more than their corresponding subsequent daily treatment times. Radiation oncologists need to be cognizant of these issues in everyday management of their patients.

EP-1451
Workflow Management: Impact on the ergonomics of a Radiotherapy department in a developing country
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Purpose or Objective: Integration of multiple technical aspects like treatment prescription, planning, delivery and quality assurance is paramount for smooth and efficient functioning of any radiotherapy department. In the developing world, bearing 60% of global cancer burden, efficient management of available resources assumes even greater importance. Workflow management software is a tool available for effective resource management in radiotherapy. The purpose of this audit is to evaluate the impact of implementation of workflow management on the organisational ergonomics of our department.

Material and Methods: Workflow management software (Aria v 11.0™) has been in use in our department since October 2014. Prior to the implementation of workflow management, workflow management was retrospectively evaluated. Proportion of cases for which treatment was started on the day of appointment was taken as a surrogate for work efficiency, which was the primary end point in this study. Other variables, like time available for target delineation (Td), treatment planning (Tp) and plan evaluation (Te) were analysed for different conformal techniques as secondary end points.

Results: Of the 343 cases analysed, 190 were treated before implementation of workflow management (group 1), while 153 were treated after that (group 2). The mean gap between planning CT scans and date of treatment (overall planning time, To = Td + Tp + Te) was 5.25 days for group 1 and 6.53 days for group 2 (p=0.104).

Among 3D-CRT plans, 29% were not started on the day of appointment in group 1, while 20% were not started on time in group 2 (p=0.13). However, mean time available for planning and evaluation (Tp + Te) increased from 1.3 days in group 1 to 2.8 days in group 2 (p=0.001). Overall planning time (To) for IMRT plans decreased from a mean of 9.4 days to 5.9 days, after workflow management (p=0.013), without significant compromise in the time available for planning and evaluation (Tp + Te).

On multivariate analysis, workflow management was an independent factor determining work efficiency (p=0.04) irrespective of the diagnosis, physician or physicist.

Conclusion: Implementation of workflow management resulted in significant improvement in work efficiency, as evidenced by an increase in proportion of cases started on time; this improvement was more substantial for IMRT planning. Time available for planning and evaluation also significantly increased with workflow management. Such improvements in work efficiency are essential for resource management in developing countries.

EP-1452
The impact of individual surgeons on the likelihood of mastectomy in breast cancer
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Purpose or Objective: Substantial variations exist in the use of mastectomy and breast-conserving surgery (BCS or lumpectomy) to treat invasive cancer. No recent analysis has queried the broader role of individual surgeons play in the decision making process for BCS or mastectomy. The goal of this study was to evaluate the impact of individual surgeons on surgical procedures for definitive treatment of breast cancer in a large cohort of Medicare beneficiaries.

Material and Methods: 36,068 women with non-metastatic breast cancer undergoing primary surgery (either BCS or mastectomy) were identified from Surveillance, Epidemiology, and End Results-Medicare linked database from 2000 to 2009. Medicare claims were used to determine surgery type and provider. Health service area stratified, multi-level, multivariable logistic models clustered by surgeon were used to determine the impact of surgeons on the likelihood of mastectomy while controlling for a patient’s clinical and demographic covariates.

Results: 8,327 women were treated with mastectomy. 20.9% of the variation in the likelihood of mastectomy was due to the individual surgeon; 18.8% of this variation in surgery was due to a patient’s clinical and demographic status. The median odds ratio, which allows for a direct comparison between the effect of the cluster variable (surgeon) and the odds ratio (OR) of fixed covariates, was 2.43. The only variables with a greater impact than surgeon were regional lymph node surgery (OR 3.0, 95% confidence interval [CI]: 2.79, 3.23) and primary tumor size 2-5 centimeters (OR 2.79, 95% CI: 2.62, 2.97).

Conclusion: Surgeons have a substantial impact on a woman’s likelihood of mastectomy for the treatment of invasive breast cancer. Further research should clarify the role of the patient in the decision making process.

EP-1453
Analysis on research and cooperation status of heavy ion J. Tian1, Q. Zhang1, X. Wang1, H. Zhang2
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Purpose or Objective: To analyze the status of research on heavy ion using the social network analysis methods and analytical methods bibliometric methods.

Material and Methods: We searched PubMed database by (“heavy ion radiotherapies”[Title/Abstract] OR “heavy ion radiotherapy”[Title/Abstract] OR “heavy ion therapy”[Title/Abstract]) OR (“heavy ion therapies”[Title/Abstract] OR “heavy ion radiation therapies”[Title/Abstract] OR “heavy ion radiation therapy”[Title/Abstract] OR “carbon ion radiotherapies”[Title/Abstract] OR “carbon ion radiotherapy”[Title/Abstract] OR “carbon ion therapy”[Title/Abstract] OR “carbon ion therapies”[Title/Abstract] OR “carbon ion radiation therapies”[Title/Abstract] OR “carbon ion radiation therapy”[Title/Abstract] OR “Heavy Ion Radiotherapy”[Mesh]) OR (“(“helium ion”[Title/Abstract] OR “helium ion”[Title/Abstract]) OR neno[Title/Abstract] OR “carbon ion”[Title/Abstract] OR “carbon ions”[Title/Abstract] AND (Radiotherapy[Title/Abstract] OR radiotherapies[Title/Abstract] OR “radiation therapy”[Title/Abstract] OR “radiation therapies”[Title/Abstract] OR “radiotherapy”[Subheading] OR “Radiotherapy”[Mesh]))) to collect all relevant research on heavy ion. The related software was used to extract the information of author, country, year of publication, publication year,MeSH terms and journal name. SPSS17.0 was used to analyze the frequency and percentage. NetDraw software was used to draw the social network plot.

Results: 907 studies were retrieved. The number of studies on heavy ion were increased from 1975 to 2014, the author
mainly came from Japan, Germany and China, the number of research on carbon ions were more than the number of research on neon ion and helium ion (Figure 1); the published paper focused on the clinical research on the effectiveness of heavy ion for cancer, at the same time, heavy ions of animal, tumor cells and equipment design were also concered, 30 kinds of tumor were researched. Cooperation degree of different researchers is not enough (Figure 1).

Conclusion: The number of research on heavy ion are increased, but there is an imbalance in regional development, the research topic focused on the clinical research and basic research topics, at the same time, the equipment and design of heavy ion are concered.

EP-1454
Analysis on research status of proton
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Purpose or Objective: To analyze the status of research on proton using the social network analysis methods and analytical methods bibliometric methods.

Material and Methods: We searched PubMed and EMBASE database by “proton OR proton radiation OR proton beam therapy OR proton beam radiotherapy OR proton beam irradiation”, to collect all relevant research on proton. The related software was used to extract the information of author, country, year of publication, publication year, MeSH terms and journal name. SPSS17.0 was used to analyze the frequency and percentage. NetDraw software was used to draw the social network plot.

Results: 2637 studies were retrieved, The number of studies on proton from one study in 1975 to 556 studies in 2014. Figure showed the research in the global distribution. As for different parts of the tumor, mainly for urinary reproductive system tumor (n=349), soft tissue tumor (n=37), skin tumor (n=100), the reticular endothelial cell tumor (n=85), respiratory system tumor (n=232), pelvic tumors (n=10), nervous system tumors (n=531), thoracic and the chest tumor (n=15), the lymphatic system (n=85), the motor system tumor (n=150), the hematopoietic system tumor (n=14), head and neck cancer (n=269), digestive system tumors (n=318), cardiovascular system tumor (n=10), breast tumor (n=211), and abdominal tumor (n=12). As for benign tumors, mainly for epidermoid tumor, epidermoid cyst, ventricle meningioma, cystadenoma, dyeing neoplasia, choroid plexus papilloma, chondroma, cartilage tumor, cavernous hemangioma, inverted papilloma of the mammary gland, mammary gland fibroma and breast fibrodenoma, adenoma and acoustic neuroma. As for type of study, conference abstract (48.2%), conference paper (1.93%), study (38.36%), review (7.61%), letter (1.22%) and comments (1.22%), editor’s note (0.59%), short-term observation (1%), and conference review (1%).

Conclusion: The number of studies on proton are increased, but the research in the global distribution is imbalance, many studies focus on the nervous system tumor, urogenital system tumor and digestive system tumor, about 50% published papers were conference abstract/paper.

EP-1455
Impact of the implementation of the radiotherapy workflow optimization software RT-Flow
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Purpose or Objective: Workflow in radiotherapy involves a lot of different actors and different steps. Subsequently, the management of agendas, schedules and prioritization becomes difficult in a busy department. This results in delays and (first) sessions being delayed or cancelled without being able to be replaced. RT-Flow is a workflow optimization and visualization application (web based), supporting different workflows and clinical prioritization schemes. Our department works with both conventional retro scheduling and industry-based ConWip (management of a Constant Work-In-Progress rather than agendas) workflow [1].

Material and Methods: RT-Flow was implemented in 2014 (3 tomo’s, 2 clinacs and 1 cyberknife). All evaluations were performed by year-to-year comparison: between 01/08 of 2013, 2014 and 2015 (+2500 patients/year). All numbers have been normalized to worked days, excluding breakdowns, holidays and maintenances for fair comparison. Productivity gain was evaluated for the following parameters: machine occupancy and number of first treatment sessions being delayed. Time between CT and prescription finalization has been evaluated before and after implementation of RT-Flow.

Results: Total machine utilization (fractions per worked day, excluding maintenances and failures) rose with >2% in saturated machine conditions. The number of delayed first sessions (all 6 machines combined, all reasons confounded) was halved from 23.6/month to 12.2/month. This was an indirect gain of productivity, as the time slot was most of the time not recovered from late delays. For the specific ConWip organized Cyberknife, machine utilization raised with 6% (on top of the earlier 30% increase due to the ConWip organization [1]). This increase was due to the better specific workflow and occupation management by RT-Flow, but also due to a slight change in case mix (3% less liver treatments for example). Mean time between CT and prescription...