

Nils Kossack¹ ; Niels John¹; Ines Weinhold¹; Lisa Seitz²; Magdalena Bravo Guijarro² ; Marlo Verket³; Dirk Müller-Wieland³; Dennis Häckl⁴

People living with obesity have different morbidity patterns than people without obesity. These patterns can be used to identify people living with obesity in the absence of BMI information or diagnosis.

Introduction

- Estimates of obesity (body mass index (BMI) ≥ 30 kg/m²) prevalence in Germany vary [1,2] and are likely to be underestimated if diagnosis prevalence is considered [3].
- A high proportion of people with obesity (PwO) suffer from comorbidity [4]. In a longitudinal registry data-based study from the UK and Finland, obesity was associated with 21 non-overlapping cardiometabolic, digestive, respiratory, neurological, musculoskeletal and infectious diseases [5].
- This evidence highlights the need for better obesity prevention and improved management of obesity in its different stages to reduce multimorbidity, but gaps remain in understanding obesity's prevalence and incidence.
- *Aim:* To develop and test a predictive comorbidity-based model (obesity score) to identify patients with a high probability of obesity, regardless of available obesity information.

Key results

- *Population:*
 - Of 3,227,677 individuals in the WIG2 Benchmark database (2021), 283,079 (8.8%) were identified as adult PwO based on at least one claim with ICD-10 diagnosis of obesity.
 - Of 502,384 individuals in the UK Biobank, 48,847 (9.7%) had a diagnosis of obesity and 122,223 (24.3 %) had a BMI ≥ 30 kg/m².
- *Obesity score model and testing:*
 - In addition to obesity-related comorbidities derived from the literature*, further obesity related conditions were identified from data analyses and assessed according to their relative risk (Table 1). Positive associations are observed between these comorbidities and obesity in both databases. Association strengths vary (Figure 1).
 - The developed model showed a good predictive performance to identify PwO in German claims data (area under curve (AUC): 81 %). Testing the model on the UK Biobank showed that it can be transferred with a small loss in predictive performance if obesity is recorded by obesity diagnosis (AUC: 76%). Applying the model with obesity detected via BMI showed a further decline in predictive performance (AUC: 69%).

Table 1: Incident cases and relative risk of obesity related conditions for people with and without obesity (2021)

Risk factor; N (%)	People with obesity	People without obesity	Relative risk (95% CI)
Sequelae of hyperalimentation	1,796 (0.63)	2,064 (0.08)	7.81 (7.32; 8.39)
Localized adiposity	1,472 (0.52)	1,707 (0.07)	7.73 (7.21; 8.29)
Glycosuria	986 (0.35)	1,880 (0.07)	4.70 (4.35; 5.08)
Isolated proteinuria	5,823 (2.06)	11,349 (0.45)	4.60 (4.46; 4.75)
Other hyperalimentation	922 (0.33)	1,885 (0.07)	4.38 (4.05; 4.74)
Disorders of purine and pyrimidine metabolism	50,386 (17.8)	10,8577 (4.28)	4.16 (4.12; 4.20)
Ventral hernia	3,783 (1.34)	8,658 (0.34)	3.92 (3.77; 4.07)
Elevated blood glucose level	10,74 (3.79)	25,049 (0.99)	3.84 (3.76; 3.93)
Other disorders of pancreatic internal secretion	1,595 (0.56)	3,733 (0.15)	3.83 (3.61; 4.03)
Gout	20,108 (7.1)	52,731 (2.08)	3.42 (3.36; 3.47)
Decubitus ulcer and pressure area	6,591 (2.33)	17,286 (0.68)	3.42 (3.32; 3.51)

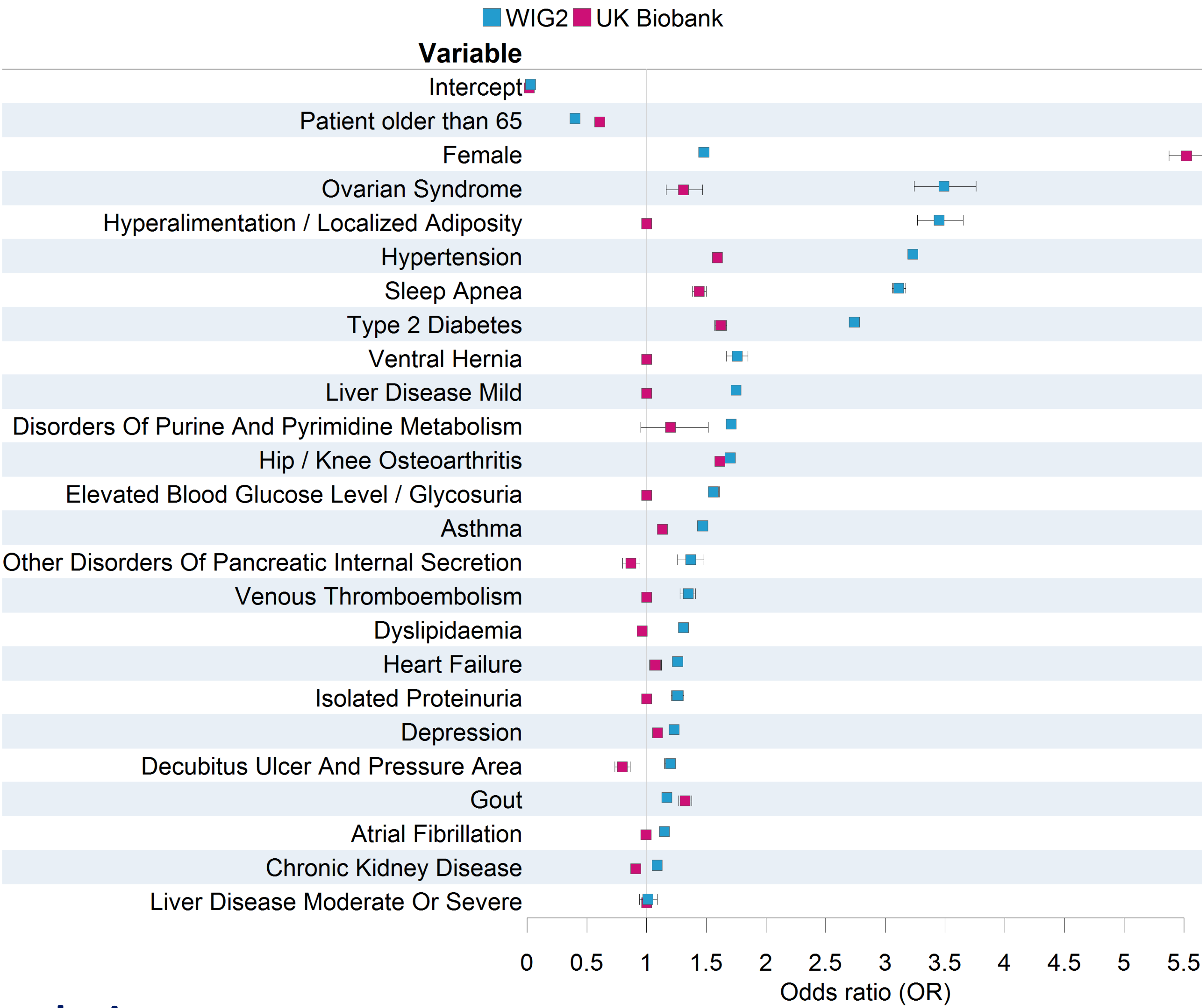
Discussion

- *Limitations:* German health insurance data lacks BMI measurements, and ICD-10-GM coding by physicians may be inconsistent and incomplete. Model performance differences might stem from documentation variations between databases.
- *Future research:* As some of the associations vary, further research should investigate the underlying reasons and analyze whether and how comorbidity patterns as predictors vary by age, sex or other factors.

Methods

- *Stepwise approach:* (1) Focused literature review to identify comorbidities associated with obesity and (2) Data-driven model development based on statutory health insurance (SHI) claims data from WIG2 Benchmark database (3) Testing the models on UK Biobank data
- *Design:* Cross-sectional, observational study of German SHI claims data (2021)
- *Eligibility:* Individuals (1) ≥ 18 years, (2) living with obesity (ICD-10-GM E66) in 2021, (3) continuously insured in 2021, (4) no pregnancy in the nine months before/after E66 diagnosis
- *Stratification:* Sex and BMI classes I, II, III and not specified obesity class
- *Comparison group:* No encoding of obesity in the observation year
- *Predictive modelling:* Descriptive statistics and logistic regression to analyze the impact of different risk factors
- *Testing* of predictive models on cohorts with either obesity diagnosis or BMI ≥ 30 kg/m² from the UK Biobank

Figure 1: Odds ratios of the prediction models trained on the WIG2 Benchmark database (2021) and the UK Biobank



Conclusion

- Obesity-related comorbidities allow to identify patients with a high probability of obesity in secondary data when obesity status is missing.
- The results showed that the associations between comorbidities and obesity are suitable for identifying individuals with a high probability of obesity in both countries and that the model developed based on German claims data can be applied to other databases. The observed predictive performances of the approach indicates useful models for discrimination of people with and without obesity. However, model performance declines with documented diagnoses in the UK Biobank and further with BMI-recorded obesity.

*Ovarian syndrome; Hyperalimentation; Hypertension; Sleep apnea; Type 2 diabetes mellitus; Liver diseases; Hip / Knee osteoarthritis; Asthma; Venous thromboembolism; Dyslipidaemia; Heart failure; Depression; Atrial fibrillation; Chronic kidney disease

References:
[1] Schienkiewitz et al. Journal of Health Monitoring 2022 7(3):23-31 [2] Mensink et al. Bundesgesundheitsblatt 2013 56 (5-6): 786–794 [3] Steffel et al. Versorgungsatlas-Bericht 21/10 [4] DiBonaventura et al. Clinicoecon Outcomes Res 2018 10:457–475 [5] Kivimäki, et al. The Lancet. Diabetes & endocrinology 2022 10 (4):253–263.

¹WIG2 GmbH, Leipzig, Saxony, Germany; ²Novo Nordisk Pharma GmbH, Mainz, Germany; ³Department of Internal Medicine I, University Hospital RWTH Aachen, Aachen, Germany; ⁴Faculty of Economics and Management, Leipzig University, Leipzig, Germany
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