



Media Exchange Certification Project of the
German Radiological Society
(Deutsche Röntgengesellschaft e. V.)

GUIDELINES FOR HANDLING MEDIA CONTAINING PATIENT INFORMATION

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1 INTRODUCTION

Radiological images are increasingly exchanged in digital form using storage media, so-called "patient CDs/DVDs". This approach is desirable in principle since it allows for a lossless exchange of medical images in diagnostic original quality and, if need be, for an import into the digital infrastructure (PACS, diagnostic workstations) of the receiving institution. This enables the attending physician to perform a direct comparison between the current and any former examinations of the patient.

However, in practice it has shown that the exchange of radiological images and accompanying information on storage media still has many problems that are increasingly reported to the German Medical Association ("Bundesärztekammer") and the German Radiological Society ("Deutsche Röntgengesellschaft", DRG). In addition to ambiguity in the work processes at the receiving institution (e. g. registration of the patient in the RIS, import into a temporary archive, reconciliation of patient and order IDs before image import into a local PACS), erroneous and non standard conformant storage media are a significant hurdle for a seamless exchange of storage media.

Because of the multitude of vendors and medical institutions, it is hardly possible to address these issues in each single case. Against this background the German Radiological Society has decided to initiate a central Media Exchange Certification Project.

Within the scope of this project, a requirements specification precisely defines the internal structure of storage media with radiological images. The German Radiological Society also organizes the awarding of certificates for systems that create storage media that are suitable for use in the context of radiology, based on a technical validation of storage media for patient information. Furthermore, a suitable work process for recipients of storage media is described in a recommendation.

The background and goals of the project are described in the whitepaper "General Information and Background of the Certification Project for Storage Media of the German Radiological Society", available for download from the Internet at the following address: <http://www.dicom-cd.de/>

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1.1 Scope

This document serves as a guideline for handling media containing patient information, intended primarily for recipients of such media. This document contains recommendations on the necessary workflow for visualizing or importing data from an exchange medium. The guideline intends to promote a reliable image exchange between medical institutions. The information on the life span of CD recordable media in Annex A is intended for creators of media containing patient information.

1.2 Normative References

- | | |
|-----------------|--|
| [DICOM 2006] | NEMA Standards Publication PS 3.1-18: <i>Digital Imaging and Communications in Medicine (DICOM)</i> , National Electrical Manufacturers Association, Rosslyn VA, 1992-2006 |
| [IHE IRWF 2006] | HIMSS and RSNA: IHE Radiology Technical Framework Supplement |

[QS-RL 2003]	2006-2007: Import Reconciliation Workflow (IRWF), Draft for Trial Implementation, http://www.ihe.net/Technical_Framework/ Richtlinie zur Durchführung der Qualitätssicherung bei Röntgeneinrichtungen zur Untersuchung oder Behandlung von Menschen nach den §§ 16 und 17 der Röntgenverordnung – Qualitätssicherungs-Richtlinie (QS-RL) – vom 20. November 2003, GMBI. 2004 S. 731.
[DIN V 6868-57]	http://www.bmu.de/files/pdfs/allgemein/application/pdf/qs_richtlinie.pdf DIN V 6868-57: Sicherung der Bildqualität in röntgendiagnostischen Betrieben – Teil 57: Abnahmeprüfung an Bildwiedergabegeräten, 2001
[AAPM TG18]	AAPM Task Group 18: Assessment of Display Performance for Medical Imaging Systems. AAPM Online Report No. 03. American Association of Physicists in Medicine, College Park, MD (2005). http://deckard.mc.duke.edu/~samei/tg18_files/tg18.pdf
[AAPM TG18 Patterns]	AAPM Task Group 18 Test Patterns in DICOM and TIFF format. http://deckard.duhs.duke.edu/~samei/tg18.htm
[NIST 2004]	Oliver Slattery, Richang Lu, Jian Zheng, Fred Byers, and Xiao Tang: Stability Comparison of Recordable Optical Discs – A Study of Error Rates in Harsh Conditions, J. Res. Natl. Inst. Stand. Technol. 109, 517-524 (2004)

1.3 Abbreviations

The following abbreviations are used in this document:

CRT	Cathode Ray Tube
DICOM	Digital Imaging and Communications in Medicine
HIS	Hospital Information System
LCD	Liquid Crystal Display
PACS	Picture Archiving and Communication System
PC	Personal Computer
PDF	Portable Document Format
RIS	Radiology Information System
XHTML	Extensible Hypertext Markup Language

1.4 Document History

Version	Changes	Date
1.0	English translation of the final 2006 edition (2006-10-27) of the German document. Translation by Michael Onken, Marco Eichelberg, Jörg Riesmeier (OFFIS)	2007-12-10

2 GENERAL RECOMMENDATIONS

For the handling of patient media at the recipient's side, there are basically two different scenarios:

- **Scenario “Basic Visualization”:** In the following, the term “Basic Visualization” is used to describe a scenario where the recipient of a medium has a common PC with a monitor and an optical drive available and wishes to read and display the data from the medium using the existing hardware.
- **Scenario “PACS Import”:** The term “PACS Import” is used to describe a scenario where the recipient of a medium operates a digital medical image archive (PACS) as well as dedicated hardware and software for visualizing DICOM objects [DICOM 2006] stored in the image archive, such as a radiological diagnostic workstation. The user wishes to import the data from the exchange medium into the image archive, and to visualize the data in a second step using the dedicated workstation.

In this section, general recommendations applying to both scenarios are given, which discuss the preparation of reading exchange media containing patient information. The guideline distinguishes between general preparations (section 2.1) and preparations for one concrete visualization (section 2.2). Furthermore, section 3 provides further recommendations for the scenario “Basic Visualization” and section 4 continues with recommendations for the scenario “PACS Import”.

2.1 General Preparations

2.1.1 Checking the Hardware Prerequisites

The recipient of an exchange medium is advised to check whether the existing hardware is adequate for reading and visualizing the medium's content. In particular the suitability of the monitor visualizing radiological image data must be checked. Information concerning technical requirements for monitors can be found in the German X-ray Regulation Quality Assurance Rule [QS-RL 2003] (“Qualitätssicherungsrichtlinie zur Röntgenverordnung”), where section 8 defines requirements for display systems used for the diagnostic reporting or general display of medical images for all anatomic regions of the body.

In addition, it should be verified that at least 256 shades of gray can be displayed. This is the case if the graphics adapter addresses 24 bits or 32 bits per pixel, but not if only 16 bits per pixel (often referred to as “high color” or “medium color quality”) are available. Furthermore, the visualization of digital medical images is a processor and memory intensive task. Because of the fast evolution of computers a concrete recommendation for minimum requirements is difficult. However, a processor with a clock rate of 1 GHz could be seen as the absolute minimum regarding computational power. Normally, the computer's main memory should not fall short of 512 MB, 1 GB or more is recommended.

2.1.2 Adaptation of Ambient Light

The recipient of an exchange medium is advised to adapt the ambient light in the room that is used for visualizing the data so that the visualization of the medium's content is not negatively affected. Normally, low ambient light is used for the visualization of radiological images because this improves the perception of low contrast details in the dark parts of the image. Furthermore, ambient lighting is always kept constant, in order to prevent the human eye from having to frequently adapt to changing lighting conditions, and in order to retain a valid calibration, if the display system has been calibrated. In particular, when setting up the monitor, the place should be chosen such that there are as little reflections from ambient light on the screen as possible, especially from ceiling lighting, windows or light boxes for images on conventional film.

Note: [AAPM TG 18] recommends a room lightness range from 15 to 60 Lux for the reporting of CT, MRT and nuclear images, and from 2 to 10 Lux for reporting of X-ray images.

2.1.3 Monitor Setup

It is recommended that the brightness, contrast and other settings of the monitor used for the visualization of media content are adjusted (and optimized if necessary) on a regular basis. The following text suggests a procedure for adjusting a standard monitor:

At first, the monitor should be adjusted so that the image is displayed horizontally and vertically centered. If supported by the monitor, a color temperature of 9300 Kelvin should be set. Now, the user should use the computer to display a completely black screen, e. g. by setting the "Desktop" background color to black. The contrast controller of the monitor should be set to its lowest level. Then the monitor's black point should be adjusted: Using the brightness control, the user should look for the point where the screen is completely black but a light increase of brightness would turn the monitor into a very dark shade of grey. Now the brightness setting is complete and the corresponding controller is not be used during the rest of the setup. In the last step, the monitor's white point is adjusted. First, the contrast controller should be turned up a bit so that the image is well recognizable. Now, the computer should be used to display a white background with some details in great contrast on top (e. g. a typical text window showing black text on white background). Now the contrast should be turned up as much as possible without an oversteering of the image (i. e. the image becoming blurred). This completes the monitor setup.

A better result can be achieved when using a test image. One such image called "TG18-QC Pattern" is available for download free for charge from [AAPM TG18 Patterns]. The workflow is identical to the one described above, the only difference being that the TG18-QC test image should be shown on the screen in its original size (i. e. not scaled to full screen). For adjusting the black point using the brightness control as described above, it is crucial that the raster lines and edges of the test images are just noticeable. For adjusting the monitor's white point using the contrast controller, the user again must take care that the screen does not oversteer – this can be checked with the Cx pattern in the test image. [AAPM TG18] also notes that the controllers for brightness and contrast are not working fully independently, so that some fine tuning may be necessary to find the best settings for minimum and maximum luminance.

After the monitor setup, the settings for brightness and contrast should not be changed. Some monitors allow for the corresponding controls to be locked or deactivated, thus preventing an accidental change of these settings.

2.1.4 Display Calibration

A further improvement of the image display quality compared to a simple monitor setup as described in the previous section can be achieved with a calibration of the display system (consisting of the monitor, the graphics board of the PC and the operating system drivers) according to a standard display function such as the DICOM Grayscale Standard Display Function [DICOM 2006, part 14] or CIELAB. However, a calibration requires specific measurement devices (photometer), specific software and possibly also specific hardware. If possible, it is recommended that a display calibration of the system used for visualizing the content of exchange media be performed on a regular basis to ensure a consistent and authentic display of radiological images. Comprehensive information about calibration procedures can be found in [DIN V 6868-57] as well as [AAPM TG18].

Note: A calibration optimizes the image display of the monitor under consideration of the current settings for brightness and contrast and of the ambient lighting conditions. Therefore, the calibration remains valid only as long as the monitor settings and ambient lighting conditions remain unchanged.

2.1.5 Disabling the Autostart Functionality

The recipient of an exchange medium is advised to explicitly disable any autostart functionality of the operating system that automatically executes specific programs from the medium. The rationale behind this recommendation is the possible immediate and automatic execution of malware (viruses, trojans, spyware etc.) contained on the medium when the medium is inserted.

Note: For Microsoft Windows operating systems, there are different ways to disable autostart functionality, e. g. by means of the Windows Explorer or the Windows Registry. Further information is available in the Windows help system under the keyword "Autoplay".

2.1.6 Installation of Anti Virus Software

It is recommended that an up-to-date anti virus software with up-to-date virus descriptions should be installed on the system. Furthermore, both should be updated on a regular, short-term basis.

2.1.7 Installation of Firewall Software

In case that the system used for reading exchange media is part of a computer network, it is recommended that an up-to-date firewall software should be installed on the system and configured appropriately. The regular update of the software as well as checking the configuration is recommended for the user or administrators of the system.

Note 1: A (software) firewall is an application that controls and restricts network communication to eliminate unwanted data flows. A firewall is typically used to control network communication within the local area network (LAN), or between the LAN and the Internet.

Note 2: Some software firewalls ("Personal Firewalls") are configured by default to block communication requests from outside, but to permit connections from "inside" to "outside". It is recommended to configure firewalls so that connections from "inside" to "outside" are also checked in order to avoid any accidental transmission of patient related data.

2.1.8 Installation of Operating System Updates

The recipient of an exchange medium is advised to install system updates for the installed operating system on a regular basis. Without these updates, some security vulnerabilities may remain unclosed, which causes the risk of malware execution on the system.

Note: For Microsoft Windows operating systems, the operating system update is started using the "Windows Update" menu item. For this activity an Internet connection is required in general.

2.1.9 Installation of a DICOM Viewer

In many cases, a DICOM viewer is available on the exchange media received that can be used for visualizing the DICOM Content of the medium. For the case that the medium does not contain a DICOM viewer, it is recommended to have such software installed on the system in advance. Regarding an installed DICOM viewer, it is also recommended to update the software on a regular basis in order to eliminate any security vulnerabilities.

Note 1: For visualization of DICOM Content many viewers are available free of charge on the Internet, for different operating systems. Furthermore, there are many commercial products available.

Note 2: Not every DICOM viewer is adequate for all kinds of DICOM images. Whether a viewer is suitable for a specific kind of image (X-ray images, CT, cine images such as Ultrasound or Angiography etc.) should be checked in advance.

Note 3: If the recipient of the medium is to perform diagnostic reporting of the images, and the images are within the scope of the German X-ray Regulation ("Röntgenverordnung"), then the system used for image display must pass an acceptance test according to the German X-ray Regulation Quality Assurance Rule [QS-RL 2003] ("Qualitätssicherungsrichtlinie zur Röntgenverordnung"). Since this acceptance test covers the overall system including hardware and software, a diagnostic reading of X-ray images is not permitted using a DICOM viewer contained on the CD.

2.1.10 Installation of Web Browsers

In case that the received media contains "Web Content" (web pages) to be visualized, a web browser should be installed on the system if the operating system does not provide a web browser or

if the user prefers not to use the web browser provided by the operating system. It is recommended that updates for any web browser on the system should be installed on a regular, short-term basis. Without those updates, possible security vulnerabilities remain open. Also, some XHTML features used by the Web Content may not be supported by outdated browser versions, leading to Web Content on the medium not being visualized appropriately.

2.1.11 Installation of a PDF Viewer

In case that the received media contains "Other Content" in the Portable Document Format (PDF) to be visualized, the installation of a PDF viewer is necessary. It is recommended to install updates for any installed PDF viewer on a regular, short-term basis to close any potential security vulnerabilities.

Note: The Portable Document Format is a cross platform file format developed by Adobe Systems, Inc. Many viewers for the visualization of PDF files are available freely on the Internet for different operating systems.

2.2 Preparation for Visualization

2.2.1 Login as Standard User

The recipient of an exchange medium is advised to log in as a standard user to the operating system before actually starting to read from the medium. It is strongly advised not to log in as a user with administrator privileges, because this may cause damages to installed software and loss of important data.

2.2.2 Enabling Anti Virus Software

It is recommended to enable an anti virus software on the local system before inserting the medium. This reduces the possibility of the execution of malware on the system.

2.2.3 Enabling Firewall Software

In case that the system used for reading exchange media is part of a computer network, it is recommended to enable the installed firewall software at the latest before inserting the medium. This ensures that a previously defined security concept for network communication is enforced.

3 RECOMMENDATIONS FOR THE SCENARIO “BASIC VISUALIZATION”

This section extends the recommendations given in section 2 for the scenario “Basic Visualization”. In this scenario, the recipient of a medium uses a standard PC with monitor and optical drive to read the received medium. The recipient intends to read and visualize the data from the medium using the existing hardware, but does not intend to permanently import the data into a local DICOM archive.

3.1 Performing a Visualization

3.1.1 Visualization of DICOM Content

The Requirements Specification for Exchange Media Containing Patient Information defined in the context of the DRG Media Exchange Certification Project defines that media must contain DICOM Content to be considered “valid” in the framework of the project. The DICOM Content consists of a central DICOMDIR file in the medium’s root directory plus additional DICOM files referenced from this file.

The recipient of an exchange medium is advised to display and review all DICOM Content. For the purpose of visualization, either a DICOM viewer possibly contained on the medium, or a previously installed DICOM viewer suitable for the objects on the medium (see section 2.1.9) can be used. The DICOMDIR file in the medium’s root directory serves as the entry point to the DICOM Content.

3.1.2 Visualization of Web Content

In case a medium contains additional Web Content, the recipient is advised to also review it. It should be noted that on a medium following the DRG requirements specification the Web Content has been derived from the DICOM Content on the same medium, and either reflects all DICOM Content on the medium or only the relevant part of the DICOM Content that truthfully reflects the clinical condition of the patient at the time of medium creation.

The file *INDEX.HTM* in the medium’s root directory serves as the entry point for the Web Content. The file *INDEX.HTM* and all Web Content referenced from this file should be viewable with a standard web browser, at least with the browser that is mentioned in the file *README.TXT*, located in the medium’s root directory.

3.1.3 Visualization of Other Content

If the medium contains so-called Other Content (e. g. reports in PDF format), the recipient is advised to also review this Other Content. It should be noted that for media following the DRG requirements specification there is no requirement for so-called Other Content to have a DICOM counterpart on the same medium. There is only a (non-binding) recommendation that a DICOM counterpart should be included on the medium for clinically relevant information. Normally, Other Content should be located in a separate directory on the medium. Other Content can be stored in any file format.

Note: For visualizing Other Content in the Portable Document Format (PDF) format, the previously installed PDF viewer can be used.

4 RECOMMENDATIONS FOR THE SCENARIO “PACS IMPORT”

This section goes beyond the recommendations given in section 2 and provides recommendations for the scenario “PACS Import”. In this scenario, the recipient of a medium uses a DICOM image archive (PACS) as well as dedicated hard- and software for visualizing the DICOM objects stored in the archive, i. e. a diagnostic workstation. After receiving the medium, the user wants to import its contents into the existing archive in order to visualize the data, once integrated, at the diagnostic workstation.

The import of DICOM objects from an exchange media with patient information into a DICOM archive has to be done using an IT system that supports the following workflow:

- Reading a DICOM medium
- Reconciliation of important identifying information in the DICOM objects read
- Forwarding of the modified DICOM objects to the archive

The importing system could be a diagnostic workstation or a review workstation with corresponding functionality or a dedicated system for the import of patient media. In the following, the system is referred to as “import workstation”.

4.1 Performing an Import and Visualization

4.1.1 Verifying the Suitability of Image Archive and Import Workstation

The recipient of an exchange medium is advised to verify that the DICOM objects to be imported are supported by the import workstation and by the image archive and, therefore, can be imported. This can be done based on the DICOM Conformance Statement of the image archive and the import workstation. It is recommended to only perform the import operation if both systems offer support for the corresponding DICOM objects.

4.1.2 Import of DICOM Content

In order to avoid conflicts in the image archive caused by the import of DICOM Content from an exchange medium, and in order to ensure that the various DICOM objects can be reliably accessed in the archive, it is absolutely required that the following information be reconciled in all imported DICOM objects:

- **(0010,0020) Patient ID:** The Patient ID (defined by the attribute tag (0010,0020) in DICOM), uniquely identifies each patient within a medical institution. Since in Germany different institutions normally assign different Patient IDs for the same person, Patient IDs cannot be used across institution boundaries and must be reconciled during the import of DICOM objects. If this reconciliation is not performed, it is nearly unavoidable that the imported DICOM objects are either associated with the wrong patient in the archive or that for one patient more than one Patient ID is used. Both inconsistencies should be absolutely avoided, because otherwise the location and access to DICOM objects in the archive as well as the correct assignment to the corresponding patient cannot be guaranteed.
- **(0008,0050) Accession Number:** The Accession Number (defined by the attribute tag (0008,0050) in DICOM) identifies a specific act in the radiology information system (RIS). It associates an act created in the RIS with the images in the archive resulting from this act. The Accession number is created by the RIS and is stored in the DICOM objects on the medium as well as in the archive so that a user accessing the images from an archive can reconstruct the relation between the act in the RIS and the corresponding images. To allow this relationship to be maintained for imported DICOM objects, the Accession Number has to be reconciled accordingly.

Note: It should be noted that a medium can contain DICOM objects belonging to more than one patient. Patient ID and Accession Number have to be adapted for each patient separately.

To allow for the reconciliation of Patient ID and Accession Number during import, it is necessary that both identifiers exist (or are being created) in the institution performing the import. This means that the patient whose data should be imported must have been admitted to the admission system of the institution (e. g. a HIS), and an import act must be created (ordered) in the RIS. If both conditions are fulfilled, then a Patient ID as well as an Accession Number are available. If for some reason no Accession Number is available from the administrative system, no value should be entered for the field Accession Number (i. e. the field should be left empty).

The actual import of the DICOM objects using the import workstation can be done using one out of two alternative different approaches (if supported by the import workstation): manual import, or using a DICOM Worklist.

4.1.2.1 Manual Import

When performing a manual import of DICOM objects, the user enters values for Patient ID and Accession Number manually. These identifiers are then used to identify the imported objects in the image archive. Both identifiers should be taken over from the administration software. Once the identifiers have been entered and import has been requested by the user, the DICOM objects from the medium are imported into the image archive. During the import process, the Patient ID and Accession Number in the DICOM objects are reconciled by the import workstation.

4.1.2.2 Import Using a DICOM Worklist

For the import of DICOM objects using a worklist, a corresponding worklist entry for the import of DICOM objects from the received media is created in the RIS. In addition to various other information, this worklist entry contains an appropriate Patient ID and Accession Number that should be used in the DICOM objects to be imported. This worklist entry is transferred to the import workstation using the DICOM Worklist Management service, providing all information to the import workstation needed for performing the import. Once the user starts the import operation, the reconciliation of Patient ID and Accession Number in the DICOM objects is performed by the import workstation automatically, using the information received in the worklist.

If both import options are available at an import workstation, it is recommended to perform the import using a DICOM worklist, because in that case the import is executed mostly automatically and the risk of incorrect data entry is reduced significantly.

4.1.2.3 Further Data Reconciliation during Import

In addition to the DICOM data elements already mentioned, (0010,0020) Patient ID and (0008,0050) Accession Number, there are several further elements that should be taken over from the administrative system into the DICOM objects to be imported:

Tag	Name	Description
(0008,1032)	Procedure Code Sequence	Machine-readable description of the procedure. It is recommended to use the value of (0032,1064) Requested Procedure Code Sequence from the DICOM worklist.
(0010,0010)	Patient's Name	Name of the patient
(0010,0030)	Patient's Birth Date	Birth date of the patient
(0010,0040)	Patient's Sex	Patient's sex
(0020,0010)	Study ID	Additional study identifier: It is recommended to take over the value of (0040,1001) Requested Procedure ID from the DICOM worklist.
(0040,0253)	Performed Procedure Step ID	Identifier of the Performed Procedure Step.

Table 2: Administrative data elements to be reconciled during import

Furthermore, the following data elements within the Request Attributes Sequence (0040,0275) should be reconciled:

Tag	Name	Description
(0032,1060)	Requested Procedure Description	Description of the requested procedure (order)
(0040,0009)	Scheduled Procedure Step ID	Identifier for the scheduled procedure step in the RIS
(0040,1001)	Requested Procedure ID	Identifier for the requested procedure in the RIS

Table 3: Data elements within the Request Attributes Sequence to be reconciled during import

For the following DICOM data elements (if present in the DICOM objects) it is recommended to append new values to the existing ones:

Tag	Name	Description
(0010,1000)	Other Patient IDs	Additional identifiers for the patient
(0008,1110)	Referenced Study Sequence	List of studies that are related to this object

Table 4: Data elements in main dataset to be appended to during import

On the other hand, some data elements shall *not* be taken over from the administration software into the DICOM objects. It does not make sense to adapt these elements in the DICOM objects during import, because the authenticity of this information could be crucial for the further use and processing of the DICOM objects. Therefore, the original values of the following data elements are kept:

Tag	Name	Description
(0020,000d)	Study Instance UID	Worldwide unique identifier for the Study
(0020,000e)	Series Instance UID	Worldwide unique identifier of the Series
(0008,0018)	SOP Instance UID	Worldwide unique identifier of this DICOM object
(0040,0254)	Performed Procedure Step Description	Description of the Performed Procedure Step
(0040,0244)	Performed Procedure Step Start Date	Date when the Performed Procedure Step was started
(0040,0245)	Performed Procedure Step Start Time	Time when the Performed Procedure Step was started
(0040,0260)	Performed Protocol Code Sequence	Machine-readable description of the Performed Procedure Step

Table 5: Data elements in main dataset not modified during import

Furthermore, the following data elements within the Request Attributes Sequence (0040,0275) shall not be modified:

Tag	Name	Description
(0040,0007)	Scheduled Procedure Step Description	Description of the Scheduled Procedure
(0040,0008)	Scheduled Protocol Code Sequence	Machine-readable description of the Scheduled Procedure Step

Table 6: Data elements not modified within the Request Attributes Sequence during import

4.1.2.4 Storage of Modifications Performed During Import

Any modifications of the DICOM objects during import shall be documented in the DICOM objects themselves. For these purposes, the DICOM standard provides two data elements introduced in the 2006 edition [DICOM 2006] that can be added to the dataset or (if already present) can be extended using an additional sequence item:

Tag	Name	Description
(0400,0561)	Original Attributes Sequence	This sequence contains all data elements holding their original data before import reconciliation.
(0018,A001)	Contributing Equipment Sequence	This sequence describes the import workstation used for import as well as the fact that the workstation has performed the import.

Table 7: Data elements for describing the modifications performed during import

Precise rules governing the use of the Original Attributes Sequence and the Contributing Equipment Sequence during import of data can be found in [IHE IRWF 2006], sections 4.61.4.1.2.1 and 4.61.4.1.2.2.

4.1.2.5 Complete Workflow Integration of the Import

IHE (Integrating the Healthcare Enterprise) is an initiative aiming at an improvement of the exchange of data and information between IT systems in the health care sector. The so-called IHE Technical Framework [IHE RTF 6.0] identifies the most important IT systems of institutions in the health care sector and specifies the most important interactions between those IT systems as so-called transactions. In detail, the IHE Technical Framework is built from so-called Integration Profiles, each of them describing a specific application scenario for which an interaction of IT systems is required. A new IHE Integration Profile [IHE IRWF 2006] entitled "Import Reconciliation Workflow" (IRWF) describes, how an import of DICOM data from patient media can be completely integrated into the clinical workflow. For this purpose, detailed requirements on an IT system called "Importer" (which corresponds to the "import workstation" in this document) are defined that exceed the recommendations provided in this document. For a complete workflow integration of patient media import into a PACS, the use of the IHE IRWF Integration Profile is highly recommended.

4.1.3 Visualization of DICOM Content

After successfully importing the DICOM Content from an exchange medium into the image archive, the imported images can be visualized using the existing diagnostic workstation.

4.1.4 Visualization of Web Content and Other Content

In case a medium contains additional Web Content or so-called Other Content, the recipient is advised to also review these contents. Sections 3.1.2 and 3.1.3 provide some recommendations on the display of these types of content.

Note: Not all clinically relevant documents on the storage media are necessarily available in DICOM format. In particular, so-called Other Content may contain important documents such as discharge letters or diagnostic reports. An import of such documents into a DICOM archive is usually not possible. An import of such documents into a different IT system, such as an electronic patient record, may be possible but is not further discussed in this guideline.

ANNEX A LIFE SPAN OF CD RECORDABLE MEDIA

In many health care institutions, optical media are used not only for the exchange purposes (i. e. the provision of data to the patient or referring doctors), but also for an archival of patient data according to the requirements of the German X-Ray Regulation ("Röntgenverordnung"), which demands an archival of at least 10 years, and up to 30 years in certain cases. In this context, the issue of the life span and of the correct creation and archival of CD-R media is important. In summary, it can be said that the security of data stored on CD-R media crucially depends on the product quality of the recordable medium and of the storage conditions. The following text provides some remarks in this context:

- A multitude of vendors and recordable media types exist. The quality of a recordable medium cannot be easily assessed by the user, since often different types of media are sold under one brand name, and even for identical media types (identifiable by the so called ATIP information that is also used by CD recorders to identify the medium type) there are different qualities. Some vendors offer CD recordable media labeled as "medical grade" or "archive grade" and guarantee a certain minimum life span for these media. In a study performed by the National Institute of Standards and Technology (NIST) in the United States [NIST 2004], CD recordable media with a coating of silver and gold and phthalocyanine as dye material performed particularly well – for these media a life span of several decades is predicted under suitable storage conditions. Since phthalocyanine is transparent, such CD media look golden from both sides.
- Due to the extensive quality assurance processes needed for medical devices, CD recorders integrated into these systems are often relatively old device types that may not "recognize"

the latest recordable media and either totally refuse such media or deliver unsatisfactory recording results when using such media. It is thus important that recorder and media “match”.

- Pasting an adhesive label onto the CD is problematic with regard to long-term archival since a chemical reaction between adhesive and CD surface cannot be ruled out in most cases. Also problematical is a labeling with unsuitable pens (solvent-containing permanent markers or ball-pens). Specific CD markers or systems that directly print on the CD surface are better suited for this purpose.
- Finally, the climatic storage conditions in the archive are important for the long-term storage of CD-R media. The temperature should ideally remain between 20 and 25 degrees Celsius, relative air moisture should amount to between 65% and 85%. Furthermore, CD-R media must be protected from UV exposure and no mechanical forces may impact the CD disks, which might contort otherwise. When CD-R media are not stored in the usual plastic boxes (“jewel boxes”) or so-called “caddies”, but in inexpensive and space-saving envelopes, jackets or other containers touching the CD surface, then an assessment of the chemical neutrality between container and CD surface is indispensable. Slowly evaporating softeners in many plastic materials react with the CD surface and make a removal of the CD without damage impossible after years. Such containers are, therefore, not suitable for long-term archival.