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The Disease Burden of Invasive Candidiasis in Germany: A Non-Interventional, Retrospective Cohort Analysis of Real-World Data

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INTRODUCTION AND OBJECTIVES

- *Candida* species are the most important and common cause of opportunistic and life-threatening invasive fungal infection worldwide.[1,2]
- Candidemia and invasive candidiasis (C/IC) are serious infections associated with high crude mortality rates, despite widespread access to 3 different classes of antifungal agents.[1–3]
- The associated health economic burden of C/IC is largely due to prolonged hospital stays and treatment within the intensive care unit (ICU), which contribute more than half of the total related costs.[3]
- The majority of studies examining the burden of candidemia/IC have utilised a single- or multi-centre design.[4,5] To our knowledge, no research to date has explored the impact of C/IC from the broader perspective of an European healthcare system.
- The study aimed to quantify the country-wide burden of C/IC by describing the patient care pathway, associated healthcare resource utilisation (HCRU) and direct healthcare costs.

METHODS

Data source

- This study examined billing data from a longitudinal dataset containing anonymised record-level patient data derived from approximately half of statutory health insurance (SHI) claims in Germany.
- The dataset covers approximately 5% of the German population and is representative in terms of age and sex, there is also good general alignment between the SHI data and the German population in terms of morbidity, mortality and drug usage. The representativeness of the data is checked annually.[6]

Study design and analysis

- A descriptive, retrospective, cohort study was conducted to examine SHI data collected between July 2014 and September 2019 for adult inpatients with a discharge diagnosis of candidemia and/or IC.
  - ICD-10-GM (International Statistical Classification of Diseases and Related Health Problems – German Modification) codes targeted for this analysis were considered most reflective of invasive nature of *candida* infection (Table 1).
  - Discharge diagnoses codes were prioritised over admission diagnoses codes as patients were more likely to contract an infection during their hospital stay, rather than being admitted for C/IC.
- Subgroup analysis was performed by common diagnosis: candidemia, IC, or both candidemia and IC (Table 1).

Table 1. ICD-10 codes in scope and subgroup composition

ICD-10-GM	Service description	Subgroup diagnosis
B37.1 B37.5 B37.6 B37.88	Candidiasis of the lungs Candidal meningitis Candidal endocarditis Candidiasis in other locations (excluding Candida esophagitis)	Invasive candidiasis (IC)
B37.7	*Candida* sepsis	Candidemia

Abbreviations: ICD-10-GM, International Statistical Classification of Diseases and Related Health Problems – German Modification.

- Key limitation of the analysis is related to the fact that exact date of C/IC diagnosis could not be determined, patients may have had other diseases and comorbidities (other than C/IC) potentially impacting HCRU, costs and mortality. It's therefore impossible to present incremental effect of C/IC this way.

RESULTS

Incidence and patient demographics

- Demographic/characteristic details for the 6,385 adult inpatients included in the cohort are shown in Table 2.
- Approximately 41% were aged between 65 and 80 years and 20% were over the age of 80 years.
- IC was the most frequent diagnosis (87.6%).
- The proportion of patients in each diagnostic subgroup remained consistent over the study period, yet the highest number of cases was reported in the last (full) year (Table 3).

All-cause mortality (ACM)

- ACM across the cohort at Days 30, 60 and 90, following admission, was 16.4%, 24.9% and 29.0%, respectively.

Table 2. Patient demographics/characteristics

Demographic/characteristic	N=6,385
Sex, n (%)	
Male	3,926 (61.5)
Female	2,459 (38.5)
Age (years), mean (SD)	66.9 (15.2)
Mean (SD) CCI score	3.25 (3.2)
Top 3 CCI components, n (%)	
Congestive heart failure	2097 (32.8)
Malignancy	1953 (30.6)
Chronic pulmonary disease	1761 (27.6)
Diagnostic subgroup, n (%)	
IC	5,593 (87.6)
Candidemia	678 (10.6)
IC + candidemia	114 (1.79)

Abbreviations: CCI, Charlson Comorbidity Index; IC, invasive candidiasis; SD, standard deviation

Table 3. Number of adult inpatients by year and subgroup

Year*	Overall (N = 6385)	Candidemia (n = 678)	IC (n = 5593)	Candidemia and IC (n=114)
2014*	**622 (9.7%)**	72 (10.6%)	536 (9.6%)	14 (12.3%)
2015	**1159 (18.2%)**	113 (16.7%)	1027 (18.4%)	19 (16.7%)
2016	**1142 (17.9%)**	103 (15.2%)	1022 (18.3%)	17 (14.9%)
2017	**1178 (18.5%)**	127 (18.7%)	1030 (18.4%)	21 (18.4%)
2018	**1300 (20.4%)**	158 (23.3%)	1117 (20.0%)	25 (21.9%)
2019*	**984 (15.4%)**	105 (15.5%)	861 (15.4%)	18 (15.8%)

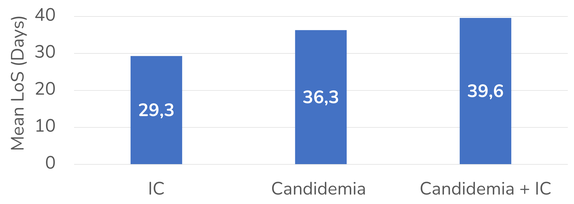
Abbreviations: IC, invasive candidiasis.

*Data captured for 2014 and 2019 did not encompass a full calendar year and therefore include fewer patients and hospitalisations, although the proportion of patients in each subgroup remained similar. This did not impact other variables or analyses.

HCRU metrics and costs

- Mean (SD) length of stay (LoS) for the indexed period was 30.3 (29.2) days and varied according to discharge diagnosis (Figure 1).
- Overall, 13.6% of the full cohort was admitted to the ICU, with a mean (SD) ICU LoS of 6.77 (12.66) days.
- Mean direct cost per patient was €34,287. The highest mean costs were observed in patients requiring ICU admission and those patients diagnosed with both candidemia and IC (Table 4 and Table 5).

Figure 1. Mean LoS in the hospital per diagnoses



Abbreviations: IC, invasive candidiasis; LoS, length of stay.

Table 4. Mean healthcare costs per patient

Overall	Candidemia	IC	Candidemia and IC
€34,287	€40,112	€33,100	€57,867

Abbreviations: IC, invasive candidiasis

Table 5. Mean healthcare costs per patient in various setups

ICU involved	No ICU involved
€60,393	€30,196

Abbreviations: ICU, intensive care unit

CONCLUSIONS

Analysis of nationwide data from Germany confirms the substantial, real-world burden of candidemia and IC and helps to contextualise the associated financial costs borne by the healthcare system.

References

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Disclosures

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