

Assessing the conversion of electronic medical records data into antibiotic stewardship quality indicators

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Background

Measuring the appropriateness of antibiotic use is crucial for antibiotic stewardship programs to identify targets for intervention and improvement of antibiotic prescription. The introduction of the electronic medical record (EMR) facilitates continuous monitoring of antibiotic use and may allow to measure the appropriateness of antibiotic use.

Objective

The aim of this project was to assess the feasibility of converting electronic medical records data into antibiotic stewardship quality indicators suggested by literature.

Methods

A retrospective observational feasibility study was conducted in a single cantonal hospital in Switzerland starting three months after the introduction of the EMR Epic software®.

Health records of all patients hospitalized between 01.10.2019 and 30.09.2021 and receiving at least one dose of an antibiotic were included.

Algorithms for quality indicators measuring the process of antibiotic prescription suggested by literature were written in R. Rstudio® was used to visualize the quality indicators in an interactive dashboard using the package shiny.

Results

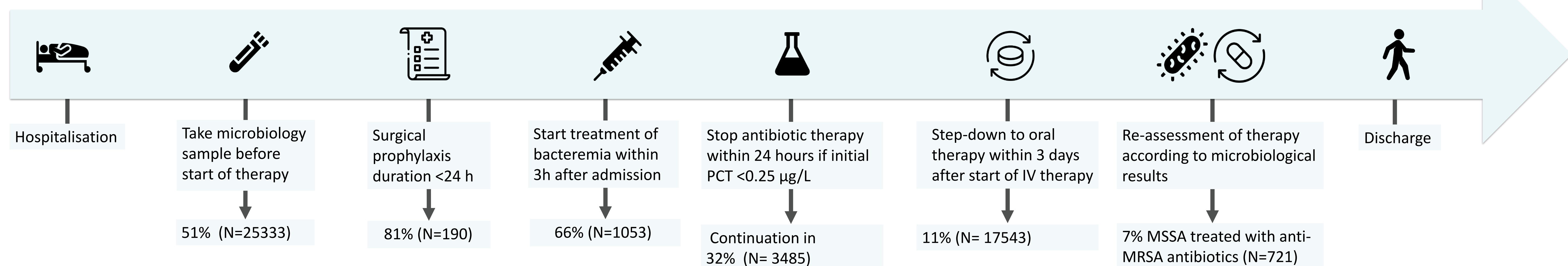


Figure 1: A selection of recommendations during the process of antibiotic prescription measured by quality indicators (proportion of patients, N= number of patients). PCT, procalcitonin; MSSA, methicillin-susceptible *Staphylococcus aureus*; anti-MRSA antibiotics: daptomycin, intravenous glycopeptides, linezolid.

- ▶ Data of 25'333 hospitalisations from 20'723 individual patients were analysed.
- ▶ 34 quality indicators were calculated.
 - ▶ Thereof 23 quality indicators were measuring the appropriateness of antibiotic therapy, i.e. the accordance with general guidelines and recommendations, as well as the types of first adjustments in antibiotic therapy.

- ▶ Data was complete for 79% (27/34) of calculated quality indicators.
- ▶ The most important issues to calculate quality indicators from an extraction of EMR were:
 - ▶ Missing (58%) or meaningless (30%) information on indication (e.g. general indication as infection) including prophylaxis
 - ▶ Data processing issues for four quality indicators such as missing or too less categorised information in the metadata

Table 1: Quality indicators measuring the process of antibiotic prescription (excluding those which are shown in Figure 1 or 2).

Quality indicator	Proportion of patients receiving antibiotics
1. Selection and initiation of therapy	
Initial CRP < 20 mg/L and continuation of AB therapy > 24 h	19 % (N=16958)
Microbiological sample taken during hospitalisation	60 % (N=25333)
Thereof BC: % patients with at least two blood samples	92 % (N=7114)
Surgical prophylaxis: % patients with AB therapy < 24 hours	81 % (N=190)
Surgical prophylaxis: % patients with one administration	39 % (N=190)
2. Re-assessment of therapy	
A. According to general guidelines and recommendations	
Prescription was not adapted to impaired renal function*1	37 % (N=1033)
Thereof prescriptions should have been stopped due to impaired renal function*1	6 % (N=378)
Prescription was edited within 3 days	42 % (N=25333)
Duration [h] of initial therapy (excluding prophylaxis)	0.73 (IQR=0.21,2.27, N=25159)
B. According to microbiological results (considering antibiotic therapy >24h after arrival of microbiological result)	
Prescription was edited within 24h after microbiological result	31 % (N=15168)
ESCR-Enterobacterales BSI treated with piperacillin-tazobactam	34 % (N=79)
Carbapenem sensible- <i>P. aeruginosa</i> treated with substances reserved for multi-drug resistant organisms*2	0 % (N=278)
VSE treated with daptomycin / linezolid	1 % (N=336)

CRP, C-reactive protein; BC, blood culture; ESCR-Enterobacterales BSI, bloodstream infection with extended-spectrum cephalosporin-resistant Enterobacterales; VSE, vancomycin-susceptible enterococci
 *1 Only antibiotics with dosing independent of body-weight or indication and clearly recommended dose reduction according to eGFR were considered.
 *2 Ceftolozane-tazobactam, ceftazidime-avibactam, cefiderocol, imipenem-cilastatin-relebactam, colistin, polymyxin B

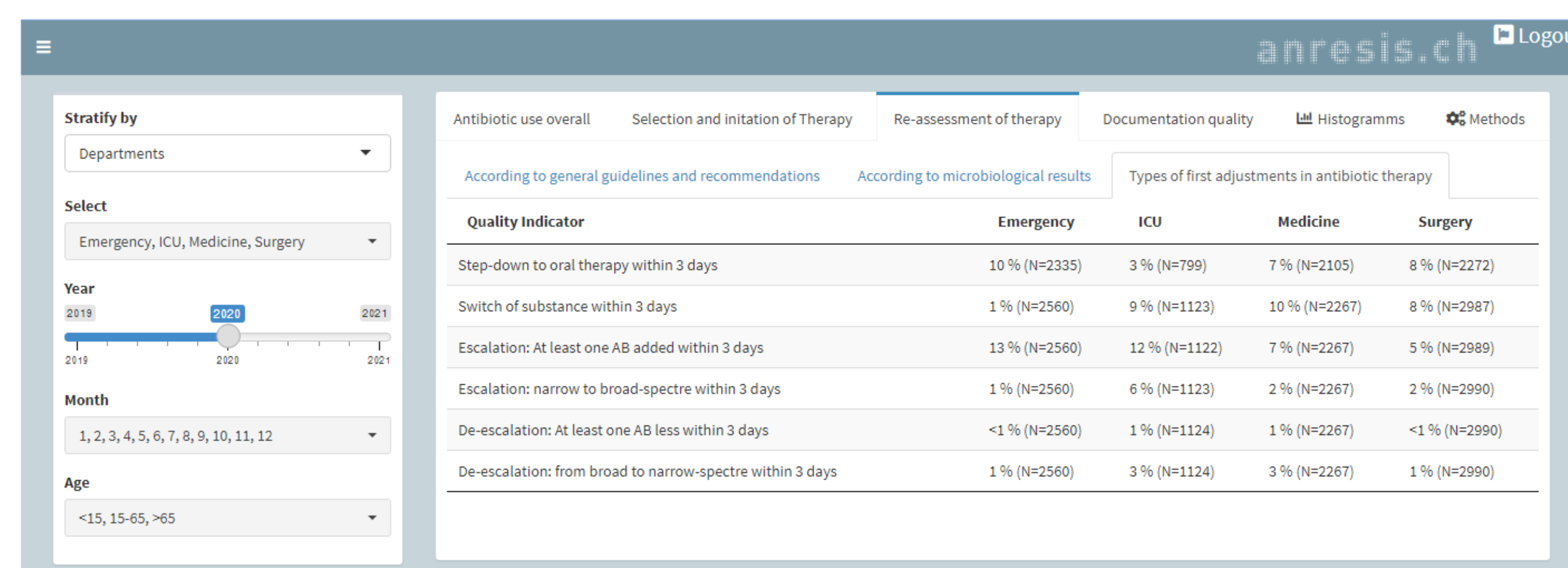


Figure 2: Screenshot of the quality indicators measuring the types of first adjustment in re-assessment of therapy visualized in the interactive dashboard. Broad-spectre antibiotics: carbapenems, cefepime, ceftazidime, piperacillin-tazobactam.

Conclusion

Calculation of quality indicators reflecting the appropriateness of antibiotic prescription out from electronic medical records was feasible.

However, a better data structure and processing within the electronic medical records is crucial for improving the validity of the results.