Purpose: We analyze the ability of standard quality assurance (QA) checks in radiation therapy to prevent errors commonly observed in the course of clinical operations.

Methods and Materials: Near-miss and error reports were collected over a 3-year period by means of voluntary reporting systems at two academic medical centers. We analyzed 250 near-misses, events that did not affect patients but which had the potential to do harm with at least "moderate side effects" (level 3 or greater on the French ASN scale) if they had not been detected prior to treatment. We determined which of these events could be detected by 13 commonly employed QA measures, including but not limited to physician plan review, physics chart check, port films, cone-beam CT. We then determined which events could have been detected by in vivo portal dosimetry with an electronic portal imaging device (EPID).

Results: QA checks vary greatly in their ability to detect reported errors. Port films, one of the most effective measures in place, had a 53% detection efficiency, while pre-treatment IMRT QA had a detection efficiency close to 0%. EPID-dosimetry had a detection rate of 83%. In some cases, EPID-dosimetry would have detected errors which were introduced after the initial IMRT QA.

Conclusions: No single QA check currently employed is 100% effective at detecting common errors. Most checks currently in use are less than 50% effective. By contrast, the data indicate that in vivo EPID-dosimetry may be substantially more effective. Further work is needed to determine if these patterns hold across multiple institutions.

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