

Effect of health service integration on the health care use of patients with alcohol use disorders in North Karelia, Finland 2016–2020: A comparative cross-sectional study

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Abstract

Background: In North Karelia, Finland, a comprehensive integration of health and social services was implemented in 2017. This study sought to evaluate the impact of integration on the utilisation of health services among patients with alcohol use disorders (AUDs).

Methods: Data from 2016 to 2020 were gathered from the electronic health records, encompassing both primary and specialised care, for patients with AUDs ($n = 4344$). Patients were identified based on AUD-related International Statistical Classification of Diseases and Related Health Problems (ICD-10) diagnosis codes. The data included information on the type of contact, reason for contact (ICD-10 code), and professional providing the service.

Results: The proportion of patients with any annual contact with health services was approximately 90%, and this proportion remained unaffected by the integration. Decreases in AUD contacts were noted across the entire patient cohort, except for those diagnosed with AUD already in 2016. Emergency care use increased among patients treated in substance abuse services after the integration of services. Remote online and telehealth contacts increased across service domains, but these changes were unrelated to the integration year.

Conclusion: The decrease in AUD contacts may be attributed to the improved identification of patients with less severe conditions, as the recording of diagnosis codes has improved. However, notable unmet care needs continue to exist.

Introduction

Excessive alcohol consumption is a leading cause of preventable deaths and diseases and a major public health concern in Finland (World Health Organization [WHO], 2019). It is associated with a wide range of health problems, including cardiovascular diseases, various cancers, and mental health disorders (Plana-Ripoll et al., 2019). Additionally, consumption of alcohol increases the risk of accidents and injuries, placing a significant burden on healthcare systems when treating alcohol-related illnesses and injuries, not to mention the suffering it causes to individuals and their families (Agardh et al., 2016). The 12-month prevalence of alcohol use disorders (AUDs) is approximately 9.1% in the Finnish adult population (WHO, 2019).

Finland has a comprehensive healthcare system aimed at providing universal access to healthcare services for all

people (Organization for Economic Cooperation and Development [OECD], 2023). One of the more specific aims of the Finnish healthcare system is to strengthen primary care services. Alcohol use disorders can be treated in general primary care services provided in health centres by general practitioners and nurses. Furthermore, these centres may include primary care substance abuse treatment (SAT) units and primary care mental health units. Specialised care for more advanced problems is provided by referral to hospitals. In certain regions some of the previously mentioned services can be outsourced. However, in Finland there are identified challenges in access to care, fragmented care processes, limited resources, and stigma, especially among patients with complex care requirements, including patients with AUDs (Rautiainen et al., 2018; Vaccari et al., 2020).

In recent decades, healthcare systems worldwide have been addressing the need for more effective and integrated service delivery models to address inequities in healthcare,

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including access to care and treatment for AUDs (Richardson et al., 2019; WHO, 2016). For instance, the World Health Organization (WHO) framework on integrated people-centred health services (IPCH) consists of five strategies, including coordination of services within and across sectors, reorienting the model of care, and strengthening governance and accountability (WHO, 2016). Yet, the evidence on the impact of integrated care models on changes in service use and care outcomes has been mixed and varied among studies (Baxter et al., 2018; de Matos et al., 2024). In particular, individuals with AUDs often need a wide range of services across the service system, thus putting them in a vulnerable position if services are fragmented. Therefore, it is important to examine treatment system performance among this patient group who often have identified unmet care needs.

In Finland, almost one-third of the population (approximately 1.6 million people) live in sparsely populated rural areas and local centers in rural areas. These remote regions have decreasing and aging populations, and the service infrastructure in rural areas is declining (European Network for Rural Development [ENDR], 2017.) At the beginning of 2023, a national social welfare and health care reform was implemented in Finland, where the responsibility for the organisation and provision of social and health care services was shifted from 309 municipalities to 21 new wellbeing services counties (Kangas & Kalliomaa-Puha, 2022). However, in the eastern part of Finland, in North Karelia (a region with over 162 000 inhabitants), the integration of all levels of health and social services was carried out in 2017, which aimed to deliver care that is more patient-centred, effective and efficient, and improve health outcomes while maximising resource use (Wikström et al., 2021).

In practice, service integration in North Karelia meant administrative integration of primary care services, previously provided by municipalities, including integration of the electronic health records system (EHR) in all health services across the region. Before the integration, SAT services were partly outsourced, and during the integration process these services were harmonised across the region and brought under the regional primary care service production. Before the administrative integration, substance use disorder services were delivered mostly by nurses. Reorientation of the models of care meant that the primary care-based system was strengthened by introducing care coordinators and multi-professional teams to primary care SAT units to improve co-ordination of care for individuals, and to align care practices. These teams included a physician, a social worker, and a representative from the Social Insurance Institution. Telemedicine was also introduced to better reach geographically isolated communities. Furthermore, the following initiatives were implemented: (a) a consulting psychiatrist was assigned to each health centre, which improved vertical integration between specialised care and primary care services, (b) a specialised network for patients with dual diagnoses was established to ensure continuity of care and effective patient guidance, (c) detoxification treatment was centralised to five health centre wards to improve the quality of care, with cases involving complex needs or drug detoxification being

referred to a specialised substance abuse service centre, (d) the specialised emergency care department employed a SAT nurse (registered nurse) seven days a week to provide service guidance and ward consultations, and (e) special attention was paid to recording diagnosis codes (ICD-10) by doctors, with extensive training provided.

Aim

The aim of this study is to examine the annual health service use patterns of individuals with AUDs before and after the regional service integration, in order to assess how the changes in treatment provision impacted service use. To better understand the effect of the system changes on the treatment of AUDs, individuals with AUD-related contact with health services before the regional service system integration occurred on 1 January 2017 were identified. Their service use was compared to those who had their first alcohol-related contact after the service system integration. Furthermore, unmet care needs related to AUD treatment were assessed through changes in emergency care use.

Methods

Study Design

The study design used was a comparative cross-sectional study.

Participants

The data included all adults living in North Karelia in Finland who had AUD-related contact during the past year between 2016 and 2020 ($n = 4344$). Deceased individuals were excluded from each year's cohort.

Measures

Participants' age, sex, home municipality, and possible date of death, together with data on primary and specialised health care contacts, were collected from the regional electronic health records.

The impact of the performed integration measures was analysed through changes in (a) service domain contact frequencies (primary care outpatient care, outpatient substance abuse services, outpatient mental health care, specialised care contacts in hospitals, and emergency care), (b) the type of contact (in-person appointments and online/telehealth remote contacts), and (c) the professional providing the service (physician, nurse, or other health professional).

AUD-related contacts were defined broadly to determine the AUD cohort. These contacts were based on the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) codes (See Table 1 below) or two International Classification of Primary Care (ICPC-2) codes, which were P15 = harmful alcohol use, long-term, or P16 = harmful alcohol use, short-term. When examining service use, any AUD-related contact meant that the person had any of the previously listed diagnoses as a main diagnosis for the visit.

Table 1**Explanation of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) codes**

ICD-10 code	Description
E24.4	Alcohol-induced pseudo-Cushing's syndrome
E51.2	Wernicke's encephalopathy
E52	Niacin deficiency [pellagra]
F10	Mental and behavioural disorders due to alcohol use
G31.2	Degeneration of nervous system due to alcohol
G40.51	Epileptic seizures related to external causes, not intractable, with status epilepticus
G62.1	Alcoholic polyneuropathy
G72.1	Alcoholic myopathy
I42.6	Alcoholic cardiomyopathy
K29.2	Alcoholic gastritis
K70.0	Alcoholic fatty liver
K70.1	Alcoholic hepatitis
K70.2	Alcoholic fibrosis and sclerosis of liver
K70.3	Alcoholic cirrhosis of liver
K70.4	Alcoholic hepatic failure
K70.9	Alcoholic liver disease, unspecified
K85.2	Alcohol induced acute pancreatitis
K86.00	Alcohol-induced chronic pancreatitis
K86.01	Alcohol-induced chronic pancreatitis with exocrine pancreatic insufficiency
K86.08	Chronic pancreatitis caused by alcohol consumption
O35.4	Maternal care for (suspected) damage to fetus from alcohol
P04.3	Newborn affected by maternal use of alcohol
Q86.0	Fetal alcohol syndrome (dysmorphic)
R78.0	Finding of alcohol in blood
T51.0	Toxic effect of ethanol
T51.1	Toxic effect of methanol
T51.2	Toxic effect of 2-Propanol
T51.3	Toxic effect of fusel oil
T51.8	Toxic effect of other alcohols
T51.9	Toxic effect of unspecified alcohol
X45	Accidental poisoning by and exposure to alcohol
Y91.0	Mild alcohol intoxication
Y91.1	Moderate alcohol intoxication
Y91.2	Severe alcohol intoxication
Y91.3	Very severe alcohol intoxication
Y91.9	Alcohol involvement, not otherwise specified
Z04.0	Blood-alcohol and blood-drug test
Z50.2	Alcohol rehabilitation
Z71.4	Alcohol abuse counseling and surveillance
Z72.1	Problems related to alcohol use, specifically alcohol use as a factor in lifestyle
Z81.1	Family history of alcohol abuse and dependence

Statistical Analyses

Basic statistics, such as frequency, percentage, mean, standard deviation, median, minimum, and maximum, were used to describe the data. The percentage point (pp) is used for the difference between percentages. Logistic and linear mixed models were used to assess the differences in binary and mean values between the years to account for the correlation structure in the data. Due to the repeated observations per person, the person ID was used as a random variable. Logarithmic transformation $\log_{10}(n+0.5)$ was used for skewed dependent variables. When analysing the cohort of new cases, random variables were not needed because people changed from year to year, and the models

used were ordinary logistic and linear regression. The R statistical program, version 4.1.3 (R Core Team, 2022), was used in the analyses. *P*-values less than 0.05 were regarded as statistically significant.

Each analysis considers each outcome (e.g., appointments, and remote contacts for substance abuse services) separately across the five years for simple trends using chi-square or correlations. Each separate bivariable analysis does not adjust for any other variables.

Ethics Approval

This study was approved by the Research Ethics Committee of the Northern Savo Hospital District (diary number 410/2015); consent was not obtained, as the study was based on registry information. The study protocol was also approved by the register administrator, the *Siun sote* – joint municipal authority for North Karelia social and health services.

Results**Data Description**

There was a total of 4344 patients in the dataset. The annual data is presented in Table 2. The annual number of people with AUD diagnoses more than doubled from 1794 to 3971 over the period under review (2016–2020). The proportion of men decreased from 76% to 72%, although the difference over the years was not statistically significant. The median age was stable at approximately 55 to 56 years, but the mean age decreased from 53.4 to 51.7 years. Each year, more than 90% of patients had at least one contact. Overall, the average total number of appointments declined smoothly over the years from 14.3 to 10.6. The mean number of remote contacts had increased since 2019, thus, the average number of contacts was lowest in 2018 and has risen since 2019, exceeding the 2016 figures.

The percentage of people who had any alcohol-related contact with the health service during the year decreased by 9%, from 37% in 2016 to 28% in 2020, and the largest change of 3.9% was observed between the years 2019 - 2020. The most common ICD-10 diagnosis code recorded was F10, (alcohol use disorder), and the second most common ICD-10 diagnosis code was K70 (alcoholic liver disease). The percentage of people who had contact with primary care ICPC-2 diagnostic codes P15 and P16 fluctuated over time, with the highest percentage occurring in 2017 (20%). The incidence of illicit drug use-related diagnosis codes F11-F19 (excluding F17, which is tobacco use) increased during the study period.

When looking at the datasets of the 2016 cohort and the 2017–2020 cohort separately, some differences can be observed between them (see supplementary Tables 1 and 2). The mean number of all contacts was similar among the 2016 cohort and slightly lower among new patients versus among all patients. Overall, annual changes in the proportion of people with AUD-related contacts were stable in the 2016 cohort, and slightly smaller in the cohort of new cases.

Primary Health Care Contacts

In primary health care, the most common service domains were outpatient care, substance abuse services, and mental health care. Altogether, these three areas cover approximately 77% of all primary care contacts in the data (see Table 3). In all of these service domains, the number of

in-person appointments declined during the study period. However, the number of remote contacts started to increase after 2018. Thus, the total number of contacts was lowest in 2018, one year after the integration, then started to slightly increase in 2019, and finally in 2020 the total number of contacts exceeded the 2016 figures. A similar trend was observed for all the data (Figure 1).

Table 2

Descriptive Statistics

	2016	2017	2018	2019	2020	P value
<i>N</i>	1794	2244	2954	3486	3971	
New cases		528	799	639	584	
Died		78	89	107	99	
% of women	24,1	25,1	26,3	27,2	27,6	0.785*
Age, mean (sd)	53.4 (14.7)	52.9 (15.2)	52.2 (16.0)	51.8(16.5)	51.7 (16.9)	< 0.001□
median (min–max)	56 (14-88)	56 (15-90)	56 (15-91)	55 (16-92)	55 (17-93)	
Proportion of people with certain type of contact						
Any contact, %	91.6	91.0	90.8	90.0	90.1	0.938*
Any contact, mean	16.2	15.3	14.1	16.4	17.3	<0.001□
Any appointment, mean	14.3	13.5	12.4	11.8	10.6	<0.001□
Any remote contact, mean	1.9	1.8	1.7	4.6	6.7	<0.001□
Any AUD-related contact, %	37.3	37.6	34.9	31.9	28.0	<0.001*
ICD-10 code F10 contact, %	30.0	28.7	26.4	25.1	21.7	<0.001*
ICD-10 codes F11-19 (illicit drug-use) contact, %	2.1	2.5	3.5	4.3	3.9	<0.001*
ICD-10 codes F10 or F11-19 contacts, %	31.1	30.1	28.8	27.9	24.3	<0.001*
ICD-10 code K70 (alcoholic liver disease) contact, %	3.1	2.8	2.5	2.4	2.1	0.711*
ICPC2 code P15 or P16 (harmful use of alcohol), %	7.1	20.5	19.4	16.7	12.7	<0.001*

Notes: AUD= Alcohol use disorder, ICD-10= 10th revision of the International Statistical Classification of Diseases and Related Health Problems, F10= Alcohol use disorder, F11-F19= illicit drug-use disorders, K70= alcoholic liver disease, ICPC2= International Classification of Primary Care, ICPC2 P15=harmful alcohol use, long-term ICPC2 P16= harmful alcohol use, short-term.

* P-value from logistic mixed model for the differences between years; □ P-value from linear mixed model for the differences between years

Primary Care

When looking at contacts by staff occupation, most of the primary care contacts were with doctors or nurses. The number of appointments declined, and the number of remote contacts increased after 2017 (Figure 2).

Primary Care Substance Abuse Services

The most common contacts in primary care substance abuse services were with nurses. The number of appointments was stable, but the number of remote contacts increased, resulting in an increase in the total number of contacts. At the same time, the number of contacts with nurse assistants or social workers declined. The number of contacts with doctors was small and quite stable, with a declining number of appointments and an increasing number of remote contacts. In the abovementioned services the recording of diagnoses increased from 85.9% to 99.1% in 2017.

Primary Care Mental Health Services

With regard to primary care mental health services, the most common contacts were with nurses or nurse assistants, with a declining number of appointments and an increased number of remote contacts. The total number of contacts decreased toward the end of the observation period. The mean number of contacts with doctors was smaller than

nurses, but with a similar pattern to the mean number of contacts with nurses. Only a minority of individuals had contact with both substance abuse services and mental health care, although this proportion showed an increasing trend (7.5% in 2016 to 9.4% in 2020).

Emergency Services in Primary Health Care

More than half of the people used emergency services in primary health care over the entire period, except for 2020. The number of all contacts declined significantly even though the number of remote contacts increased slightly.

Specialised Health Care Contacts

Approximately 60–62% of patients used specialised health care services with more than four contacts per person as a yearly average. The mean number of appointments per person per year was the highest in 2017 (3.92) and had decreased to 3.35 by 2020. At the same time, the number of remote contacts nearly doubled from 0.48 to 0.93 per person. Less than one-fifth made contact for alcohol-related issues in specialised care. Similarly, the percentage of people making contact for psychiatric problems was highest in 2018 (20%), but there was more variation between the years. Fewer than half of the study participants had emergency contacts in specialised care.

Emergency Services in Specialised Health Care

Emergency care_contacts in specialised emergency health care were more common among individuals who were

treated in primary care outpatient SAT services. In 2016, use of emergency services at either the primary or specialised level occurred in 65.3% of individuals in SAT, and in 68.5% of individuals in SAT in 2020. (Table 4).

Table 3

Primary Health Care Contacts

	2016	2017	2018	2019	2020	P-value
Any contact, % of users	87.7	86.8	86.4	86.3	85.7	0.861*
Any contact, mean	11.9	10.8	9.9	12.3	13.0	<0.001□
Appointments, mean	10.5	9.6	8.8	8.3	7.2	<0.001□
Remote contacts, mean	1.4	1.3	1.1	4.0	5.8	<0.001□
Outpatient care (T11^a)						
Any contact, % of users	75.1	71.5	69.4	73.2	72.1	<0.001*
Any contact, mean	4.56	3.98	3.49	4.81	5.09	<0.001□
Appointments, mean	3.73	3.38	3.02	2.77	2.08	<0.001□
Remote contacts, mean	0.83	0.60	0.47	2.05	3.00	<0.001□
Substance abuse services (T73^a)						
Any contact, % of users	26.3	26.2	25.6	23.8	21.0	<0.001*
Any contact, mean	2.58	2.39	2.24	2.43	2.63	<0.001□
Appointments, mean	2.43	2.19	1.98	1.67	1.47	<0.001□
Remote contacts, mean	0.15	0.20	0.26	0.76	1.16	<0.001□
Mental health care (T71^a)						
Any contact, % of users	20.0	21.3	19.8	24.0	23.3	<0.001*
Any contact, mean	2.20	2.11	1.64	2.21	2.26	<0.001□
Appointments, mean	1.94	1.75	1.34	1.31	1.19	<0.001□
Remote contacts, mean	0.26	0.36	0.30	0.90	1.07	<0.001□
Contact to both T73 and T71						
Any contact % of users	7.5	9.5	8.6	10.8	9.4	<0.001*
Emergency care						
Any contact, % of users	58.6	58.7	57.7	57.2	45.3	<0.001*
Any contact, mean	2.14	2.10	1.98	1.86	1.22	<0.001□
Appointments, mean	2.12	1.99	1.90	1.67	0.87	<0.001□
Remote contacts, mean	0.03	0.10	0.08	0.19	0.35	<0.001□
T73 users Emergency contacts (all levels of care)						
Any contact % of users	65.3	66.6	67.8	69.1	68.5	0.818*
Any contact, mean	4.14	4.33	3.82	3.90	3.82	0.879□

Notes:

A T11= outpatient care, T73= outpatient substance abuse services, T71=outpatient mental health care.

* P-value from logistic mixed model for the differences between years; □ P-value from linear mixed model for the differences between years

Figure 1

Mean Number of Primary Health Care Contacts per Person in Different Service Sectors and by Type of Contact

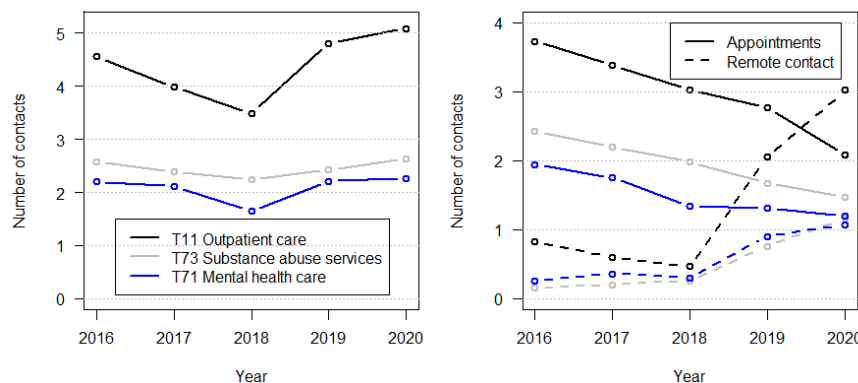


Figure 2

Mean Number of Primary Care Contacts in Outpatient Care (T11), Outpatient Substance Abuse Care (T73), and Outpatient Mental Health Care (T71) by Different Professionals and by Type of Contact

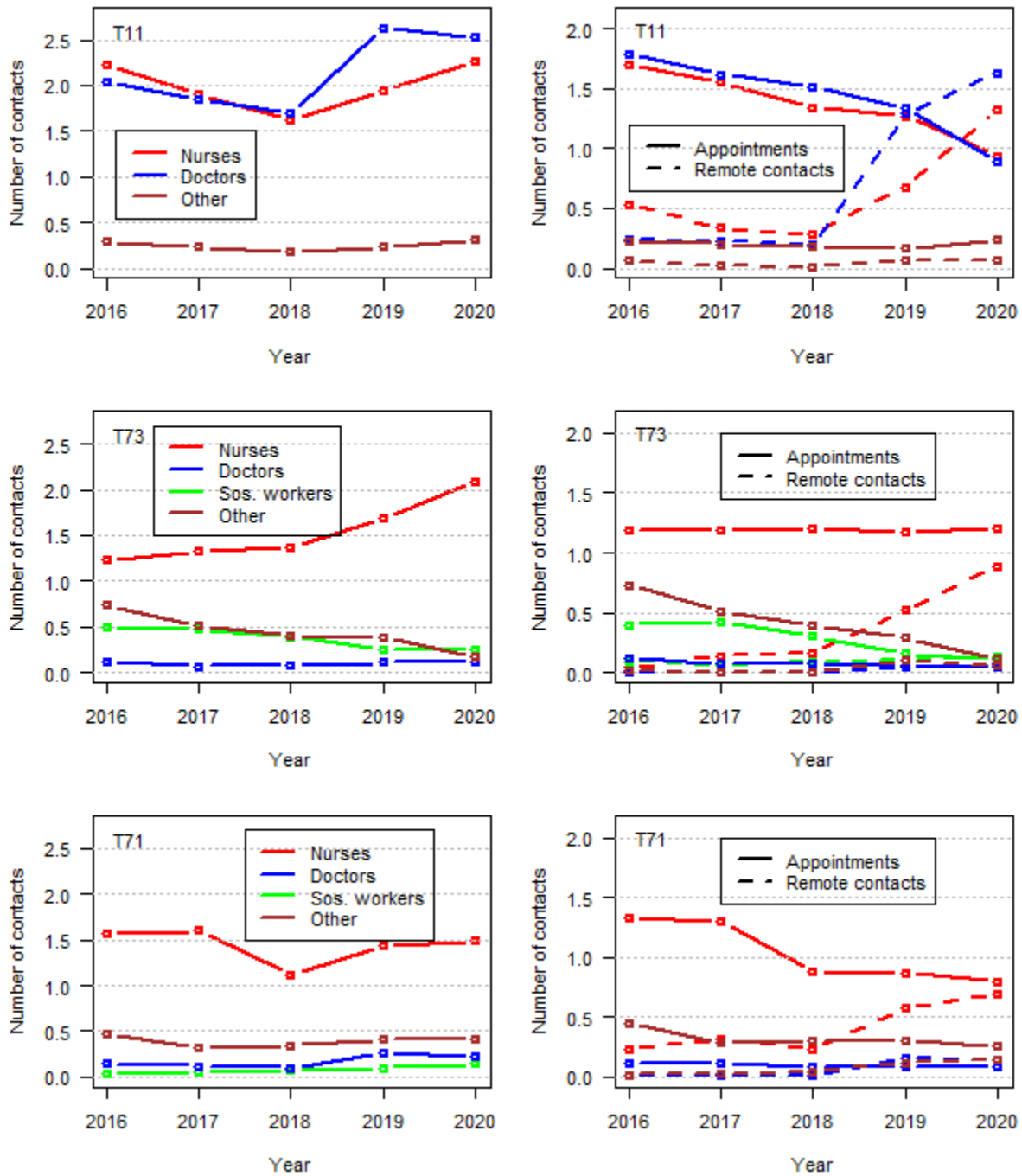


Table 4

Specialised Health Care Contacts

	2016	2017	2018	2019	2020	P-value
Any contact, %	61.5	60.2	60.2	59.6	61.0	0.653*
Any contact, mean	4.33	4.49	4.18	4.13	4.28	0.641□
Appointments, mean	3.85	3.92	3.65	3.51	3.35	0.024□
Remote contacts, mean	0.48	0.56	0.53	0.63	0.93	<0.001□
Any alcohol-related contact, %	19.1	19.3	19.4	16.1	12.9	<0.001*
ICD 10 ^a = F10 ^b contact, %	14.9	13.9	14.2	12.7	10.4	<0.001*
ICD 10 ^a = F10 ^b contact, mean	0.37	0.39	0.49	0.45	0.35	<0.001□
ICPC = P15/P16 ^c contact, %	1.1	9.8	11.4	9.3	5.6	<0.001*
ICPC = P15/P16 ^c contact, mean	0.01	0.28	0.35	0.30	0.16	<0.001□
Psychiatry contact, %	9.4	18.8	20.1	18.2	15.6	<0.001*
Psychiatry contact, mean	0.77	0.96	1.02	0.94	0.78	<0.001□
Emergency care contact, %	48.0	46.3	45.6	44.5	46.2	0.230*
Emergency care contact, mean	1.55	1.81	1.67	1.53	1.56	0.187□

Notes:

^a ICD 10 = 10th revision of the International Statistical Classification of Diseases and Related Health Problems.

^b F10= Alcohol use disorder, ICPC2= International Classification of Primary Care,

^c ICPC2 P15=harmful alcohol use, long-term; ICPC2 P16= harmful alcohol use, short-term.

* P-value from logistic mixed model for the differences between years

□ P-value from linear mixed model for the differences between years

Discussion

System-level integration of services had various effects on the utilisation of healthcare services by patients with AUDs. Our findings suggest that the overall pattern of increasing remote contacts and decreasing in-person appointments within the healthcare system mainly explains the observed changes. Furthermore, the decrease in AUD contacts among the entire patient cohort can be attributed to the timely identification of individuals with less complex and advanced diseases and facilitated by improvements in the recording of diagnostic codes. This conclusion is supported by several observations: first, approximately 90% of patients maintained contact with healthcare services before and after the integration, and the mean number of contacts to the service system remained quite stable; second, a decline in alcohol-related contacts was observed across the entire patient population, excluding the cohort already diagnosed with AUDs in 2016; and finally, the percentage of individuals seeking specialised emergency care, an indicator of unmet healthcare needs, remained stable.

Previous studies on service integration outcomes have yielded mixed results (Baxter et al., 2018), and its effect on costs, remains unclear (Rocks et al., 2020). The availability of comprehensive individual level EHR data across the North Karelia region enabled the researchers to assess the impact of the integration measures on the use of health services among patients with AUDs. Some evidence exists that integration of SAT services into primary care increases both the identification of substance use problems and access to SAT services, but scarcity of resources may limit the reach of these services (Padwa et al. 2012). Furthermore, administrative service system integration often requires simultaneous operational activities to achieve patient-centred outcomes (Taskinen & Hujala, 2020). It seems that the timely and need-based client-centred care pathways continue to develop in the North Karelia region. Currently,

the focus has been on resource allocation toward remote services in all service domains to meet the demands of patients in the sparsely populated region.

An increasing number of remote contacts was also observed in primary care outpatient SAT services. As the number of appointments decreased, remote contact increased, most likely due to improved use of procedures and diagnostic codes by health professionals and later due to the emergence of the COVID-19 pandemic. Similar trends were also identified among other patient groups and services (Inglin et al., 2022; Lavikainen et al., 2022). The role of remote contacts in AUD treatment is unclear and will require a longer time period to observe. Previous literature has shown that telemedicine is an effective tool for increasing patient accessibility to health care services (Kruse et al., 2020). Lengthy travel times pose a barrier for in-person visits that remote contacts may partly compensate for (Lankila et al., 2022). As North Karelia is a sparsely populated region, remote contacts may support access to services; however, among this patient group, there may also be challenges in using remote services, which require suitable equipment and skills (Seddon et al., 2021; Sweeney et al., 2022). A recent qualitative study of North Karelia substance abuse and mental health services identified that poor health confidence was associated with not using digital services (Hörhammer et al., 2025). In the future, it will be important to examine the socio-demographics of individuals using remote services in relation to different care outcomes and patient experiences, to better understand for whom this remote service modality is the most suitable.

Understanding the suitability of different service modalities is especially important, as we also found some indications of unmet care needs. Approximately 25% of individuals with alcohol-related diagnoses had contact with outpatient substance abuse services, and the mean number of total contacts to outpatient substance abuse services increased

only slightly between 2016 and 2020. At the same time, the number of new individuals with alcohol-related diagnostic codes elsewhere in the health service system increased. In fact, we observed that the annual number of new people with alcohol-related diagnoses more than doubled during the follow-up period of 2016–2020. Additionally, specialised care emergency department contact could be seen as another indicator of unmet care needs (Miele et al., 2023). We found that overall emergency service use among individuals in substance abuse treatment continued to remain at a high level, and that 65.3% of individuals in SAT had contact with either primary care or specialised care emergency services in 2016, and 68.5% in 2020. In the entire patient group, the level of these contacts remained stable, except in 2020 when contacts dropped, which may also reflect the decrease in alcohol consumption levels in Finland during the COVID-19 pandemic (Mäkelä et al., 2020). However, the number of deaths showed an increasing trend and should be further studied, as other studies have reported an increase in alcohol-related deaths in the first year of the COVID-19 pandemic (White et al., 2022).

Several possible factors should be noted in the interpretation of the results. For instance, chronic liver diseases (such as ICD-10 code K70) can also be induced by moderate alcohol consumption (Díaz et al. 2023) and may thus confound the results of this study and explain the decreasing trend of alcohol-related contacts in the whole study population. The increased emergency service use rate among individuals in substance abuse treatment may be partly associated with the lack of a proper number of physicians in substance abuse services, affecting, for instance, prescribed pharmaceutical support. Furthermore, despite extensive care instructions, there may be variation in treatment protocols within the county, indicating a transition phase where the use of new remote contact methods is currently practiced, and best practices are sought. A notable strength of this study, however, was the high quality of the data, which covered all parts of the service provision. Although we observed improvements in diagnosis coverage during the study period, it is important to note that underdiagnosis is often present in AUDs due to a lack of health care professionals' skills in identification, and stigmatising attitudes (Keyes et al., 2010; Rivera-Segarra et al., 2019; Vaccari et al., 2020). Furthermore, it is important to note that the mean number of contacts as a performance indicator for service reform integration may not be sufficient, as client segments are often heterogeneous, and typically, the service use data are highly skewed. The skewness of the data was taken into consideration in our analyses. However, in future a prospective follow-up study by client segments using individual-level analyses might provide more in-depth information. Additionally, laboratory markers to assess the effectiveness of the treatment would be important to examine in future studies.

Conclusions

To conclude, following the regional service system integration and implementation of remote services in North Karelia, divergent development of service use was observed among individuals with AUDs. On the one hand, the

increased provision of remote contacts seems to have had positive effects, as alcohol problems may be identified in a more timely manner, and alcohol-related service use showed a decreasing trend. On the other hand, the number of individuals with access to SAT services did not increase notably, even though the proportion of new individuals with alcohol-related diagnoses coded elsewhere in the service system increased. Additionally, emergency care service use increased among patients in substance abuse treatment, thus potentially indicating that remote contact may not be sufficient for all individuals with AUDs. Nevertheless, a longer follow-up period is needed, as well as the acceleration of integration processes at the operational, professional, and clinical levels of care, to secure improved services for all patients and better access to substance abuse treatment.

Availability of Data and Materials

The datasets generated and analysed during the current study are not publicly available. Access to data is regulated by the European Union and Finnish laws and therefore, sharing of sensitive data is not possible and data are not publicly available. An anonymised version of the data is available for researchers who meet the criteria as required by the European Union and Finnish laws for access to confidential data with a data permit of an appropriate authority. Contact information: aimeistoneuvonta@siunsoite.fi for data requests from the *Siun soite* – Joint municipal authority for North Karelia social and health services.

Authors' Contributions

All authors participated in planning and designing the study. EV, M-LL and KW drafted the article and M-LL performed data analysis. PK and TL critically reviewed the document. All authors contributed to and approved the final manuscript.

List of Abbreviations

AUD	Alcohol use disorder
ICD-10	10th revision of the International Statistical Classification of Diseases and Related Health Problems
ICPC-2	International Classification of Primary Care
P15	Harmful alcohol use, long-term
P16	Harmful alcohol use, short-term
SAT	Primary care outpatient substance abuse treatment
T11	Primary care outpatient care
T71	Outpatient mental health care
T73	Outpatient substance abuse service

References

- Agardh, E. E., Danielsson, A.-K., Ramstedt, M., Ledgaard Holm, A., Diderichsen, F., Juel, K., & Grittner, U. (2016). Alcohol-attributed disease burden in four Nordic countries: A comparison using the Global Burden of Disease, Injuries and Risk Factors 2013 study.

- Addiction*, 111(10), 1806–1813. <https://doi.org/10.1111/add.13430>
- Baxter, S., Johnson, M., Chambers, D., Sutton, A., Goyder, E., & Booth, A. (2018). The effects of integrated care: A systematic review of UK and international evidence. *BMC Health Services Research*, 18, 350. <https://doi.org/10.1186/s12913-018-3161-3>
- Díaz, L. A., Arab, J. P., Louvet, A., Bataller, R., & Arrese, M. (2023). The intersection between alcohol-related liver disease and nonalcoholic fatty liver disease. *Nature Reviews Gastroenterology & Hepatology*, 20, 764–783. <https://doi.org/10.1038/s41575-023-00822-y>
- de Matos, R. C., do Nascimento, G., Fernandes, A. C., & Silva, M. T. (2024). Implementation and impact of integrated health and social care services: An umbrella review. *Journal of Public Health Policy*. Advance online publication. <https://doi.org/10.1057/s41271-023-00465-y>
- European Network for Rural Development (ENDR). (2017). *Smart Countryside study Finland - Working document*. ENDR Contact Point. Brussels: European Commission. https://ec.europa.eu/enrd/sites/enrd/files/tg_smart-villages_case-study_fi.pdf
- Hörhammer, I., Suvanto, J., Kinnunen, M., & Kujala, S. (2025). Usefulness of self-guided digital services among mental health patients: The role of health confidence and sociodemographic characteristics. *International Journal of Medical Informatics*, 194, 105693. <https://doi.org/10.1016/j.ijmedinf.2024.105693>
- Inglin, L., Wikström, K., Lamidi, M.-L., & Laatikainen, T. (2022). The adverse effect of the COVID-19 pandemic on health service usage among patients with type 2 diabetes in North Karelia, Finland. *BMC Health Services Research*, 22, 105. <https://doi.org/10.1186/s12913-022-08105-z>
- Kangas, O., & Kallioma-Puha, L. (2022). *Finland finalises its largest-ever social and healthcare reform*. ESPN Flash Report 2022/39, European Social Policy Network (ESPN), Brussels: European Commission. <https://ec.europa.eu/social/BlobServlet?docId=25947&langId=en>
- Keys, K. M., Hatzenbuehler, M. L., McLaughlin, K. A., Link, B. G., Olfson, M., Grant, B. F., & Hasin, D. S. (2010). Stigma and treatment for alcohol disorders in the United States. *American Journal of Epidemiology*, 172(12), 1364–1372. <https://doi.org/10.1093/aje/kwq304>
- Kruse, C. S., Lee, K., Watson, J. B., Lobo, L. G., Stoppelmoor, A. G., & Oyibo, S. E. (2020). Measures of effectiveness, efficiency, and quality of telemedicine in the management of alcohol abuse, addiction, and rehabilitation: Systematic review. *Journal of Medical Internet Research*, 22(1), e13252. <https://doi.org/10.2196/13252>
- Lankila, T., Laatikainen, T., Wikström, K., Linna, M., & Antikainen, H. (2022). Association of travel time with mental health service use in primary health care according to contact type: A register-based study in Kainuu, Finland. *BMC Health Services Research*, 22(1), 1458. <https://doi.org/10.1186/s12913-022-08815-4>
- Lavikainen, P., Lamidi, M.-L., Repo, T., Inglin, L., Martikainen, J., & Laatikainen, T. (2022). Effects of COVID-19 pandemic and lockdown on monitoring and treatment balance of Finnish coronary heart disease and type 2 diabetes patients. *Clinical Epidemiology*, 14, 1363–1373. <https://doi.org/10.2147/CLEP.S387461>
- Mäkelä, P., Ylöstalo, T., Warpenius, K., Karlsson, T., Jääskeläinen, M., & Ståhl, T. (2020). Koronaepidemian vaikutukset suomalaisten alkoholinkulutukseen – kokonaisarvio kevään ja kesän 2020 muutoksista. [Effects of the coronavirus epidemic on alcohol consumption in Finland: An overall assessment of changes in spring and summer 2020]. *Tutkimuksesta tiiviisti*, 30, 1–16. <https://urn.fi/URN:ISBN:978-952-343-556-8>
- Miele, A. S., Fleury, M. S., Zeluff, H., Mendieta, A., & Phillips, C. (2023). Driven by need, shaped by access: Heterogeneity in patient profiles and patterns of service utilization in patients with alcohol use disorders. *Drug and Alcohol Dependence*, 246, 109825. <https://doi.org/10.1016/j.drugalcdep.2023.109825>
- Organization for Economic Cooperation and Development (OECD)/European Observatory on Health Systems and Policies. (2023). *Finland: Country Health Profile 2023, State of Health in the EU*. OECD Publishing, Paris/European Observatory on Health Systems and Policies, Brussels. <https://doi.org/10.1787/e7af1b4d-en>
- Padwa, H., Urada, D., Antonini, V. P., Ober, A., Crèvecoeur-MacPhail, D. A., & Rawson, R. A. (2012). Integrating substance use disorder services with primary care: The experience in California. *Journal of Psychoactive Drugs*, 44(4), 299–306. <https://doi.org/10.1080/02791072.2012.718643>
- Plana-Ripoll, O., Pedersen, C. B., Agerbo, E., Holtz, Y., Erlangsen, A., Canudas-Romo, V., Andersen, P. K., & Laursen, T. M. (2019). A comprehensive analysis of mortality-related health metrics associated with mental disorders: A nationwide, register-based cohort study. *Lancet*, 394(10211), 1827–1835. [https://doi.org/10.1016/S0140-6736\(19\)32316-5](https://doi.org/10.1016/S0140-6736(19)32316-5)
- R Core Team. (2022). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. <https://www.R-project.org/>
- Rautiainen, E., Ryyänänen, O.-P., & Laatikainen, T. (2018). Care outcomes and alcohol-related treatment utilization profiles of patients with alcohol-use disorder: A prospective cohort study using electronic health records. *Nordic Studies on Alcohol and Drugs*, 35(4), 329–343. <https://doi.org/10.1177/1455072518783972>
- Richardson, A., Richard, L., Gunter, K., & Derrett, S. (2019). Interventions to integrate care for people with serious mental illness and substance use disorders: A systematic scoping review protocol. *BMJ Open*, 9, e031122. <https://doi.org/10.1136/bmjopen-2019-031122>
- Rivera-Segarra, E., Varas-Díaz, N., & Santos-Figueroa, A. (2019). “That’s all fake”: Health professionals’ stigma and physical healthcare of people living with serious mental illness. *PLoS ONE*, 14(12), e0226401. <https://doi.org/10.1371/journal.pone.0226401>
- Rocks, S., Berntson, D., Gil-Salmeron, A., Kadu, M., Ehrenberg, N., Stein, V., & Tsiachristas, A. (2020). Costs and effects of integrated care: A systematic literature review and meta-analysis. *The European*

- Journal of Health Economics*, 21(9), 1211–1221.
<https://doi.org/10.1007/s10198-020-01217-5>
- Seddon, J., Trevena, P., & Wadd, S. (2021). Addressing the needs of older adults receiving alcohol treatment during the COVID-19 pandemic: A qualitative study. *Aging & Mental Health*, 26(5), 919–924.
<https://doi.org/10.1080/13607863.2021.1910794>
- Sweeney, M. M., Holtyn, A. F., Stitzer, M. L., & Gastfriend, D. R. (2022). Practical technology for expanding and improving substance use disorder treatment: Telehealth, remote monitoring, and digital health interventions. *Psychiatric Clinics of North America*, 45(3), 515–528.
<https://doi.org/10.1016/j.psc.2022.05.006>
- Taskinen H. & Hujala A. (2020). Integraatio – sosiaali- ja terveystalvelujen uudistamisen ydintä [Integration – the core of social and health care reform]. In A. Hujala & H. Taskinen, [Eds.] *Uudistuva sosiaali- ja terveystala* (pp. 7–12). Tampere University Press.
- Vaccari, P., Ramírez-Vielma, R., Saldivia, S., Cova, F., Vielma-Aguilera, A., Victoriano, V., Ulloa-Vidal, N., & Grandón, P. (2020). Stigma toward people with a diagnosis of severe mental disorder in primary healthcare centers: Perspectives of service users and health teams in Chile. *International Journal of Mental Health Systems*, 14, 6. <https://doi.org/10.1186/s13033-020-0340-5>
- White, A.M., Castle, I.J.P., Powell, P.A., Hingson, R.W., & Koob, G.F. (2022). Alcohol-related deaths during the COVID-19 pandemic. *JAMA*, 327(17), 1704–1706
<https://doi.org/10.1001/jama.2022.4308>
- Wikström, K., Lamidi, M. L., Rautiainen, P., Tirkkonen, H., Kivinen, P., & Laatikainen, T. (2021). The effect of the integration of health services on health care usage among patients with type 2 diabetes in North Karelia, Finland. *BMC Health Services Research*, 21(1), 65.
<https://doi.org/10.1186/s12913-021-06059-2>
- World Health Organization (WHO). (2016). *Framework on integrated, people-centred health services*. Sixty-Ninth World Health Assembly A69/39. 2016. https://apps.who.int/gb/ebwha/pdf_files/WHA69/A69_39-en.pdf?ua=1.
- World Health Organization (WHO). (2019). *Global alcohol report: Country profile: Finland*. World Health Organization.
<https://www.who.int/publications/m/item/alcohol-fin-2019>