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All-Cause Healthcare Resource Use In Recurrent Respiratory Papillomatosis: A Claims-Based Comparison With Matched Controls

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INTRODUCTION

- Recurrent respiratory papillomatosis (RRP) is a rare, chronic respiratory disease caused by infection from human papillomavirus (HPV) types 6 or 11, leading to the growth of papillomas in the respiratory tract.[1; 2]
- Without treatment, papillomas can lead to airway obstruction, pulmonary complications, and increased risk of tracheotomy in severe cases.[1-3; 7; 8]
- RRP has historically been managed through repeated surgeries.[5]
- On average, adult patients with RRP undergo 13.5 surgeries over their lifetime, though 9% have undergone ≥100 surgeries [1]; recurrence is common, making RRP a lifelong, debilitating condition with no known cure.[1; 3-6]
- Iatrogenic laryngeal injury risk increases with the number of surgical interventions.[1;5]
- Daily lives of patients with RRP can be heavily impacted, affecting health related quality of life (HRQoL) and the ability to work.[1; 8]
- Despite the clinical burden, there is limited real-world evidence on the healthcare resource utilization (HCRU) of adult patients with RRP.

OBJECTIVE

- To compare components of all-cause HCRU between adult patients with RRP and matched non-RRP controls in the United States (US).

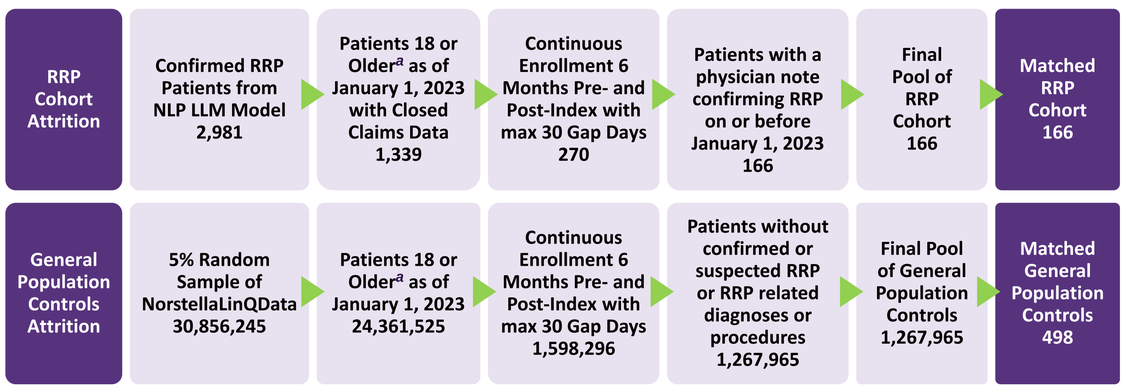
METHODS

- Confirmed RRP patients were identified via NorstellaLinQ electronic medical records (EMR) (comprised of 40+ health systems and 600+ hospitals) and linked with NorstellaLinQ Closed Claims, comprised of 245M+ US Lives covered by Commercial, Medicare Advantage, and Medicaid) for longitudinal analysis.
- Patients were identified using a natural language processing (NLP) workflow leveraging multiple large language models (LLMs). The models underwent iterative optimization through systematic manual review, where EMR physician notes were validated against model outputs and refined using insights from published RRP literature.
- To balance a mix of incident and prevalent RRP patients across varying stages of disease severity, January 1, 2023, was selected as the uniform random index date. Outcomes were assessed six months pre- and post-index.

METHODS (CONT.)

- Confirmed RRP patients were matched to non-RRP controls in a 3:1 ratio using logistic propensity score matching (PSM)(caliper = 0.15; **Figure 1**). Matching variables included:

Figure 1. Non-RRP controls and RRP matched cohort



[a]Age was calculated as of 1/1/2023 (index) date

- **Outcomes:** All-cause HCRU measures, RRP-related medications, and RRP-related procedures were compared between groups. A sub-analysis examined HCRU in RRP patients with ≥3 vs. 0 surgical debulking procedures.
- **Statistical Analysis:** Unpaired t-tests and incidence rate ratios (IRR) were used to compare continuous utilization measures; 95% confidence intervals (CIs) were calculated for all IRRs to assess statistical significance.

RESULTS

Baseline Characteristics:

- **Table 1** shows similar characteristics between the matched cohort of patients with RRP and non-RRP controls.

Table 1. Baseline characteristics of non-RRP controls versus patients with RRP

Characteristic	Non-RRP Controls (Matched)	RRP Patients	SMD (after matching)
N	498	166	–
Mean Age (SD)	49.5 (16.3)	48.9 (16.7)	0.04
% Male	58.4%	59.0%	0.01
Region, N (%)			
Midwest	75 (15.1%)	22 (13.3%)	0.05
Northeast	33 (6.6%)	11 (6.6%)	0.00
South	117 (23.5%)	41 (24.7%)	0.03
West	273 (54.8%)	92 (55.4%)	0.01

Abbreviations: N = number of patients; SD = standard deviation; SMD = standard mean difference

All-Cause Healthcare Resource Use:

- Patients with RRP had significantly higher HCRU in the pre- and/or post-index period vs. non-RRP matched controls (**Table 2**):
  - **More than 2X as many emergency room visits (pre-index mean: 0.27 vs. 0.12)**
  - **12-13X as many inpatient visits (pre- and post-index mean: 0.64 vs. 0.05)**
  - **3X as many outpatient visits (pre-index mean: 1.78 vs 0.30; post-index mean: 1.41 vs. 0.32)**

Medication Use:

- Patients with RRP required significantly higher medication use in both the pre- and post-index periods vs. non-RRP matched controls (**Table 2**):
  - **7-9X as many opioid prescriptions (pre-index mean: 2.58 vs. 0.35; post-index mean: 2.73 vs. 0.31)**
  - **2X as many non-opioid prescriptions (pre-index mean: 0.83 vs 0.40; post-index mean: 0.91 vs. 0.41)**
  - **4X as many corticosteroid prescriptions (pre-index mean: 1.66 vs. 0.39; post-index mean: 1.73 vs. 0.42)**
  - **3-5X as many mental health medication prescriptions (pre-index mean: 2.17 vs 0.62; post-index mean: 3.10 vs. 0.57)**

Procedures:

- In addition to the well-documented need for surgical intervention, RRP patients experienced significantly greater need for medication and other procedures vs. non-RRP matched controls (**Table 2**):
  - **3-4X more mental health visits (pre-index mean: 1.47 vs. 0.34; post-index mean: 1.27 vs. 0.39)**
  - **6X more anesthesia administrations (pre-index mean: 0.28 vs 0.05; post-index mean: 0.26 vs. 0.04)**
- Over a six-month timeframe:
  - **7% of RRP patients needed speech therapy sessions (N=12) vs. <1% of controls (N=4)**
  - **26% of RRP patients needed chest imaging procedures (N=44) vs. 8% of controls (N=39)**

Table 2. IRR for HCRU, medication use, and procedures in patients with RRP vs. matched controls

Outcome	Pre-index		Post-index	
	IRR (95% CI)[a]	*P*-value[b]	IRR (95% CI)[a]	*P*-value[b]
ER Visits	2.28 (1.50, 3.43)	0.013	0.60 (0.32, 1.05)	0.064
Inpatient Visits	12.23 (7.90, 19.58)	<0.001	13.25 (8.45, 21.59)	<0.001
Outpatient visits	2.92 (2.07, 4.10)	<0.001	2.59 (1.82, 3.68)	0.007
Opioids Use	7.47 (6.24, 8.96)	0.002	8.71 (7.25, 10.52)	<0.001
Non-opioids	2.09 (1.67, 2.61)	0.007	2.23 (1.80, 2.77)	0.015
Corticosteroids	4.29 (3.56, 5.18)	<0.001	4.12 (3.44, 4.95)	<0.001
Mental Health Medications	3.50 (2.99, 4.08)	0.001	5.44 (4.70, 6.31)	0.023
Speech therapy	70.5 (18.46, 599.19)	0.028	26.57 (12.16, 68.82)	0.060
Mental Health Visits	4.31 (3.53, 5.27)	0.022	3.28 (2.69, 4.01)	0.042
Chest Imaging	6.31 (4.93, 8.12)	0.003	4.98 (3.86, 6.45)	<0.001
Anesthesia	5.88 (3.52, 10.05)	0.003	6.45 (3.71, 11.57)	<0.001

[a]RRs >1 indicate higher rates in RRP patients vs. controls; <1 indicate lower rates. [b]Unpaired t-tests were used to compare RRP patients and matched controls; *P*<0.05 indicated statistical significance. **Abbreviations:** CI = confidence interval; ER = emergency room; IRR = incidence rate ratio; RRP = recurrent respiratory papillomatosis.

DISCUSSION & CONCLUSIONS

- Use of NorstellaLinQ, a large, linked claims and EMR dataset, provides broad representation in the US. However, generalizability to certain sub-populations, including Medicare fee for service (FFS), is limited.
- Logistic PSM on age, sex, payer type, and region reduced confounding, although residual confounding is possible.
- While the study assessed six months pre- and post-index, which may not capture the long-term burden of a chronic disease like RRP, this window enables consistent baseline and outcome assessment in a real-world setting.
- **Conclusions: In addition to the well-published burden of repeat surgeries for patients with RRP, these data clearly show a broader impact in terms of HCRU for these patients, including emergency and healthcare visits, opioid use, and mental health services, highlighting the profound impact on patients' quality of life. More effective treatments that reduce surgeries may also alleviate the burden on patients and the healthcare system.**

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CONTACT INFORMATION

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