APPENDIX A: ICD-9 and ICD-10 Discharge Diagnosis Code Validation

Children ages 2 months to 18 years hospitalized at Cincinnati Children's Hospital Medical Center (CCHMC) between 2012-2017 with lymphadenitis related discharge diagnosis codes listed in **Table A1** were identified using the PHIS database. We excluded patients with complex chronic conditions[9] as well as those transferred in from another institution.

Table A1. Lymphadenitis Related ICD-9 and ICD-10 Diagnosis Codes

Diagnosis	ICD-9 codes	ICD-10 codes
Acute lymphadenitis	683	L04.0, L04.9
Cellulitis or abscess, carbuncle or furuncle of neck	682.1	L02.11-12, L03.221-222
Chronic or nonspecific lymphadenitis	289.1, 289.3	I88.1, I88.9
Neck swelling, mass or lump	784.2	R22.1
Enlarged lymph nodes	785.6	R59.9

Targeted electronic medical record (EMR) review of was conducted to confirm the diagnosis of cervical lymphadenitis on 156 patients with ICD-10 codes and 150 patients with ICD-9 codes (**Table A1**). Patients were classified as having cervical lymphadenitis if they had either a clinician documented discharge diagnosis of lymphadenitis of the neck, or if they had had fever and documented unilateral neck swelling with at least 1 associated skin change (erythema, induration, or fluctuance) (**Table A2**).

Table A2. Data Elements for Validation

Data Element	EMR source
Clinician documented diagnosis: "lymphadenitis" or "lymphadenitis with abscess" of the neck	Discharge summary or progress note on day of discharge.
Fever: defined as any reported temperatures (≥ 38 C or 100.4 F) prior to admission or measured in the ED, via any measurement route.	Emergency department (ED) Note: History of Present Illness + ED vital signs
Neck Swelling: Must be unilateral. If bilateral neck swelling is noted, it must be clearly asymmetrical.	ED Note: Physical exam section
Overlying skin changes: Must have at least one of the following: Erythema, induration, fluctuance.	ED Note: Physical exam section

We calculated positive predictive values (PPV) for each of the codes listed in **Table A1**. We then excluded codes with PPV of less than 20% (i.e., discharge diagnosis codes: 784.2, 785.6, R22.1, and R59.9, which had PPV ranging from 0% to 16%). The aggregate PPV of the remainder of the discharge diagnosis codes in **Table A1** was 82.5% for ICD-10 codes and 68.1% for ICD-9 codes.

To improve the PPV of these codes we excluded the following groups of patients defined *a priori* as likely to not have cervical lymphadenitis: 1) patients who did not receive antibiotics during hospitalization; 2) patients with billing codes for CT, ultrasound, or MRI of chest, abdomen, pelvis, or extremities; and 3) patients with discharge diagnosis codes for Kawasaki disease, retropharyngeal or parapharyngeal abscess, mastoiditis, dental abscess, or lymphoma/other oncological diagnoses. After applying theses additional exclusions, the PPV improved to **95.1%(95%CI: 88.9%-98.4%) for ICD-10 codes** and **87.5%(95%CI: 79.2%-93.4%) for ICD-9 codes**. Applying these exclusions resulted in incorrect exclusion of 3 (1%) patients with cervical lymphadenitis.

Additionally, in order to estimate sensitivity, we conducted a convenience sampling of patients who did not have any of the codes listed in **Table A1**, but who had CT or ultrasound imaging of the neck and received parenteral antibiotics typically prescribed for cervical lymphadenitis (i.e. clindamycin, ampicillin-sulbactam, or vancomycin). On EMR review, only 6 (4%) of these patients had cervical lymphadenitis.