

Automatic Detection of Skin and Subcutaneous Tissue Infections from Primary Care Electronic Medical Records

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Skin and Subcutaneous Tissue Infection (SSTI) epidemic in NZ



- Infectious.
- Caused by staphylococcus aureus and/or streptococcus pyogenes bacteria.
- Rates from 298/100,000 in 1990 to 547/100,000 in 2007.
- There are social and ethnic inequalities reported in the disease risk factors.
- Antibiotics are effective in treating SSTI; but delaying treatment or non-adherence to treatment can lead to complications & hospitalizations.



Study aim and design



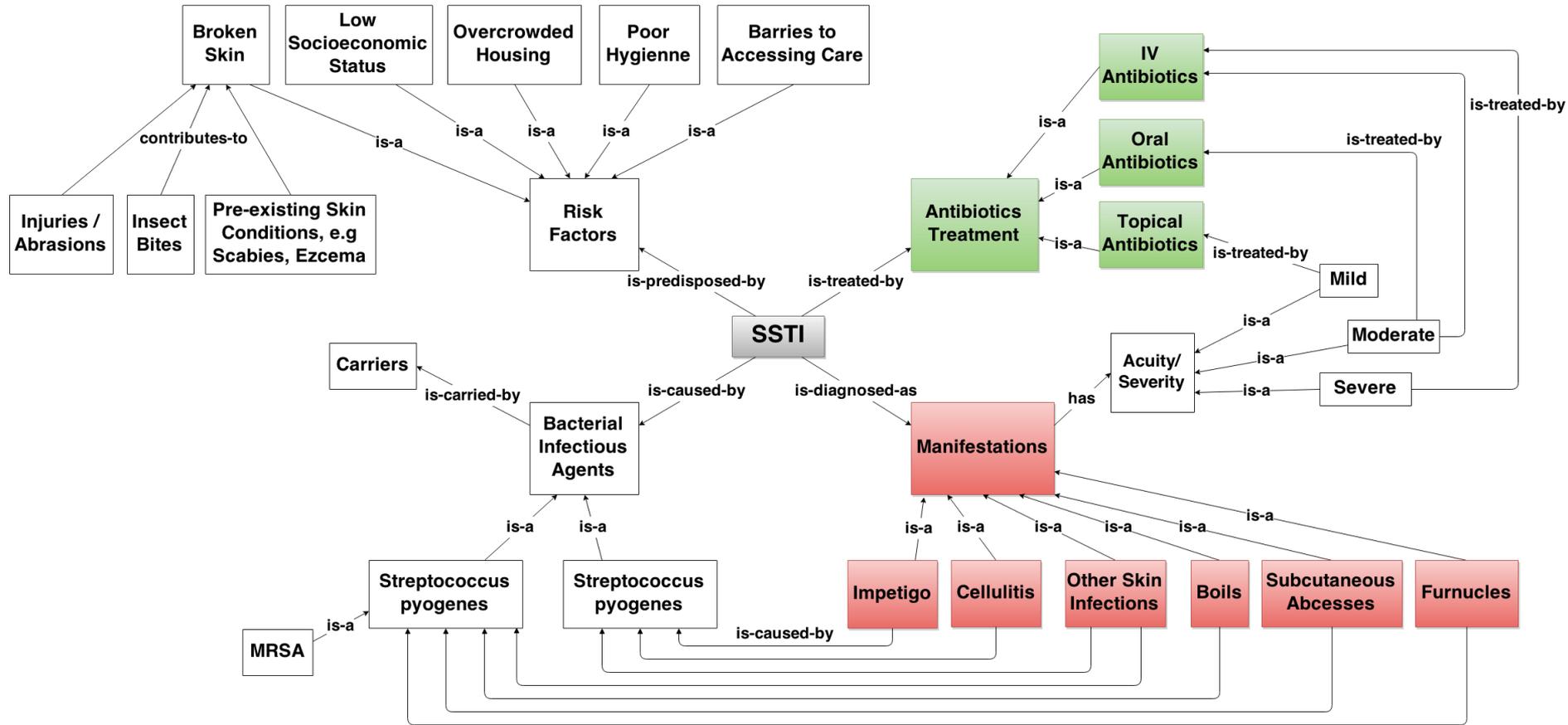
- To explore the feasibility and performance of automatic detection of SSTI occurrences and recurrences by analyzing ambient primary care EMRs.
- Four general practices in Auckland that serve large numbers of Pacific and Māori patients participated in the study.

Study data



- EMR data on child and adolescent populations (age \leq 20):
 - Demographic information
 - Laboratory testing results
 - Diagnoses
 - Notes
 - Prescriptions
- Data range: Oct/2011 - Oct/2014

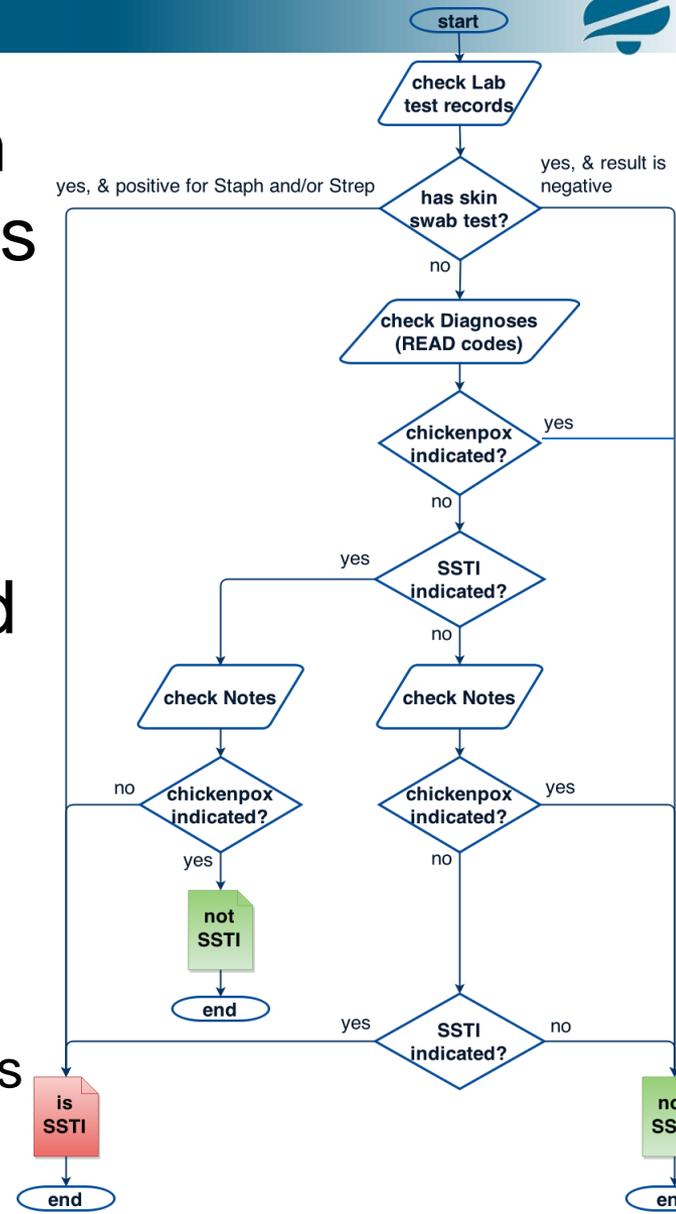
A high-level SSTI ontology



SSTI ID process



- A skin swab lab test can confirm the presence of bacteria colonies on skin.
- READ coded Dx: e.g., cellulitis, impetigo, subcutaneous abscess, boil, folliculitis, infected eczema.
- Clinical notes may include SSTI READ / SNOMED terms and synonyms.
 - Exclude SSTI interpretation from notes alone if chickenpox mentioned



Findings – High SSTI rates



- 3,886 \leq 20 year-olds living in 1,833 households were included in the main analysis.
- 1,382 (36%) from 864 house-holds (47%) had an average of two SSTI occurrences in the last three years (total SSTI occurrence number = 2,714).
- SSTI occurrence rate was 230 per 1000 person-years.

Findings – SSTI treatment & recording



- 91% of SSTI occurrences were treated with oral antibiotics (e.g., penicillin) or topical antibiotics (e.g., fusidic acid).
- Among all identified SSTI occurrences
 - 22% were coded with a READ diagnosis and 16% were confirmed by skin swab tests.
 - Only 7% of SSTI cases didn't have note entries associated with SSTI
 - 65% of SSTI cases had neither Dx nor lab records, i.e., identified by notes only.

Findings – SSTI algorithm evaluation



- 1,245 casual patients (unfunded, aged ≤ 20) in the participating practices. A random sample of 200 of these patients was included in the evaluation.
- PPV=64%, sensitivity=94%, specificity=97%, NPV=99.6%, F_1 score=0.76.

	Condition positive	Condition negative
Test outcome positive	16	9
Test outcome negative	1	281

Study implications – SSTI Risk ID



- Reliable EMR based identification of SSTIs provides a basis for:
 - assessing size of the problem, for funding and planning purposes,
 - identifying patients for follow up,
 - evaluating intervention effect.

Study implications – Targeted interventions



- Screening
- Education
- Early treatment
- Social / economic support to address a range of risk factors associated with infections, e.g., overcrowding.

Check skin infections



Study implications – EMR analysis



- Low levels of use of READ codes from SSTIs challenges the approach of using diagnosis alone in their identification.
- Via note text mining, without checking diagnosis or laboratory results, 93% of SSTI occurrences had been identified in our study.
 - Suggests that diagnosis codes and laboratory results might not add as much value as expected in such analyses.

Study limitations



- Small number of general practices in one metropolitan region,
 - We went where intuition of local practitioners was that SSTI rates are high
 - Findings dependent on data recording practices of relatively small group of GPs and nurses

Conclusion



- It is feasible to automatically detect SSTI from the EMR data collected as part of routine primary care delivery.
- There are high occurrence and recurrence rates for SSTI in population aged ≤ 20 .
- There is an opportunity to improve SSTI risk management in the community.

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