

Radiologists to help each other to improve efficiency by decreasing time to look up patient's relevant clinical history in electronic medical record.

ID: 20001217

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Purpose:

- The aim of the study is to prove that it takes less time to look up relevant clinical history from electronic medical record (EMR), if the information is already provided in a specific space in the EMR by a fellow radiologist. This space is easily viewable and editable by an interpreting radiologist. It is recommended that pertinent history be placed in this space and subsequently be updated by fellow radiologists after each complex imaging exam.
- The time needed to gather this information is one of the factors contributing to increase in turn around time for radiologists. Patient's with complex oncological and surgical histories need frequent imaging and every time a radiologist may spend significant amount of time to look up the same clinical information as his/her peers.

Materials and Methods:

- In collaboration with ACMIO (Assistant chief medical officer) and Radiant Epic team, a space labelled as "Specialty Comments" was added to the SNAPSHOT of patient's charts in EMR (Fig.1). The Specialty Comment was available, viewed and edited by radiologist's logged in through radiology department. For our research purpose the specialty comment was labelled as boxed history as a variable for data analysis. If the history was not provided in that space, then it was labelled as without boxed history.
- Inclusion criteria included outdoor, adult patients with oncological histories undergoing CT chest, abdomen and pelvis with IV contrast. The time to look up history were documented in total minutes and seconds, when the boxed history was provided as well as when the boxed history was not available, and the interpreting radiologist had to search the EMR to gather the relevant information. The stopwatch function of a smart phone was used to calculate time in minutes and seconds.
- A general guideline was provided for obtaining pertinent clinical history (Fig.2). It included the type of cancer, time of diagnosis followed by treatment or recurrences with their dates. Additional complex procedures with dates, for e.g. biopsies, surgeries, drain placement or removal as well as path results were to be included as deemed necessary. The reason for obtaining the current study was one of the last factors.

The screenshot displays the Epic EMR interface. At the top, a navigation bar includes options like 'Protocol Work List', 'Chart', 'Study Review', 'Study History', 'Patient Lists', 'My Reports', 'Recent Studies Report', 'Schedule', and 'Protocol'. A search bar is visible on the right. The main content area is titled 'SnapShot with Recent Visits' and features a left-hand navigation menu with categories such as 'Chart Review', 'Care Everywhere...', 'Order Inquiry', 'Review Flows...', 'Results Review', 'Allergies', 'History', 'Problem List', 'Implants', 'Demographics', and 'Letters'. The central panel is divided into several sections: 'Specialty Comments' (with an 'Edit' and 'Show All Report' button), 'Family Comments' (with an 'Edit' button), and 'Family History' (containing a table of family members). A yellow arrow points to the 'Specialty Comments' section. To the right, a 'Meds w/Allergies' section lists various medications, with a red arrow pointing to an 'Edit' button. Below the medications is an 'Immunizations/Injections' section listing flu shots.

Relationship	Status	Condition
Father	Deceased	Heart disease
Mother	Deceased	Heart disease

Medication	Dosage
aspirin chewable tablet	
baclofen (LIORESAL)	10 MG tablet
bumetanide (BUMEX)	2 MG tablet
calcium carbonate (TUMS)	500 mg (200 mg calcium) chewable tablet
cholecalciferol, vitamin D3	1,000 unit tablet
cyanocobalamin (VITAMIN B-12)	1000 MCG tablet
diphenhydramine (BENADRYL)	25 mg tablet
emollient combination (LUBRIDERM)	lotion
famotidine (PEPCID)	20 MG tablet
guaifenesin (ROBITUSSIN)	100 mg/5 mL Liqd
HYDROcodone-acetaminophen (NORCO)	5-325 mg per tablet
ipratropium-albuterol (DUO-NEB)	0.5 mg-3 mg(2.5 mg base)/3 mL nebulizer solution
loratadine (CLARITIN)	10 mg tablet
magnesium oxide	400 mg magnesium Tab
metoprolol tartrate (LOPRESSOR)	50 MG Immediate Release tablet
miconazole nitrate (SECURA EXTRA THICK ANTIFUNGAL)	2 % cream
polyethylene glycol (MIRALAX)	17 gram packet
senna-docusate (SENNAPLUS)	8.6-50 mg tablet
warfarin (COUMADIN)	1 mg tablet
warfarin (COUMADIN)	2 mg tablet

Immunization	Date
Influenza, injectable, quadrivalent, preservative free	12/8/2016, 9/25/2015
Influenza, seasonal, injectable	10/5/2012, 11/2/2011

(Fig. 1). The dashboard on EMR (EPIC) shows the snapshot of the patient's information. The yellow arrow indicates the specialty comment that can be edited by the radiologist. The red arrow points towards the edit button to document the findings.

Clinical History for a Radiologist- Quality improvement project

Selection of cases:

Outpatients adults with history of cancer for CT C/A/P.

Components of history:

- Include the type of cancer and year of diagnoses. If it was diagnosed with in a year, then mention the date.
- Status post surgery/ chemotherapy/ radiation dated (date when completed).
- Mention if currently on chemotherapy or radiation therapy (last radio/chemotherapy date).
- Other surgeries.
- Lastly mention why the current study is being done? For e.g. for annual follow up, rising tumor markers or new symptoms etc.

Effective extraction of history from EMR charts:

- Look at recent note from heme/onc or radiation oncologist.
- Look at recent note from department specialty of the cancer for which the study is being read.
- Look up prior reports to see if some one wrote better history as well as read previous imaging findings.
- Click on **surgical history** in any of the notes.
- If interval surgery/procedure is done, then look for it on procedure log/procedure **Result** tab in top row.
- Path result available on **AP** tab in top row.
- Lab results are available through **Result review** in left hand column.

How to calculate time:

Without boxed history:

Start the stop watch on your smart phone as soon as you start looking for history in EPIC chart. Stop the timer when you are done. If you have to go back to EPIC to look for more information while dictating report, then add the additional time.

Boxed history:

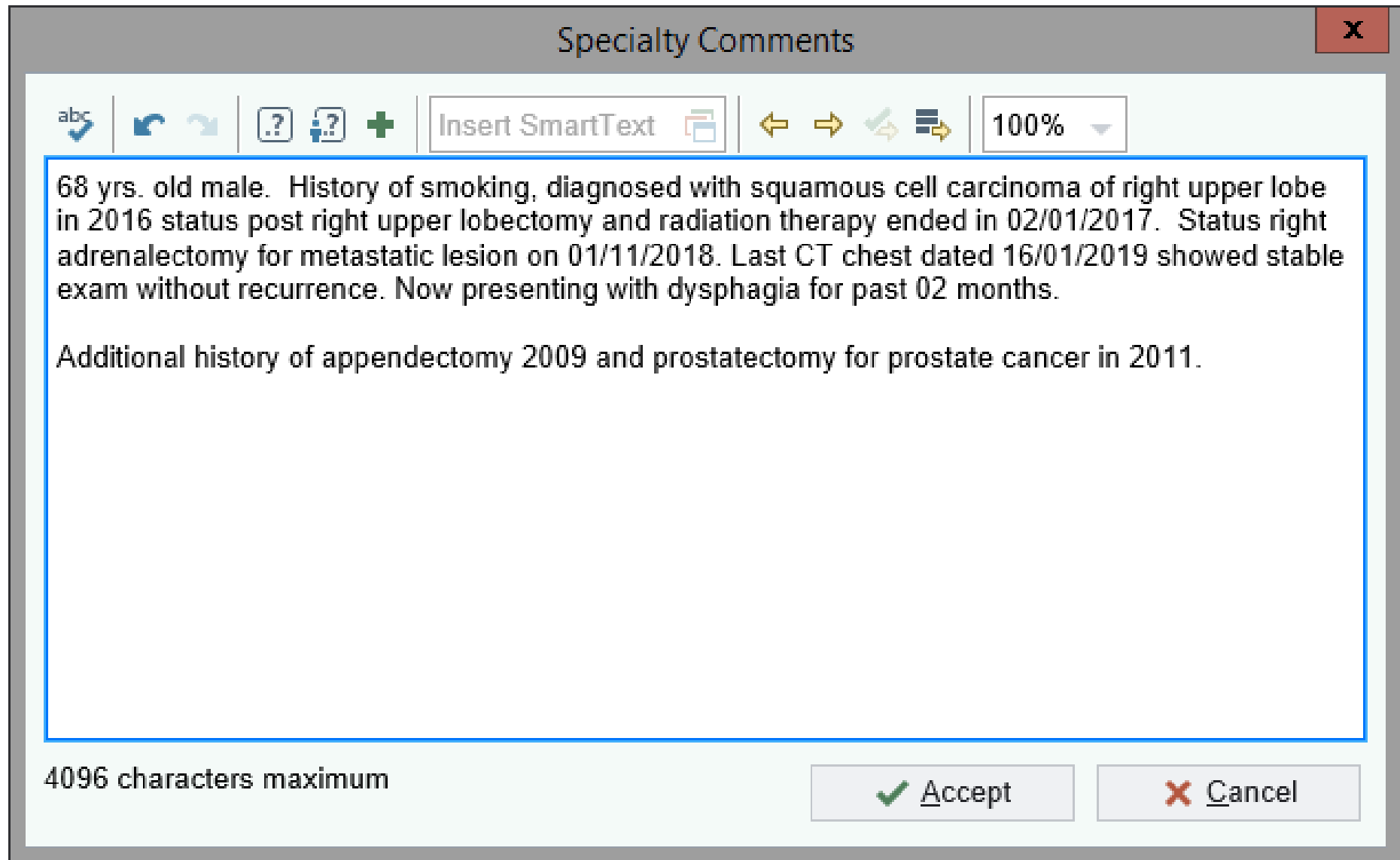
Start the stop watch on your smart phone as soon as you start reading the boxed history. Stop the timer when you are done. If you have to go back to EPIC to look for more information while dictating report, then add the additional time.

Sample of a history:

Status post liver transplant for alcoholic cirrhosis with HCC diagnosed in 2007. Status post left adrenalectomy for mets in 2008. Recurrent HCC in the transplanted liver segment 7, status post TACE and SBRT radiation in 2008. Prostate carcinoma s/p brachytherapy 2004. Htn, aortic stenosis and ascending aortic aneurysm. Here for annual follow up for liver transplant.

Your help is greatly appreciated.

(Figure 2): Criteria for acquisition of patient's relevant clinical history.



(Fig. 3). Sample history of patient undergoing CT C/A/P with IV contrast.

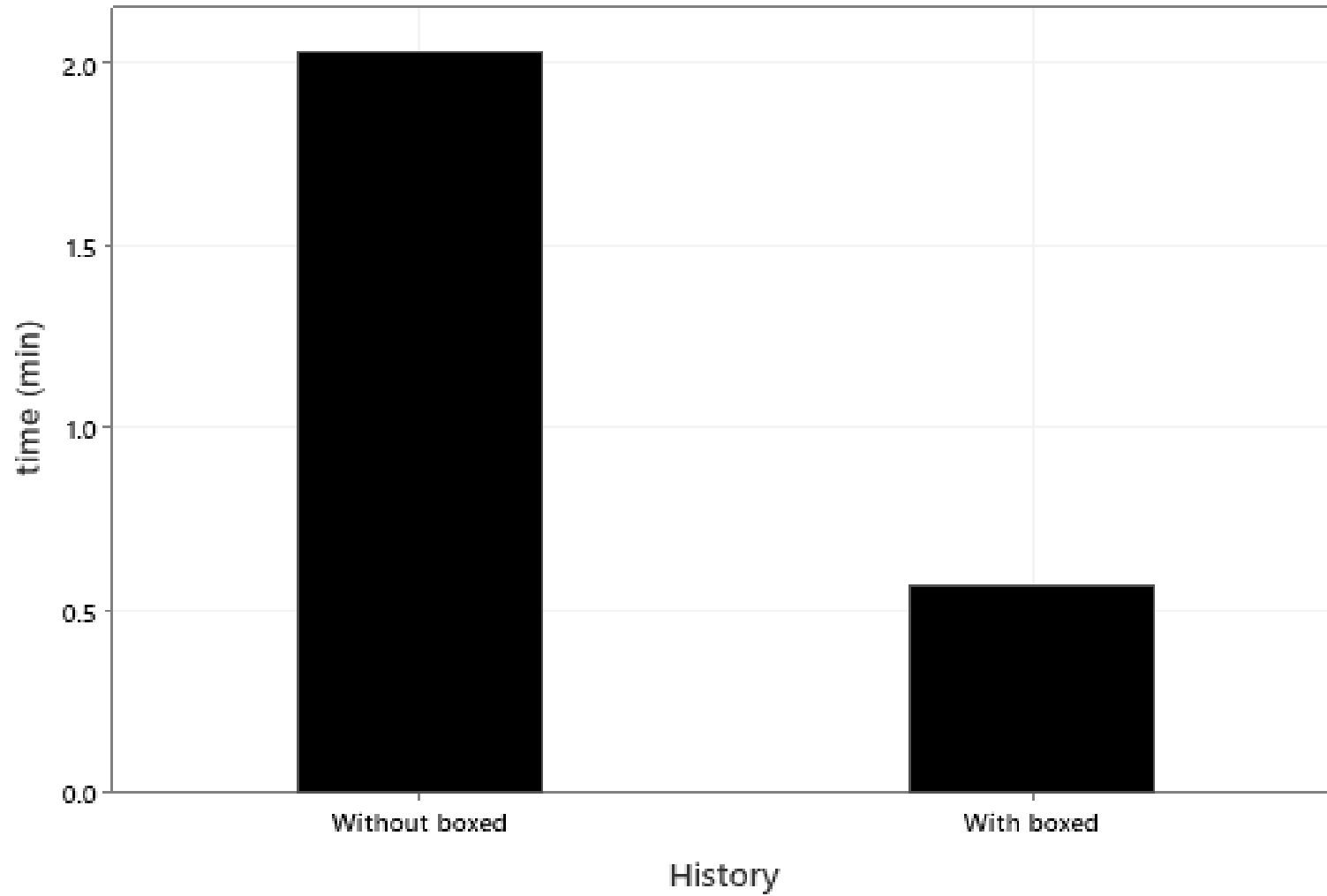
Results:

- A total of 85 cases were included in the study. Two reading radiologists provided the time for reading history from EMR labelled as without boxed history and reading from provided boxed history by another radiologist. 46 cases without boxed history and 41 with boxed history. 19 cases were included to document time taken to create the boxed history.
- Descriptive statistics, including means, medians and 95% confidence intervals for the means, were computed for the lookup times for cases with and without boxed history for each reader.
- The p-value and confidence interval for this statistic were obtained using the GLM procedure in SAS statistical software to fit an analysis-of-variance (ANOVA) model with test, history and their interaction included as predictors in the model. We used a significance level of $\alpha = 0.05$ for testing. All tests and confidence intervals were two-sided.
- All the lookup times for reader 1 were higher when boxed history was present, compared to when it was not present. For reader 2, we saw that all but 3 of the cases without boxed history had longer look-up times (Table.1). For each reader, the lookup time for cases without box histories was significantly higher (each $p < 0.0001$), (Graph 1 and 2). Comparing the averages of the reader means with respect to history, the mean lookup times significantly differed by 1.46 minutes: 0.57 (with) versus 2.03 (without), $p < 0.0001$. The mean time for creating the boxed histories was 3.81 minutes [95% CI: 3.41, 4.21].

Reader	History	N	Mean reading time in minutes and seconds [CI]	Median reading time in minutes and seconds	Difference in History means [CI]	p-value
1	Without boxed	22	1.95 [1.64, 2.26]	1.97	1.56 [1.24, 1.88]	<0.0001
	With boxed	20	0.39 [0.34, 0.44]	0.39		
2	Without boxed	24	2.11 [1.71, 2.51]	1.93	1.36 [0.94, 1.78]	<0.0001
	With boxed	19	0.76 [0.61, 0.89]	0.72		

- Table 1: For each reader, the lookup time for cases without box histories was significantly higher than with boxed history (each $p < 0.0001$).

- N = number of cases; CI = 95% confidence interval; p -value is for testing if the difference in history means is zero.



(Graph 2): Comparison of reader averaged lookup times

Conclusion:

- A pertinent history directed to radiologist's needs resulted in statistically significant decrease in time spent by interpreting radiologist to look through the electronic medical records for patients with complex oncological histories.
- Radiologist can help each other by documenting the relevant clinical history and updating it on a regular basis after each advanced radiological cross-sectional study. This has potential wide-ranging advantages, including quality reporting, decrease in turnaround time, reduction in interpretation errors as well as radiologist's continued learning.
- Due to wide use of EMR, the space for documenting the clinical history may be reproduced or some similar space may be developed by optimizing the electronic health records.