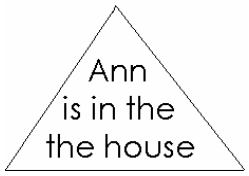
DATA TRANSFER (From the original ROSIS reports)



Did you read:
"Ann is in the house"?
If yes,
look again!

Data transfer is a common problem across many activities, and is well recognised as a challenge in radiotherapy. "Data transfer errors are mostly due to human mistakes or inattention. The reasons for these errors are transcription errors, rounding off errors, forgotten data or interchange of data . . ."(1)
As the complexity of radiotherapy increases, so too does the amount of data that must be transferred between the various stages of treatment preparation and delivery. The ICRP(2) estimated that for a treatment of 4 fields and 30 fractions, a total of 1,000 parameters will be set for the entire treatment. This of course is much greater for more conformal treatments.
The transfer of data is often made more complicated by the fact that some data must also be transformed from one type to another (e.g. from text to an image), and from one format to another (e.g. from paper to computer monitor). Failure to correctly transfer all data for a patient treatment has the potential to result in major under-/over-doses and/or geographic misses.
Independent verification of all the treatment parameters prior to or during the first patient treatment, using chart checks, beam checks, portal imaging, and in-vivo dosimetry is crucial to detecting data transfer errors in treatment preparation.

Both the literature and the ROSIS database testify to the existence of mistakes in radiotherapy due to incorrect data transfer. Readers are referred to the work of the The IAEA(32), Leunens et al(1), Holmberg et al(4), Valli et al(5), Macklis et al(6), Keung Yeung et al(7), Fiorino et al(8) for more research on data transfer errors in RT. *(References given at end of email message)*

ROSIS

Of the first 600 ROSIS reports, nearly half (49%; 294/600) were considered to have an element of data transfer which either directly caused or contributed to the occurrence of the incident. 130 of these 294 (44%) resulted in incorrect treatment being delivered (for at least one fraction). A substantial number of these data transfer errors had originated pre-treatment, but were not detected until treatment.

Of the 294 data transfer incidents,

- 156 (53%) were detected by chart check
- 100 (34%) were detected at the time of patient treatment
- 21 (7%) were detected by portal imaging
- 22 (7%) were detected by other means
- 8 (3%) were detected by quality assurance of equipment
- 7 (2%) were detected by clinical review
- 1 (0%) was detected by in-vivo dosimetry

(More than 1 detection method may be listed per report)

Of course, although percentages have been quoted here for comparison, care must be taken in interpreting data from reporting systems. According to Chappell(9):

"Incident data are ideally suited for

- proving the existence of a safety issue,
- understanding its possible causes,
- defining potential intervention strategies, and
- tracking the safety consequences once intervention has begun"

However, because reporting systems are dependent on people to report (and in many cases, identify) incidents, they may not reflect the true scenario. According to Chappell, "caution should always be used when employing incident data to determine the prevalence of a safety problem . . . [as] the relationship between incidents that are reported and those that occur is not known". From the ROSIS reports we know that data transfer is a problem – but we don't have information about its magnitude. We know some of the forms it can take, but we can't say we know them all. Nonetheless, we can prove that data transfer errors still exist in RT – meaning that at a local level, preventative strategies may be implemented or reviewed, and that further research may be needed.

Particular ROSIS reports which may be of interest include:

Incident Report 393, Incident Report 471, Incident Report 527, Incident Report 507, Incident Report 624, Incident Report 36, Incident Report 452
These reports highlight simple, straightforward, data transfer errors, that we are sure occur in all departments!

Incident Report 393: Interchange of Data: fields transposed
"Treatment card prescribed incorrectly by clinician. Ant and Post fields annotated on treatment card and also at the simulation stage on setting up instructions the wrong way round. Therefore DICOM transferred incorrectly. Fortunately, monitor units for each field identical."

Incident Report 471: Wrong reference image sent
"Planning department transferred incorrect DRRs to the patient database. When the first day images were taken on set, the radiographers noticed large discrepancies between the two sets of images. Further investigation revealed that images from a different plan (same patient) had been sent."

Incident Report 507: Forgotten Data: Changed MU Values
"Daily dose was altered by clinician. The updated treatment plan therefore registered new MU values. The new plan was not DICOM transferred to the linac and radiographers initially failed to notice the new mu's."

Incident Report 624: Forgotten Data: Changed relative moves to isocentre
"Moves made from reference tattoos to isocentre based on review of EPIs taken at first 3 fractions of ph1. Additional moves of 4mm inf and 3mm left needed. These moves were not transferred to ph2 script/relative move section of Visir. Original moves used for 1st fraction of ph2. Realised at 2nd fraction that relative moves in Visir and on script did not tally with those in the messages that had been automatically carried over from ph1."

Incident Report 36: Transcription error: isocentre from film to treatment plan
"Treatment planning staff incorrectly transferred the isocentre position onto the treatment plan from the simulator films. This resulted in an isocentre position 1.0cm too posterior"

Incident Report 452: Transcription error: field size
"Incorrect electron field size indicated on polaroid, input into verification system and used for treatment. (1cm wider than intended). Field size indicated correctly on diagram on script but transferred incorrectly to polaroid. Picked up at chart check with 1 fraction remaining."

Incident Report 782.
Here, procedures were not followed for checking transferred data, resulting in incorrect treatment delivery.

> "Patient receiving parallel pair treatment to pelvis with 10 MV x-rays. Referred back to simulator to have ant field reconfigured (decided to use wedge in treatment field so needed to rotate collimator thro' 90 deg and re-conform MLC to shape field). New settings transferred electronically from simulator back to treatment unit, but photon energy was set to 6 MV (default). All treatment details for patients without a computer plan are exported for the default machine which only has 6 MV. The correct machine and energy is entered once the treatment has been imported into the R&V system. Because the patient was already on treatment, the full process was not followed. In-vivo dosimetry measured entrance dose which was in tolerance because the 10 MV monitor unit setting was used. Error was found by chart check after 6 fractions of 6 MV."

Incident Report 52, Incident Report 727, Incident Report 388:
These reports illustrate the communication element of data transfer – where important information was omitted from the transfer of data. These mistakes could have been detected by appropriate portal imaging systems, but none were.

> Incident Report 52
> "We used ct for the simulation and the dosimetry but this patient is treated for a tumour of the leg. The simulation was done with the foot first instead of the head and when the images were transferred to the TPS this information was not evident for the physicist and the position was inverted but the patient was treated as for the CT so the lateral beams were inverted. 10 fractions were done in this condition. After correction a dosimetry was done and the differences were not very important . . .
> It is because when the images are transmitted from the CT not orientation is written on the films but due to the position of the treated volume the physicist normally should know this problem."

> Incident Report 727
> "The patient needed mediastinal radiotherapy for non-Hodgkin lymphoma. He was planned for 3DCRT on mediastinal mass. In simulator tattooing two tattoos were done on the skin: one central and one for aligning in lower position. In CT acquisition the physician put metal marker on both. The physicist centred the beam on the lower tattoo (the alignment one) but didn't specify the shift in the setup note in R&V. The beam was centered in the upper tattoo with a difference of 10 cm. The day of starting treatment DRR was not available in the image network and EPID image could not be matched to DRR. Another Epid image was not checked. The doctor who discovered the error visited the patient for dysphasia.
> The correction consisted in making a new plan for giving dose to the missed lower volume."

> Incident Report 388
> "A liver metastasis is to be treated with relatively small fields. There is one set-up isocentre and another treatment isocentre. The planned off set from the set up position to the treatment position is not performed. Portal images are taken and approved in a position more then 5 cm from the correct one. Bad routines for the transfer of information of the displacement. The reference images were too small, i.e. not enough anatomical information. The set up was 2 vertebras wrong."

Overall, it is clear that basic mistakes in data transfer are a frequent cause of misadministration of radiotherapy. These mistakes are most often a consequence of our fallibility as humans. Nonetheless, while it may be difficult to prevent the initial mistake, with good quality assurance procedures it is possible to catch most of these mistakes before or at the beginning of the patient's treatment.

References

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(2) Prevention of Accidental Exposures to patients undergoing radiation therapy. ICRP Publication 86 2000

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(4) Preventing treatment errors in radiotherapy by identifying and evaluating near misses and actual incidents. O Holmberg, B McClean. Journal of Radiotherapy in Practice 2002;3(1):13-25

(5) Evaluation of most frequent errors in daily compilation and use of a radiation treatment chart. MC Valli, M Prina, A Bossi, LF Cazzaniga, D Cosentino, L Scandolaro, A Ostinelli, A Monti, P Cappelletti. Radiotherapy and Oncology 1994;32:87-89

(6) Error rates in clinical radiotherapy. Roger M Macklis, Tim Meier, Martin S Weinhous. J Clin Oncol 1998;16:551-556

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(8) Quality assurance by systematic in vivo dosimetry: results on a large cohort of patients. Claudio Fiorino, Daniela Corletto, Paola Mangili, Sara Broggi, Antonio Bonini, Giovanni Mauro Cattaneo, Rossella Parisi, Alberto Rosso, Patrizia Signorotto, Eugenio Villa, Riccardo Calandrino. Radiotherapy and Oncology 2000;56:85-95

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