded to product; details published on website
 - Logo can be attached to product and printed on CDs
 - Vendor needs to pay fees for the validation service
- **Radiologists using a certified system can be sure that their CDs are „state of the art“ and will not displease their customers (unless these totally decline a receipt of digital images)**
- **Recipients of CDs created by certified products can be sure that the CDs can be read and processed without much pain**

Validation Process: Organisational Procedure



Conclusion



- **The exchange of radiological images on DICOM CDs is a desirable thing in principle**
 - teleradiology may supplement or replace CDs in the future, but will have the same conformance/interoperability issues
- **The current problems can be solved if vendors and users co-operate**
 - better CDs with conformance to DRG specification
 - better procedures for reading and importing "patient CDs"
- **The QA Initiative of the German Roentgen Society provides for an improved interoperability of DICOM CDs through specifications, user guides and a nation-wide testing/validation procedure**
 - Whether or not the initiative will be successful in the end largely depends on the German radiologists. Only if they insist on validated products, the QA initiative will change the "state of the art" as observed at DRK 2006
 - Time will tell...