Impact of Telemedicine Encounters on Survival Outcomes: A Time-Varying Cox Analysis Using EHR-derived Data

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Background

- Literature indicates that telemedicine offers several potential benefits in oncology, including overcoming geographic barriers, reducing financial burdens, and providing efficient care delivery, reducing financial burdens, and providing efficient care delivery.[1-5]
- RCTs have demonstrated that web-based symptom monitoring improves median overall survival in lung cancer populations.[6] Furthermore, multi-site trial found that quality of life (QOL) outcomes for telemedicine were equivalent to in-person care.[3]
- Within the advanced NSCLC population, patients with EGFR mutations or ALK rearrangements treated with long-term oral targeted therapies require constant toxicity monitoring and early detection of treatment resistance.[7]

Objective

- To estimate the association between time-varying telemedicine exposure and survival outcomes or death in a cohort of EGFR/ALK positive NSCLC patients initiating first-line therapy

Methods

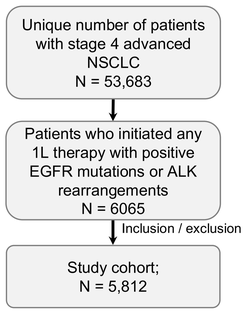
Study design and data source

- A retrospective cohort study was conducted using EHR-derived data from the US Flatiron Health Research Database spanning from January 2011 to December 2023.[8]

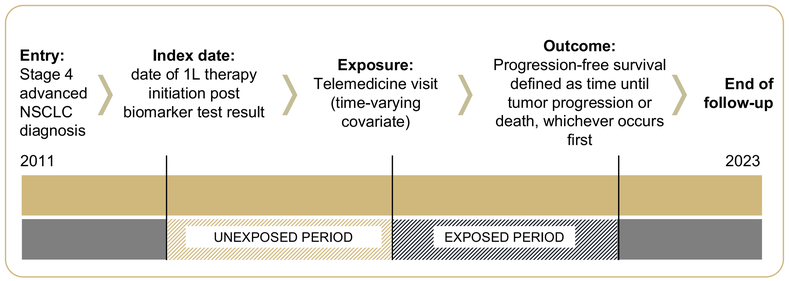
Study cohort

- Participants were included if they had diagnosis of stage IV, IVA, IVB advanced NSCLC, initiated any first-line(1L) therapy and had a positive biomarker test result for EGFR mutation or ALK rearrangement prior to 1L therapy
- Participants were excluded if they had no follow-up after treatment initiation, had progression or death occurring within 14 days of 1L initiation, and had been diagnosed with brain metastases or bone metastases prior to 1L initiation date

Figure 1. Study Cohort Selection



Study measures



- **Covariates:**
  - All models were adjusted for covariates including: Age, Gender, Race, Ethnicity, Smoking status, Histology, Biomarker type, Treatment category, ECOG values, Insurance type, Telemedicine use prior to 1L, Covid period within which 1L initiated (temporal effects)

Methods

Statistical Analysis

- **Primary Analysis:** Extended Cox Proportional Hazards Model with time-varying exposure for telemedicine, adjusted for covariates.
- **Sensitivity Analysis:** Extended Cox Proportional Hazards Model with time-varying exposure for telemedicine, same as the primary analysis, but adjusting for the event dates i.e., start of the month and end of the month as death date
- **Exploratory Analysis:** We examined the effect of telemedicine within each therapy group using separate stratified models.

Results

- A total of **5,812** patients were included within the study, with **1,298** patients who had at least one telemedicine visit and **4,514** patients who had no telemedicine visit during entire follow-up period.
- Patients with at least 1 telemedicine visit were slightly younger with median age 65 (57-73, p<0.001).

Table 1. Demographic and Clinical Characteristics of the Study Population by Treatment Group

Variable	Telemedicine N = 1,298[1]	No Telemedicine N = 4,514[1]	p-value[2]
Biomarker status, n(%)			0.014
ALK rearrangement	218 (17%)	635 (14%)	
EGFR mutation	1,080 (83%)	3,879 (86%)	
Age (years), median (range)	65 (57-73)	67(59-76)	<0.001
Gender (Male), n(%)	414 (32%)	1,683 (37%)	<0.001
Race, n(%)			0.004
White	727 (56%)	2,655 (59%)	
Black or African American	90 (6.9%)	311 (6.9%)	
Asian	188 (14%)	486 (11%)	
Other/Unknown	293 (23%)	1,062 (24%)	
Ethnicity, n(%)			0.024
Hispanic or Latino	77 (5.9%)	292 (6.5%)	
Not Hispanic or Latino	939 (72%)	3,299 (73%)	
Missing	282 (22%)	923 (20%)	
Smoking Status, n(%)			0.001
Former	566 (44%)	2,132 (47%)	
Never	732 (56%)	2,358 (52%)	
Unknown	0 (0%)	24 (0.5%)	
Insurance Type, n(%)			<0.001
Commercial	783 (60%)	2,290 (51%)	
Medicaid	43 (3.3%)	150 (3.3%)	
Medicare	142 (11%)	484 (11%)	
Other	141 (11%)	544 (12%)	
Missing	189 (15%)	1,046 (23%)	
Histology, n(%)			0.2
Non-Squamous cell carcinoma	1,256 (97%)	4,316 (96%)	
Squamous Cell carcinoma	22 (1.7%)	98 (2.2%)	
Histology NOS	20 (1.5%)	100 (2.2%)	
ECOG Performance Status, n(%)			<0.001
0	435 (34%)	1,079 (24%)	
1	450 (35%)	1,563 (35%)	
≥2	157 (12%)	684 (15%)	
Unknown	256 (20%)	1,188 (26%)	
Pre-1L Telemedicine, n(%)	208 (16%)	102 (2.3%)	<0.001
COVID period, n(%)			<0.001
Pre-COVID	682 (53%)	3,413 (76%)	
COVID	318 (24%)	412 (9.1%)	
Post-COVID	298 (23%)	689 (15%)	

1 n / N (%); Median (Q1-Q3); 2 Pearson's Chi-squared test; Wilcoxon rank sum test; Fisher's exact test

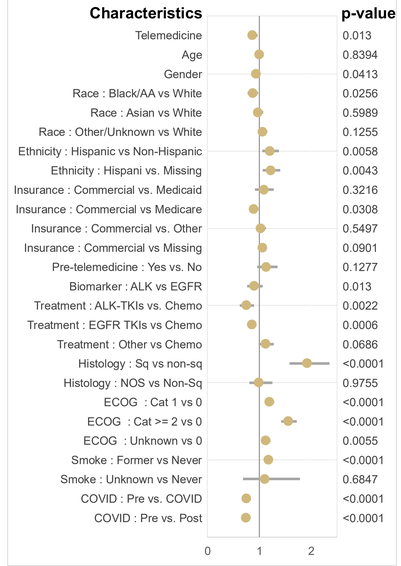
Results

Table 2. Association of telemedicine use with time to progression or death: primary and sensitivity analysis

Model	HR	95% CI	P-value
Primary analysis (death = mid-month)	0.87	0.78-0.97	0.013
Sensitivity (death = start of the month)	0.88	0.79-0.98	0.0164
Sensitivity (death = end of the month)	0.86	0.77-0.96	0.0065

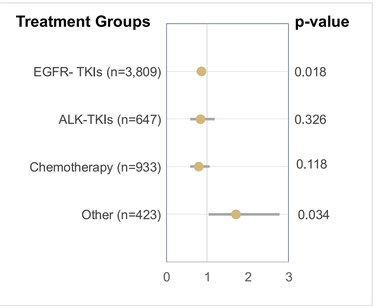
- Both primary and sensitivity models showed consistent results. (**Table 2**)

Figure 2. Hazard ratios for all covariates in the adjusted primary model



- Known prognostic factors such as ECOG-performance, squamous histology, smoking history, and treatment groups were strong predictors of hazard. (**Figure 2**)
- **Exploratory analysis:** Association was directionally consistent for EGFR TKIs (significant), ALK-TKIs, and chemotherapy cohorts. (**Figure 3**)

Figure 3. Hazard Ratios for telemedicine use from separate time-varying Cox models by treatment groups



Conclusions

- Patients receiving telemedicine during 1L therapy had a lower hazard of the event during exposed intervals compared to unexposed intervals
- This association suggests that telemedicine may provide timely monitoring, better care coordination, or earlier intervention, potentially improving outcomes

Limitations

- Lack of comorbidity data restricts a full understanding of treatment effects since baseline health status remains unknown.
- Non-randomized assignment of telemedicine may have introduced selection bias
- This analysis did not restrict outcome for those occurring with a line of therapy

References

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