

Healthcare Resource Utilization of Severe, Uncontrolled T2LOW and Non-T2LOW Asthma in Finland during 2018-2021

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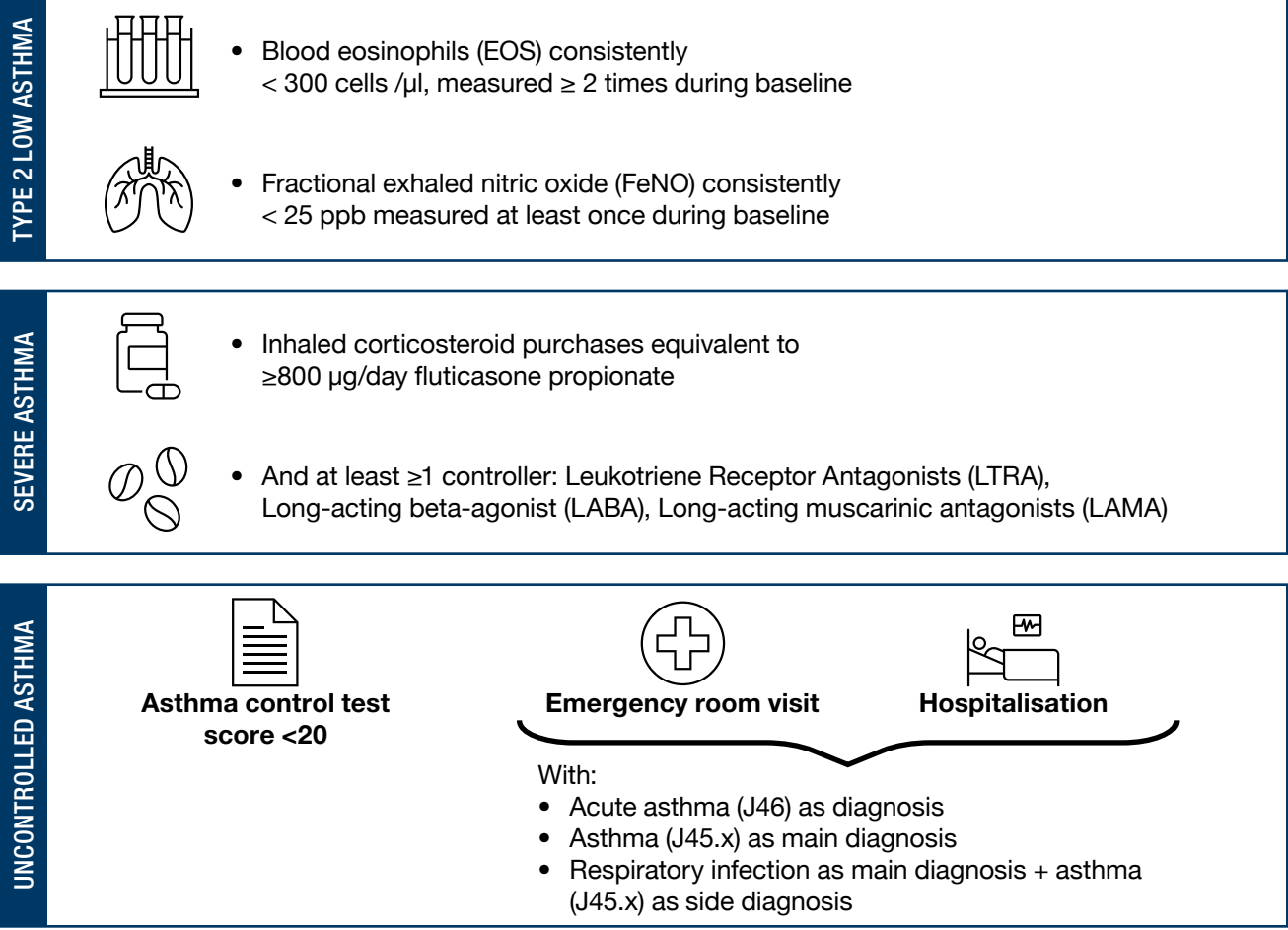
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INTRODUCTION AND AIM

Patients with asthma and low levels of type 2 inflammation biomarkers (T2 low) have limited effective treatment options. Such biomarkers indicating T2 low include blood eosinophils and fractional exhaled nitric oxide (FeNO). The healthcare resource utilization (HCRU) of severe, uncontrolled T2 low asthma remains unexplored. The aim of the study was to estimated HCRU of T2 low and non-T2 low patients using real world data.

PATIENTS AND METHODS

Adult patients with asthma diagnosis during baseline (1.1.2012-31.12.2017) at the pulmonary department of Turku University Hospital, Finland were included and followed from 1.1.2018 until 31.12.2021 or death. The cohort was formed as in **Figure 1**, altogether 66 patients had severe uncontrolled T2 low asthma and 103 severe uncontrolled non-T2 low asthma.



HEALTHCARE RESOURCE UTILISATION

Total HCRU, including open care medications and specialty care visits, and comorbidities were evaluated during follow-up 2018-2021. The main drivers for the HCRU were assessed with gamma and negative binomial regression models, using different dependent variables and baseline covariates as independent variables. Average per patient cumulative costs were plotted as a function of follow-up time. Medication costs, included in the all-cause HCRU, consisted of drug purchases of the ATC classes R* (respiratory system), A10* (diabetes), C* (cardiovascular system), H02* (systemically used corticosteroids), J* (anti-infectives for systemic use), N06A* (antidepressants), M05* (drugs for treatment of bone diseases).

RESULTS

PATIENT CHARACTERISTICS

Of the severe uncontrolled asthma patients with T2 status available, 40% (N 66) of patients were identified with T2 low and 60% (N 103) with non-T2 low asthma, **Table 1**. Patients with severe uncontrolled T2 low asthma were more frequently female and younger vs. non-T2 low patients. Asthma control test results indicated poor asthma control in both groups.

HEALTHCARE RESOURCE UTILISATION (HCRU)

Total all-cause HCRU costs were similar in the severe uncontrolled T2 low and non-T2 low patients, even if the average cost was slightly higher in T2 low patients, **Figure 2**. Respiratory related costs were 15-16% of total HCRU related costs.

When assessing the contribution of outpatient visits, emergency room visits and hospitalization on the total HCRU related costs, outpatient visits were the main cost driver, **Figure 3**. There was a non-significant tendency towards higher PPY costs for both outpatient visits and hospitalizations in T2 low patients vs. non-T2 low. Respiratory related costs accounted for 30-41% of all outpatient costs in both groups.

Medication related costs were lower in T2 low than non-T2 low patients: 1 585€ [95% CI: 1 222, 2 027] vs. 2 500€ [1 758, 3 495], the costs split by ATC categories of interest are presented in **Figure 4**. The main proportion (67%) of drug costs were more specifically related to drugs for obstructive airway diseases (R03) with 1 060 € vs. 1 652€ costs/PPY in T2 low vs. non-T2 low. One patient was on immunoglobulin replacement treatment included in the J* category (anti-infectives for systemic use).

The average cumulative cost per patient was similar in patients with T2 low vs. non-T2 low, with all-cause costs cumulating in four years of follow-up to 37 524€ [95%CI: 27 160, 47 888] in T2 low vs. 34 712€ [25 484, 43 940] in non-T2 low, **Figure 5**. The corresponding average cumulative respiratory related costs were 5 178€ [3 150, 7 205] in T2 low vs. 5 209€ [4 104, 6 313] non-T2 low.

Regression modeling identified no differences between the T2-status groups when assessing inpatient days per patient year, with independent predictors being older age, male sex and comorbidity burden (p<0.05). On the other hand, severe asthma predicted higher all-cause healthcare costs per patient year (HR 1.39, p 0.022), even when T2 status showed no association.

CO-DIAGNOSES DURING FOLLOW-UP

Observing significantly higher all-cause healthcare resource utilisation related cost than respiratory related costs, led to the investigation of diagnoses from specialty care among T2 low and non-T2 low patients from the follow-up period. Of the healthcare contacts Z-diagnoses i.e. contacts for examinations (approx. 40%), were most common, followed by breathing abnormalities (R06, in 30-40% of patients), sleep disorders (G47) and respiratory infections (J-diagnoses). Fifteen diagnoses were enriched ($\geq$ 1.5 fold) in T2 low patients vs. non-T2 low, including mainly diagnoses of symptoms (R), Mental, behavioral, and neurodevelopmental disorders (F) and respiratory infections (J).

Table 1. Patient characteristics of T2 low and non-T2 low severe uncontrolled asthma patients at baseline		
	Non-T2low	T2low
N	103	66
Male	39 (38%)	11 (17%)
Age, median (IQR)	56 (46, 66)	48 (39, 55)
COPD	8 (7.8%)	8 (12%)
Nasal polyps	14 (14%)	0 (0%)
Smoking (ever)	14 (14%)	6 (10%)
Smoking (Missing)	< 5 (< 4.9%)	6 (9.1%)
BMI < 18.5	< 5 (< 4.9%)	< 5 (< 7.6%)
BMI $\geq$ 18.5 to < 25	21 (21%)	22 (37%)
BMI $\geq$ 25 to < 30	39 (39%)	13 (22%)
BMI 30 $\geq$	37 (37%)	24 (40%)
BMI (Missing)	< 5 (< 4.9%)	6 (9.1%)
Eosinophils, max., median (IQR)	540 (375, 954)	165 (100, 230)
FeNO, max., median (IQR)	24 (14, 50)	12 (9, 17)
IgE, max., median (IQR)	222 (53, 427)	24 (10, 77)
IgE (Missing)	23 (22.3%)	16 (24.2%)
Asthma control test, min, median (IQR)	12.0 (8.0, 15.0)	11.0 (8.0, 14.0)

Figure 1. Cohort formation work flow

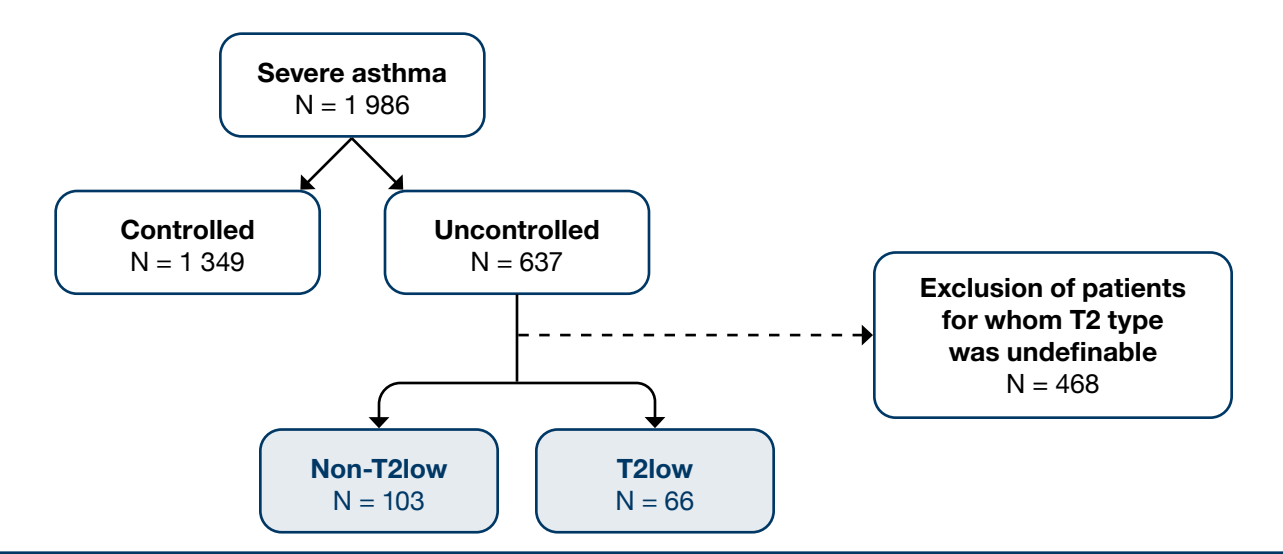


Figure 2. Healthcare resource utilisation related all-cause (blue) and respiratory related (red) costs per patient-year (PPY, mean and 95% CI) during follow-up in non-T2 low (left) and T2 low patients (right).

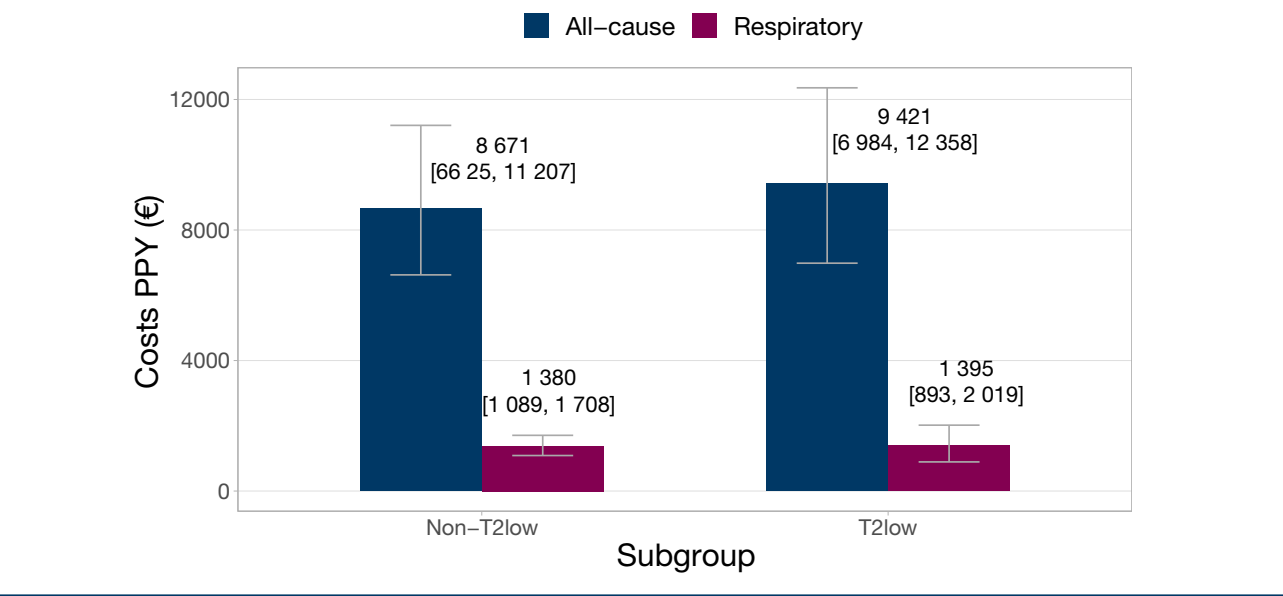


Figure 3. Healthcare resource utilisation related all-cause (blue) and respiratory (red) costs per patient-year (PPY, mean and 95% CI) during follow-up in non-T2 low (left) and T2 low patients (right). Costs stratified into emergency room (ER), hospitalizations, and outpatient visit related costs.

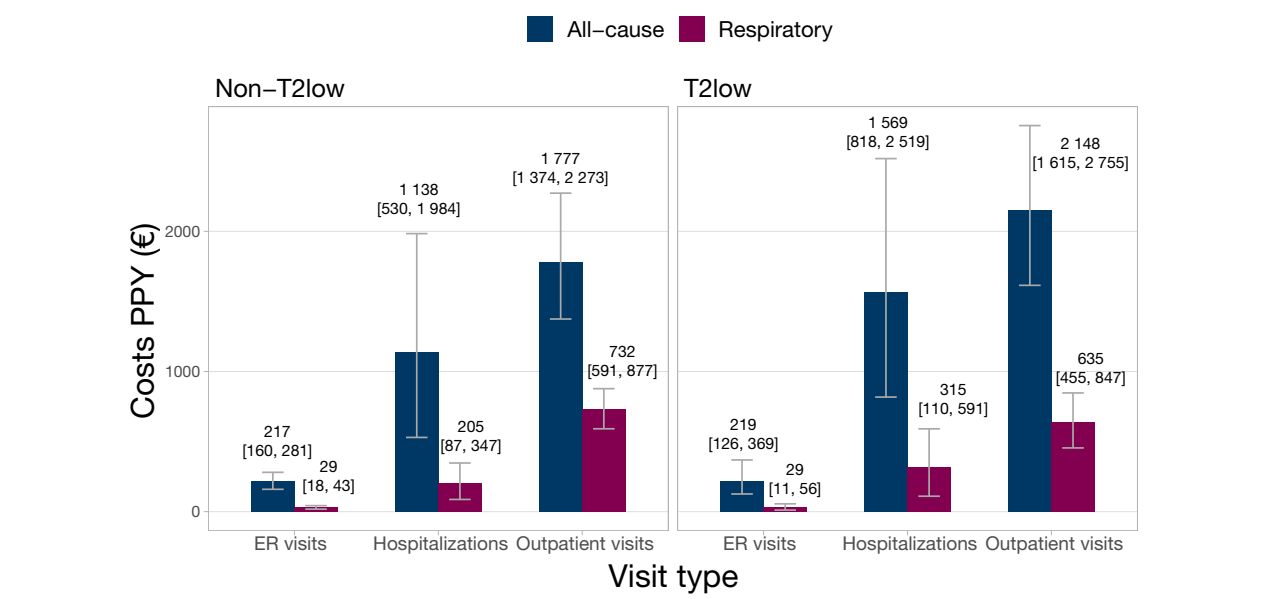


Figure 4. Medication costs per patient-year (PPY, mean and 95% CI) per ATC classes of interest during follow-up in severe uncontrolled T2 low (red) vs. non-T2 low patients (blue). A10* (diabetes), C* (cardiovascular system), H02* (systemically used corticosteroids), J* (anti-infectives for systemic use), M05* (drugs for treatment of bone diseases, N06A* (antidepressants), R* (respiratory system).

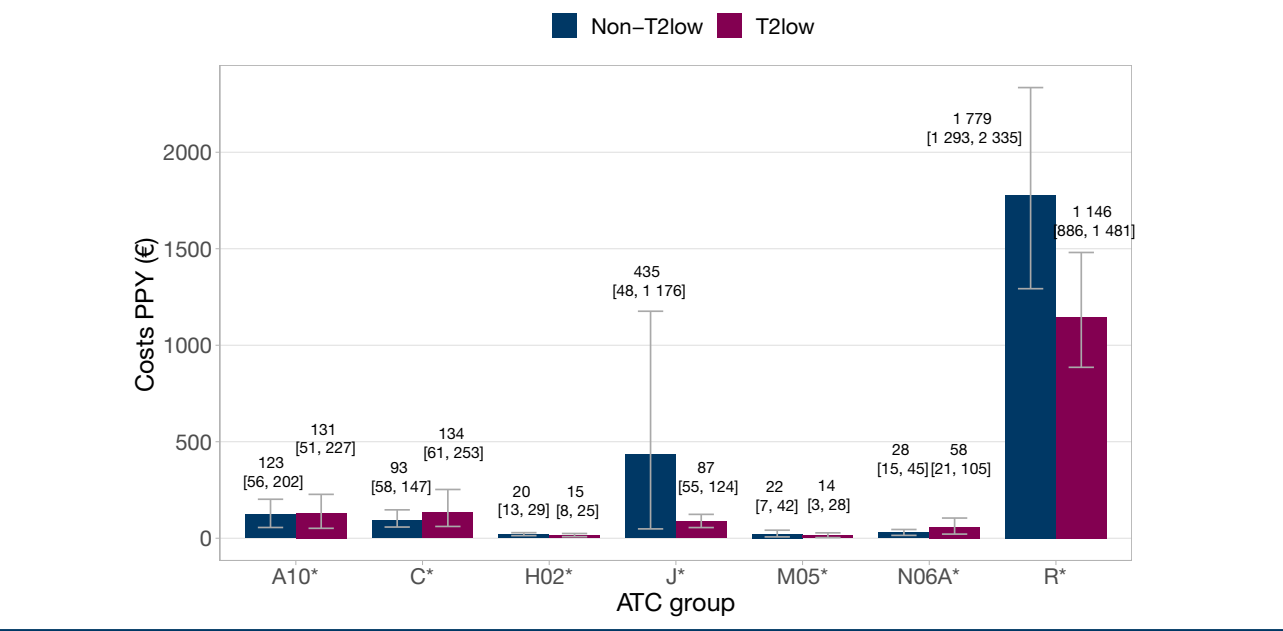
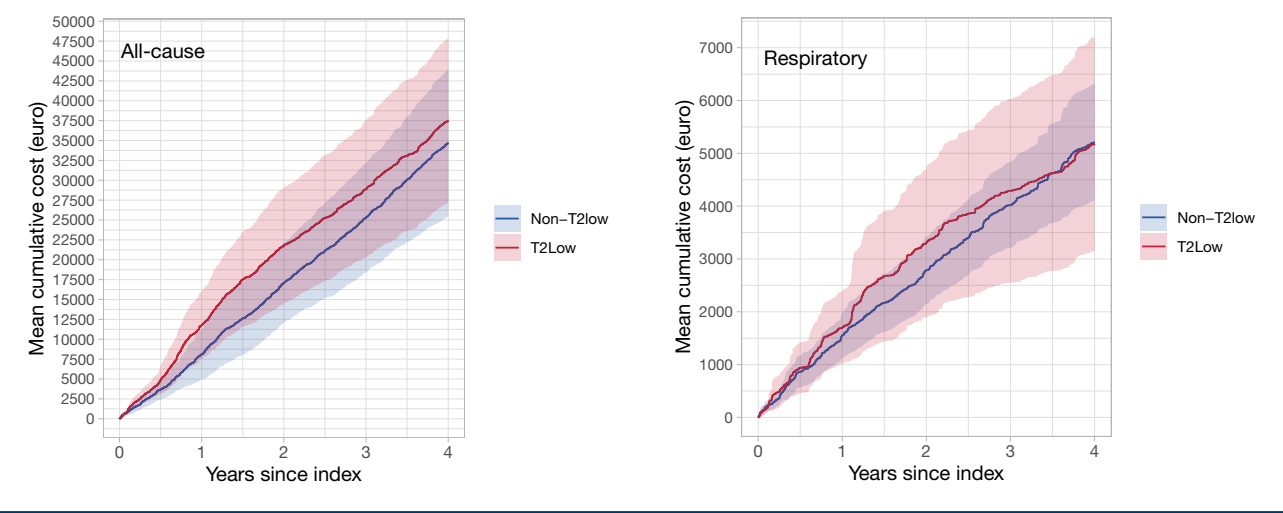


Figure 5. Mean cumulative function of all-cause healthcare costs during follow-up in severe uncontrolled T2 low vs. non-T2 low patients



CONCLUSIONS

Patients with uncontrolled severe T2 low asthma use as much healthcare resources as corresponding non-T2 low patients, but presently with limited treatment options. There is a significant comorbidity burden in the included severe uncontrolled patient group, evidenced by a total of healthcare costs in the range of 8 700€ to 9 400€ per patient-year, with respiratory related costs contributing 15-16% of overall HCRU costs. The remaining 85% of all-cause HCRU cost came from a variety of illnesses, and their relatedness to T2 status and/or asthma requires further research.

The all-cause HCRU costs of the patients in our study are 8 to 9-fold higher than what has been reported in the Finnish background population of 1 036 € per patient-year for somatic specialty care for patients of similar age 41-64 years*, which is comparable to the median age of the patients in our study (48-56 years). Medication related costs, included in the total HCRU cost in our study, were on average 1 500-2 500 € per patient-year, and significantly lower in severe uncontrolled T2low patients.

This study brought new insights on the HCRU of severe uncontrolled asthma patients per T2 status, which has not previously been investigated.

*Indexed to 2021 price from 2011 average cost of 916€ per patient year. Reference: Somaattisen erikoissairaanhoidon kokonaismenot ja menot asukasta kohti ikä- ja sukupuoliryhmittäin 2011. https://www.julkari.fi/bitstream/handle/10024/116156/URN_ISBN_978-952-302-192-1.pdf