Routine Capture of Structured Data Elements Provides Insight into Unique Dose-Toxicity Relationships in Irradiated Head and Neck (HN) Cancer Patients

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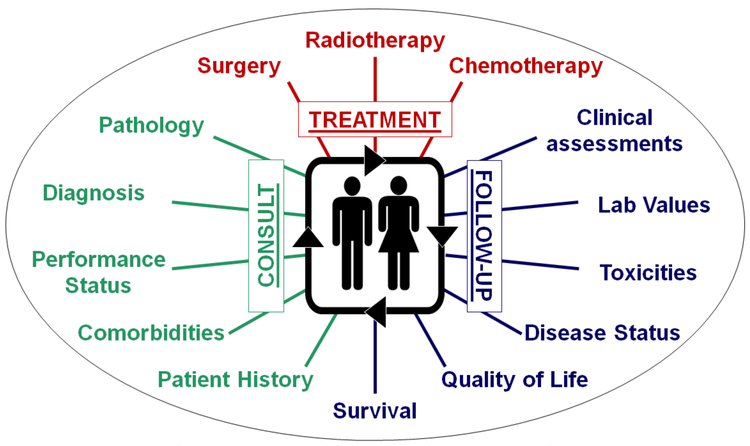
Purpose/Objectives

- **Oncospace**: An in-house, analytic database for clinical informatics and decision support in radiation oncology



Summary of structured data elements in Oncospace

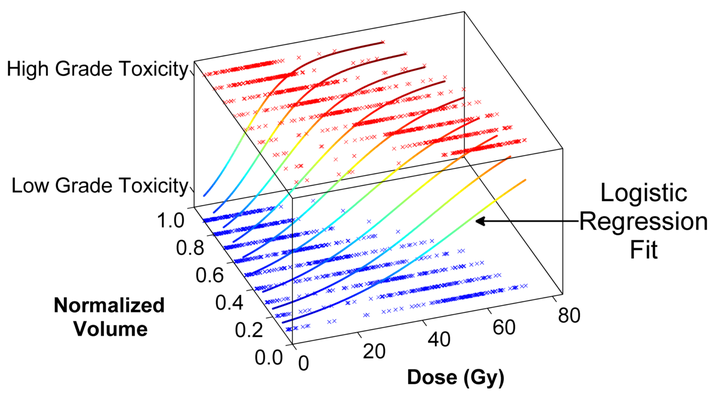
- **Purpose**
  - Establish a data-mining framework for large-scale dose-toxicity analysis
  - Review notable dose-toxicity relationships for potential quality improvement initiatives

Materials/Methods

1. Data Extraction
- Dose-volume histogram (DVH) curves
- Radiation-induced toxicity scores (CTCAE)
- Date of toxicity assessment

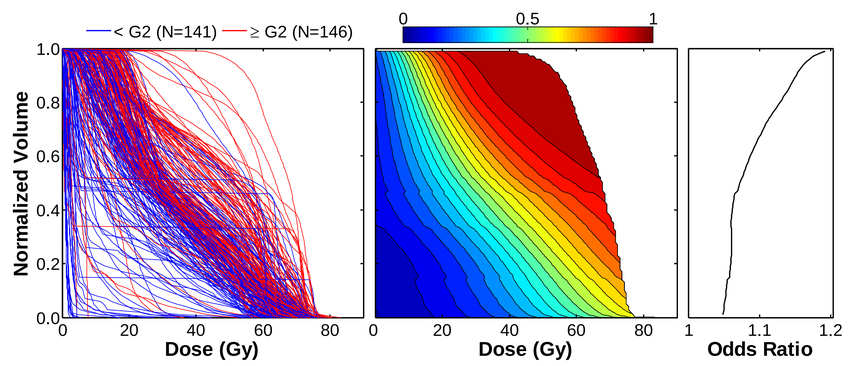
2. Data Processing
- Filter assessments by date from start of RT
- Separate DVH curves by toxicity threshold
  - "Low-Grade": toxicity < threshold
  - "High-Grade": toxicity ≥ threshold

3. Analysis
- Interpolate DVH curves at normalized volume thresholds
- Logistic regression of dose points with respect to low- versus high-grade toxicity
- Repeat at each percent normalized volume



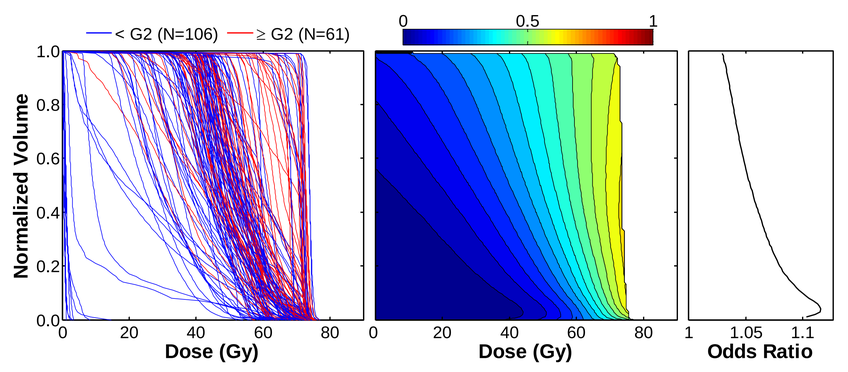
Results

Figure 1: Combined parotid dose as a predictor of xerostomia



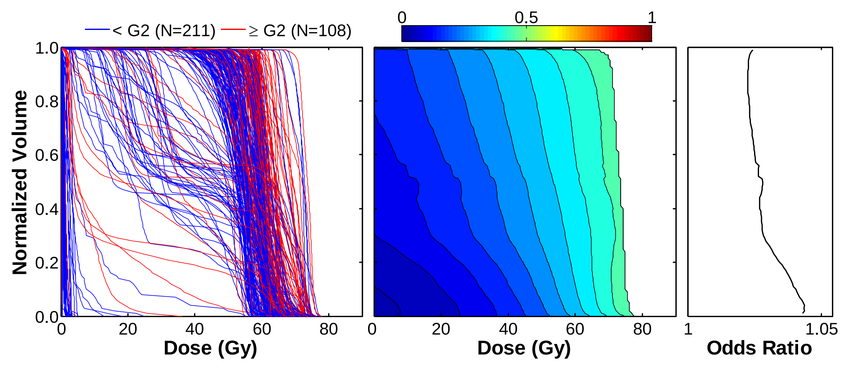
- Xerostomia assessed 3 to 6 months after radiotherapy
- Maximum odds ratio of 1.192 occurs at 99% volume (p<0.001)

Figure 2: Larynx dose as a predictor of dysphagia



- Dysphagia assessed 0 to 12 months after radiotherapy
- Maximum odds ratio of 1.116 occurs at 5% volume (p<0.001)

Figure 3: Thyroid dose as a surrogate for voice changes



- Voice changes 0 to 6 months after radiotherapy
- Maximum odds ratio of 1.043 occurs at 5% volume (p<0.001)

TABLE 1: Summary of dose-toxicity relationships

Toxicity / Risk Structure	N (%)	Structure Volume	Odds Ratio	p-value
Dental Caries: Grade ≥1				
Oral mucosa	32 (16%)	3%	1.096	0.047
Dysphagia: Grade ≥1				
Constrictor muscles	44 (31%)	1%	1.116	0.004
Cricopharyngeal muscle	33 (38%)	17%	1.052	0.021
Endolarynx	33 (38%)	3%	1.055	0.046
Dysphagia: Grade ≥2				
Larynx	65 (39%)	1%	1.135	<0.001
Esophagitis: Grade ≥1				
Esophagus	71 (30%)	1%	1.062	<0.001
Larynx	30 (36%)	1%	1.097	0.008
Thyroid	56 (24%)	10%	1.099	<0.001
Hearing Loss: Grade ≥2				
Left + right outer ear	44 (38%)	70%	1.097	0.010
Mucositis: Grade ≥3				
Parotid glands	57 (18%)	99%	1.110	<0.001
Oral mucosa	50 (25%)	1%	1.080	0.001
Mandible	56 (17%)	20%	1.078	<0.001
Nausea: Grade ≥3				
Parotid glands	177 (45%)	99%	1.144	<0.001
Trismus: Grade ≥1				
Mandible	64 (27%)	5%	1.072	0.003
Voice Changes: Grade ≥1				
Larynx	41 (36%)	2%	1.169	<0.001
Thyroid	74 (38%)	1%	1.088	0.005
Xerostomia: Grade ≥2				
Parotid glands	141 (49%)	99%	1.192	<0.001
Submandibular glands	67 (36%)	1%	1.057	0.048
Mandible	271 (64%)	20%	1.085	<0.001

Conclusions

- Prospective data collection enables large-scale analysis of radiation-induced toxicities
- Results validate well-known dose-toxicity models, including aspiration and dysphagia with respect to dose to the larynx or pharyngeal constrictors
- Data-mining framework provides novel insight discovery to the nature of dose-toxicity relationships