Electronic Transmission of Gamma Knife Records to a Radiation Oncology Record and Verify System and E-mail.

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Purpose:

Create a mechanism for paperless documentation of Gamma Knife treatment plans (GammaPlan) in PDF format that can be integrated into a record and verify system for radiation oncology. The mechanism must not violate FDA approval of the GammaPlan computer environment.

Material and Methods:

GammaPlan has a separate binary database that is not directly importable into the Mosaiq record and verify system without the development of in-house software, but inclusion of "foreign software" into the GammaPlan UNIX-based computer platform would violate FDA approval. Therefore, a mechanism was devised that uses a combination of scripts in the UNIX environment and a generic Windows XP-based PC that "listens" on the local network, to convert and combine user selected paper printouts into one PDF file. Various "Freeware" programs were installed on the PC, which include Ghostscript, Fictional Daemon, and ImageMagick. UNIX Korn shell scripts were written for the GammaPlan platform and are launched when each document is printed as a PostScript file by GammaPlan. These files are stored locally before sending them to the PC for conversion to a PDF document. The PDF file is uploaded to the eScan folder of Mosaiq for manual importing into the Documents folder. A Korn shell script uses Elm to e-mail the PDF document with a comment and HIPAA notice to the physician's e-mail account.

Results:

The software has been used for 7 months without significant problems. One potential problem is that the PC must be logged onto in order for the software to work. We check that the computer is up and running from the UNIX platform. Also, we had two instances when the PC was running https which blocks communications between GammaPlan and the PC.

Conclusions:

The software works well as it was designed under the constraints imposed by the FDA.

Supporting Material

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Various "Freeware" programs were installed on the PC, which include Ghostscript, Fictional Daemon, and ImageMagick. UNIX Korn shell scripts were written for the GammaPlan platform and are launched when each document is printed as a PostScript file by GammaPlan. Each document is temporarily stored locally as a separate file including the JPG formatted Snapshot of the screen displaying the isodose distribution. Another script is launched manually, which harvests the temporarily files and sends them to the PC. The Fictional Daemon software on the PC uses telnet in order to receive the PostScript file via FTP, and in the same telnet shell GhostScript is launched remotely on the PC to convert the PostScript file to a PDF document. Since GhostScript cannot convert JPEG images to the PDF format, ImageMagick is used to complete this task. Once all of the patient's GammaPlan printouts have been individually converted to PDF format, all of the PDFs are then concatenated into a single PDF file. After the PDF file is generated, the PC then writes the PDF file to the eScan folder on the Mosaiq file system computer. The PDF document is manually imported into the Documents folder of Mosaiq as if it were a scanned document. Finally, a Korn shell script uses Elm to optionally send the PDF document containing the treatment plan, with a free text comment and standard HIPAA notice to the physician's e-mail account.

Results:
Fig, 2 shows multiple documents combined into the resultant PDF file. Which pages or documents that are included in the PDF file are simply those that were printed during paper generation of the plan. The Authorized User can only sign the paper version and not the electronic version. If one wishes the signatures to appear in the electronic document that page must be scanned in manually. However, the document can always be signed electronically in Mosaiq.

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Conclusions:
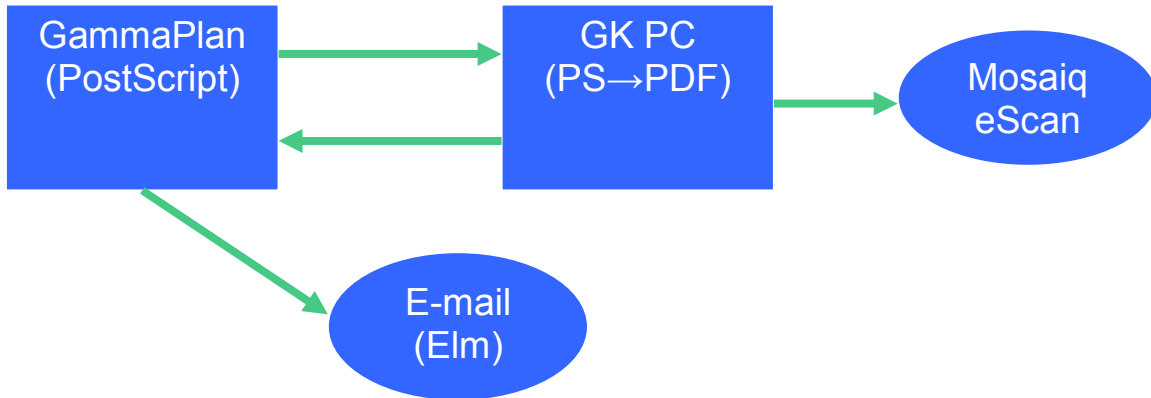The software works well as it was designed under the constraints imposed by the FDA.

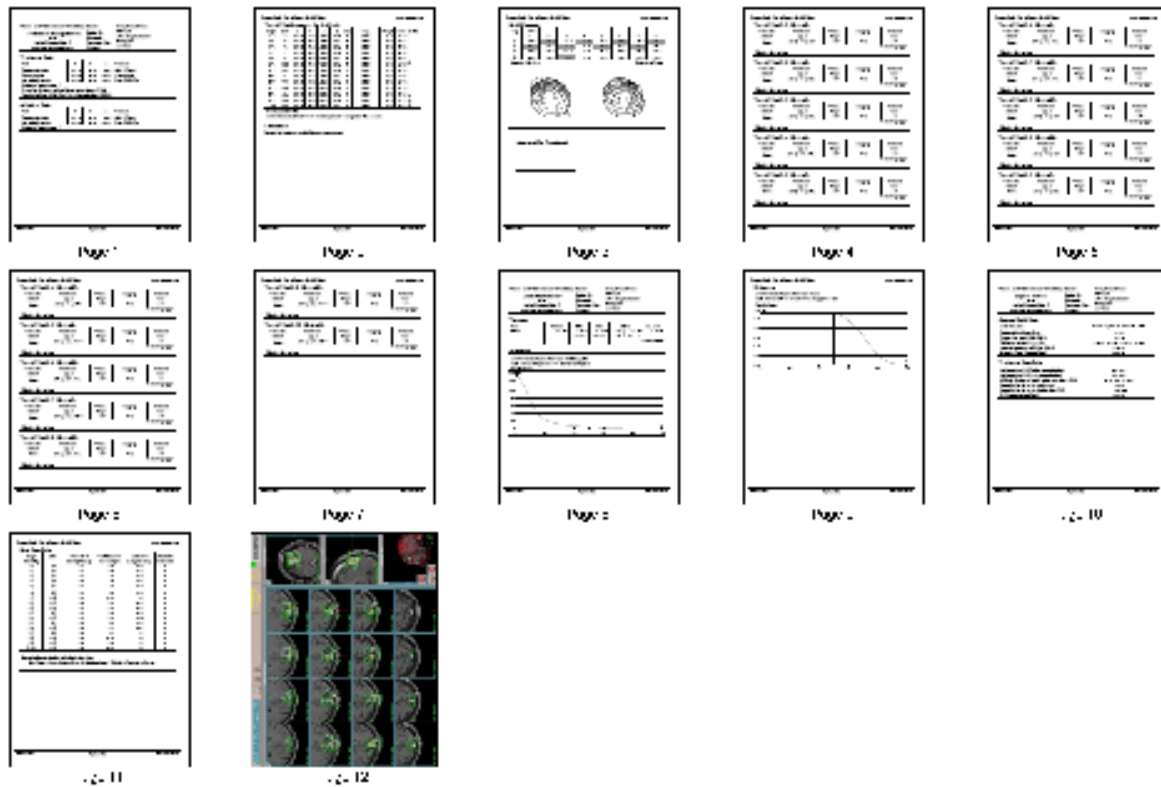Fig.1 Diagram of the data flow when converting GammaPlan treatment plans to PDF format.

Fig 2. An example of the resultant PDF document showing the combined documents contained therein.