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How do individuals with alcohol problems use social and healthcare services in Finland? Comparison of service use patterns between two high-need patient groups

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Abstract

Aims: Alcohol use disorders (AUDs) are associated with high risk of comorbidities and excess use of social and healthcare services. We examined health service use (HSU) frequencies of patients with AUD in comparison to those with type 2 diabetes mellitus (T2DM). **Design:** A random sample of individuals with AUD ($n = 396$) were identified based on ICD-10 codes and HSU

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patterns, morbidity and mortality were compared with age- and gender-matched T2DM controls ($n = 792$) using logistic regression analysis. Six years (2011–2016) of electronic health record (EHR) data from the North Karelia district in Finland were used. **Results:** Similarities in comorbidity patterns existed, although mental health comorbidity (odds ratio [*OR*] 1.86) was more prevalent in the AUD group. The average annual HSU varied according to the groups: T2DM patients had more continuous contact with public health nurses in primary care, whereas AUD patients were more likely to experience somatic specialised care hospitalisations (*OR* 11.30) and have frequent somatic primary healthcare doctor visits (*OR* 3.30) and frequent emergency room doctor visits in specialised care (*OR* 8.89). Furthermore, patients with AUD had a 7.5 times higher risk of death compared with T2DM patients. **Conclusions:** This study identified rather similar comorbidity status for the AUD and T2DM patients, but their HSU patterns differed noticeably. AUD patients had higher frequencies of hospitalisation periods and emergency service use and were at a higher risk of death compared with T2DM patients, indicating greater challenges in the organisation of care for AUD patients compared with those having T2DM.

Keywords
alcohol use disorder, comorbidity, diabetes, electronic health records, register study, service use, type 2 diabetes

Although the performance of the Finnish healthcare system is high regarding the quality of care (Collaborators GHAaQ, 2018), inequities exist in the access to healthcare services. (OECD, 2005; OECD, 2017). Patients with alcohol use disorders (AUDs) are one of the identified high-cost patient groups with unmet care needs (Graham et al., 2017; Probst et al., 2015; Rautiainen et al., 2020; Wu et al., 2018). Previous studies have compared the health service use (HSU) of AUD patients with that of the general population or among those with other mental health (MH) conditions and they have identified both excess use of somatic healthcare and underutilisation of addiction services (Cohen et al., 2007; de Weert-van Oene et al., 2017; Graham et al., 2017; Rehm et al., 2015). It is known that accessibility and availability of services in the regional treatment system as well as morbidity, socio-economic status, and treatment-seeking behaviour modify treatment use (Babitsch et al., 2012; Grant, 1997; Mojtabai & Crum, 2013). There is also evidence that stigmatisation of patients with AUD among health professionals mediates access to treatment (Mojtabai, 2014; Saunders et al., 2006; van Boekel et al., 2013). Gilchrist et al. (2011) noted that healthcare personnel had significantly lower regard for working with substance users compared with patients having depression or diabetes. To improve the equity of the service system, a more thorough understanding of the HSU patterns of different chronic conditions is required. Currently, little evidence is available on the overall HSU of AUD patients compared with those having other resource-demanding chronic diseases.

In this study, we monitored and quantitatively compared the HSU of patients with AUD to that of a patient group with another resource-demanding chronic disease less affected by stigmatising attitudes: type 2 diabetes (T2DM). Certain similarities exist between these two conditions: both AUD and T2DM are common health conditions, both are described as chronic progressive disorders associated with poor health status, both carry a certain level of social stigma and both involve excess use of social and healthcare services (Abdoli et al., 2018; Harris, 2000; Struijs et al., 2006; Ulrich et al., 2016; Wu et al., 2018). Thus, both patient groups are considered high-need populations

with complex healthcare demands (Cohen, 2014; Forouhi & Wareham, 2014) and they are within the most expensive 10% of social and health service users in Finland (Leskelä et al., 2013; Rautiainen et al., 2020) and elsewhere (Bloom et al., 2011; Manthay et al., 2016; Miquel et al., 2018).

Furthermore, multimorbidity is common in these two patient groups; AUDs are associated with a high risk of comorbidities and increased risk of death (Agardh et al., 2016; Kendler et al., 2016; Rehm et al., 2017). Heavy alcohol consumption and alcoholism are associated with several diseases and conditions, such as infectious diseases, cancer, diabetes, neuropsychiatric diseases, cardiovascular disease, liver and pancreas diseases, and injuries (Odlaug et al., 2016; Rehm, 2011; Rehm et al., 2010; Rehm et al., 2017), whereas T2DM is one of the most prevalent and costly chronic conditions worldwide; it is a metabolic disorder leading to a range of microvascular and macrovascular complications (Forouhi & Wareham, 2014; International Diabetes Federation, 2017; Struijs et al., 2006). Mental health problems are also prevalent in both patient groups and may affect service use (de Alba et al., 2020; Yule & Kelly, 2019). In Finland, the prevalence of AUD is approximately 7% and T2DM prevalence is nearly 10% (Koski, 2017; Peltonen et al., 2006; WHO, 2014).

System monitoring, including detailed examination of HSU patterns across social and healthcare services, is required to gain a better understanding of care pathways for AUD patients and to identify possible inequities in access to these services. As the AUD management framework increasingly resembles that of other chronic medical conditions (Proctor & Herschman, 2014), it is especially important to examine continuity of care, which has been associated with enhanced care outcomes in the treatment of AUD (Costello, 1980; McLellan et al., 2014; Proctor & Herschman, 2014; Vannicelli, 1978). Continuous patient engagement and motivation are essential components of the successful care of T2DM (Koponen et al., 2017), and managed care according to the diabetes guidelines diminishes the use of secondary care for T2DM patients (van der Heijden et al., 2014). McLellan et al. (2014) suggested that the chronic care model, currently used in diabetes management, could also be applicable to treatment of AUDs in many respects.

In this study, we examined the HSU of AUD patients across primary and secondary care during a six-year follow-up period. We compared the HSU and comorbidity profiles of patients with AUD to those with T2DM using register information gathered from the electronic health records (EHRs) in North Karelia region in Finland. Our aim was to gain a better understanding of how patients with AUD use social and healthcare services. Finland, among other Nordic countries, has excellent register data on HSU which can be utilised for research purposes.

Materials and methods

Study design and setting of the study

This register-based cohort study was conducted in the North Karelia region in Eastern Finland, which was one of the first areas in the country to adopt a uniform EHR across municipalities in primary healthcare, specialised care and adult social work. North Karelia is a sparsely populated region with approximately 163,000 inhabitants, and the prevalence of chronic conditions is high in the region (Koskinen, 2019; Regional Council of North Karelia, 2021). The uniform registries enable extensive data collection on visits, treatment periods, procedures and diagnoses.

Overall, the organisation of social and healthcare services in Finland is based on principles of universalism, and the role of primary care is emphasised as primary care acts as a gatekeeper for specialised services. Fragmentation of services is a challenge in the current system, creating difficulties for the care of multimorbid patients. Furthermore, high user fees and long waiting times for primary care services

affect people particularly in the lower socio-economic (SES) groups (OECD, 2005). Currently, the treatment of both AUDs and T2DM is organised mainly through primary care in North Karelia.

Use of registers

Register data on HSU were retrieved from a regional EHR system called Mediatri. These data included all contacts with different social and healthcare professionals and treatment periods for primary healthcare, specialised care and adult social work, as well as specialised AUD and MH services. Mediatri is a structured EHR system containing extensive information on each contact, including date of contact, type of contact (visit or telephone call), reason for contact (ICD-10 code), service domain, and professional group. Respectively, information on age, gender, place of residence and the number of chronic conditions (ICD-10 codes), was available in Mediatri. Statistics Finland registries provide information on date of death and this information directly linked to regional EHRs.

Participants

The study sample consisted of working-aged (18–65 years old) AUD patients ($n = 396$), and T2DM patients ($n = 792$) were used as a reference group. Individuals with both AUD and T2DM were excluded from the study. A random sample of AUD patients was formed retrospectively from the EHR based on alcohol-related ICD-10 codes (WHO, 2019): G312, G405, G4050, G4051, G4052, and G621 (diseases of the nervous system), F100, F101, F102, F103, F104, F105, F106, F108, and F109 (mental and behavioural disorders), I426 (diseases of the circulatory system), K292, K700, K701, K702, K703, K704, K709, and K860 (diseases of the digestive system), T510, T511, T512, T513, T518, and T519 (injuries, poisonings and certain other consequences of external causes), and codes X45 and X69 (alcohol-related external causes of morbidity and mortality). For each AUD patient, two age- and gender-matched T2DM control patients without an AUD were procured. The age- and gender-matched T2DM patients ($n = 792$) were randomly selected from a T2DM cohort ($n = 10{,}204$) previously collected in the North Karelia region (Sikiö et al., 2014). The cohort was followed over time for six years, i.e., 2011–2016.

Variables

Health service use variables examined included visits to different primary care professionals, specialised care doctor visits and treatment periods in primary and specialised care. Primary care professionals included medical doctors, registered nurses, public health nurses, psychologists and social workers. Diabetes nurse visits are included in registered nurse and public health nurse visits, as diabetes nurse visits are not registered separately. Also, the use of dental care, physiotherapy, mental health (MH) and specialised AUD services was examined – dental care included all dental care professionals (i.e., dentists and dental hygienists), physiotherapy included physiotherapists, MH services included all nurses and doctors working in MH services, and specialised AUD services included nurses and doctors working in AUD services. HSU variables were dichotomised and HSU was defined as either "1+ average annual visits", "3+ average annual visits" or "any contact with service" in question, depending on the service type. Dichotomisation was carried out due to highly skewed visit data, and cut-off values were based on variable distribution.

Multimorbidity was defined as two or more chronic conditions determined from permanent ICD-10 diagnoses coded in the EHR. Permanent diagnoses are used for chronic conditions that affect the care of the patient for a long period of time. The number of permanent diagnoses is examined at chapter level, including all the ICD-10 diagnosis codes (i.e., ICD-10 chapters I–XXII). T2DM complications (ICD-10

codes E11.00–E11.8) and deterioration of AUD (ICD-10 codes F10.6–F10.9) were excluded from the total number of comorbidities of the individuals, as they are consequences of the same disease. Mental health comorbidity was defined as having one or more permanent MH diagnosis (ICD-10 codes F00-F99, excl. F10) and permanent AUD diagnosis included ICD-10 codes F10.1-F10.9. Lastly, date of death was automatically linked to EHR data from the Statistics Finland registries.

Data on SES is not routinely recorded in the EHR. To estimate the SES of the AUD group we used data on social service client records to identify the proportion of those receiving income support. AUD cohort was identified as belonging to the low SES group, as the majority of the study subjects received income support. In contrast, aggregate-level data were available for the North Karelian T2DM cohort (n = 10,204) (Sikiö et al., 2014). The aggregate-level data on SES were retrieved from Statistics Finland and the majority of the total T2DM cohort (n = 10,204) were identified as retired (77.5%). We excluded retired T2DM individuals (aged 65 years or older, n = 7,795) and the distribution of SES for the remaining T2DM individuals (n = 2,299) consisted of the following: manual employees (25%), long-term unemployed (21%), white collar employees (10%), blue collar employees (23%) and entrepreneurs (13%). Thus, we can estimate the T2DM random sample (n = 792) to consist of approximately similar SES proportions.

Statistical methods

IBM SPSS Modeler version 18.0 was used to derive the HSU variables from the EHR data and IBM SPSS Statistics 24 was used in the statistical analyses. Health service use was measured as a yearly mean number of visits by considering the term of eligibility of the study subjects, that is, if the person died during the follow-up period, their eligibility was shorter. The yearly mean number of visits during the six-year follow-up was divided by the term of eligibility. Date of death was automatically linked to EHR data from the Statistics Finland registries. Differences in HSU between the groups were described using chi-squared (χ^2) and Fischer's exact tests. Group differences in the frequency of HSU were examined using binary logistic regression analyses, taking the T2DM group as the reference group and adjusting the model for age and gender. For the risk of death, Cox regression analysis was used.

Results

Characteristics of the cohort

The characteristics of the AUD and T2DM cohorts are described in Table 1. The majority of the individuals were male and over 45 years of age. Comorbidity (number of permanent diagnoses) did not differ statistically between the groups, except for the prevalence of AUD diagnoses (ICD-10 group F10 codes) and mental health diagnoses, which were more common in the AUD group.

Prevalence of comorbidities

Figure 1 presents the most common comorbidities for both groups. For the AUD group, the three most prevalent comorbidities were (1) diseases of the circulatory system, (2) mental-health-related conditions (ICD-10 diagnostic group F00–F99, excl. F10), and (3) diseases of the digestive system. For the T2DM group, the corresponding disease group prevalence was (1) diseases of the circulatory system, (2) diseases of the musculoskeletal system and connective tissue, and (3) diseases of the digestive system. The groups differed only regarding the mental health-related conditions, diseases of the circulatory system and diseases of the musculoskeletal system, and connective tissue.

Comparison of the average annual use of health services

Average annual visits to different social and healthcare professionals in the health services

Table 1. Characteristics of the alcohol use disorder (AUD) and type 2 diabetes (T2DM) cohorts.

	AUD (n = 396)		T2DM (n = 792)		
	n	%	*n*	%	*P*
Age at baseline					
≤ 45 years	129	32.6	258	32.6	
> 45 years	267	67.4	534	67.4	
Gender					
Male	295	74.5	590	74.5	
Female	101	25.5	202	25.5	
Permanent dg sum					0.197[a]
0	100	25.3	175	22.1	
1	88	22.2	148	18.7	
2	64	16.2	124	15.7	
3	48	12.1	100	12.6	
4	33	8.3	76	9.6	
5+	63	15.9	169	21.3	
Multimorbidity					0.088[a]
0	100	25.3	175	22.1	
1	88	22.2	148	18.7	
2+	208	52.5	469	59.2	
Permanent mental health diagnosis					< 0.001[a]
Yes	87	22.0	107	13.5	
No	309	78.0	685	86.5	

Notes. dg = diagnosis. Permanent mental health diagnosis = ICD-10 mental and behavioural disorder codes F00–F99, excl. F10.
[a]Pearson chi-square.

and use of dental care, specialised AUD services, and MH services are described in Table 2. Furthermore, we examined group differences in the frequency of HSU (see Table 3). Overall, frequent HSU was more common in the AUD group. The use of specialised care and hospitalisations were especially more common in the AUD group compared with T2DM patients. In primary care, AUD patients visited a doctor more frequently compared with T2DM patients, and over 10% of the AUD patients had an average of seven or more such visits per year. In contrast, frequent public health nurse contacts in primary care were more common in the T2DM group.

Comparison of HSU patterns between the groups revealed that AUD patients were 8.89 times more likely to have at least one yearly visit to the emergency room (ER). Reasons for ER visits differed between the groups and the most common reasons for ER visits among AUD patients were: (1) mental and behavioural disorders due to psychoactive substance use (27.7%); (2) injury, poisoning and certain other consequences of external causes (20.9%); and (3) symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (15.5%). Respectively, the most common

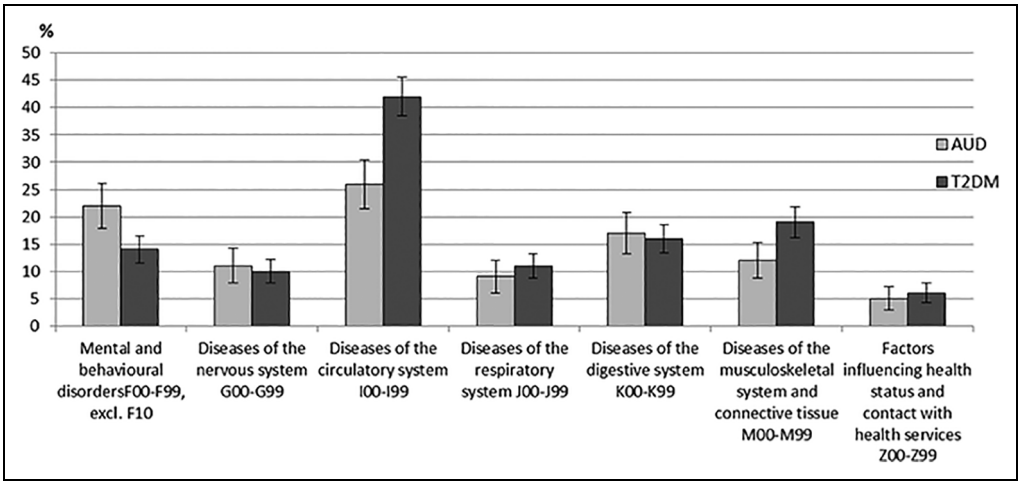

Figure 1. Most common comorbidities of the alcohol use disorder (AUD) and type 2 diabetes (T2DM) groups.

Table 2. Annual average health service use (HSU) of patients with AUD compared with patients with T2DM.

	AUD (n = 396)		T2DM (n = 792)		
	n	%	*n*	%	*P*
Primary healthcare visits					
MD visits all					< 0.001
0	8	2.0	46	5.8	
< 1	55	13.9	249	31.4	
1.0–2.9	169	42.7	456	44.9	
3.0–6.9	122	30.8	126	15.9	
7.0+	42	10.6	15	1.9	
MD visits ICD10 codes S00–T98 (traumas)					< 0.001
0	178	44.9	534	67.4	
< 1	168	42.4	251	31.7	
≥ 1	50	12.6	7	0.9	
MD visits ICD10 codes F00–F99, excl. F10 (mental health)					< 0.001
Yes	160	40.4	79	10.0	
No	236	59.6	713	90.0	
Registered nurse visits					< 0.001
0	57	14.4	56	7.1	
< 1	153	38.6	274	34.6	
1.0–2.9	126	31.8	310	39.1	
3.0–5.9	35	8.8	114	14.4	
6.0+	25	6.3	38	4.8	
Public health nurse visits					< 0.001
0	256	64.6	296	37.4	
< 1	108	27.3	340	43.0	
1.0–2.9	27	6.8	112	14.2	
3.0+	5	1.3	43	5.4	
Psychologist contact					0.230
Yes	20	5.1	19	2.4	
No	376	94.9	773	97.6	
Social worker					< 0.001
Yes	46	11.6	9	1.1	
No	350	88.4	783	98.9	
Physiotherapy					< 0.001
0	200	50.5	484	61.6	
< 1	112	28.3	197	24.9	
1.0–2.9	47	11.9	76	9.6	
3.0+	37	9.3	35	4.4	
Primary healthcare inpatient hospitalisations					< 0.001
0	130	10.9	651	54.8	
< 1	149	37.6	120	15.2	
≥ 1	117	29.5	21	2.7	
Dental care					0.367
0	173	43.7	333	42.1	
< 1	108	27.3	225	28.4	
1.0–2.9	83	21.0	187	23.6	
3.0+	32	8.1	46	5.8	
Mental healthcare services					
MH contact					< 0.001
Yes	171	43.2	146	18.4	
No	225	56.8	646	81.6	
Specialised AUD services					
AUD contact					< 0.001
Yes	234	59.1	16	2.0	
No	162	40.9	776	98.0	
Specialised healthcare					
MD visits, all somatic					< 0.001
0	26	6.6	130	16.4	
< 1	72	18.2	317	40.0	
1.0–2.9	138	34.8	233	29.4	
3.0–6.9	106	26.8	89	11.2	
7.0+	54	13.6	23	2.9	
MD visits, ER					< 0.001
0	102	25.8	409	51.6	
< 1	164	41.4	328	41.4	
1.0–2.9	90	22.7	45	5.7	
3.0+	40	10.1	10	1.3	
MD visits, all psychiatric					< 0.001
0	254	64.1	719	90.8	
< 1	95	24.0	58	7.3	
≥ 1	47	11.9	15	1.9	
Inpatient periods, somatic					< 0.001
0	69	17.4	359	45.3	
< 1	166	41.9	374	47.2	
1.0–2.9	116	29.3	50	6.3	
3.0+	45	11.4	9	1.1	
Inpatient periods, psychiatric					< 0.001
Yes	72	18.2	25	3.2	
No	324	81.8	767	96.8	

Notes. MD = medical doctor; SPE = specialised care; MH = mental health; ER = emergency room; AUD = alcohol use disorder; T2DM = type 2 diabetes.

reasons for ER visits among T2DM patients were: (1) symptoms, signs and abnormal clinical and laboratory findings, not elsewhere

Table 3. Average annual health service use of patients with alcohol use disorder (AUD) compared with patients with type 2 diabetes (T2DM).

	OR	*p*	95% CI
Primary healthcare			
3+ MD visits, all			
AUD	3.30	< 0.001	(2.50–4.30)
T2DM (reference)	1.00		
Age ≤ 45 (> 45 ref.)	1.17	0.280	(0.87–1.57)
Male gender (female ref.)	0.76	0.070	(0.56–1.03)
1+ MD visits, traumas (ICD10 codes S00–T98)			
AUD	16.27	< 0.001	(7.30–36.26)
T2DM (reference)	1.00		
Age ≤ 45 (> 45 ref.)	0.74	0.300	(0.42–1.31)
Male gender (female ref.)	1.32	0.410	(0.68–2.59)
Any MD visit, mental health (ICD10 codes F00-F99, excl. F10)			
AUD	6.57	< 0.001	(4.79–9.02)
T2DM (reference)	1.00		
Age ≤ 45 (> 45 ref.)	0.40	< 0.001	(0.29–0.54)
Male gender (female ref.)	0.73	0.790	(0.52–1.02)
3+ Public health nurse visits			
AUD	0.22	< 0.010	(0.09–0.57)
T2DM (reference)	1.00		
Age ≤ 45 (> 45 ref.)	1.48	0.250	(0.76–2.89)
Male gender (female ref.)	1.03	0.930	(0.53–2.01)
1+ Physiotherapy visits			
AUD	1.66	< 0.01	(1.21–2.29)
T2DM (reference)	1.00		
Age ≤ 45 (> 45 ref.)	2.17	< 0.001	(1.49–3.17)
Male gender (female ref.)	0.79	0.180	(0.56–1.12)
PHC hospitalisations			
1+ PHC hospitalisations			
AUD	16.10	< 0.001	(9.85–26.15)
T2DM (reference)	1.00		
Age ≤ 45 (> 45 ref.)	2.30	< 0.001	(1.45–3.67)
Male gender (female ref.)	1.58	0.060	(0.98–2.55)
Dental care			
1+ dental care visits, all			
AUD	0.98	0.880	(0.75–1.28)
T2DM (reference)	1.00		
Age ≤ 45 (> 45 ref.)	0.74	< 0.050	(0.57–0.96)
Male gender (female ref.)	0.76	0.050	(0.57–1.01)
Mental health services			
Any MH visits, all			
AUD	3.60	< 0.001	(2.73–4.76)
T2DM (reference)	1.00		
Age ≤ 45 (> 45 ref.)	0.40	< 0.001	(0.30–0.53)
Male gender (female ref.)	0.55	< 0.001	(0.40–0.74)
3+ MH nurse visits			
AUD	1.51	< 0.050	(1.00–2.29)
T2DM (reference)	1.00		
Age ≤ 45 (> 45 ref.)	0.42	< 0.001	(0.28–0.62)
Male gender (female ref.)	0.54	< 0.010	(0.35–0.82)

(continued)

Table 3. (continued)

	OR	*p*	95% CI
Specialised care			
3+ somatic hospitalisations			
AUD	11.30	< 0.001	(5.45–23.41)
T2DM (reference)	1.00		
Age ≤ 45 (> 45 ref.)	0.96	0.900	(0.53–1.80)
Male gender (female ref.)	2.97	< 0.050	(1.24–7.10)
Any psychiatric hospitalisations			
AUD	7.20	< 0.001	(4.45–11.65)
T2DM (reference)	1.00		
Age ≤ 45 (> 45 ref.)	0.32	< 0.001	(0.21–0.50)
Male gender (female ref.)	0.77	0.280	(0.47–1.24)
3+ ER MD visits			
AUD	8.89	< 0.001	(4.39–18.00)
T2DM (reference)	1.00		
Age ≤ 45 (> 45 ref.)	0.49	< 0.050	(0.27–0.88)
Male gender (female ref.)	0.97	0.940	(0.50–1.89)
3+ somatic MD visits			
AUD	4.13	< 0.001	(3.11–5.49)
T2DM (reference)	1.00		
Age ≤ 45 (> 45 ref.)	0.90	0.490	(0.67–1.22)
Male gender (female ref.)	0.77	0.110	(0.56–1.06)
1+ psychiatric MD visits			
AUD	7.41	< 0.001	(4.05–13.55)
T2DM (reference)	1.00		
Age ≤ 45 (> 45 ref.)	0.24	< 0.001	(0.14–0.42)
Male gender (female ref.)	0.63	0.110	(0.35–1.11)

Notes. ER = emergency room; MD = medical doctor; PHC = primary healthcare; MH = mental health. Binary logistic regression model, adjusted for age and gender.

classified (16.9%); (2) diseases of the musculoskeletal system and connective tissue (13.5%); and (3) injury, poisoning and certain other consequences of external causes (13.2%). Also, hospitalisations in specialised care (odds ratio [*OR*] 11.30), somatic visits to doctors in specialised care settings (*OR* 4.13) and primary healthcare doctor visits due to trauma (S00–T98) (*OR* 16.27) were more common in the AUD group.

Furthermore, we examined MH comorbidity, multimorbidity (2+ permanent diagnoses) and risk of death between the two groups (see Table 4). AUD patients were more likely (*OR* 1.85) to have a permanent MH diagnosis. Multimorbidity was less prevalent in the AUD group (*OR* 0.76), but the probability of death was remarkably higher (HR 7.5) for AUD patients compared with T2DM patients.

Discussion

In this study, treatment-system-wide HSU frequencies and comorbidity profiles of AUD patients were compared with another high-need patient group, patients with T2DM. In previous research, both of these patient groups have been associated with excess HSU and a high prevalence of comorbidities compared with the general population (de Weert-van Oene et al., 2017; Egede & Ellis, 2010; Graham et al., 2017). In this study, we were able to examine HSU across the treatment system, including primary care and dental care. We

Table 4. Probabilities of mental health comorbidity, multimorbidity and death for the alcohol use disorder (AUD) and type 2 diabetes (T2DM) groups.

	AUD ($n = 396$)		T2DM ($n = 792$)			AUD vs. T2DM		
	n	%	*n*	%	*P*	*OR*	*P*	95% CI
Mental health comorbidity					< 0.001	1.85[a]	< 0.001	(1.34–2.55)
Yes	87	22.0	107	13.5				
No	309	78.0	685	86.5				
Multimorbidity*					0.088	0.76[a]	< 0.05	(0.60–0.97)
0	100	25.3	175	22.1				
1	88	22.2	148	18.7				
2+	208	52.5	469	59.2				
Died					< 0.001	7.5[b]	< 0.001	(4.98–11.30)
Yes	93	23.5	38	4.8				
No	303	76.5	754	95.2				

[a]Binary logistic regression. [b]Cox-regression (HR). *Multimorbidity definition was 2+ permanent ICD-10 diagnoses; in the binary logistic regression 0–1 diagnoses = no multimorbidity vs. 2+ diagnoses = multimorbid.

observed AUD patients to be more frequent emergency-service users, making significantly more visits to primary healthcare (PHC) doctors and having more hospitalisation periods in specialised and PHC wards compared with T2DM patients. Frequent emergency service use and frequent hospitalisations can be seen as measures of unmet care needs and inadequate service provision at the primary care level (Parkman et al., 2017; Sweeney & Gray, 1995). Thus, it seems that, despite rather frequent visits to PHC doctors, the care needs of AUD patients remain largely unmet, and their help-seeking extends to emergency services rather than specialised addiction services. Mental and behavioural disorders due to psychoactive substance use were indeed the most common main diagnosis for ER visits among AUD patients.

Patients with T2DM, on the other hand, were identified as having more regular contact with public health nurses in primary care, and many also made frequent visits to registered nurses in PHC, likely indicating sufficient continuity of preventive care and self-care support in the primary care setting, and thus highlighting the importance of continuous treatment contact and secondary prevention in the case of chronic conditions (Van Walraven et al., 2009; Wolinsky et al., 2010). Continuous treatment motivation has an integral role in the successful care of T2DM patients (Koponen et al., 2017) and a previous study by Chen et al. (2013) identified continuity of care as being associated with better medication adherence and better healthcare outcomes among T2DM patients. Similarly, in the care of AUD patients, a continuous outpatient nurse contact in MH services or in specialised AUD services could play an important role in achieving better care outcomes. Some evidence already exists concerning the effectiveness of continuing care for AUD patients (Blodgett et al., 2014; Dennis & Scott, 2012), although difficulty obtaining access to these services is currently an identified barrier (Cunningham & Breslin, 2004; Mojtabai, 2014; Saunders et al., 2006). To better understand challenges and obstacles for continuous care of patients with AUD, including the role of stigma, future HSU research should focus on patient experience and patient-reported outcomes.

We also examined the most common comorbidities and prevalence of multimorbidity in the AUD and T2DM groups. Multimorbidity is increasingly prevalent in PHC settings (Barnett et al., 2012; France et al., 2012) and it is associated with increased HSU and healthcare costs,

as well as poorer health status and care outcomes (Cohen, 2014; Fortin et al., 2014; Payne et al., 2013; Perkins et al., 2004). We identified surprisingly similar comorbidity patterns for the two high-need groups examined in this study. Thus, the excess HSU identified among AUD patients is most likely due to alcohol and other substance-use-related acute health problems. However, ER visits due to injury, poisoning and certain other consequences of external causes were common in both patient groups, although more prevalent among AUD patients compared with T2DM patients (20.9% vs. 13.2%). Only the prevalence of permanent mental health diagnoses was more common in the AUD group compared with the T2DM group, which is contrary to the previous study by Wu et al. (2018), identifying the majority (74.9%) of high-risk diabetes patients as having comorbid non-addiction mental health disorders and 12.5% as having an alcohol disorder. However, only the high-risk patients were included in their study.

With regard to access to GP services, the Finnish healthcare system has been referred to as one of Europe's most inequitable (Collaborators GHAaQ, 2018; OECD, 2005). The findings of this study reflect the current inability of the service system to meet the complex needs of patients with AUD, as they have a significantly higher mortality rate. They also account for more emergency visits, trauma consultations and hospitalisations compared to patients with T2DM. Previous studies have addressed the importance of understanding the complexity of medical conditions, along with social and behavioural needs, to ensure good care coordination (Ryan et al., 2016). This is especially important in the care of AUD patients, who have increased risk of accidents and emergency visits (Cherpitel & Ye, 2008; Cryer et al., 1999). By comparing two high-need patient groups, we were able to detect remarkable differences in HSU patterns and in the risk of death. As a recent systematic review by Pereira Gray et al. (2018) demonstrated, continuity of contact with a doctor is associated with a decreased risk of death. Our study also highlights the important role of nurses in the care of chronic conditions. Nurses coordinate the care pathways across services and actively support and empower patients, which has been identified to reduce unplanned and overlapping HSU (National Audit Office of Finland, 2017). In Finland, the role of nurses has also been acknowledged in a recent Current Care Guideline (2021) for chronic conditions.

Limitations

This study has several limitations that should be considered when interpreting the results and conclusions. First, insufficient cases were available for a combined AUD + T2DM group and thus we excluded those control group patients with a permanent AUD diagnosis or alcohol-related (ICD-10 codes F10.0–F10.9) visits to health services. However, it is most likely that some of the patients with T2DM may have had an unidentified AUD and vice versa. We identified 16 T2DM patients who contacted specialised AUD services. As no alcohol-related diagnosis information was coded for their EHR, we were unable to assess whether they visited AUD services for alcohol-related reasons or due to other substances or for MH reasons. Furthermore, none of the AUD cohort had a permanent T2DM diagnosis coded in their EHR at baseline, although some individual T2DM cases were diagnosed during the follow-up.

In addition, comorbidity and multimorbidity were assessed based on the number of permanent diagnoses. The number of comorbidities is most likely an underestimation, especially regarding mental health diagnoses. Furthermore, the influence of illegal drugs or prescription drugs on health problems related to AUD was not examined in this study.

Also, one major limitation in this study is the lack of individual-level SES data, which is one possible explanation for the differences observed in HSU, as SES is associated with care processes and outcomes (Grintsova et al., 2014; Sikiö et al., 2014). In this study, we were

not able to include individual-level SES status; instead we used aggregate-level information. We identified AUD patients as having low SES as the majority of them received income support, whereas the majority of T2DM patients most likely were employed. Thus, it is also important to note the role of occupational healthcare. In the majority of municipalities in North Karelia, occupational health services are provided by municipal health centres or municipal enterprises (Sauni et al., 2013) that use the same EHR system which we were able to access. A private occupational health service provider operated in only two municipalities and this private occupational HSU we were not able to examine.

Conclusions

Despite the rather similar comorbidity patterns, significant differences in the frequency of HSU were identified between the AUD and T2DM groups in this cohort study. Patients with AUD were identified as frequent emergency-service users and as being more frequently hospitalised compared to patients with T2DM, who had more frequent public health nurse contact in primary care services. AUD patients made significantly more visits to PHC doctors, indicating unmet care needs, and their help-seeking extended to emergency services rather than specialised addiction services. These findings highlight the importance of care coordination. Furthermore, continuous treatment contact with nurses plays an important role in the care of chronic conditions. In the future, placing more emphasis on patient experience and patient-reported outcomes could help to address challenges related to services. This information should be collected systematically to improve effectiveness of the treatment system and quality of care.

Ethics approval

This study was approved by the Research Ethics Committee of the Northern Savo Hospital District; consent was not obtained, as the study was based on registry information.

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