



Evaluating the direct cost of clinically relevant medication errors in hospitalized patients

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1. Background & Objectives

Background: Medication errors (MEs) present a considerable risk for patients' health and contribute to the economic burden of any healthcare system. They are defined as a "failure in the treatment process that lead to or has the potential to lead to, harm to patient", and can occur at any stage in the medication use process [1,2]. If MEs reach the patient, they can lead to temporary suffering, permanent psychological distress, physical disability or even death. Furthermore, MEs pose a significant financial burden on both the patients and healthcare systems. According to the WHO, unsafe medication practices account for an annual global cost of \$42 billion [3]. However, no standard methodology has been defined for the reporting of the cost of MEs so far, and the results reported in current literature vary greatly [4].

Objectives: This case-control study aims to provide the first qualitative, detailed analysis of the direct cost of MEs in Swiss hospitals – information crucial to raise awareness, guide future resource allocation and incentivize clear strategies for the improvement of patient safety.

2. Methods

We conducted an observational case-control study with data of stationary patients admitted between January 2021 and December 2023 in seven Swiss tertiary care hospitals. MEs were defined as a preventable, clinically relevant event, involving at least one medicinal product. Errors occurring during outpatient care were excluded. The majority of MEs were identified using our internal critical incident reporting system. Lab data was analyzed for toxic medication blood levels, elevated liver enzymes, or decreased kidney function. Drug data was assessed for the use of antidotes like Flumazenil, as well as potentially dangerous or contraindicated drug combinations. All possible cases were individually validated for their clinical relevance in the hospital's clinical information system (MKIS).

Patients were hard matched on their diagnostic related group (DRG), insurance type and hospital. Following, cases with less than 10 controls were only matched with a age range of +/- 10 years, while those with more than 10 controls were further matched on age (+/- 5), admission type, ICU, OR and heart catheterization lab visits. If a case had not been on the ICU, in the OR or in the heart catheterization lab, we excluded controls that had been, as these are indication for comorbidities and general wellbeing.

The cost analysis was performed using accounting data listing 25 individual cost objects. As no patients gave birth during their hospitalization, this cost object was the only one excluded from our analysis. The cost of cases were then compared to the median cost of the corresponding controls. The median was chosen here, as it is more robust to outliers than the mean of a population.

3. Results

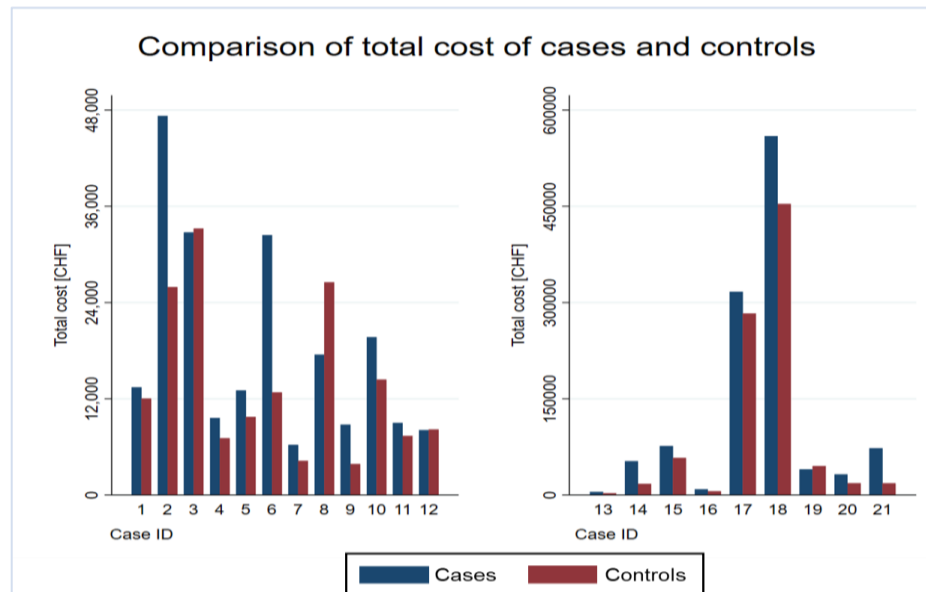


Fig. 1: Comparison of total cost of cases and controls. Cases 1 to 12 – less complex DRGs and matched more accurately - are shown on the left. Cases 13 to 21 are shown on the right.

The differences in total cost (TC) are shown in Figure 1, with an average difference of CHF 14955.3 (IQR 1628.7 – 20052.2). As cases 13 to 21 reflect much more complex DRGs with longer hospitalizations, their TC are much higher. The average cost of a ME of cases 1 to 12 was CHF 4372.4, while the cost of a ME among cases 13 to 21 was CHF 29065.9. Seemingly, these are huge differences, but when comparing the cost of a ME to the TC of hospitalization, a ME led to an increase by 31.7% for cases 1 to 12 and 28.9% for cases 13 to 21. Therefore, a ME incurs, on average, an increase in the cost of hospitalization by 29.4% - independently of the complexity of the DRG.

We report an average additional length of stay (LOS) of 4.3 days for patients who experienced a severe ME. Individual cost (IC) were on average increased by CHF 3072.7 (IQR -27.6 – 1750.8), with the main cost drivers being the cost of medication (CHF 1792.2) and external services (CHF 1596.5) (Fig 2.).

General cost (GC) were elevated by an average of CHF 11054.4 (IQR 125.5 – 17151.7). Here, the main cost drivers were cost of nursing (CHF 7477.5), prolonged time on the ICU (CHF 1280.3), the cost of physicians services (CHF 838.5) and additional therapies (CHF 557.0). These additional cost are often associated with the worsening of patients' wellbeing, additionally required consultations from specialists, and the transfer to special wards like the ICU or intermediate care (IMC).

Average increased cost of individual cost objects

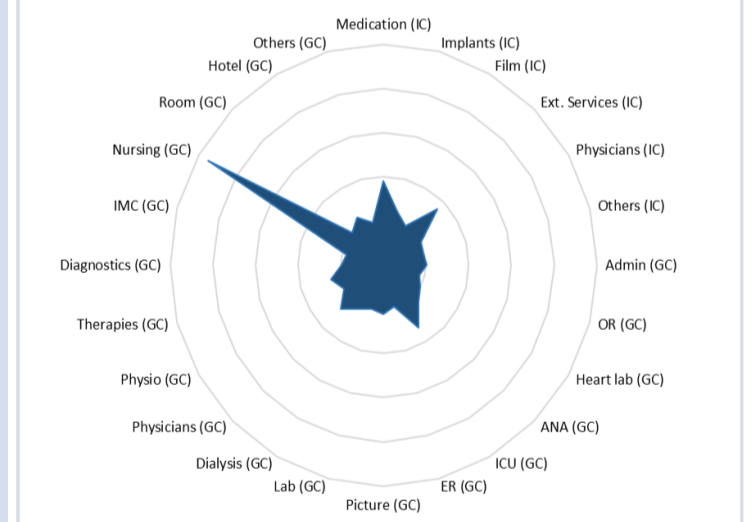


Fig. 2: Average increased cost of individual cost objectives. Individual cost = IC; General cost = GC.

5. Conclusion

Following the identification of 21 errors, we analyzed not only their influence on total cost, but rather on all individual cost objects. We report the average cost of a ME at 29.4% of the total cost of hospitalization, amounting to an average cost of CHF 14'995.3 for our cases. Alongside the prolonged LOS by 4.3 days, these were mostly influenced by the cost of nursing, physicians, special wards and medication.

Patient safety should, without a doubt, be the highest priority for stakeholders of a private hospital. Through this analysis, we have provided further incentive for action by underlining that the improvement of clinical performance marginally influences annual financial outcomes. Whether it is the decision to hire (further) clinical pharmacists, more nursing staff or invest into new technologies, we have provided the required information to make resourceful and beneficial decision.

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