Tampere University

TINO KAROLAAKSO

Disability Pensions Due to Mental Disorders in Finland

The role of social factors and mental health services

Tampere University Dissertations 955

Tampere University Dissertations 955

TINO KAROLAAKSO

Disability Pensions Due to Mental Disorders in Finland

The role of social factors and mental health services

ACADEMIC DISSERTATION
To be presented, with the permission of
the Faculty of Social Sciences
of Tampere University,
for public discussion in the Jarmo Visakorpi Auditorium
of the Arvo Building, Arvo Ylpön katu 34, Tampere,
on 23 February 2024, at 13 o'clock.

ACADEMIC DISSERTATION
Tampere University, Faculty of Social Sciences
Finland

Responsible supervisor and Custos	Professor Sami Pirkola Tampere University Finland	
Supervisor	Professor Emeritus Martti T. Tuomisto Tampere University Finland	
Pre-examiners	Professor Luis Salvador-Carulla University of Canberra Australia	Professor Emeritus Jyrki Korkeila University of Turku Finland
Opponent	Docent Kristian Wahlbeck Tampere University Finland	

Cover design: Roihu Inc.

ISBN 978-952-03-3291-4 (print)
ISBN 978-952-03-3292-1 (pdf)
ISSN 2489-9860 (print)
ISSN 2490-0028 (pdf)
http://urn.fi/URN:ISBN:978-952-03-3292-1

Carbon dioxide emissions from printing Tampere University dissertations have been compensated.

PunaMusta Oy – Yliopistopaino
Joensuu 2024

"There is no health without mental health."

— *World Health Organization*

"People aren't just people, they are people surrounded by circumstances."

— *Sir Terry Pratchett, I Shall Wear Midnight*

"Now, I'm only saying all this because – well – because I like you."

— *Moominpappa, in Tove Jansson's Moominpappa at Sea*

PREFACE

The origins of this dissertation include, as many major endeavors often seem to, almost existential level angst and a faint, idealistic, and perhaps somewhat naïve idea that something should be done.

As a career-beginning clinical psychologist in adult psychiatry, I had been struggling for some time with an ever-increasing number of patients. By 2017 this had developed to a point where I felt inadequate about my work and unsure about my possibilities to help the people whose lives I touched. I felt that our service system was failing them, because, among other things, the average possible appointment interval was around four weeks between sessions, which is not sufficient for adequate psychosocial care. As a result, I was also struggling with the feeling that I personally was failing them.

This was not only the case in the local services I was working in, but I had been hearing the same message from various colleagues around the country. This led me to the conclusion that there was something more or different we should be doing regarding mental health, both in society in general and in treatment provision in the big picture of mental health services. I suppose these system-level frustrations and a deep feeling of compassion for those in need initially got me into health service system research. As the late Sir Terry Pratchett wrote, "There is no justice, there is just us". If you want something to change, you must be ready to herald the change yourself and do the required heavy lifting.

As it turned out, in late 2017, I learned that the professor of social psychiatry at Tampere University, Sami Pirkola, was starting a research project called RETIRE regarding disability pensioning, which would include the possibility of studying Finnish mental health services using prior service system data from the European REFINEMENT – project. We set up a meeting to discuss whether our mutual interests aligned, which we quickly found they did, and I joined the ranks of the doctoral candidates at Tampere University.

Thus, I want to express my profound appreciation to Professors Sami Pirkola and Martti T. Tuomisto for acting as my supervisors during this doctoral thesis work. I am deeply grateful for all the excellent guidance you have provided me regarding scientific research in your respective fields of social psychiatry and psychotherapy. I

genuinely admire Professor Pirkola's expertise and knowledge, and I am grateful for all the insightful discussions we have had along the road, for example concerning the relationship between mental health and changing working life, as well as the intricacies of complex mental health service systems. I have always felt that you have made my work one of your top priorities no matter how much you have had on your plate, for which you have my everlasting gratitude. Professor Tuomisto has provided me with sound and professional advice throughout the project, ranging from the highest quality scientific customs to insights from the psychological perspective of my research. I also had the pleasure of collaborating with you regarding occupational health research in my special psychologist studies, resulting in a study which has successfully been published elsewhere. Thank you for all your help on both accounts.

I warmly thank the pre-examiners, Professor Luis Salvador-Carulla and Professor emeritus Jyrki Korkeila, for their careful review of this thesis. Your valuable comments and suggestions improved the thesis in its final stage. I also express my deep gratitude to docent Kristian Wahlbeck for acting as the opponent in my public defence of this dissertation.

A wide range of people have made this dissertation possible. Docent Reija Autio, this work would not have been completed without you, as you held the integral statistical knowledge that has shaped these studies into what they are. Thank you for all your work and for the hours we spent reviewing the data and statistical analyses. Dr. Turkka Näppilä, thank you for all your hard work and assistance with the RETIRE data; your expertise made my life a million times easier. MD Helena Leppänen and Dr. Päivi Rissanen, my doctoral candidate colleagues, thank you for your companionship on this journey and for sharing the intricacies of DP research. Dr. Kirsti Nurmela, thank you for observant conversations and your support regarding socioeconomic differences in mental health, as well as for our work camaraderie. Professor Sakari Karvonen, I'm grateful for your expertise in contextual and regional determinants of health in Finland. I was pleased to receive support from a national expert of your calibre. MPH Petra Suontausta, you have been the hands-on specialist regarding our service system data, and your help has been vital for studying and making any deductions from it, which has earned you my deepest thanks. MD Kimmo Suokas, thank you for your support and for all the inspirational discussions we have had concerning a wide range of topics, from epidemiological research methodology to R-adventures. In addition, I'd also like to express my gratitude to Dr. Taina Ala-Nikkola and Marjut Vastamäki for their support and advice in analysing the service system data, and to Michael Bailey, who has language-checked all the manuscripts included in this thesis, as well as this dissertation text

itself. I am also grateful to the faculty of social sciences of Tampere University for their financial support of this dissertation through a paid doctoral position that spanned several years, as well as to the Finnish Foundation for Psychiatric Research for their support through a research grant at the early stages of this dissertation.

Other noteworthy people who have contributed to this dissertation include my co-workers and peers at Tampere University. The infamous baddies of the notorious Lounasmestarit-group, including but not limited to Maija, Olli, Annastiina, Laura, Anna-Leena, Leena, Mari and Saila, thank you for all the lunches and shenanigans over the years. A special nod and a grin to my university roommate Essi, who has endured my nonsense for most of this journey as well as given excellent research advice and great laughs repeatedly. Thank you to all the people at Pirte Occupational Health, where I worked part-time as an occupational health psychologist and private practitioner during most of this thesis. And, of course, I have also had the pleasure of joining the "rollercoaster which you cannot buy a ticket to", the Terapiat etulinjaan/First-Line Therapies-initiative, nationally helping to develop tools and apply evidence-based care models for primary mental health care. Sara, Kasperi, Pasi, Aino, Tuula, Jaakko, Tiina, Assi, Anne-Tiina, Sinikka and Samuli, as well all the others associated with the initiative around Finland, thank you for being part of the change that does the heavy lifting.

I would not be here without my parents Jaana and Matti, whose support and life teachings have allowed me to rise to many challenges. I know I can always count on you for anything. And to my siblings Tessa and Teemu, you will always have a special place in my heart and be a special pain in my butt. Thank you for being so different from me, and at the same time so exactly like me.

And to my wife and life partner Pia. You are my rock, my best friend, most trusted advisor and lover. You are the best thing that has ever happened to me, and I am most grateful of all that you are here, and that you are who you are. All other things deserving saying are said privately, between only the two of us.

Toijala, September 4th, 2023
Tino Karolaakso

ABSTRACT

Mental disorders are one of the most common and disabling health conditions worldwide, causing considerable human suffering and significant economic costs. In Finland, mental and behavioural disorders are the most extensive diagnostic group for which people receive disability allowance. Previous research has identified important social and regional differences regarding mental disorder disability pension (DP) rates, but more systematic research is required to understand these disparities. In addition, the role and possibilities of mental health services (MHS) in preventing DPs due to mental disorders are still for the most part unexplored, with no consensus among experts and stakeholders on the best practice of MHS provision in different contexts to prevent DPs.

The aim of this dissertation was to study in depth the different risk factors and dynamics affecting the mental disorder-based DP process, from macro-level sociodemographic and socioeconomic factors to contextual regional settings. By considering these factors and the populational context, the definitive objective of this thesis was to identify and describe the connections between MHS and mental disorder DP by applying the Mental Health Ecosystems research approach. This dissertation is part of the RETIRE – research project, which aims to study the risk factors and sequences of mental health-based disability pensioning and to analyse the effectiveness of service systems in different hospital districts in Finland.

We utilised national register data to study all Finnish citizens granted a temporary, permanent, full or partial DP due to a mental disorder for the first time between 2010 and 2015 with added controls. This enabled us to study the DP risk associated with different socioeconomic backgrounds and hospital districts. To study the connections between MHS and mental disorder DP, we used regional outpatient and inpatient data provided by the national registers and detailed data on the MHS provision in seven hospital districts analysed using the DESDE-LTC-tool. We also applied the Gini-Simpson Diversity Index (GSDI) as a novel way to measure service diversity. The association of social and regional determinants, and of MHS utilisation factors, with mental disorder DP risk was studied with regression analyses. This study also performed a broad standard assessment and comparison between the MHS patterns of Finland's three most populous hospital districts in order to further

study the possible underlying factors concerning discovered mood disorder DP risk differences.

The present dissertation discovered significant differences in mental disorder DP risk regarding the social and regional determinants of mental health. The high risk of people with low educational and income levels, as well as of white-collar workers and students, for mental and mood disorder DP was highlighted. The revealed regional variation in DP risk was not explained solely by the districts' sociodemographic and -economic differences, pointing towards the role of service system characteristics in explaining these differences.

The analysis of the DESDE-LTC data on MHS provision implied that greater richness and diversity of MHS, especially in outpatient and community-based settings, is associated with lower DP risk and may thus be an indicator of a well-developed and balanced, high-quality service system that is more effective in preventing mood disorder DP and meeting the different needs of the population. Our findings also point to the role of sufficient resourcing in all MHS and outpatient services, so that the essential services can provide adequate psychosocial treatment responding to individual and populational needs.

The findings reported in this dissertation contribute to our understanding of the factors and mechanisms at different levels of mental health ecosystems affecting meso- and macro-level early retirement due to mental disorders. In the ongoing health and social service structure reform and the work to implement the Finnish Mental Health Strategy 2020–2030, both the need to consider the local context and local needs, as well as national cooperation and joint service development, must be seen as vital in order to avoid past mistakes of creating fragmented services and to ensure equal, broad, high-quality services that meet the needs of the population.

TIIVISTELMÄ

Mielenterveyden häiriöt (mt-häiriöt) ovat yksi maailman yleisimmistä ja toimintakykyä merkittävästi laskevista terveysongelmista, jotka aiheuttavat huomattavaa inhimillistä kärsimystä ja merkittäviä taloudellisia kustannuksia. Suomessa mielenterveyden ja käyttäytymisen häiriöt ovat laajin diagnostinen ryhmä, jonka perusteella maksetaan työkyvyttömyystukea. Aiemmat tutkimukset ovat havainneet merkittäviä sosiaalisia ja alueellisia eroja mt-häiriöiden perusteella myönnetyissä työkyvyttömyyseläkkeissä, mutta järjestelmällisempää tutkimusta tarvitaan näiden eroavaisuuksien ymmärtämiseksi. Lisäksi mielenterveyspalvelujen roolista ja mahdollisuuksista mt-häiriöistä johtuvien työkyvyttömyyseläkkeiden ehkäisyssä ei ole juurikaan olemassa tutkimustietoa, eikä asiantuntijoiden ja muiden sidosryhmien kesken ole yksimielisyyttä palvelujen tarjoamisen parhaista käytännöistä varhaiseläköitymisen ehkäisemiseksi eri ympäristöissä.

Tämän väitöskirjan tavoitteena oli tutkia perusteellisesti mt-häiriöperusteiseen työkyvyttömyyseläköitymiseen vaikuttavia erilaisia riskitekijöitä ja dynamiikkoja, lähtien makrotason sosiodemografisista ja sosioekonomisista tekijöistä kontekstuaalisiin alueellisiin yhteyksiin. Nämä taustatekijät ja kontekstit huomioituaan tämän väitöskirjan jatkotavoitteena oli tunnistaa ja kuvata mielenterveyspalvelujen ja mt-häiriöperusteisen työkyvyttömyyseläköitymisen välisiä yhteyksiä hyödyntäen tutkimuksen viitekehyksenä Mielenterveyden Ekosysteemit-lähestymistapaa. Tämä väitöskirja on osa RETIRE-tutkimusprojektia, jonka tavoitteena on tutkia mt-häiriöperusteisen työkyvyttömyyseläkkeen riskitekijöitä ja seuraamuksia sekä analysoida palvelujärjestelmien toimivuutta eri sairaanhoitopiireissä Suomessa.

Tämä väitöskirja hyödyntää valtakunnallisten rekisteriaineistojen tietoja kaikista Suomessa vuosina 2010-2015 myönnetyistä työkyvyttömyyseläkkeistä, jotka oli myönnetty ensimmäistä kertaa ja ensisijaisesti mielenterveyden häiriön diagnoosin perusteella. Työkyvyttömyyseläköityneiden tutkimushenkilöiden lisäksi tutkittaville poimittiin kontrollihenkilöt rekistereistä. Tämä aineisto mahdollisti erilaisiin sosioekonomisiin taustoihin ja sairaanhoitopiireihin liittyvän eläköitymisriskin tutkimisin. Mt-palvelujen ja mt-häiriöiden perusteella myönnettyjen työkyvyttömyyseläkkeiden välisten yhteyksien tutkimiseen hyödynsimme lisäksi

valtakunnallisten rekisterien alueellisia avo- ja sairaalahoitotietoja, sekä DESDE-LTC-työkalulla yksityiskohtaisesti analysoitua mt-palveluiden järjestämisen aineistoa seitsemän sairaanhoitopiirin alueelta. Tässä väitöskirjassa hyödynnetään myös Gini-Simpsonin diversiteetti-indeksiä uutena tapana mitata mt-palveluiden monimuotoisuutta. Sosiaalisten ja alueellisten tekijöiden sekä mt-palveluiden käytön yhteyttä mt-häiriöperusteiseen työkyvyttömyyseläköitymisriskiin tutkittiin regressioanalyysien avulla. Tässä tutkimuksessa toteutettiin myös laaja standardoitu arviointi ja vertailu Suomen kolmen väkirikkaimman sairaanhoitopiirin mt-palveluiden järjestämisen mallin välillä, jonka avulla pyrittiin tunnistamaan ja arvioimaan löydettyjen alueellisten mielialahäiriöperusteisten eläköitymiserojen taustalla olevia tekijöitä.

Tässä väitöskirjassa havaittiin merkittäviä sosiaalisia ja alueellisia eroja mt-häiriöiden perusteella myönnetyissä työkyvyttömyyseläköitymisen riskeissä. Tuloksissa korostuivat matalan koulutus- ja tulotason sekä toimihenkilöiden ja opiskelijoiden suuri riski varhaiseläköitymiseen mielenterveyden- ja mielialahäiriöiden perusteella. Alueiden sosiodemografiset ja sosioekonomiset erot eivät riittäneet selittämään alueellisia eroja eläköitymisessä, joka viittaa palvelujärjestelmän piirteiden rooliin näiden erojen taustalla.

Mt-palvelujen järjestämistä koskevan DESDE-LTC-aineiston analysointi antoi viitteitä mt-palvelujen laajemman tarjonnan ja monimuotoisuuden yhteydestä matalampaan eläköitymisriskiin, erityisesti avohoidossa ja paikallisissa palveluissa. Laaja palvelutarjonta ja monimuotoisuus voivat siten olla merkki hyvin kehittyneestä, tasapainoisesta ja laadukkaasta palvelujärjestelmästä, joka tehokkaammin onnistuu ehkäisemään mielialahäiriöstä johtuvaa työkyvyttömyyseläköitymistä ja vastaamaan väestön erilaisiin tarpeisiin. Löydöksemme viittaavat myös riittävän resursoinnin tarpeeseen mt- ja avohoitopalveluissa, jotta keskeiset palvelut kykenevät tarjoamaan riittävää ja tarpeenmukaista psykososiaalista hoitoa vastatakseen yksilöiden ja väestön tarpeisiin.

Tässä väitöskirjassa esitetyt havainnot tuottavat lisäarvoa ymmärrykseemme mielenterveysekosysteemien eri tasojen tekijöistä ja mekanismeista, jotka ovat yhteydessä mt-häiriöperusteiseen varhaiseläköitymiseen. Käynnissä olevassa Suomen terveys- ja sosiaalipalvelurakenneuudistuksessa sekä Mielenterveysstrategian 2020–2030 toimeenpanotyössä tulisi olennaisena huomioida sekä paikallisen kontekstin ja paikallisen väestön tarpeet palvelujentarjonnassa, että valtakunnallinen yhteistyö ja yhteinen palvelukehitys. Näin voimme välttää aiemmat virheet, jotka ovat alueellisesti luoneet hajanaisia palveluita, sekä varmistamme kaikille tasa-arvoiset, laajat, korkealaatuiset ja väestön tarpeita vastaavat palvelut.

CONTENTS

List of Figures

List of Tables

ABBREVIATIONS

BSIC	Basic Stable Input of Care
CI	Confidence Interval
DESDE-LTC	DEscription and Evaluation of Services and DirectoriEs for Long Term Care
DP	Disability Pension
DSM-5	The Diagnostic and Statistical Manual of Mental Disorders, 5th edition
EU	European Union
ESDS	The European Socio-Demographic Schedule
ESMS	European Service Mapping Schedule
ESMS-R	European Service Mapping Schedule-Revised
FTE	Full-time Equivalents
GDP	Gross Domestic Product
GSDI	Gini-Simpson Diversity Index
HUS	Hospital District of Helsinki and Uusimaa
ICD-10	International Statistical Classification of Diseases and Related Health Problems, 10th Revision
IRR	Incidence Rate Ratio
LTSA	Long-term Sickness Absence
MHS	Mental Health Services
MTC	Main Types of Care
OECD	Organisation for Economic Co-operation and Development
OR	Odds Ratio
REFINEMENT	Research on Financing Systems' Effect on the Quality of Mental Health Care in Europe
RTW	Return to Work
SD	Standard Deviation
SES	Socioeconomic Status
THL	Finnish Institute for Health and Welfare
WHO	World Health Organization

ORIGINAL PUBLICATIONS

Publication I	Karolaakso, T., Autio, R., Näppilä, T., Nurmela, K., & Pirkola, S. (2020). Socioeconomic factors in disability retirement due to mental disorders in Finland. *European Journal of Public Health, 30*(6), 1218–1224. https://doi.org/10.1093/eurpub/ckaa132
Publication II	Karolaakso, T., Autio, R., Näppilä, T., Leppänen, H., Rissanen, P., Tuomisto, M. T., Karvonen, S., & Pirkola, S. (2021). Contextual and mental health service factors in mental disorder-based disability pensioning in Finland - a regional comparison. *BMC Health Services Research, 21*(1), 1081–1081. https://doi.org/10.1186/s12913-021-07099-4
Publication III	Karolaakso, T., Autio, R., Suontausta, P., Leppänen, H., Rissanen, P., Näppilä, T., Tuomisto, M. T., & Pirkola, S. (2023). Mental health service diversity and work disability: associations of mental health service system characteristics and mood disorder disability pensioning in Finland. *Social Psychiatry and Psychiatric Epidemiology,* 1-12. https://doi.org/10.1007/s00127-023-02481-5
Publication IV	Karolaakso, T., Autio, R., Suontausta, P., Leppänen, H., Suokas, K., Rissanen, P., Tuomisto, M. T., & Pirkola, S. (2023). Patterns of mental health services and mood disorder disability pensions: a standard comparison of Finland's three largest hospital districts. *BMC Psychiatry, 23*(1), 1–828. https://doi.org/10.1186/s12888-023-05342-2

1 INTRODUCTION

Mental disorders are one of the most common and disabling health conditions worldwide. In the EU, approximately 38.2% of the population has a mental or neurological disorder any given year, with no significant differences in the prevalence between countries (Wittchen et al., 2011). The economic burden of mental health problems is considerable. Direct and indirect costs in the EU are estimated by the OECD at around 4.1% of gross domestic product (GDP), meaning more than 600 billion euros annually (OECD/EU, 2018). For Finland, this has been estimated to be relatively even higher, the annual total costs being around 5.3% of GPD (11.1 billion euros). In addition, these high cost estimates still do not consider, for example, the interconnected social effects that especially severe mental disorders may exert on individuals within their immediate social networks, thus increasing the ultimate economic and health consequences. One undesired and unfortunate mental disorder outcome for an individual and for society in general is the loss of working ability for a prolonged period, resulting in a disability pension (DP). The association of mental health and work disability has long been a subject of high research interest, and recently it has also gained wide coverage in the public debate.

There is a range of factors and different levels of individual and social elements affecting DPs and loss of working ability due to mental disorders. Population-level occupational structure and working life itself have both undergone significant changes during the last decades. Nowadays, at the beginning of the 21st century, most of the population works in the service sector and in expert occupations, in contrast to the 20th century, when the majority worked in the primary sector and in agriculture. Changes in working life have included elevated competency and education requirements; demand for resilience in the face of rapid change, uncertainty and complex environments; ability to manage and prioritise one's own work; higher need for creative, cognitive, and social skills as well as continuous occupational learning and development requirements (Kokkinen, 2020; Vorma et al., 2020). These have the potential to create dangerously stress-inducing work environments in which the well-being and health of an individual or a group start to

decrease, contributing to a heightened risk of developing a diagnosable mental disorder and gradual loss of working ability.

There are also previously reported sociodemographic, socioeconomic, and regional differences in DP due to mental disorders (Ervasti et al., 2013; Gustafsson et al., 2014; Laaksonen & Gould, 2013), but their nature and role in the DP process require more detailed research. More importantly, research lacks information concerning the role of mental health services (MHS) in preventing DPs. In order to understand the effects of MHS, it is necessary to consider the context in which they operate. A new research approach called Mental Health Ecosystems has gained increasing attention and interest to enable this. It is a whole systems approach to allow the study of complex local and regional health systems (Furst et al., 2019; Rosen & Salvador-Carulla, 2022). It provides a framework for analysing the different components of mental health systems, their socioeconomic and demographic context, and enables identification of the different patterns of care (Furst et al., 2023).

Against this background, this dissertation and the RETIRE – research project were born (Pirkola et al., 2020). RETIRE has aimed to study the risk factors and pathways to mental disorder-based disability pensioning. The overarching aim of this dissertation was to investigate the factors related to loss of working ability using comprehensive register data on Finnish mental disorder DPs between 2010 and 2015. The dissertation first studies the social and regional determinants of mental health, then applies the Mental Health Ecosystems approach, utilising it to investigate the role of MHS in municipalities and hospital districts. Combined with the social and regional determinants, this allows a whole system framework for understanding DP risk differences. Throughout this dissertation, "Mental Health Ecosystems" with capitalised letters will refer to the applied research approach, while mental health ecosystems with small initials will refer to individual health ecosystems.

The ultimate goal of this dissertation is to help improve the lives of people on the verge of potential DP due to mental health problems. We hope this research will succeed in increasing insight into the complex phenomena affecting the relationship between mental health, work disability and the mental health ecosystem of the population. We also hope that the work reported will help healthcare professionals, policy makers and stakeholders identify relevant points of influence to create effective change in populational DP risks.

2 REVIEW OF THE LITERATURE

2.1 Mental health

Mental health is a complex concept, defying any simple description that would include all individual meanings and experiences. According to the classic definition of the World Health Organization (WHO), (good) mental health is a state of well-being in which the individual realises their abilities, can cope with the everyday stresses of life, can work productively and fruitfully, and can contribute to their community (World Health Organization, 2021). Similarly, the national Finnish Mental Health Strategy 2020-2030 characterises mental health as an integral part of overall well-being and health, as well as the essential foundation of psychosocial functioning that should not be understood as mere absence of disease or disorder (Vorma et al., 2020). Mental health should be understood not as a static state but as a dynamic internal equilibrium which enables people to use their abilities in harmony with the values of their society throughout their life course (Galderisi et al., 2015; Vorma et al., 2020). Many other aspects of well-being and psychosocial functioning can be seen to be central to mental health: the ability to create and maintain social relationships and function in social roles; the ability to participate in and perform meaningful activities; having a general feeling that life has a purpose and significance; the ability to experience self-confidence; cognitive skills relevant to decision making and problem-solving; resilience to recover after adversities; and the ability to recognise, express and modulate one's own emotions, as well as empathize with others (Fusar-Poli et al., 2020; Galderisi et al., 2015; Vorma et al., 2020).

An individual's mental health does not exist in a void but is shaped and influenced by the highly complex world we all inhabit. Different interrelated levels of influencing factors exist, both spatial and temporal, from which individual and populational mental health emerges. At the individual level, factors associated with mental health include biological (for example, genetic hereditary traits and biological disorders), psychological (such as maladaptive beliefs and rumination), and social factors (interaction and dynamics between oneself, family and close social networks) (Bolton & Gillett, 2019; Engel, 1977). An individual's family situation can be an essential factor associated with mental health. In Finland, people living alone and

unmarried have been shown to have more psychiatric symptoms and disorders than those who are cohabiting (Joutsenniemi et al., 2006; Markkula et al., 2015; Pirkola et al., 2005).

The individual's biopsychosocial totality takes place and develops in the context of their own life course with different life events, which in turn affect the probability of what subsequent life events occur and how the individual reacts to them (Paananen et al., 2013; World Health Organization & Calouste Gulbenkian Foundation, 2014). This can accumulate positive or negative effects on the individual's mental health and overall well-being. On the populational level, determinants of mental health also include cultural, political, economic and environmental factors, for example, national policies, working conditions, social protection, living conditions and community social support (World Health Organization, 2021).

2.1.1 Mental disorders

One way to operationalise problems with mental health is through the concept of mental and behavioural disorders. The most widely used diagnostic manuals focusing on psychiatric nosology are the International Classification of Diseases (most recent version ICD-11) and the DSM (DSM-5) (American Psychiatric Association, 2013; World Health Organization, 2016). ICD and DSM aim to provide models of aetiology and reliable diagnostic constructs for mental disorders. Thus mental disorders can be defined diagnostically as a range of conditions characterised by alterations in thinking, mood, and behaviour, that cause distress, impairment of functioning and at worst significant suffering, disability and death (American Psychiatric Association, 2013; Stein et al., 2022; World Health Organization, 2016). Mental disorders include, for example, depressive and anxiety disorders, psychotic disorders, drug dependence and disorders of personality, development and behaviour (Wittchen et al., 2011). They are by no means a homogenous group but highly heterogenic, with different severities and effects on cognition, affect and behaviour that can vary significantly even between individuals with the same diagnosis. Different diagnostic groups comprise common mental disorders, including mood- and anxiety disorders and severe mental illnesses, including schizophrenia and bipolar disorder (World Health Organization & Calouste Gulbenkian Foundation, 2014).

The diagnosis systems for mental disorders have made extensive global and national epidemiologic research possible for determining the prevalence and incidence of mental health problems and enabled significant advances in developing evidence-based treatments for various conditions (Kessler et al., 2005; Stein et al., 2022). However, they have also received considerable critique from for example, ignoring relevant contextual issues surrounding individual mental health problems and for the lack of scientific validity for psychiatric diagnoses as latent disease processes (Bergström, 2023; Hayes & Hofmann, 2021; Stein et al., 2022).

2.2 Working ability and disability

Mental health is widely recognised as being closely connected to work and working ability, as witnessed by WHO's and many other attempts to define mental health (Vorma et al., 2020; World Health Organization, 2021). Mental health plays a crucial role in an individual's ability to work effectively. In Finland, mental and behavioural disorders have been one of the most extensive diagnostic groups for which people have entered early disability retirement in recent years. In 2022, approximately 99 600 persons were on DP for mental disorders, accounting for 55% of all Finnish DPs and 2.9% of the Finnish population aged 16-64 (Finnish Centre for Pensions, 2023). The Finnish mental disorder DPs consist mainly of depression and other mood disorders (F30-39) as the leading cause for early retirement, with approximately ten Finns receiving a new DP due to depression per day (Finnish Centre for Pensions, 2021). In other Nordic countries, one Norwegian study found that DPs for mental disorders were responsible for the most working years lost (33.8%) compared to other diagnostic groups (Knudsen et al., 2012). A recent Danish study also reported that approximately 7.87 working years are lost for those with mood disorders compared to the general population (Plana-Ripoll et al., 2023). In OECD countries, there is evidence that mood disorders are the fastest-growing cause of disability among all mental health disorders, especially among young people (OECD, 2022).

In the Finnish DP scheme, when a person's working ability is decreased by a physical or mental condition at ages between 16 and 64, they may be entitled to a DP (Ministry of Social Affairs and Health, 2013). The applicant is generally required to have had reduced working ability and sickness allowance for 300 days before applying for DP. Medical insurance specialists then evaluate the application. The evaluation process is centralized nationally. The DP may be granted either

indefinitely or temporarily for a set period. Generally, in the case of mental disorders, DP is first granted as temporary DP with appropriate medical treatment and a rehabilitation plan (Mattila-Holappa, Joensuu, Ahola, Koskinen, et al., 2016), when return to work (RTW) is anticipated after suitable treatment and rehabilitation. Temporary DP is also known as a rehabilitation allowance.

Previous research has identified several factors influencing and moderating a person's likelihood of RTW after an absence from work and long-term sickness absence (LTSA) compared to entering a DP (Blank et al., 2008; de Vries et al., 2018). Crucial predictors for RTW are the diagnostic category of the mental disorder, as well as its severity, duration, recurrence and comorbidity, with people suffering from common, mild to moderate mental disorders with a more recent onset being more likely to RTW. (Blank et al., 2008; de Vries et al., 2018; Dewa et al., 2002; Gjesdal et al., 2008; Hees et al., 2012; Hjarsbech et al., 2011; Nielsen et al., 2012).

Work-related barriers to RTW have been identified to include inadequate possibilities for work content- and context adjustments, poor relationships and a lack of support from colleagues and supervisors, inadequate occupational health guidance as well as personal maladaptive coping behaviours in the context of work (de Vries et al., 2018; Joosen et al., 2022; Nieuwenhuijsen et al., 2004). Self-reported job strain and effort-reward imbalance in the workplace have also been reported to be associated with DP due to depressive disorders (Juvani, 2018). With the changes in working life during the 21st century, non-manual occupations commonly have high psychosocial demands and other requirements from the individual and from the population (Kokkinen, 2020; Vorma et al., 2020). Thus, the work context, possible adjustments to the individual's prevailing working ability and communal support can be seen as crucial in preventing further decrease and, ultimately, the complete loss of the individual's working ability.

Research regarding psychological factors and RTW vs. DP is scarce, but there is evidence of low emotion regulation and low cognitive skills associated with a higher risk of mental disorder DP (Upmark et al., 1999), as well as positive expectations concerning sick leave duration or returning to work associated with a higher rate of RTW (de Vries et al., 2018). Furthermore, insufficient treatment of mental disorders during LTSA has been indicated to have adverse effects on working ability and working life engagement (Cornelius et al., 2014). By contrast, an adequate and comprehensive treatment and rehabilitation plan after work disability due to a mental disorder predicts positive employment outcomes (Mattila-Holappa, Joensuu, Ahola, Koskinen, et al., 2016).

Regarding sociodemographic factors, older age predicts lower RTW before DP (Cornelius et al., 2014; de Vries et al., 2018; Mattila-Holappa et al., 2017). Some suggested reasons for this have been: that older employees might be granted DP more easily than younger employees; the accumulation of problems and recurrent disability episodes taxing personal resources over the life course and resulting in lower self-efficacy; as well as insufficient personal resources for seeking a new occupation through vocational training (Mattila-Holappa et al., 2017). Regarding gender, women have been found to have a higher rate of LTSA for mental disorders, especially depression, but men have a higher risk of DP and a lower RTW rate (Blank et al., 2008; Cornelius et al., 2014; Gjesdal et al., 2008; Karlsson et al., 2008). Suggested explanations for this include a higher threshold among men for help-seeking, higher risk of alcohol abuse and greater severity of mental disorders among men on LTSA (Gjesdal et al., 2008; Karlsson et al., 2008).

2.3 Socioeconomic status

Socioeconomic status (SES) can be seen as a multidimensional construct reflecting a person's living and working conditions as well as material, psychological and social resources, which guide peoples' choices and behaviours contributing to their social, environmental and behavioural risks and stress (Compton & Shim, 2015). Previous research has acknowledged low SES and social/income inequality as central epidemiological risk factors for mental disorders (Compton & Shim, 2015; Fryers et al., 2003; Hakulinen et al., 2023; Linder et al., 2019; Lorant et al., 2003; A. Macintyre et al., 2018; Patel et al., 2018; Pickett & Wilkinson, 2010; Pirkola et al., 2005; Pulkki-Råback et al., 2012; World Health Organization & Calouste Gulbenkian Foundation, 2014). SES can be defined with one or several factors, the most common in previous research being education, occupation and income (Leinonen et al., 2012). However, the use of different SES factors varies between studies and they have seldom been examined and compared in the same study (Hakulinen et al., 2023).

Low SES consequently also predicts a greater risk of mental disorder DP. Studies have found a link between low occupational status (Ervasti et al., 2013; Halonen et al., 2017; Samuelsson et al., 2012; Virtanen et al., 2011), unemployment (Hultin et al., 2012; Lamberg et al., 2010), low education (Ahola et al., 2011; Ervasti et al., 2013; Mattila-Holappa, Joensuu, Ahola, Vahtera, et al., 2016), low income (Gustafsson et al., 2014) and increased risk of DP. A study by Leinonen et al. (2011) interestingly reported a non-linear association between occupational status and mental disorder

DP, whereas the association was linear in the case of musculoskeletal diseases and all reasons for DP. The study reported semi-professionals and routine white-collar employees as having a higher risk of mental disorder DP than managers, professionals and blue-collar workers. This may imply that the relationship between occupational status and DP may differ compared to the other SES factors.

SES factors after LTSA contributing to a higher risk of DP also include lower occupational status, education, income and financial problems, as well as poorer employment history and attachment to working life (Brown et al., 2009; Ervasti et al., 2013, 2014; Gjesdal et al., 2008; Mattila-Holappa, Joensuu, Ahola, Vahtera, et al., 2016; Pirkola et al., 2020; Pulkki-Råback et al., 2012; Virtanen et al., 2011). However, research findings differ in the strength of the association (de Vries et al., 2018; Nielsen et al., 2012). Higher SES has been commonly associated with a lower risk of DP due to mental disorders, RTW and lower rates of recurrent disability episodes (Ervasti et al., 2013; Virtanen et al., 2011). However, some studies have reported upper white-collar workers as having a relatively higher risk of mental disorder LTSA and DP than blue-collar workers (Hämmig & Bauer, 2013; Salonen et al., 2018, 2020). This may be connected to white-collar workers often having more psychosocially demanding work, which might be more challenging to return to after experiencing sickness absence for mental health problems.

The effects of different SES factors on health and DP are connected and mediated by the other SES factors; for example, a person's income is mediated by their educational level and occupational status (Lahelma et al., 2004; Leinonen et al., 2012). In Finland, prior research has suggested that income level and personal economic difficulties may have a stronger association with mental disorders than education or occupational status (Lahelma et al., 2006; Pulkki-Råback et al., 2012). All in all, several of the SES factors should be considered simultaneously when studying the effects of SES, because they are ultimately only partly independent or interdependent determinants of health and cannot be directly substituted with one another (Geyer et al., 2006; Hakulinen et al., 2023; Laaksonen & Silventoinen, 2011; Lahelma et al., 2004).

2.3.1 Theoretical frameworks for the association between SES and mental health

Several theories exist to explain the association between SES and health/mental health. This association has been widely acknowledged as complex and bidirectional

(Hakulinen et al., 2023). Thus, the following hypotheses are not mutually exclusive, but several mechanisms are probably working on the populational and individual levels.

The most prevalent theories explaining individual SES and mental health differences are the social causation and social selection hypotheses (Dohrenwend et al., 1992; Hakulinen et al., 2023; Melchior et al., 2013; Miech et al., 1999). Social causation suggests that a higher prevalence of mental disorders results from lower SES, as people in lower SES positions have a greater likelihood of experiencing different adversities, have more insufficient material resources and higher economic uncertainty and psychosocial stress. The social selection hypothesis assumes that the already healthier individuals are able to achieve higher SES status and the less healthy or disabled drift down towards lower SES, unable to achieve higher educational, occupational or income levels because of prior health or mental health problems (Dohrenwend et al., 1992; Hakulinen et al., 2023). This is moderated by intergenerational and intragenerational sorting processes and the likelihood of experiencing early life adversities.

The materialist hypothesis suggests that income level enables greater access to certain services and resources, which affects the likelihood of exposure to physical and psychosocial risk factors (Øversveen et al., 2017). Furthermore, the neo-material hypothesis, aiming to explain the mechanism on national and regional levels, suggests that greater income inequality leads to poorer mental health outcomes through a broader range of material deprivation relevant directly or indirectly to well-being. Greater income inequality thus results in less public spending and general investments in the accessibility of health care, education, housing, public transport, pollution control and healthy food availability (Patel et al., 2018). Studies have indicated a higher prevalence of mental disorders in countries with higher SES differences, demonstrating greater risk in populations with higher income inequality than in populations with lower inequality (Patel et al., 2018; Pickett & Wilkinson, 2010).

The cultural-behavioural hypothesis suggests that health and mental health differences are due to health behaviour differences. Certain unhealthy health behaviours may be more common or socially acceptable in lower SES: alcohol and drug consumption, smoking, dietary intake, low exercise levels, risky sexual behaviour, and high/low health service usage (Øversveen et al., 2017). This also connects to the inverse care hypothesis suggesting that although there is a higher prevalence of disorders in the lower SES groups, treatment rates tend to be lower,

and there is thus a mismatch of treatment need and treatment provision (Ervasti et al., 2013; Hart, 1971).

In addition, some more complex models for SES and health/mental health connections exist. Patel et al. (2018) proposed an ecological framework to conceptualize the mechanisms operating at the individual, neighbourhood and national levels. At the individual level, the aforementioned social causation/selection pathways are presumably at play, where the effects of income inequality on health are likely to be mediated through psychological stress (Patel et al., 2018; Pickett & Wilkinson, 2010). At the neighbourhood level, two main mechanisms are suggested: the social comparison hypothesis argues that comparing oneself to those in higher SES in a highly unequal setting creates feelings of social defeat or status anxiety and the social capital hypothesis suggests that the society's social capital, including social trust and organisational structures facilitating social integration, is eroded by high income inequality. On the national level, the previously mentioned neo-material hypothesis is mainly proposed as a mechanism for maintaining the association between SES and health.

WHO has promoted a life-course approach framework to understand the social gradient in mental health (World Health Organization & Calouste Gulbenkian Foundation, 2014). The life-course approach combines aspects from several theories allowing different mechanisms and processes of causality, structure and agency. It recognises health inequality ultimately as the accumulation of biopsychosocial advantages and disadvantages over time, where prior disadvantages create more likelihood for further social, environmental and behavioural risks (Compton & Shim, 2015; Øversveen et al., 2017; World Health Organization & Calouste Gulbenkian Foundation, 2014).

Other prominent attempts to assert sociological theories explaining the association between SES and health include the Fundamental Cause Theory and Giddens' Structuration theory (Øversveen et al., 2017). Fundamental Cause Theory suggests that social factors such as SES and social support are probably real causes of health inequalities as meta-mechanisms. They represent access to central resources, affect multiple health and disorder outcomes through various mechanisms and processes, and consequently sustain a connection with health and disorders even when the underlying mechanisms change (Link & Phelan, 1995). Thus, health inequalities at the societal level persist despite public health improvement. According to this theory, individually based risk factors should be contextualized, by considering "what puts people at risk of risks", to improve society's health as a whole and successfully implement different levels of health interventions.

Giddens' Structuration theory, in turn, states that through the continuing structure in people's daily social practices, social structures act as both the medium and the outcome of human agency. This results in human agency reproducing the social systems they participate in, and in the structural order itself (Giddens, 1984). Agency and structure are thus mutually interdependent processes, reproducing and transforming social life dialectically, with neither having causal primacy. The vital aspect is how people's habits and behaviours produce and reproduce the environments and structures in which they live and work and how these practices are embedded in nested social systems of different size and complexity (Giddens, 1984; Øversveen et al., 2017).

2.4 Regional determinants and differences

In addition to individual-level biopsychosocial, sociodemographic and socioeconomic factors, the characteristics of our living environment and the surrounding population are also associated with our health and working ability (Macintyre et al., 2002). One way to conceptualise and operationalise these regional determinants (so-called "place effects") is through compositional, contextual and collective factors (Bratberg et al., 2009; Diez-Roux, 2000; S. Macintyre et al., 2002):

i) compositional factors are the characteristics of the individuals comprising the local population. These include the variation in age, gender, ethnicity, socioeconomic-, educational and occupational level, and marital and family status, among others.

ii) contextual factors refer to geographical, environmental and economic conditions that create the opportunity structures in the local physical and social environment. These include, for example, regional economic prosperity, industrial structure and access to resources.

iii) collective factors are a third group of determinants proposed by Macintyre et al. (2002). They include the cultural, social, and historical influences that affect the behaviours and lives of the individuals in the population. These include the sociocultural and historical features of communities, minority groups, social norms (including intergenerational practices and beliefs), traditions, values, interests, and societal policies. In many conceptualisations, however, collective factors are integrated with contextual factors.

These place effects can significantly impact the behaviour and health outcomes of individuals, from which the geographical variation in health emerges in a complex, dynamic manner. Thus, these different factors are a point of interest for research in themselves and must be considered when studying mental health outcomes such as DPs (Furst et al., 2020; S. Macintyre et al., 2002).

Significant regional differences have previously been reported in many Western countries regarding sickness absence and DPs due to mental disorders (Andersson, Nyman, et al., 2006; Andersson, Wiles, et al., 2006; Cattrell et al., 2011; Hensing et al., 2006; Samuelsson et al., 2012). Previous research has suggested local area unemployment and socioeconomic gradient as critical contextual factors affecting DP rates for all reasons (Agovino & Parodi, 2015; Krokstad et al., 2004; Murray et al., 2016; Reime & Claussen, 2013). However, compositional factors have been suggested to contribute more to mental disorder sickness absence and DP rates than contextual factors (Bratberg et al., 2009; Laaksonen & Gould, 2014). Then again, it is important to note that the distinction between "compositional" and "contextual" may be more apparent than real, because the properties of individuals or households used in conceptual and statistical models are themselves shaped by the characteristics of the locality used in the same models (Macintyre et al., 2002).

Studies concerning regional differences in Nordic countries have found associations between mental disorder DP rates and urban/rural environments (Andersson, Nyman, et al., 2006; Andersson, Wiles, et al., 2006). The effects of social fragmentation, migration, unemployment, and alcohol dependence on DP rates in different geographical settings have been suggested as possible explanations. In one Swedish study, higher population density was associated with an overall increased risk of psychosis and mood disorders (Sundquist et al., 2004). A recent Finnish study supported a higher prevalence of psychotic disorders in urban environments even after adjusting for socioeconomic and sociodemographic factors (Suokas et al., 2023).

Finland has greater sociodemographic and socioeconomic differences between larger regions than between smaller residential neighbourhoods (Kestilä et al., 2019; Laaksonen & Silventoinen, 2011). Distances are also long both within and between regions. There are well-documented regional differences in health, and prior research in Finland has identified that geographical differences in sociodemographic and -economic structure are associated with differences in regional health, health behaviour and mortality (Blomgren et al., 2004; Hyyppä & Mäki, 2001; Kauppinen & Karvonen, 2009; Kestilä et al., 2019; Pirkola et al., 2009). The more disadvantaged regions have poorer health outcomes, lower population density, longer distances

between population centres, older average age, and lower socioeconomic population distribution. These regions are mainly located in the eastern and northern parts of the country. The capital area, the southern regions by the Archipelago Sea and the historical Tavastia region, as well as the western region of Ostrobothnia, have traditionally had better health outcomes, higher population density and an overall higher socioeconomic distribution (Blomgren et al., 2019; Kauppinen & Karvonen, 2009; Kestilä et al., 2019; Laaksonen & Gould, 2013; Perälä et al., 2008). Furthermore, the southern and western regions have a higher proportion of the Swedish-speaking minority, which is also associated with better health outcomes and lower DP and mortality rates (Sipilä & Martikainen, 2009). This health inequality has been explained by collective factors and cultural differences, including a higher social capital in the Swedish-speaking minority (Hyyppä & Mäki, 2001; Laaksonen & Gould, 2013).

Despite the differences in overall health, however, no significant regional variation has been reported in mental disorder and mood disorder prevalence in Finland (Markkula et al., 2015; Pirkola et al., 2005). In the case of psychotic disorders, their prevalence has been previously reported to follow the traditional east-north – south-west differences (Haukka et al., 2001; Perälä et al., 2008). However, a recent Finnish study found that after adjusting for socioeconomic and sociodemographic factors using comprehensive register data on both primary and secondary care on the whole population, the distribution of psychotic disorder and schizophrenia diagnoses no longer followed the previously reported geographical gradient, commonly calculated from inpatient data in previous studies (Suokas et al., 2023).

Regarding mental disorder DPs in Finland, research about their regional variance and contextual factors is scarce. One study found different regional mental disorder DP rates, with mood disorder DPs having a greater regional variance than other mental disorder DPs (Laaksonen & Gould, 2013). In the case of non-affective psychotic disorder DPs, differences in regional DP rates have been reported, which differ from regional differences in the lifetime prevalence of psychotic disorders (Kiviniemi et al., 2011; Perälä et al., 2008). These differences appear not to be explained by the region's contextual factors, including unemployment rate or health care spending.

2.5 Mental health services

MHS and service provision are important in providing timely psychosocial treatment to the population with mental disorders and preventive services to the population at an increased risk of experiencing mental health problems. Access to MHS and rehabilitation, the screening and recognition of mental disorders as well as local treatment practices have all been suggested as possible explanations for the regional variation in mental disorder DP rates (Andersson, Nyman, et al., 2006; Andersson, Wiles, et al., 2006; Kiviniemi et al., 2011). However, one Norwegian study did not find associations between the provision of psychiatric care (represented by the number of staff and availability of beds) and regional differences in mental disorder DP (Andersson et al., 2007). Nevertheless, higher DP rates have been associated with high involuntary treatment rates (Kiviniemi et al., 2011). This may reflect the influence of differences in regional treatment practices, which may be considered a source of regional inequality leaving people living in different regions of Finland in unequal positions. A previous study has also identified that well-developed, high-quality MHS with a wider variety and a higher rate of outpatient and 24-hour emergency services is associated with decreased suicide rates in Finland (Pirkola et al., 2009).

The development of MHS in Finland and worldwide during the past decades has been characterised by specific major trends in the service system: decentralisation and dehospitalisation (Keskimäki et al., 2019; Lahtinen, 2006; Patana, 2014; Thornicroft & Tansella, 2004). The focus of service provision has been shifted from inpatient and hospital treatment to outpatient and local community-based care since the 1980s. As a part of this shift in Finland, the provision of MHS was almost entirely transferred from the central government to municipalities in 1993, which unfortunately coincided with the severe national economic recession of the early 1990s (Patana, 2014; Pirkola et al., 2009). This resulted in unintended municipal divergence in the provision of MHS related to the different economic circumstances of the municipalities, creating regional inequality and disintegration of MHS provision (Ala-Nikkola et al., 2014; Pirkola et al., 2009).

Until 2022, the Finnish municipalities were responsible for organising the public MHS, either alone or together via 21 hospital districts (Keskimäki et al., 2019; Patana, 2014; Pirkola et al., 2009). Some districts had arranged mental health outpatient visits mainly in primary health care and some in psychiatric special health care (Patana, 2014). It is important to note that the hospital districts' geographical size is not directly associated with the population size. Almost one-third of the Finnish

population resides in the capital area, the hospital district of Helsinki and Uusimaa (HUS). Only about one percent of the population lives in the hospital district of East Savo, and the hospital district of Lapland has the largest surface area of all the districts, but only a little over two percent of the Finnish population reside in the region.

Rehabilitative psychotherapy is available for most people within the scope of private services and is publicly reimbursed by the Social Insurance Institution of Finland. There is substantial regional variation in the availability of rehabilitative psychotherapy services, as they are mostly concentrated in the university hospital areas (Linnaranta et al., 2023; Patana, 2014). Prior research has also identified significant SES differences in the use and attendance of rehabilitative psychotherapy, with higher SES associated with more frequent psychotherapy use and longer psychotherapy duration (Leppänen et al., 2022, 2023).

At the beginning of 2023, the national reform of healthcare, social welfare and rescue services shifted public MHS provision from the municipalities to the newly founded wellbeing services counties (Ministry of Social Affairs and Health, 2023). The wellbeing services counties' boundaries follow for the most part the boundaries of the old hospital districts. This transfer in organisational responsibility has the potential to support better coordination and integration of regional MHS provision and system development, as MHS provision faces several challenges in the near future, including population decline, aging, and migration from rural to urban areas. These factors create pressure to deliver adequate services in urban areas while posing a risk of shortage in educated mental health professionals in rural regions.

Public MHS are also crucial in preventing psychiatric DPs, especially for mood disorders, with timely and effective treatment. From the health service system perspective, a DP can be seen as a failure of the MHS to promote a person's mental health or pre-empt and treat manifesting mental health problems. As such, the regional rate of DP recipients can be seen as one outcome indicator for the quality of services and service structure, when other regional factors have been taken into account.

2.5.1 Mental Health Ecosystems Approach

Studying the effects of MHS and outcomes of service provision requires consideration of the local context and place effects of the MHS environment. The Mental Health Ecosystems approach is an emerging discipline which takes a whole-

systems approach to mental healthcare, enabling the analysis of the complex environment and context of mental health systems, and guiding the translation of this information into policy and practice (Furst et al., 2020). This novel and holistic approach can be used to study complex mental health phenomena and service systems by considering them to emerge in natural complex adaptive systems. A mental health ecosystem can be defined to include the totality of the circumstances and complex interactions that relate to a given health phenomenon in a defined environment (Furst et al., 2020; Rosen & Salvador-Carulla, 2022). Mental health ecosystems are subsets of general health systems, that are comprised of relevant features to mental health in four main domains:

i) the places and communities in which we live
ii) the wider determinants of health (for example, the social and demographic characteristics of the environment)
iii) our health behaviours and lifestyles
iv) integrated healthcare provision at the different levels of the ecosystem: nano (patient–professional level), micro (service level), meso (local area level) and macro (regional/country level).

The first three domains are connected and comprised by the place effects of health. The fourth domain also considers the different levels of service provision (Tansella & Thornicroft, 1998). The Mental Health Ecosystems approach moves the field of MHS research away from delivering simplistic solutions to complex challenges (Furst et al., 2020). Considering the context of MHS provision can help researchers and policymakers to understand the different outcomes of identical interventions and service models in different environments.

To study and compare the features of the MHS provision, a standardised description of local care delivery context comparable across different regions and even countries is required. The European Service Mapping Schedule (ESMS) for adult MHS is one such sophisticated standardised classification system. The ESMS has been further developed and adapted for assessing other target groups, such as children, adolescents and ageing populations, as well as people with drug and alcohol problems or disabilities. This expanded version is called "Description and Evaluation of Services and DirectoriEs" (DESDE). It has also been further amended to evaluate chronic or long-term care (DESDE-LTC) (Romero-López-Alberca et al., 2019; Salvador-Carulla et al., 2013). In the original Finnish translation, the DESDE-LTC classification system was also called ESMS-R (Salvador-Carulla et al., 2012). The

DESDE-LTC/ESMS-R classification system provides a standardised taxonomy for describing, classifying and measuring MHS and their resources.

Previously, the DESDE-LTC has been applied to compare the service systems of different countries (Cetrano et al., 2018; Gutiérrez-Colosía R. et al., 2019; Rezvyy et al., 2007; Romero-López-Alberca et al., 2019; Sadeniemi et al., 2018; Salinas-Perez et al., 2020; Salvador-Carulla et al., 2008) and to study the MHS within a single country or smaller regions to support the evidence-informed policy making and development of the MHS (Ala-Nikkola, Sadeniemi, et al., 2016; Dernovšek & Šprah, 2008; Fernandez et al., 2015, 2017; Sadeniemi et al., 2014; Tibaldi et al., 2005). Recently, DESDE-LTC has been used to study the MHS provision in urban and rural contexts (Furst et al., 2023; Salinas-Perez et al., 2023). These studies have found significant variations in care availability and capacity, as well as critical gaps in the care provision across the studied macro- and meso-level geographical areas. This emphasises the importance of continuing MHS research to identify and monitor indicators of high-quality services and provide information for experts, policymakers and stakeholders to help organise MHS for the population's needs and to identify and fill the gaps in MHS provision.

Previous research in Finland with DESDE-LTC data has identified that the number of different types of MHS (as different service classes, service richness) is positively associated with catchment area population size, which explains up to 84% of the service variation (Ala-Nikkola et al., 2014; Ala-Nikkola, Sadeniemi, et al., 2016). Furthermore, the studies on outpatient and inpatient treatment characteristics indicate at least partly regionally fragmented MHS (Ala-Nikkola, Pirkola, et al., 2016; Sadeniemi et al., 2014). However, the current research literature needs more information on the associations of the features of MHS provision and structure with the risk of mental disorder DP in different regional contexts. Previous studies have also focused on MHS richness while naming it service diversity, without implementing statistical diversity indices regularly used in other similar fields of study. With a more profound understanding of these associations and service diversity, regional MHS provision could be developed to prevent mental disorder-based disability more efficiently.

3 AIMS OF THE STUDY

The current mental health policies have guided MHS system development, focusing on outpatient care and community-based care over hospital-focused care systems (Keskimäki et al., 2019; Thornicroft et al., 2008; Vorma et al., 2020; World Health Organization, 2021). However, there is no consensus among experts and stakeholders on the best practice of MHS provision on a system level in different contexts (local health area as the meso-level of service organisation) (Rock & Cross, 2020; Rosen et al., 2020). Research literature still lacks information linking MHS characteristics to indicators of service-level effectiveness, for example on the risk of regional DP for mental disorders.

The overarching aim of this dissertation was to study the different risk factors and dynamics affecting mental disorder-based DP processes. We begin with the social and regional determinants of mental health, studying DP risk differences related to individual-level sociodemographic and socioeconomic factors as well as to different regional and contextual settings. After considering these factors and the local populational context, this thesis aims to identify and describe the connections between MHS and mental disorder DP, especially in the case of mood disorders, where the role of MHS can be seen as crucial in preventing work disability with effective timely treatment. This dissertation is part of the RETIRE – research project, which aims to study the risk factors and sequences of mental health-based disability pensioning and to analyse the effectiveness of service systems in different hospital districts in Finland (Pirkola et al., 2020).

Study I of this dissertation examines the interconnected effects of SES factors with mental disorder DP on the macro-level, focusing additionally on the two largest diagnostic groups in mental disorder DP in Finland, ICD-10 classifications F30–39 (mood disorders) and F20–29 (non-affective psychotic disorders) (World Health Organization, 2016). To the best of our knowledge, this study was the first to examine the relationship between multiple SES factors and mental disorder DP extensively in a large, high coverage national data set in a case–control setting for risk calculation.

Study II investigates the contextual and MHS utilisation factors together with the regional differences in Finnish hospital districts in all mental disorder DPs and

separately in mood disorder DPs and non-affective psychotic disorder DPs. We hypothesised that the regional factors reflecting socioeconomic deprivation, employment, access to MHS and local treatment practice would be associated with different regional DP risks. In this unique research setting, we studied the effects of regional determinants on mental disorder DP with a wide range of contextual and MHS utilisation factors while controlling for the compositional factors of the population.

After studying the socioeconomic and regional differences in DP, Study III examines the associations between the MHS provision and municipal mood disorder DP risk in 104 municipalities located in seven hospital districts, as well as the differences between these associations in different urbanity-level settings: urban, semi-urban and rural municipalities. We studied the effects of MHS resources, service richness and diversity, outpatient care, and local community-based and centralized services on mood disorder DP, while controlling for the compositional factors of age and gender. We primarily aimed to explore which MHS factors in which urbanicity context might be associated with mood disorder DP, in order to produce new relevant information and research questions to promote further contextual MHS research. As a preliminary hypothesis, we hypothesised that a higher diversity rate in MHS, especially in outpatient care and community-based services, would mainly contribute to lower mood disorder DP risk, which the municipality context could moderate.

After Study II identified regional mood disorder DP risk differences in the three largest Finnish hospital districts, Study IV, in turn, provided a standard assessment and comparison between the MHS patterns of these districts: HUS with a lower mood disorder DP risk compared to the Finnish national mean, the hospital district of Southwest Finland with a Finnish national average risk level of DP, and the hospital district of Pirkanmaa with a higher risk of DP. As Finland's three largest hospital districts, these study areas provided a representative naturalistic setting in a Nordic welfare country to assess regional MHS with known mood disorder DP risk differences but equal disorder prevalence. Study IV analyses the hospital districts' contextual and MHS characteristics in relation to the identified differences in mood disorder DP risk. It also explores the variation in MHS resources and resource allocation as well as service richness and diversity in all MHS, outpatient care and local community-based and centralized services. To the best of our knowledge, there is no prior study performing a standard assessment of MHS provision characteristics on this scale regarding the regional DP risk differences. Additionally, Studies III-IV are, to our knowledge, the first to apply diversity indices in MHS research, although

they are commonly used in ecological research. These studies apply the Gini-Simpson Diversity Index (GSDI) to measure the diversity and evenness of MHS provision on the municipality- and hospital district levels.

This dissertation applies the Mental Health Ecosystems approach in studying the relationship between mental disorder-based disability pensioning and MHS provision in Studies III-IV. On a broader scope, Studies I-II also contribute to understanding the other mental health ecosystem domains at the macro- and meso-level. The domains of the wider determinants of health, as well as the places and communities in which we live, are explored through the socioeconomic and regional differences in DP. Although the domain of health behaviours and lifestyles is outside the direct scope of this dissertation, it is connected to the places, communities and social determinants of health (Compton & Shim, 2015) and is thus indirectly included in the discussion concerning the context of socioeconomic differences and mechanisms affecting health.

4 MATERIALS AND METHODS

The use of different data in Studies I-IV is shown in Table 1.

Table 1. The registers and datasets used in Studies I-IV

	RETIRE-data on disability pension recipients and controls	Sotkanet-data on population characteristics and mental health service utilisation	DESDE-LTC-data on mental health service provision and resources
Study I	X		
Study II	X	X	
Study III	X	X	X
Study IV		X	X

4.1 Study population: RETIRE-research data on disability pensions (Studies I-III)

The study population of this dissertation was composed of all Finnish citizens granted a temporary, permanent, full or partial DP due to a mental disorder (ICD 10: F04-F69, F80-F99) for the first time between 2010 and 2015 (N= 50 728) (Pirkola et al., 2020). The utilised data was gathered and combined from the registers of the Social Insurance Institution of Finland, The Finnish Centre for Pensions, the Finnish Institute for Health and Welfare (THL) and Statistics Finland. The cases (DP recipients) were initially matched with three controls based on their gender, age and hospital district, obtained from the population registers of Statistics Finland. The combined database was stored and analysed on the server of Statistics Finland via remote desktop use.

The following cases were omitted from the final data in the preliminary analysis:

i) individuals with any previous pensions or pensions for primarily somatic reasons
ii) individuals aged under 18 or over 65

iii) individuals who had moved to a new hospital district during the last three years before DP
iv) individuals residing in the hospital district of the Åland Islands, because of the district's small sample size and divergent sample

The final data set in Studies I-II included 36 879 cases with mental disorder DP. In Study III, we focused on DP recipients with a mood disorder as their primary diagnosis for granted DP in seven of the Finnish hospital districts. Thus, we further excluded those DP recipients who had been granted their DP for other than mood disorders, and recipients living in different areas than the 104 municipalities in these seven hospital districts comprising the study area. The final data set of Study III included 13 783 first-time mood disorder DP recipients.

In Study I, we used the original controls matched for the DP recipients to study SES factors at the national macro-level (n = 94 388). In Study II, we used the Finnish population data as an exposure in our models for regional risk: the information on the age, gender, occupational status and residential hospital district of the whole Finnish population aged 18 to 65 in 2015 was acquired from Statistics Finland (n = 2 991 434). In Study III, we used the Finnish population (aged 18 to 65) data from 2015 in the 104 study municipalities (n = 1 950 205) as an exposure and with adjustments based on the compositional factors of gender and age. The data management flowchart regarding the study population and controls in Studies I-III is shown in Figure 1.

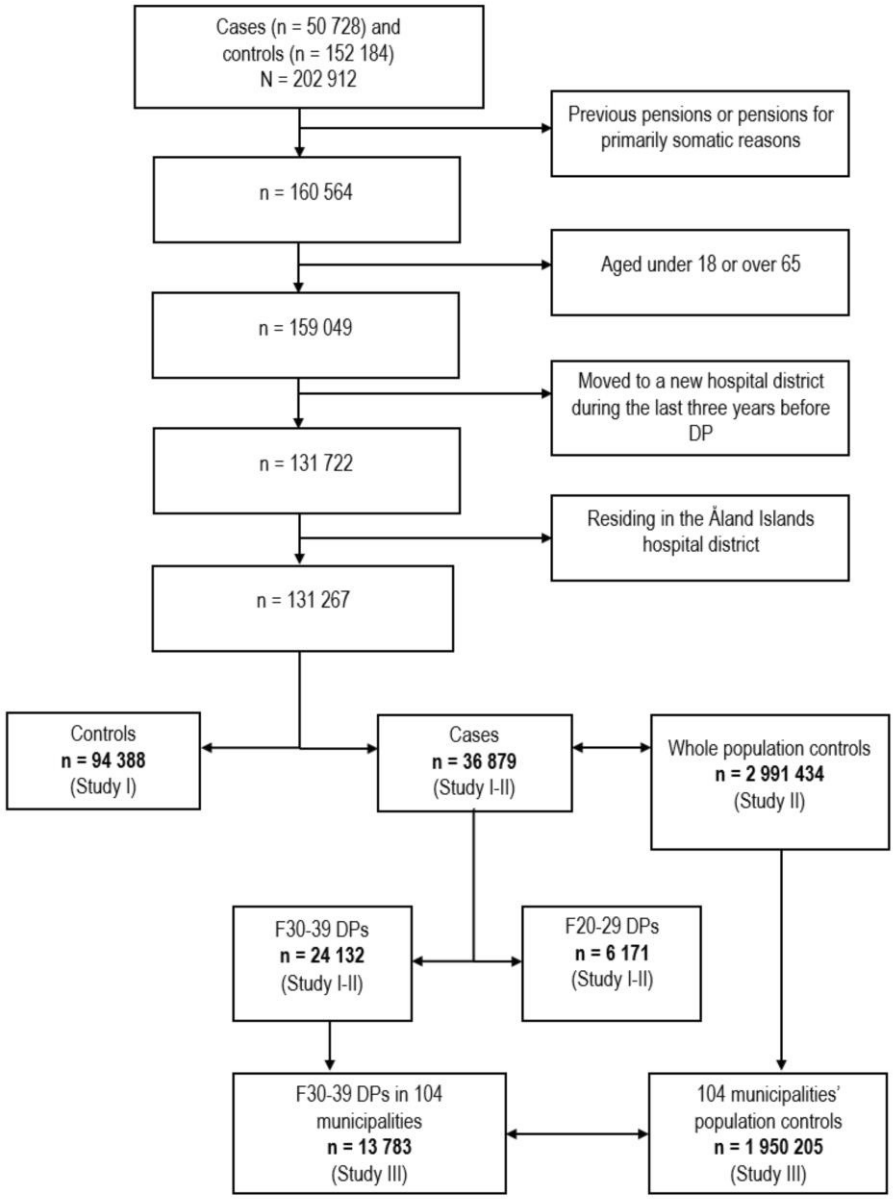


Figure 1. Flowchart of the study population in Studies I-III

4.2 Study area (Studies I-IV)

Study I centered on the macro-level of Finland, and Study II on all the Finnish hospital districts. Study III focused on the seven hospital districts with comprehensive DESDE-LTC data on MHS provision. The study area of Study III was comprised of HUS (1 046 365 inhabitants at the end of 2015), Southwest Finland (289 656 inhabitants), Pirkanmaa (also known as the Tampere Region; 322 436 inhabitants), Kymenlaakso (101 580 inhabitants), South Karelia (78 248 inhabitants), Kainuu (43 847 inhabitants) and Lapland (69 129 inhabitants), as shown in Figure 2. These hospital districts included 113 municipalities, from which we excluded those with less than 2 000 inhabitants, with the final data set having 104 municipalities. These municipalities included about 60% of all Finnish citizens aged 18 to 65.

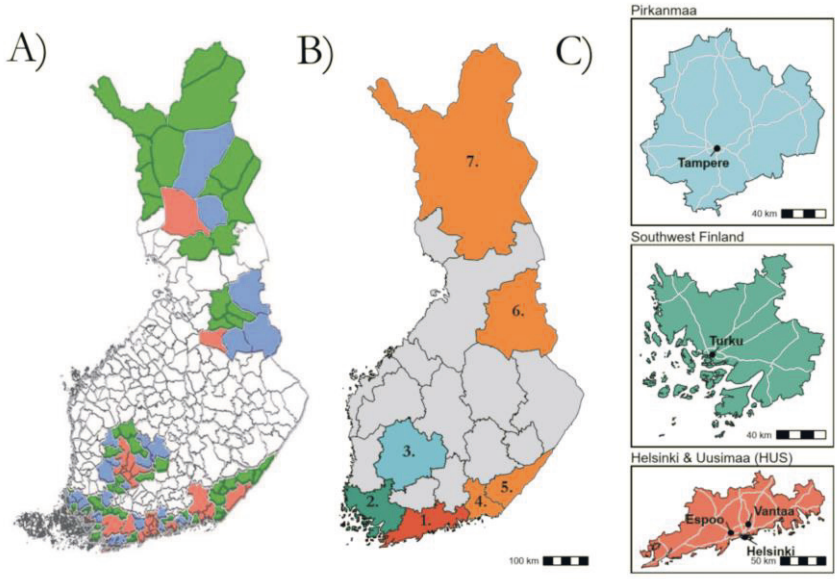


Figure 2. Map of the catchment area in Studies III-IV
Note. A) Municipalities in Study III. Red: urban municipalities; Blue: semi-urban municipalities; Green: rural municipalities. B) Hospital districts in Study III: 1. Helsinki and Uusimaa (HUS), 2. Southwest Finland, 3. Pirkanmaa, 4. Kymenlaakso, 5. South Karelia, 6. Kainuu and 7. Lapland. C) Study IV examines the most populous hospital districts: 1. HUS, 2. Southwest Finland and 3. Pirkanmaa.

Study IV's catchment area consisted of HUS, Southwest Finland and Pirkanmaa, the three most populous hospital districts in Finland's southern, most urban area. HUS includes the southern capital area, along with several other urban cities and semi-urban areas. It is the largest area by population and produces approximately 40% of the Finnish GDP, with the economic structure being largely service-oriented. Southwest Finland is situated by the Archipelago Sea and has a long history of being the most important Finnish trading centre from the Middle Ages until the 19th century. Pirkanmaa is one of the fastest-growing regions in the Finnish inland territory. It was mostly a rural region until the 18th century, after which it became one of the leading centres of Finnish industrial production. The catchment area of Study IV had a total population of 1 658 457 inhabitants aged 18 to 65 at the end of 2015, and 11 456 first-time mood disorder DP receivers in 2010-2015.

4.3 Explanatory variables (Studies I-II)

Based on prior literature, we selected three factors from the RETIRE-data in Study I to represent the several dimensions of SES and the social determinants of mental health: education, income and occupational status. In addition, we also studied family type, because previous studies have indicated its association with mental health and it also embodies the person's living arrangements and social environment. The SES value used in the analyses was from one year before entering DP.

Family type was categorised into four groups: living alone; couple (living together with a partner without children); couple with children (living with a partner and one or more children); and single parent.

Education was categorised into five groups in line with the classification of Statistics Finland. The basic level indicates at most nine years of education, the length of mandatory primary education in Finland. Upper secondary education means 11 to 12 years of education, including high school or vocational school. Short-cycle tertiary education lasts 2 to 3 years after upper secondary education and includes qualifications which are not polytechnic degrees. Lower-degree level tertiary education indicates 3 to 4 years of education after upper secondary education and comprises polytechnic and lower university degrees. Higher-degree level tertiary education includes education with a duration of at least 5 to 6 years after upper secondary education, leading to master's degrees, scientific licentiates and doctorate degrees.

Income was calculated for each case and control by dividing the income of the person's household (measured by Statistics Finland) by OECD's consumption unit, in which the size of the consumption unit represented by the household dwelling unit is indicated as the sum of the weights of its members. The resulting average income in euros per person per year was divided into five quantiles based on the data: lowest (less than 14 454e), middle-lower (14 455e – 20 468e), middle (20 469e – 25 931e), middle-higher (25 932e – 33 254e) and highest (more than 33 255e).

The occupational status of the cases and controls were classified into seven groups by the classification of Statistics Finland: blue-collar workers, lower white-collar workers, upper white-collar workers, entrepreneurs, agriculture and forestry entrepreneurs, students and the unemployed.

In Study II, the compositional factors used included age, gender, occupational status and region of residence by hospital district. Age was classified into five groups for the analyses: 18-25 years, 26-35 years, 36-45 years, 46-55 years, and 56-65 years. Occupational status was classified into eight groups according to Statistics Finland's classification: blue-collar workers, lower white-collar workers, upper white-collar workers, entrepreneurs, agriculture and forestry entrepreneurs, students, unemployed and unknown occupational status.

Regional contextual factors were chosen based on the European Socio-Demographic Schedule (ESDS) and were collected for the year 2015 from the Sotkanet Indicator Bank, an information portal provided by THL that offers key population welfare and health data (Beecham & Johnson, 2000; The Finnish Institute for Health and Welfare, 2023). The six contextual sociodemographic and -economic factors studied were:

i) Swedish-speaking population as a proportion of the total population
ii) persons with foreign background per 1 000 persons
iii) general at-risk-of-poverty rate
iv) employed as a proportion of the total population
v) long-term unemployed as a proportion of the labour force
vi) annual sale of alcoholic beverages per capita as litres of pure alcohol

4.4 Data on mental health services

4.4.1 Regional MHS utilisation (Study II)

The MHS use factors considered in Study II were collected from the Sotkanet Indicator Bank for 2015. The nine factors used in the study were:

i) population density as population/km² (used as a proxy indicator for the accessibility of MHS)
ii) all mental health outpatient visits of adults, per 1 000 persons aged 18 and over (including both primary health care and psychiatric special health care visits)
iii) outpatient visits in psychiatric units, per 1 000 persons aged 18-64
iv) mental health visits in primary health care, per 1 000 persons aged 18-64
v) recipients of rehabilitative psychotherapy, per 1 000 persons aged 18-64
vi) involuntary referrals for observation in psychiatric inpatient care, per 1 000 persons aged 18-64
vii) periods of care in psychiatric inpatient care, per 1 000 persons aged 18-64
viii) patients in psychiatric inpatient care, per 1 000 persons aged 18-64
ix) the number of care days in psychiatric inpatient care, per 1 000 persons aged 18-64

4.4.2 DESDE-LTC -data (Studies III-IV)

The MHS of the catchment area in Studies III-IV were analysed using the DESDE-LTC-tool (Salvador-Carulla et al., 2013). In the DESDE-LTC taxonomy, MHS are classified into 89 different Main Types of Care (MTC). MTCs are the main descriptors of the units' general care function (for example, acute hospital care or non-acute outpatient care) and are provided by the Basic Stable Inputs of Care (BSIC). BSICs are the de facto organisational units providing the MTCs. The mapped MTCs were allocated to one of the six main classes of DESDE-LTC:

i) information for care (I)
ii) accessibility to care (A)
iii) self-help and voluntary help (S)
iv) outpatient care (O)

v) day care (D)
vi) residential care (R)

The outline and main classes of the DESDE-LTC's hierarchical taxonomy-based coding tree are presented in Figure 3. A detailed presentation of the classes is shown in Figure 4.

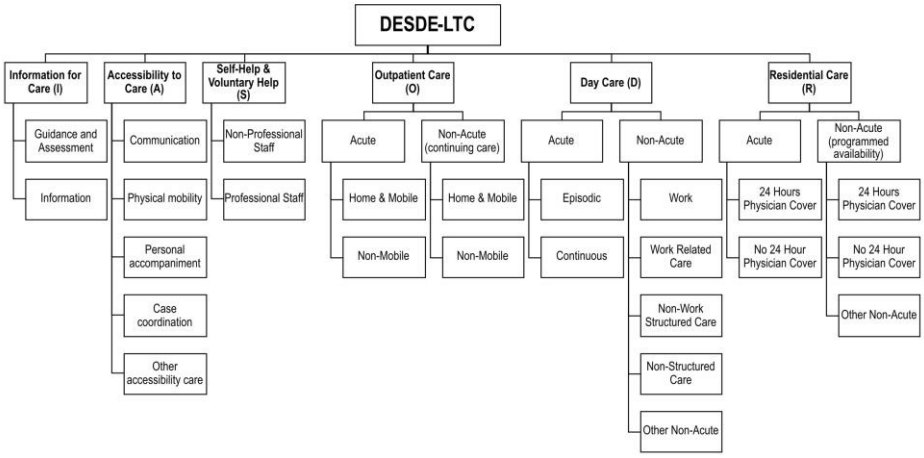
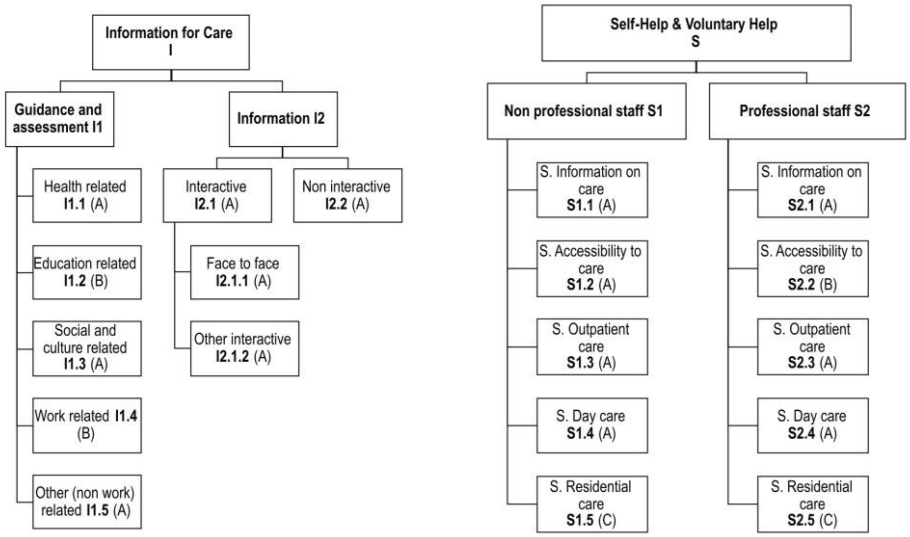
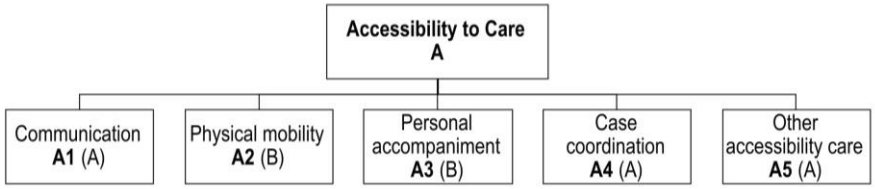
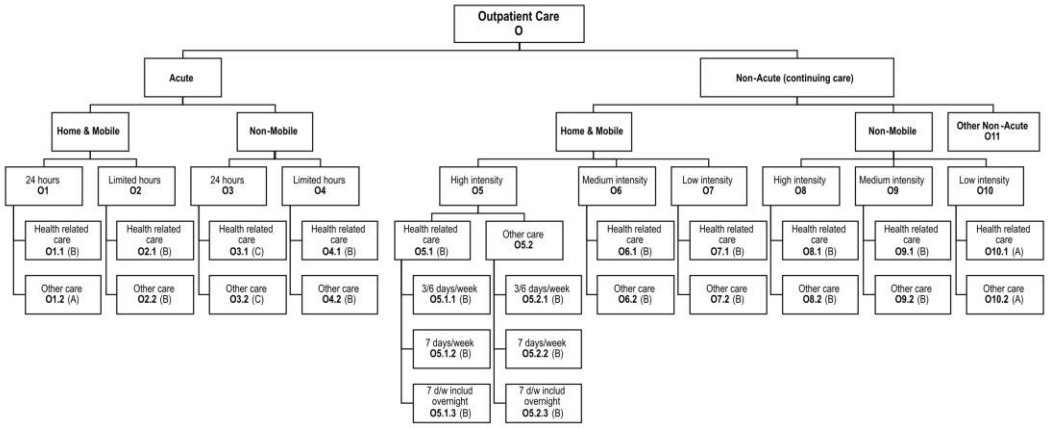
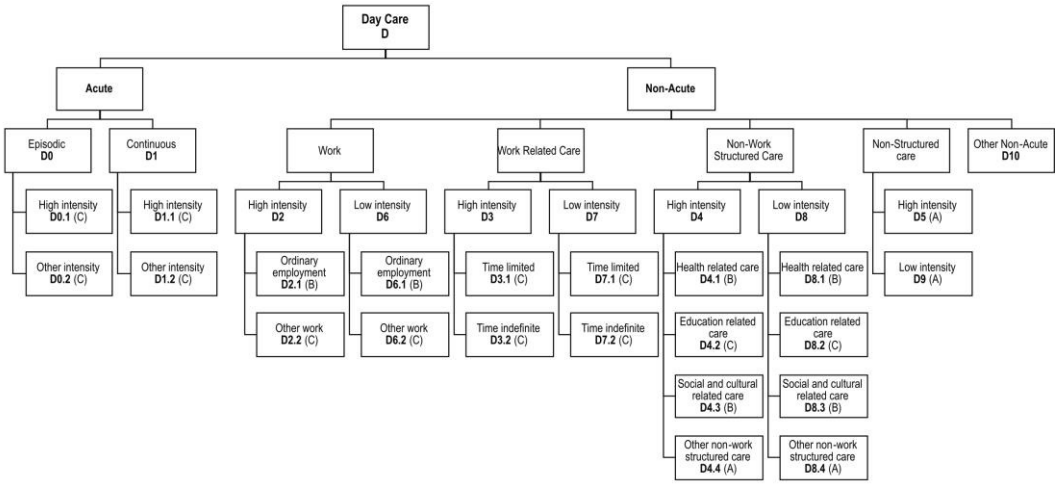


Figure 3. Outline and main classes of the DESDE-LTC's hierarchical taxonomy-based coding tree




Accessibility to Care
A
Communication
A1 (A)
Physical mobility
A2 (B)
Personal accompaniment
A3 (B)
Case coordination
A4 (A)
Other accessibility care
A5 (A)


Outpatient Care
O
Acute
Non-Acute (continuing care)
Home & Mobile
Non-Mobile
Home & Mobile
Non-Mobile
Other Non-Acute
O11
24 hours
O1
Limited hours
O2
24 hours
O3
Limited hours
O4
High intensity
O5
Medium intensity
O6
Low intensity
O7
High intensity
O8
Medium intensity
O9
Low intensity
O10
Health related care
O1.1 (B)
Other care
O1.2 (A)
Health related care
O2.1 (B)
Other care
O2.2 (B)
Health related care
O3.1 (C)
Other care
O3.2 (C)
Health related care
O4.1 (B)
Other care
O4.2 (B)
Health related care
O5.1 (B)
Other care
O5.2
3/6 days/week
O5.1.1 (B)
7 days/week
O5.1.2 (B)
7 d/w includ overnight
O5.1.3 (B)
3/6 days/week
O5.2.1 (B)
7 days/week
O5.2.2 (B)
7 d/w includ overnight
O5.2.3 (B)
Health related care
O6.1 (B)
Other care
O6.2 (B)
Health related care
O7.1 (B)
Other care
O7.2 (B)
Health related care
O8.1 (B)
Other care
O8.2 (B)
Health related care
O9.1 (B)
Other care
O9.2 (B)
Health related care
O10.1 (A)
Other care
O10.2 (A)


Day Care
D
Acute
Non-Acute
Episodic
D0
Continuous
D1
Work
Work Related Care
Non-Work Structured Care
Non-Structured care
Other Non-Acute
D10
High intensity
D0.1 (C)
Other intensity
D0.2 (C)
High intensity
D1.1 (C)
Other intensity
D1.2 (C)
High intensity
D2
Low intensity
D6
High intensity
D3
Low intensity
D7
High intensity
D4
Low intensity
D8
High intensity
D5 (A)
Low intensity
D9 (A)
Ordinary employment
D2.1 (B)
Other work
D2.2 (C)
Ordinary employment
D6.1 (B)
Other work
D6.2 (C)
Time limited
D3.1 (C)
Time indefinite
D3.2 (C)
Time limited
D7.1 (C)
Time indefinite
D7.2 (C)
Health related care
D4.1 (B)
Education related care
D4.2 (C)
Social and cultural related care
D4.3 (B)
Other non-work structured care
D4.4 (A)
Health related care
D8.1 (B)
Education related care
D8.2 (C)
Social and cultural related care
D8.3 (B)
Other non-work structured care
D8.4 (A)

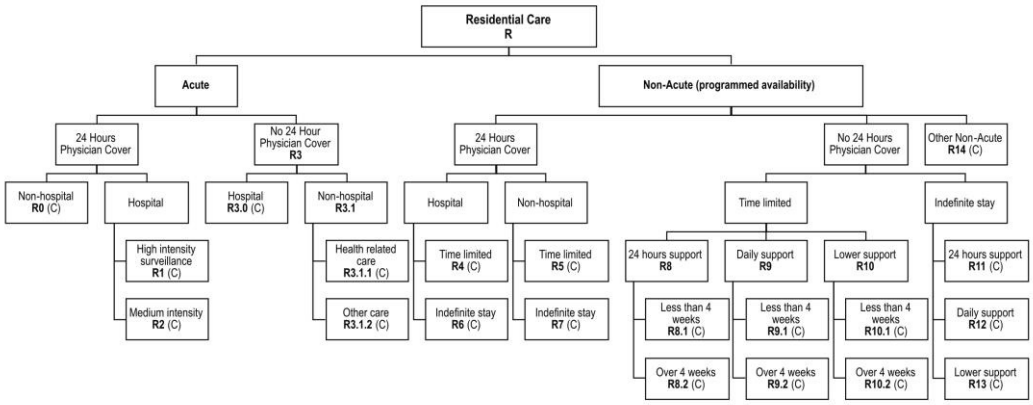


Figure 4. DESDE-LTC classification mapping tree
Note. Includes the Local Service variable: A = local services without gatekeeping, B = local services with gatekeeping, C = centralized services.

The MHS data from HUS, Kymenlaakso, South Karelia and Southwest Finland was collected during 2012-2013 for the REFINEMENT project (Research on Financing Systems' Effect on the Quality of Mental Health Care in Europe; see, for example, Ala-Nikkola et al., 2014; Gutiérrez-Colosía R. et al., 2019). MHS in the Pirkanmaa, Lapland and Kainuu hospital districts were analysed retrospectively for 2013 and 2014. These years 2012-2014 correspond with the RETIRE's DP data timespan of 2010-2015 in this thesis, as no major alterations were made to these municipal MHS during these years. The data was collected systematically by four researchers, who received training for the DESDE-LTC coding (Ala-Nikkola, Sadeniemi, et al., 2016). The MHS data was collected according to DESDE-LTC protocol standards (Ala-Nikkola et al., 2014; Salvador-Carulla et al., 2012, 2013). Coding validity and reliability were supported through a compiled standardised handbook published by THL, bearing the original Finnish translation name ESMS-R (Salvador-Carulla et al., 2012), as well as with a systematic mapping procedure, case-based mapping training and assessment of inter-rater reliability by vignettes (Ala-Nikkola et al., 2014). The data was collected using public data sources and interviews with the municipalities' and private care providers' health and social care representatives. Only the services for adults with mental health and substance abuse

problems were mapped and analysed. The data collection covered all the services within the scope of the obligation of public service provision to arrange adult population MHS. This included services at the primary care, secondary care and tertiary care levels, as well as social and substance abuse services. The utilised DESDE-LTC dataset is the most comprehensive available data concerning Finland's MHS system characteristics and resources.

The classification of local vs. centralized services is not initially coded in the DESDE-LTC taxonomy. We used a categorising variable designed by Ala-Nikkola et al. (2018) to identify local services with and without gatekeeping, and centralized services. These were reclassified from the existing DESDE-LTC data. The Local Service variable was created using a modified Delphi panel procedure. The DESDE 5.0, nearing completion, will have an additional code to classify gatekeeping functions to MTCs.

Services classified as 24-hour service housing without a fixed term (DESDE-LTC classes R11-13) were excluded from the present study. These residential services presumably do not affect the DP process, as they are targeted primarily to people already on a pension. Furthermore, the information measuring service personnel resources with full-time equivalents (FTE) was missing from 174 services in Study III and 111 services in Study IV, which were excluded from the analysis regarding the service resources. However, the services with missing FTE consisted mainly of self-help and volunteer care services (DESDE-LTC class S): 71.3% in Study III and 76.6% in Study IV. Only 6.9% in Study III and 4.5% in Study IV were outpatient care (O) services with missing FTE data. The final MHS data set in Study III included 1 088 MTCs in 104 municipalities; and in Study IV, the three hospital districts had a total of 810 MTCs with FTE of 5068 and an overall service richness of 63 different MTCs.

In line with the Mental Health Ecosystems approach, the municipalities' and hospital districts' demographic characteristics were also collected from the Sotkanet Indicator Bank in Studies III-IV. The demographic characteristics were collected based on the European Socio-Demographic Schedule (ESDS) for 2015 in order to be congruent with the previously available DP data (The Finnish Institute for Health and Welfare, 2023).

Five different MHS types from the DESDE-LTC-data were finally studied in Studies III-IV: 1) all MHS, 2) outpatient care (DESDE-LTC class O), 3) local services without gatekeeping, 4) local services with gatekeeping, and 5) centralized services. Outpatient services included only those services where patients were seen in an outpatient setting without the services being residential or day care services.

Local services without gatekeeping included three service classes for outpatient care and four classes for day care. It also included almost all the information for care, accessibility to care and self-help and voluntary care services. Local services with gatekeeping included most of the outpatient care services, but also five classes of day care services, one information for care and one self-help and voluntary care service class. Centralized services mainly comprised day care and residential care and one type of regionally concentrated special outpatient care service class. For further details, see Ala-Nikkola et al., 2018. For these five different types of MHS, three DESDE-LTC-service system characteristic factors were used in Study III and seven factors in Study IV:

i) number of units as main types of care (MTC) (Study IV)
ii) MTC per 100 000 inhabitants (Study IV)
iii) service resources as the number of personnel in full-time equivalents (FTE) (Study IV)
iv) FTE per 1 000 inhabitants (Study III); per 100 000 inhabitants (Study IV)
v) share of resources, calculated as the personnel FTE percentage of all FTE (Study IV)
vi) service richness as the different MTC classes (Studies III-IV)
vii) service diversity as the Gini-Simpson Diversity Index (GSDI), calculated with service richness and number of MTC (Studies III-IV) (Gini, 1912; Simpson, 1949)

The formulation of MHS types and factors from the DESDE-LTC data is displayed in Figure 5.

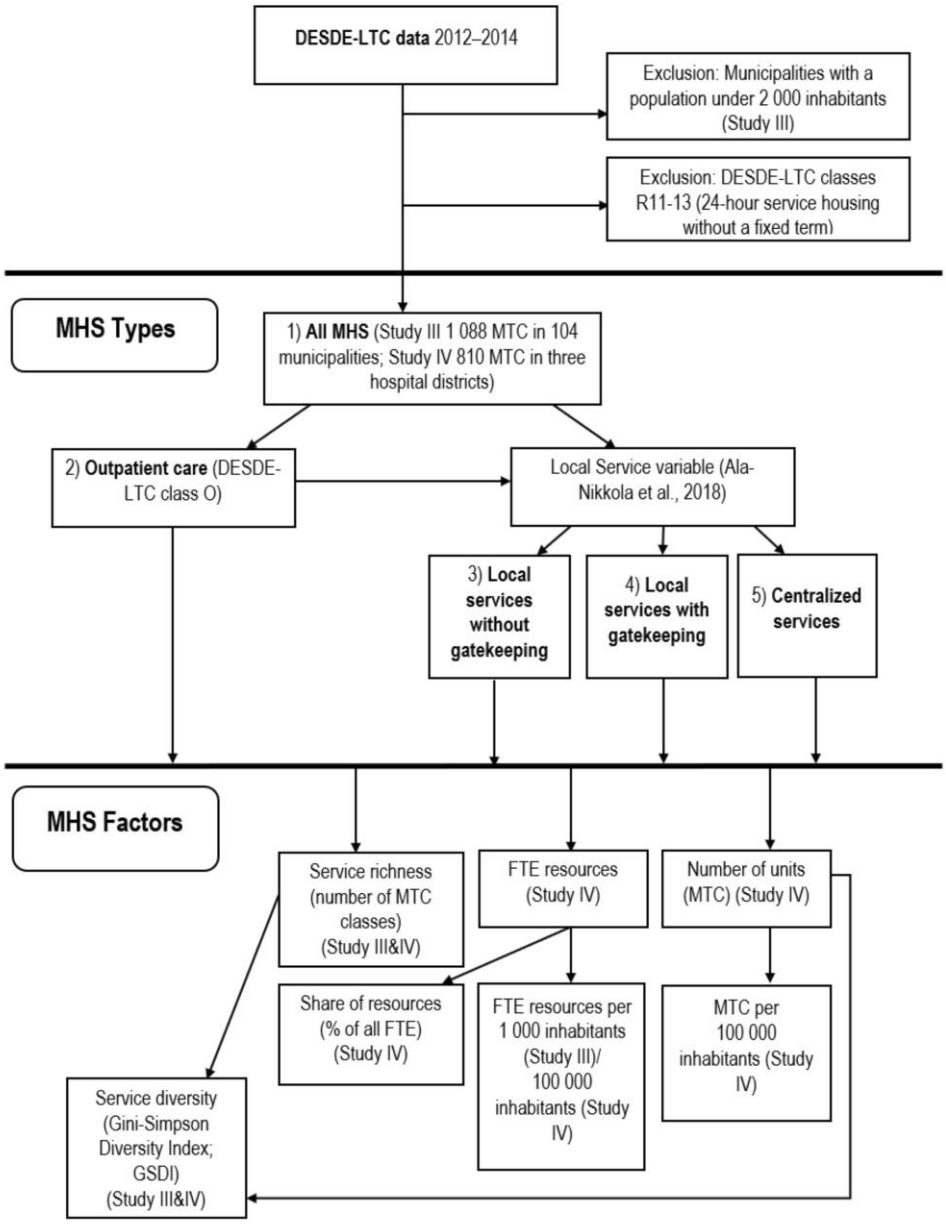


Figure 5. Flowchart of DESDE-LTC data management

In Study III, the FTE per 1 000 inhabitants was established by calculating the sum of FTE for each municipality in order to evaluate the effect of the number of personnel in the MTCs. In cases where the same MTC provided services to

inhabitants in two or more municipalities, the MTC's FTE was divided and allocated to the municipalities based on the proportion of the population of each municipality (for example, MTC X provided services with an FTE of Y to four municipalities, one of them being municipality Z. Municipality Z's inhabitants consisted of 20% of all the persons of the area to whom MTC X provided services. Thus 20% of the Y was allocated to the municipality Z's overall FTE.) Secondly, we divided the sum of FTE for each municipality by 1 000 inhabitants.

4.4.3 Gini-Simpson Diversity Index (Studies III-IV)

Although service richness can be used as a simple way to indicate service diversity, it only reflects the number of service classes reported, regardless of the number of different available MTCs provided for the inhabitants. Simpson's index D reflects the probability that any two individuals randomly picked from an infinitely large population will belong to the same species or class (Simpson, 1949). It is commonly applied as (1 – D), known as the Gini-Simpson Diversity Index (GSDI). The GSDI thus measures the probability that two randomly selected individuals belong to different species. GSDI is also known as the Gibbs-Martin index or the Blau index in psychology, sociology, and management studies. GSDI and similar diversity indices are commonly used in ecological and ecosystem service research to calculate species or class diversity in a given environment or area (Hölting et al., 2019; Magurran, 2021). By combining and weighing service richness with the number of available units in the DESDE-LTC class, the GSDI defines an index of 0 to 1 for the MHS diversity of the municipalities and hospital districts. A GSDI close to 1 signifies that there are several DESDE-LTC classes in the designated area, and that the available MTC proportion of DESDE-LTC classes is even. A low GSDI indicates that the area's MHS is not diverse. For example, if there is only one class of MTC according to the DESDE-LTC taxonomy in the municipality/hospital district, the GSDI is 0.

This gives a more multifaceted approach to the diversity of services, considering evenness between service provision rather than the mere number of DESDE-LTC classes commonly used in previous MHS research (named service richness in this dissertation). To our knowledge, Studies III-IV are the first to assess the applicability of GSDI to the evaluation of MHS diversity in municipalities and meso-level regional MHS ecosystems, made possible by the DESDE-LTC taxonomy of MHS.

GSDI values in Studies III-IV were calculated for the MHS provision factors with R version 4.0.1 (R Core Team, 2020), RStudio (RStudio Team, 2018) and the R-package diverse (Guevara, M. R., Hartmann, D., Mendoza, 2016). For a given area, and in this study for one municipality, the GSDI was calculated as follows:

$$1 - \sum_{i} (p_i^2)$$

where:

i) p_i is the "species" (DESDE-LTC class) proportion, $p_i = x_i \,/\, N$.
ii) N is the total number of individuals (in this case the available MTC) in the community (municipality/hospital district)

Example 1: Municipality X has 44 MTC available to its population. These 44 MTC belong to 18 different DESDE-LTC classes, so X's overall MHS service richness is 18. Of these services, D1.2 has one MTC, D3.2 has three MTC, O10.1. has seven MTC, R2 has six MTC, et cetera. Thus, following the above formula, the GSDI for X is calculated as follows:

$$\begin{aligned} 1 - \; & ((1/44)^2 + (3/44)^2 + (7/44)^2 + (6/44)^2 + (1/44)^2 + (3/44)^2 + (1/44)^2 \\ & + (2/44)^2 + (2/44)^2 + (2/44)^2 + (1/44)^2 + (1/44)^2 + (1/44)^2 \\ & + (1/44)^2 + (7/44)^2 + (1/44)^2 + (2/44)^2 + (2/44)^2) \end{aligned}$$

= GSDI for X is approximately 0.9070248 ≈ 0.91.

Example 2: Hospital district Y has 145 outpatient care (O) MTC available to its population. These 145 MTC belong to 16 different DESDE-LTC classes, so the service richness of Y's outpatient care is 16. Of these services, O1.1 has one MTC, O2.1 has three MTCs, O3.1 has two MTCs, O4.1 has ten MTCs, et cetera. The GSDI for Y's outpatient care is calculated as follows:

$$\begin{aligned} 1 - \; & ((1/145)^2 + (3/145)^2 + (2/145)^2 + (10/145)^2 + (3/145)^2 + (6/145)^2 \\ & + (2/145)^2 + (13/145)^2 + (1/145)^2 + (4/145)^2 + (1/145)^2 \\ & + (2/145)^2 + (8/145)^2 + (44/145)^2 + (44/145)^2 + (1/145)^2) \end{aligned}$$

= GSDI for Y's outpatient care is approximately 0.7959096 ≈ 0.80.

It is important to note that the GSDI is comparable only if the catchment areas are on the same spatial scale (Magurran, 2021). This means that the above municipality-level and district-level GSDI values are not comparable with each other, as is evidenced by the results of these examples.

4.5 Statistical analysis

In Study I, the differences between the SES factors were calculated with the Chi-Squared test, while the differences between the continuous variables were determined with the independent samples t-test. We used conditional logistic regression to detect the associations between the different exposures, i.e., SES factors and family type and the outcome DP. We first created crude models, i.e., univariate models for each exposure separately, with which we computed the odds ratios (OR) and 95% confidence intervals (95% CI). Further, for controlling confounding factors, we adjusted the model with education, income, occupational status and family type and used a multivariable conditional logistic regression model in which these exposures were entered simultaneously. The models were evaluated with Nagelkerke's pseudo-R^2. The collinearity of the exposures was assessed with a generalised variance inflation factor adjusted for each exposure based on the degrees of freedom. Since all exposures resulted in a generalised variance inflation factor below 2, there was no indication of issues with collinearity. Furthermore, the interaction between exposures was assessed, but since there were no improvements to the model, the interactions were not included in the final model. Some SES information was missing within the data: regarding income, the final numbers of cases and controls were the following: all cases n = 35 707; F30–39 n = 23 756; F20–29 n = 5 689 and controls n = 93 394. In occupational status, the final numbers of cases and controls in the analysis were: all cases n = 28 113; F30–39 n = 19 452; F20–29 n = 4 064 and controls n = 91 494. These missing values were omitted from the regression analysis. Statistical analyses were conducted with SPSS Statistics Version 25 and R package ggplots2 (Wickham, 2016).

In Study II, the original continuous variables (both the contextual and MHS use variables) were transformed into categorical factors with four groups (named highest to lowest) using one standard deviation (SD) of each variable for the categorisation.

The lowest group included values smaller than one SD subtracted from the mean and the highest larger than one SD added to the mean (i.e. lowest: value < mean - SD; lower: mean - SD < value < mean; higher: mean < value < mean + SD; highest: value > mean + SD). Each hospital district was assigned to one of the groups in each factor accordingly. Three variables (Swedish-speaking population, persons with foreign background and population density) did not have values smaller than one SD subtracted from the mean, so no hospital districts were assigned to the lowest group in the corresponding categorised factors.

As the dependent variable is the number of events and the data was over-dispersed, we applied negative binomial regression analysis to study the levels of risk for mental disorder DP in the Finnish hospital districts. The negative binomial model was tested against other count models and found to be most suitable for this data. Incidence rate ratios (IRR) and 95% CI were calculated separately for the hospital districts for all mental disorder DP, mood disorder DP and non-affective psychotic disorder DP. The regression analyses were performed by applying robust standard errors, using the Finnish population as an exposure. First, the IRRs were analysed using crude models to obtain the crude IRR for each hospital district. Second, the compositional factors of age, gender and occupational status were added to the analysis to obtain the adjusted IRRs for the hospital districts. Furthermore, the regional factors were added to the models to detect the associations between the contextual and MHS use factors and the risk of retiring.

The models were compared with the Akaike information criterion, Bayesian information criterion scores and Pseudo R^2 to determine the most suitable model. Due to the correlative nature of the regional factors, they were added to the model one at a time. The models with the regional factors were also adjusted based on age, gender and occupational status. These statistical analyses were conducted with Stata Version 16.0, and the illustration of the IRR in Finland was drawn with R and the packages gdalUtils, rgdal, tmap, and maptools (Bivand et al., 2020; Bivand & Lewin-Koh, 2020; Greenberg & Mattiuzzi, 2020; R Core Team, 2020; Tennekes, 2018).

In Study III, the municipalities were divided into three groups for the statistical analysis based on the 2015 classification by Statistics Finland for describing the degree of urbanisation of their residence: urban, semi-urban and rural. Urban municipalities included those in which at least 90% of the population lived in urban settlements or where the population of the largest urban settlement was at least 15 000. In semi-urban municipalities, at least 60% but less than 90% of the population lived in urban settlements, and the population of the largest urban settlement was between 4 000 and 15 000 inhabitants. In rural municipalities, less than 60% lived in

urban settlements, and the population of the largest settlement was less than 15 000 inhabitants, or between 60% and 90% of the population lived in urban settlements, and the largest settlement was less than 4 000 inhabitants.

Means and standard deviations were calculated for the MHS provision factors to characterise the data. A one-way ANOVA test was used to determine whether the municipality groups had statistically significant differences concerning the MHS factors. The associations of MHS provision factors with mood disorder DP were analysed using negative binomial regression models. The regression analyses were performed by applying robust standard errors, using the Finnish population data within each municipality as an exposure and with adjustment based on the compositional factors of gender and age. IRR and 95% CI were calculated for the models. Because of varying multicollinearity between the different MHS types and municipality groups, the analysis for each MHS factor was modeled separately. In all statistical analyses, p-values < 0.05 were considered statistically significant. The statistical analyses were performed with SPSS version 28.0.

In Study IV, Chi-squared tests and Poisson regression with the number of inhabitants as an exposure were used for studying the statistical differences between the three hospital districts. The statistical analyses were performed with R using EpiR packages (Carstensen et al., 2022; R Core Team, 2020).

5 RESULTS

5.1 The social determinants of mental disorder-based disability pensioning

5.1.1 Sociodemographic and socioeconomic differences (Study I)

Table 2 shows the distribution of the principal F-diagnoses with which DPs were granted for all DP recipients, and separately for women and men. The mean age for all mental disorder DP recipients was 44 years (SD: 13.3). The largest group was mood disorders (F30-39), accounting for 65.4% of all mental disorder-related DPs. The mean age for mood disorder DP recipients was 47 years (SD: 12.1). The second largest DP group was non-affective psychotic disorders (F20-29), with 16.7% of DPs and a mean age of 36 years (SD: 12.4). In mood disorders, female gender and older persons represented a more prominent part of the retired population, whereas in non-affective psychotic disorder DPs male gender and younger persons were emphasised ($p < 0.001$).

The sociodemographic and SES characteristics are presented in Table 3 for DP recipients (separately for mood disorders and non-affective psychotic disorders) and their controls in the RETIRE-data. 55.6% of all DP recipients were women. Compared to controls, the DP recipients were more often living alone and had lower educational and income levels ($p < 0.001$), the differences being even more apparent in non-affective psychotic disorder DPs compared to mood disorder DPs ($p < 0.001$). Regarding occupational status, the most significant difference between DP recipients and controls was in students. The student category was a markedly larger group in all DP recipients than in controls (DP recipients 14.4% vs. controls 6.4%; $p < 0.001$). This difference was also notably higher in non-affective psychotic disorder than in mood disorder DP, in which over a quarter of all DP recipients were classified as students (F20-29: 27.3% vs. F30-39: 10.9%; $p < 0.001$).

Table 2. The principal diagnoses for granted disability pensions due to mental disorder in Finland in 2010-2015

Principal diagnosis	All (Percent) N = 36 879	Women (Percent) N = 20 499	Men (Percent) N = 16 380
F04-09	475 (1.3%)	180 (0.9%)	295 (1.8%)
F10-19	1 318 (3.6%)	304 (1.5%)	1 014 (6.2%)
F20-29	6 171 (16.7%)	2 568 (12.5%)	3 603 (22.0%)
F30-39	24 132 (65.4%)	14 937 (72.9%)	9 195 (56.1%)
F40-48	2 735 (7.4%)	1 644 (8.0%)	1 091 (6.7%)
F50-59	247 (0.7%)	210 (1.0%)	37 (0.2%)
F60-69	535 (1.5%)	259 (1.3%)	276 (1.7%)
F80-89	1 069 (2.9%)	335 (1.6%)	734 (4.5%)
F90-99	197 (0.5%)	62 (0.3%)	135 (0.8%)

Note. All diagnostic category differences between genders were statistically significant at $p < 0.001$.
F04–09 Organic, including symptomatic, mental disorders
F10–19 Mental and behavioural disorders due to psychoactive substance use
F20–29 Schizophrenia, schizotypal and delusional disorders
F30–39 Mood (affective) disorders
F40–48 Neurotic, stress-related and somatoform disorders
F50–59 Behavioural syndromes associated with physiological disturbances and physical factors
F60–69 Disorders of adult personality and behaviour
F80–89 Disorders of psychological development
F90–99 Behavioural and emotional disorders with onset usually occurring in childhood and adolescence F90-98, and Unspecified mental disorder F99

Table 3. Sociodemographic and socioeconomic characteristics of persons with disability pension (DP) granted for mental disorders in 2010-2015

Group		All cases (Percent) N = 36 879	F30-39 (Percent) N = 24 132	F20-29 (Percent) N = 6 171	Controls (Percent) N = 94 388
Gender					
	men	16 380 (44.4%)	9 195 (38.1%)	3 603 (58.4%)	-
	women	20 499 (55.6%)	14 937 (61.9%)	2 568 (41.6%)	-
Age					
	18-25	5 141 (13.9%)	2 005 (8.3%)	1 639 (26.6%)	-
	26-35	5 919 (16.0%)	3 152 (13.1%)	1 755 (28.4%)	-
	36-45	6 417 (17.4%)	4 252 (17.6%)	1 213 (19.7%)	-
	46-55	10 131 (27.5%)	7 616 (31.6%)	1 039 (16.8%)	-
	56-65	9 271 (25.1%)	7 107 (29.5%)	525 (8.5%)	-
Family type					
	Living alone	16 311 (44.2%)	9 068 (37.6%)	3 817 (61.9%)	20 628 (21.9%)
	Couple	9 302 (25.2%)	7 303 (30.3%)	733 (11.9%)	29 645 (31.4%)
	Couple with children	7 642 (20.7%)	5 261 (21.8%)	1 110 (18.0%)	37 104 (39.3%)
	Single parent	3 624 (9.8%)	2 500 (10.4%)	511 (8.3%)	7 011 (7.4%)
Education					

	Basic level	10 821 (29.3%)	5 847 (24.2%)	2 170 (35.2%)	16 090 (17.0%)
	Upper secondary level	17 338 (47.0%)	11 527 (47.8%)	3 016 (48.9%)	44 451 (47.1%)
	Short-cycle tertiary	4 192 (11.4%)	3 377 (14.0%)	350 (5.7%)	13 229 (14.0%)
	Lower-degree tertiary	2 339 (6.3%)	1 742 (7.2%)	353 (5.7%)	10 277 (10.9%)
	Higher-degree tertiary	2 189 (5.9%)	1 639 (6.8%)	282 (4.6%)	10 341 (11.0%)
Income					
	Lowest	11 906 (33.3%)	6 308 (26.6%)	2 757 (48.5%)	11 890 (12.7%)
	Middle-lower	8 276 (23.2%)	5 554 (23.4%)	1 310 (23.0%)	16 143 (17.3%)
	Middle	6 191 (17.3%)	4 554 (19.2%)	794 (14.0%)	19 780 (21.2%)
	Middle-higher	4 993 (14.0%)	3 814 (16.1%)	519 (9.1%)	21 954 (23.5%)
	Highest	4 341 (12.2%)	3 526 (14.8%)	309 (5.4%)	23 627 (25.3%)
Occupation					
	Blue-collar worker	5 849 (20.8%)	4 088 (21.0%)	925 (22.8%)	22 248 (24.3%)
	Lower white-collar worker	8 293 (29.5%)	6 639 (34.1%)	668 (16.4%)	29 718 (32.5%)
	Upper white-collar worker	3 371 (12.0%)	2 672 (13.7%)	330 (8.1%)	15 986 (17.5%)
	Entrepreneur	1 621 (5.8%)	1 283 (6.6%)	144 (3.5%)	6 610 (7.2%)
	Agriculture entrepreneur	376 (1.3%)	274 (1.4%)	63 (1.6%)	1 784 (1.9%)
	Student	4 048 (14.4%)	2 128 (10.9%)	1 110 (27.3%)	5 828 (6.4%)
	Unemployed	4 555 (16.2%)	2 368 (12.2%)	824 (20.3%)	9 320 (10.2%)

Note. Separately for all mental disorder DP, mood disorder DP (F30-39), non-affective psychotic disorder DP (F20-29) and study controls.

We further assessed the characteristics of students. The mean age of students was higher for mental disorder DP recipients (28 years, SD: 9.9) than for controls (26 years, SD: 9.5) ($p < 0.001$). The students with mood disorder DPs were older (mean 31 years, SD: 10.8) than those with non-affective psychotic disorder DPs (mean 27 years, SD: 8.0) ($p < 0.001$). In the case of mood disorder DPs over half of the student pensioners had an upper secondary level education (51.6%), and for non-affective psychotic disorder DPs approximately half of the DP recipients had only primary level education (49.6%).

5.1.2 Socioeconomic risk factors (Study I)

The OR and 95% CI were calculated for all mental disorder-related DPs and mood/non-affective psychotic disorder DPs using conditional logistic regression analysis (Table 4). The crude model was adjusted for age, gender and hospital district based on the matched case-control design. The final model was adjusted for family

type, education, income and occupational status. The highest risk for DP was associated with the student category in overall mental disorder DP and mood disorder DP, and with the lowest income group in non-affective psychotic disorder DP. The overall effects of education and income levels on DP exhibited a negative trend, with higher education and income associated with a lower risk of mental disorder DP. In the case of family type, living alone was associated with the highest risk for DP. Couples with children had the lowest risk for DP in all models except for non-affective psychotic disorders, in which couples without children had the same level of DP risk.

While the ORs in other SES factors remained consistent in their direction after adjusting for all factors in the final models, the risk of mental disorder DP increased in white-collar occupational groups above the reference point of blue-collar workers' risk in all mental disorder and mood disorder DPs. The OR for entrepreneurs also increased to the same risk level as that of blue-collar workers in the final statistical models. The OR for agriculture and forestry entrepreneurs mainly remained stable before and after controlling for other factors, even lower than for blue-collar workers. The OR for the unemployed remained higher compared to blue-collar workers, except in mood disorder DPs, which decreased to a similar level as for blue-collar workers after controlling for all the factors in the model. Figure 6 illustrates the final statistical model's OR and 95% CI for all mental disorder and mood/non-affective psychotic disorder DPs as a dot plot figure.

Table 4. Socioeconomic differences for all mental disorder-related disability pensions (DP), mood disorder (F30-39) DP and non-affective psychotic disorder (F20-29) DP in Finland by odds ratio (OR) and 95% confidence interval (95% CI)

	All mental disorder DP				F30-39 DP				F20-29 DP			
	Crude model		Final model		Crude model		Final model		Crude model		Final model	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Family type												
Couple with children (reference)	1.00		1.00		1.00		1.00		1.00		1.00	
Living alone	3.97	3.84 – 4.11	2.15	2.06 – 2.24	3.32	3.18 – 3.47	2.09	1.99 – 2.20	6.15	5.64 – 6.70	2.65	2.37 – 2.95
Couple	1.55	1.49 – 1.61	1.53	1.46 – 1.59	1.66	1.59 – 1.74	1.72	1.63 – 1.81	1.13	1.01 – 1.26	1.00	0.88 – 1.14
Single parent	2.50	2.38 – 2.63	1.58	1.49 – 1.67	2.50	2.36 – 2.65	1.61	1.50 – 1.73	2.43	2.14 – 2.77	1.56	1.33 – 1.82
Education												
Higher-degree tertiary (ref.)	1.00		1.00		1.00		1.00		1.00		1.00	
Basic level	3.46	3.28 – 3.66	1.98	1.84 – 2.14	2.69	2.52 – 2.87	1.71	1.57 – 1.87	5.10	4.40 – 5.91	2.37	1.90 – 2.97
Upper secondary level	1.89	1.80 – 1.99	1.32	1.24 – 1.42	1.83	1.72 – 1.94	1.36	1.26 – 1.48	2.21	1.93 – 2.54	1.23	1.00 – 1.51
Short-cycle tertiary	1.51	1.42 – 1.60	1.29	1.20 – 1.39	1.52	1.42 – 1.63	1.32	1.21 – 1.43	1.47	1.23 – 1.76	1.15	0.90 – 1.47
Lower-degree tertiary	1.07	1.01 – 1.15	0.99	0.92 – 1.07	1.12	1.04 – 1.21	1.03	0.95 – 1.13	1.09	0.92 – 1.30	0.96	0.76 – 1.21
Income												
Highest (ref.)	1.00		1.00		1.00		1.00		1.00		1.00	
Lowest	6.54	6.25 – 6.85	2.30	2.17 – 2.45	4.84	4.59 – 5.11	2.12	1.97 – 2.28	14.29	12.40 – 16.47	3.21	2.69 – 3.83
Middle-lower	3.22	3.07 – 3.36	2.20	2.08 – 2.32	2.89	2.74 – 3.04	2.24	2.10 – 2.38	5.06	4.39 – 5.84	2.54	2.15 – 3.00
Middle	1.88	1.80 – 1.97	1.65	1.57 – 1.74	1.79	1.70 – 1.88	1.67	1.57 – 1.77	2.76	2.38 – 3.20	2.10	1.78 – 2.48
Middle-higher	1.32	1.26 – 1.38	1.25	1.19 – 1.31	1.26	1.20 – 1.33	1.25	1.18 – 1.32	1.76	1.51 – 2.06	1.54	1.30 – 1.82
Occupation												
Blue-collar worker (ref.)	1.00		1.00		1.00		1.00		1.00		1.00	
Lower white-collar worker	0.98	0.94 – 1.02	1.21	1.15 – 1.26	1.06	1.01 – 1.11	1.28	1.21 – 1.35	0.62	0.55 – 0.70	0.74	0.65 – 0.85
Upper white-collar worker	0.73	0.70 – 0.77	1.31	1.23 – 1.39	0.77	0.72 – 0.81	1.34	1.24 – 1.44	0.58	0.50 – 0.67	1.06	0.88 – 1.27
Entrepreneur	0.86	0.81 – 0.92	0.99	0.92 – 1.06	0.90	0.83 – 0.97	1.03	0.95 – 1.12	0.72	0.59 – 0.89	0.85	0.68 – 1.06
Agriculture entrepreneur	0.71	0.63 – 0.80	0.79	0.70 – 0.90	0.66	0.58 – 0.76	0.76	0.66 – 0.88	1.31	0.95 – 1.81	1.49	1.05 – 2.11
Student	3.40	3.20 – 3.62	2.93	2.74 – 3.14	3.87	3.56 – 4.21	3.50	3.20 – 3.83	3.35	2.94 – 3.83	2.50	2.16 – 2.91
Unemployed	1.78	1.70 –1.87	1.34	1.27 – 1.42	1.29	1.21 – 1.37	1.05	0.98 – 1.12	2.33	2.06 – 2.64	1.50	1.30 – 1.73

Note. Crude model: Conditional logistic regression model for data with controls matched based on gender, age and hospital district. Final model: Multivariable conditional logistic regression model adjusted based on all factors in the table.

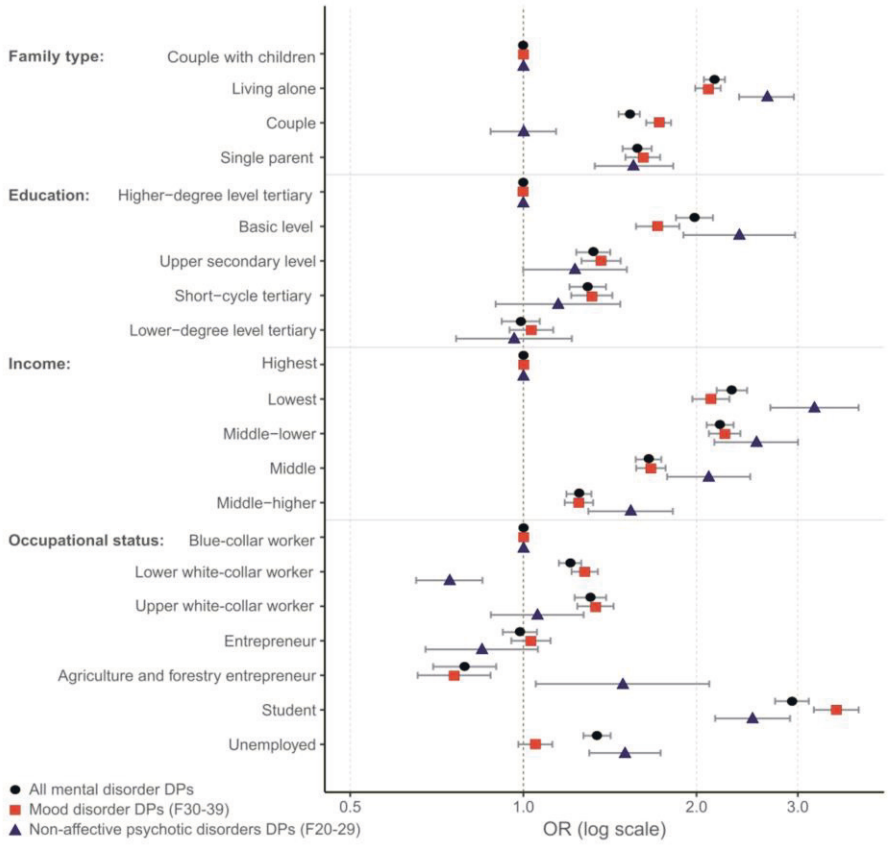


Figure 6. Socioeconomic differences for all mental disorder-related disability pensions (DP) (black), mood disorder F30-39 DP (red) and non-affective psychotic disorder F20-29 DP (blue) in Finland by odds ratio (OR) and 95% confidence interval (95% CI) as a dot plot figure of final statistical models
Note. Reference groups for each factor as 1.0.

5.1.3 Regional differences (Study II)

In Study II, we observed distinct differences between hospital districts in mental disorder DP and regional differences between the mood disorder and non-affective psychotic disorder DP groups. Hospital district differences adjusted for the compositional factors age, gender and occupational status by IRR and 95% CI for

all mental disorder DPs, mood disorder DPs and non-affective psychotic disorder DPs are shown in Table 5 and Figure 7.

A higher risk of overall mental disorder DP compared to the national level of risk was found in the hospital districts of North Savo, North Ostrobothnia, South Ostrobothnia and Kainuu. A lower risk of mental disorder DP was found in HUS, Päijät-Häme and Vaasa. Concerning diagnostic categories, a higher risk for mood disorder DP was found in Pirkanmaa, North Savo, North Ostrobothnia, South Ostrobothnia and Kainuu, and a lower risk in HUS, Päijät-Häme, East Savo and Vaasa, as well as a slight indication of lower risk in Kanta-Häme. In the case of non-affective psychotic disorder DP, a higher risk was found in Päijät-Häme, North Karelia and North Ostrobothnia, and a lower risk was found in Vaasa, with some indications of a lower risk observed in Southwest Finland and Länsi-Pohja.

Compared to the national mean risk, only the hospital district of North Ostrobothnia had a higher risk, and the hospital district of Vaasa a lower risk of DP in all three diagnostic categories. Interestingly, the hospital district of Päijät-Häme had a distinct pattern of DP, with a higher risk of non-affective psychotic disorder DP but a lower risk of mood disorder DP compared to the Finnish mean risk. Furthermore, the hospital districts of HUS, Pirkanmaa, North Savo and North Karelia varied in their IRR for mood disorder DP and non-affective psychotic disorder DP: HUS and North Karelia had a higher risk of non-affective psychotic disorder DP than mood disorder DP, whereas Pirkanmaa and North Savo had a higher risk of mood disorder DP than non-affective psychotic disorder DP.

Table 5. Hospital district differences between all mental disorder–related disability pensions (DP), mood disorder (F30–39) DP and non–affective psychotic disorder (F20–29) DP in Finland, 2010–2015 by incidence rate ratio (IRR) and 95% confidence interval (95% CI)

	All mental disorder DP		F30-39 DP		F20-29 DP	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
National mean	1.00		1.00		1.00	
Helsinki and Uusimaa (HUS)	0.85	0.78 – 0.93	0.84	0.78 – 0.90	1.09	0.93 – 1.27
Southwest Finland	0.96	0.89 – 1.04	1.03	0.95 – 1.11	0.87	0.77 – 0.99
Satakunta	0.97	0.89 – 1.06	0.99	0.90 – 1.09	0.93	0.80 – 1.08
Kanta–Häme	0.90	0.81 – 1.01	0.87	0.77 – 0.99	0.91	0.76 – 1.09
Päijät–Häme	0.86	0.78 – 0.95	0.78	0.70 – 0.86	1.29	1.10 – 1.50
Kymenlaakso	1.08	0.99 – 1.18	1.08	0.99 – 1.17	1.11	0.97 – 1.28
Pirkanmaa	1.02	0.94 – 1.11	1.11	1.03 – 1.20	0.87	0.75 – 1.00
Central Finland	1.01	0.91 – 1.11	1.06	0.97 – 1.16	0.99	0.86 – 1.15
North Savo	1.17	1.07 – 1.28	1.33	1.21 – 1.46	1.00	0.85 – 1.17
East Savo	0.86	0.72 – 1.03	0.70	0.59 – 0.84	0.88	0.65 – 1.18
South Savo	1.05	0.95 – 1.16	1.03	0.93 – 1.15	1.12	0.94 – 1.33
North Karelia	0.95	0.86 – 1.04	0.92	0.83 – 1.02	1.19	1.05 – 1.36
South Karelia	1.01	0.92 – 1.11	1.07	0.97 – 1.17	1.11	0.93 – 1.32
Vaasa	0.76	0.68 – 0.84	0.71	0.63 – 0.80	0.65	0.53 – 0.80
Länsi–Pohja	0.99	0.85 – 1.15	1.04	0.89 – 1.22	0.74	0.55 – 0.99
North Ostrobothnia	1.22	1.13 – 1.31	1.29	1.21 – 1.39	1.27	1.10 – 1.46
Central Ostrobothnia	1.13	0.95 – 1.35	1.04	0.93 – 1.16	1.02	0.81 – 1.29
South Ostrobothnia	1.15	1.05 – 1.25	1.19	1.07 – 1.32	1.09	0.92 – 1.28
Kainuu	1.19	1.05 – 1.36	1.18	1.02 – 1.36	1.16	0.93 – 1.44
Lapland	1.02	0.91 – 1.14	1.03	0.92 – 1.16	0.99	0.80 – 1.23
Nagelkerke Pseudo–R^2	0.790		0.799		0.668	
Akaike information criterion	9531.933		7930.831		5375.144	
Bayesian information criterion	9709.399		8108.298		5552.61	

Note. Negative binomial regression model adjusted based on the compositional factors of gender, age and occupational status.

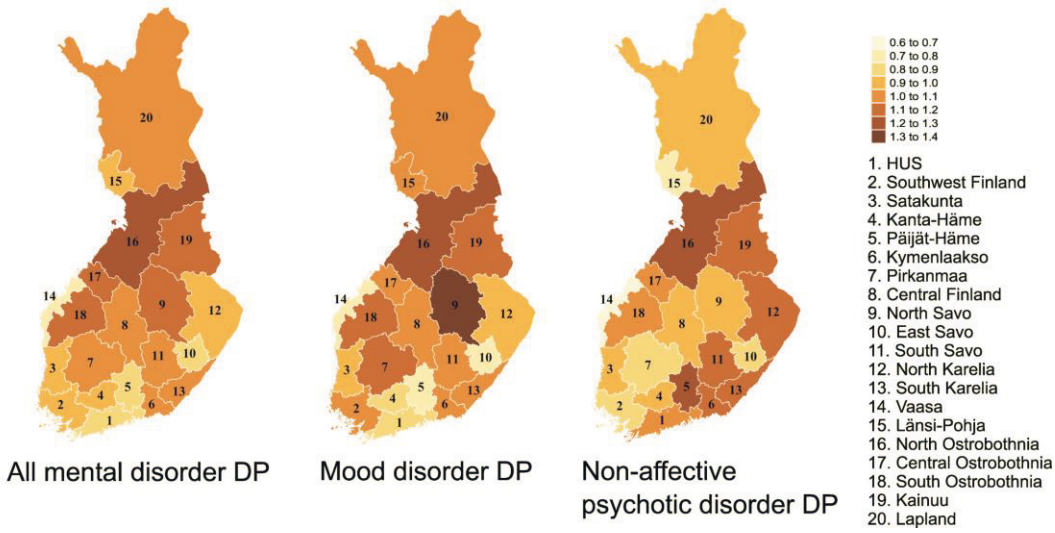


Figure 7. Hospital district differences in all mental disorder-related disability pensions (DP), mood disorder (F30–39) DP and non-affective psychotic disorder (F20–29) DP in Finland, 2010–2015, by incidence rate ratio (IRR)
Note. Negative binomial regression model adjusted based on the compositional factors gender, age and occupational status

5.1.4 Contextual differences (Study II)

The categorisation of hospital districts to the regional contextual factors can be seen in Figure 8. The heatmap rows are sorted based on the IRR of the districts. The IRR and 95% CI calculated for district-level contextual factors, adjusted for the compositional factors of age, gender and occupational status, are shown in Table 6.

The highest rates of Swedish-speaking and foreign background populations were associated with a lower level of regional risk for all mental disorder and mood disorder DP compared to the national mean. The Swedish-speaking population's highest rate was associated with a lower non-affective psychotic disorder DP risk. It is important to note that the hospital district of Vaasa was the only district with the proportion of the Swedish-speaking population higher than one SD added to the Finnish mean, so only Vaasa comprised this highest group.

The lowest general at-risk-of-poverty rates were associated with a lower regional risk of all mental and mood disorder DP compared to the national mean. The hospital districts HUS, Kanta-Häme, Vaasa and Central Ostrobothnia comprised this lowest group. In the case of non-affective psychotic disorder DP, a lower but interestingly not the lowest general at-risk-of-poverty rate indicated a lower DP risk.

In all three diagnostic categories the higher, but again interestingly not the highest, general at-risk-of-poverty rate indicated a higher risk of DP compared to the national mean.

The highest employment rate was associated with lower regional risk levels in all mental and mood disorder DP compared to the national mean (hospital districts HUS and Vaasa). The highest long-term unemployment rates were associated with a higher regional risk of non-affective psychotic disorder DP compared to the national mean. Furthermore, the lowest rates of long-term unemployment were associated with a lower regional non-affective psychotic disorder DP risk. Concerning the regional alcoholic beverage sale rate, a higher risk of mood and non-affective psychotic disorder DP associated with the higher, but not with the highest, regional sale rate compared to the national mean was observed.

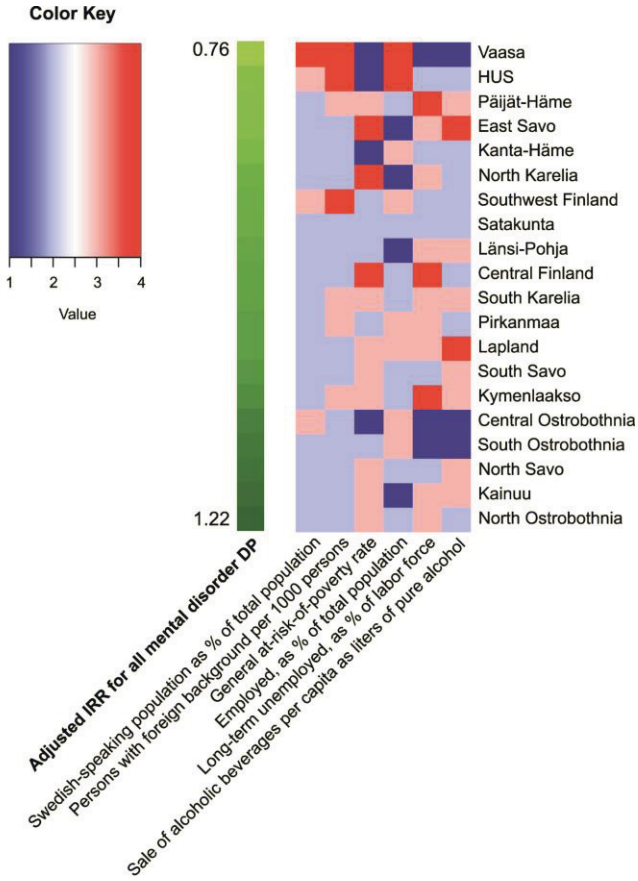


Figure 8. Categorisation of hospital districts to contextual factors
Note. Heatmap rows sorted based on the IRR of the districts: 4 = highest, 3 = higher, 2 = lower, 1 = lowest.

Table 6. Associations of regional differences in contextual factors for all mental disorder-related disability pensions (DP), mood disorder (F30-39) DP and non-affective psychotic disorder (F20-29) DP in Finland by incidence rate ratio (IRR) and 95% confidence interval (95% CI)

	All mental disorder DP		F30-39 DP		F20-29 DP	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Swedish-speaking population as proportion of total population	p < 0.001		p < 0.001		p < 0.001	
Highest	0.84	0.78 – 0.90	0.79	0.73 – 0.86	0.74	0.63 – 0.85
Higher	1.04	0.99 – 1.11	1.05	1.00 – 1.11	1.14	1.03 – 1.26
Lower	1.14	1.09 – 1.20	1.20	1.14 – 1.26	1.19	1.09 – 1.29
Lowest	NA		NA		NA	
Persons with foreign background per 1000 inhabitants	p < 0.001		p < 0.001		p = 0.115	
Highest	0.90	0.86 – 0.93	0.89	0.85 – 0.92	0.93	0.86 – 1.00
Higher	1.03	0.99 – 1.07	1.03	0.99 – 1.07	1.05	0.98 – 1.12
Lower	1.09	1.05 – 1.12	1.10	1.06 – 1.13	1.03	0.98 – 1.09
Lowest	NA		NA		NA	
General at-risk-of-poverty rate	p < 0.001		p < 0.001		p < 0.001	
Highest	0.98	0.92 – 1.03	0.96	0.91 – 1.02	1.04	0.96 – 1.13
Higher	1.10	1.06 – 1.14	1.12	1.08 – 1.17	1.13	1.06 – 1.20
Lower	1.04	1.00 – 1.08	1.09	1.04 – 1.13	0.89	0.84 – 0.95
Lowest	0.90	0.85 – 0.95	0.85	0.81 – 0.89	0.95	0.88 – 1.03
Employed, as proportion of total population	p < 0.001		p < 0.001		p = 0.003	
Highest	0.84	0.80 – 0.90	0.82	0.78 – 0.87	0.96	0.87 – 1.06
Higher	1.05	1.01 – 1.10	1.08	1.04 – 1.13	0.92	0.86 – 0.99
Lower	1.09	1.05 – 1.13	1.13	1.08 – 1.17	1.09	1.03 – 1.16
Lowest	1.03	0.98 – 1.09	1.00	0.94 – 1.06	1.03	0.95 – 1.13
Long-term unemployed, as proportion of labor force	p = 0.056		p = 0.003		p = 0.017	
Highest	0.98	0.93 – 1.03	0.96	0.92 – 1.01	1.11	1.03 – 1.20
Higher	1.05	1.01 – 1.09	1.08	1.04 – 1.12	1.04	0.97 – 1.11
Lower	0.97	0.94 – 1.01	1.00	0.96 – 1.04	0.98	0.91 – 1.04
Lowest	1.00	0.94 – 1.06	0.97	0.91 – 1.03	0.89	0.81 – 0.98
Sale of alcoholic beverages per capita, as liters of pure alcohol	p = 0.102		p = 0.014		p = 0.038	
Highest	0.96	0.89 – 1.04	0.92	0.85 – 1.00	0.97	0.84 – 1.11
Higher	1.05	1.00 – 1.10	1.08	1.03 – 1.13	1.10	1.02 – 1.19
Lower	0.99	0.95 – 1.03	1.02	0.98 – 1.07	1.03	0.96 – 1.10
Lowest	1.00	0.94 – 1.07	0.98	0.92 – 1.04	0.91	0.82 – 1.01

Note. Negative binomial regression model adjusted based on the compositional factors of gender, age and occupational status. National mean as a reference: 1.00.

5.2 Mental health services and disability pensioning

5.2.1 MHS utilisation at the hospital district level (Study II)

The categorisation of hospital districts to the MHS use factors and their association with regional DP risk levels is shown in Figure 9. The IRR and 95% CI calculated for MHS use factors in all Finnish hospital districts, adjusted for the compositional factors of age, gender and occupational status, are shown in Table 7.

Regarding population density, which we used as a proxy for the geographical accessibility of MHS, there was a lower risk associated with the highest population density in all mental disorder DP and mood disorder DP, as well as a higher risk of DP associated with a lower population density in all mental disorder DP and mood disorder DP compared to the national mean. It is naturally essential to note that HUS was the only hospital district with the highest density in population, with half of the other districts categorised as having a lower population density rate. No hospital district was categorised as having the lowest population density rate, as none had values smaller than one SD subtracted from the national population density mean.

In all adult mental health outpatient visits (including both in specialised psychiatric units and in primary health care), the highest and lowest numbers of visits were associated with a higher regional risk of DP in all mental and mood disorders. North Savo and Kainuu had the highest numbers of visits, whereas Kymenlaakso, Pirkanmaa and North Ostrobothnia had the lowest. The same association of higher regional risk with the lowest number of visits was also observable in outpatient visits in specialised psychiatric units in all three diagnostic categories, but the highest number of visits was associated only with a higher risk of mood disorder DP. Regarding primary health care, the lowest rate of visits, in HUS and Vaasa, showed a lower risk of all mental and mood disorder DP, while the highest rate of visits, found in South Karelia and Kainuu, was associated with a higher risk.

Interestingly, there was no association between the regional risk of all mental disorder DP and the number of recipients of rehabilitative psychotherapy. However, in the case of mood disorder DP the higher number of recipients was associated with a higher regional risk and the lower number with a lower risk, and in non-affective psychotic disorder DP the highest number of recipients was associated with a higher risk and the lowest number showed some indication of lower risk.

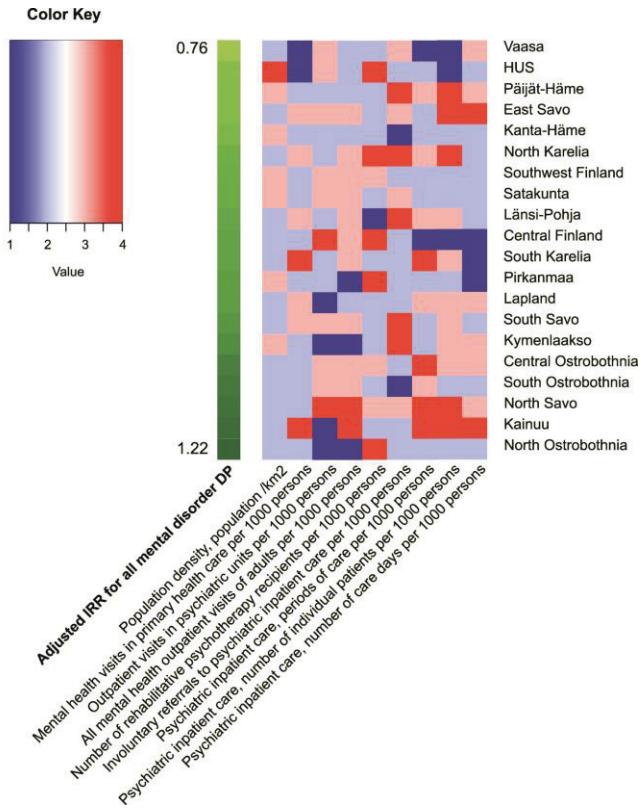


Figure 9. Categorisation of hospital districts to mental health service (MHS) utilisation factors
Note. Heatmap rows sorted based on the IRR of the districts: 4 = highest, 3 = higher, 2 = lower, 1 = lowest.

Concerning psychiatric inpatient care, the rate of involuntary referrals showed no association with regional all mental disorder DP risk. However, regarding mood disorder DP, the highest numbers of involuntary referrals showed a slight indication of a lower DP risk compared to the national mean, while in non-affective psychotic disorder DP, the highest number of referrals was associated with a higher DP risk. When observing hospitalisation periods, a lower regional risk of DP for all three diagnostic categories was associated with the lowest number of care periods and a higher risk was associated with the highest number of care periods in all mental and mood disorders compared to the national mean. The lowest numbers of inpatient care patients were also associated with a lower regional risk of DP in all mental and mood disorder DP compared to the national mean, and the highest numbers of individual patients with a higher risk of DP for non-affective psychotic disorders.

There was no association between the regional risk of DP and the number of days in psychiatric inpatient care.

Table 7. Associations of regional differences in mental health service use factors for all mental disorder-related disability pensions (DP), mood disorder (F30-39) DP and non-affective psychotic disorder (F20-29) DP in Finland by incidence rate ratio (IRR) and 95% confidence interval (95% CI)

	All mental disorder DP		F30-39 DP		F20-29 DP	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Population density, population/km² (proxy for the accessibility of treatment)	p < 0.001		p < 0.001		p = 0.200	
Highest	0.89	0.84 – 0.96	0.87	0.83 – 0.92	1.06	0.95 – 1.18
Higher	1.02	0.98 – 1.06	1.03	0.99 – 1.07	0.94	0.88 – 1.01
Lower	1.10	1.06 – 1.14	1.12	1.08 – 1.16	1.00	0.94 – 1.07
Lowest	NA		NA		NA	
All mental health outpatient visits of adults per 1 000 persons	p < 0.001		p < 0.001		p = 0.628	
Highest	1.14	1.07 – 1.21	1.20	1.13 – 1.28	1.01	0.91 – 1.12
Higher	0.97	0.94 – 1.01	0.96	0.93 – 1.00	0.97	0.91 – 1.03
Lower	0.84	0.81 – 0.88	0.79	0.75 – 0.82	0.99	0.92 – 1.07
Lowest	1.07	1.02 – 1.12	1.10	1.05 – 1.14	1.04	0.96 – 1.12
Outpatient visits in psychiatric units per 1 000 persons	p < 0.001		p < 0.001		p = 0.014	
Highest	1.05	1.00 – 1.11	1.13	1.07 – 1.19	0.96	0.88 – 1.05
Higher	0.93	0.89 – 0.97	0.89	0.86 – 0.92	0.94	0.88 – 1.00
Lower	0.93	0.89 – 0.97	0.91	0.88 – 0.95	0.99	0.93 – 1.06
Lowest	1.10	1.05 – 1.15	1.09	1.05 – 1.14	1.12	1.04 – 1.21
Mental health visits in primary health care per 1 000 persons	p < 0.001		p < 0.001		p = 0.471	
Highest	1.12	1.05 – 1.19	1.13	1.06 – 1.21	1.09	0.97 – 1.22
Higher	1.00	0.95 – 1.06	0.98	0.93 – 1.04	0.99	0.91 – 1.08
Lower	1.07	1.03 – 1.11	1.10	1.06 – 1.14	0.99	0.93 – 1.05
Lowest	0.84	0.79 – 0.89	0.81	0.77 – 0.86	0.94	0.84 – 1.04
Number of rehabilitative psychotherapy recipients per 1 000 persons	p = 0.125		p < 0.001		p = 0.027	
Highest	0.99	0.94 – 1.05	0.99	0.94 – 1.05	1.15	1.04 – 1.27
Higher	1.06	1.00 – 1.13	1.09	1.03 – 1.16	1.01	0.90 – 1.12
Lower	0.97	0.92 – 1.02	0.93	0.88 – 0.97	1.09	1.00 – 1.20
Lowest	0.98	0.87 – 1.10	1.00	0.88 – 1.13	0.79	0.62 – 0.99
Involuntary referrals to psychiatric inpatient care per 1 000 persons	p = 0.145		p = 0.010		p < 0.001	
Highest	0.98	0.94 – 1.02	0.95	0.90 – 0.99	1.13	1.05 – 1.21

Higher	0.96	0.92 – 1.01	0.98	0.93 – 1.04	0.87	0.80 – 0.94
Lower	1.03	0.99 – 1.07	1.05	1.01 – 1.09	1.03	0.96 – 1.09
Lowest	1.03	0.97 – 1.09	1.02	0.96 – 1.10	1.00	0.90 – 1.10
Psychiatric inpatient care, periods of care per 1 000 persons	p < 0.001		p < 0.001		p = 0.004	
Highest	1.13	1.07 – 1.19	1.16	1.11 – 1.22	1.06	0.97 – 1.15
Higher	0.99	0.95 – 1.04	0.97	0.92 – 1.02	1.11	1.03 – 1.19
Lower	1.00	0.96 – 1.04	1.00	0.96 – 1.04	1.01	0.95 – 1.08
Lowest	0.89	0.84 – 0.95	0.89	0.83 – 0.95	0.84	0.76 – 0.93
Psychiatric inpatient care, number of individual patients per 1 000 persons	p < 0.001		p = 0.004		p = 0.048	
Highest	1.02	0.98 – 1.07	1.01	0.96 – 1.06	1.10	1.02 – 1.18
Higher	1.06	1.01 – 1.10	1.05	1.01 – 1.09	1.01	0.94 – 1.08
Lower	1.05	1.01 – 1.09	1.09	1.05 – 1.13	0.96	0.90 – 1.02
Lowest	0.88	0.84 – 0.93	0.87	0.83 – 0.91	0.95	0.87 – 1.03
Psychiatric inpatient care, the number of care days per 1 000 persons	p = 0.806		p = 0.082		p = 0.484	
Highest	1.04	0.95 – 1.13	0.96	0.87 – 1.06	1.03	0.89 – 1.19
Higher	0.98	0.94 – 1.03	0.98	0.93 – 1.03	1.00	0.92 – 1.08
Lower	0.98	0.94 – 1.03	1.00	0.96 – 1.04	1.03	0.96 – 1.10
Lowest	1.00	0.95 – 1.05	1.06	1.01 – 1.12	0.94	0.87 – 1.03

Note. Negative binomial regression model adjusted based on the compositional factors of gender, age and occupational status. National mean as a reference: 1.00.

5.2.2 MHS provision and mood disorder DP at the municipality level (Study III)

In accordance with the Mental Health Ecosystems approach, when studying the implications of MHS provision and organisation to DP risks, the catchment area features are first reported in order to understand the local context in which the health services are provided. The characteristics of the studied 104 municipalities and the municipality groups allocated by the degree of urbanicity are reported in Table 8. Urban municipalities included 29% of all the municipalities, but 79% of all DP recipients and 81% of all the catchment area population resided in them. Urban municipalities also had a lower ratio of mood disorder DP, mental health index and dependency ratio in the population, as well as a higher rate of higher education qualifications and population density. The characteristics of the semi-urban and rural municipalities were primarily similar, although semi-urban municipalities had lower unemployment rates. Rural municipalities also had the lowest rates of population density and higher education qualifications, but also the lowest rate of those not in education or training at age 17–24.

Table 8. Demographic characteristics of the municipalities in Study III

	All municipalities	Urban municipalities	Semi-urban municipalities	Rural municipalities
Municipalities included in the study	104	30	26	48
First-time mood disorder F30-39 DP receivers 2010-2015	13 783	10 943	1 872	968
Total population aged 18 to 65, end of 2015	1 951 261	1 584 015	240 458	126 788
The ratio of mood disorder DP, % of the population aged 18 to 65	0.71%	0.69%	0.78%	0.76%
Mental health index, not age-standardised *	98.8 (39.7–184)	94.5 (52.7–126.9)	100.4 (52.8–136.9)	100.7 (39.7–184)
Unemployment rate, as % of total population *	12.8% (6.8–22.9%)	13.1% (7.6–19.9%)	12.1% (6.8–20.1%)	13.0% (7–22.9%)
Household-dwelling-units with one person, as % of all household/dwelling units *	38.9% (22.2–51.2%)	39.8% (29.9–51.1%)	38.5% (23.9–45.8%)	38.6% (22.2–51.2%)
Population density, population/km^2 *	47.4 (0.5–2936.6)	407.4 (8.2–2936.6)	31.2 (0.8–115.8)	11 (0.5–48.1)
The demographic dependency ratio, as the number of people aged under 15 and over 64 per hundred working-age people aged 15-64 *	67.3 (44–102.8)	58.9 (44–72.3)	67.6 (57–79.9)	72.4 (55.2–102.8)
Higher education qualifications, as % of the total population aged 20 and over *	25.0% (13.8–57.1%)	31.7% (21–57.1%)	24.8% (16–35%)	21% (13.8–34.4%)
Not in education or training aged 17-24, as % of the total population of the same age *	8.6% (3.5–16%)	8.9% (5.5–15%)	9% (5.4–14.3%)	8.1% (3.5–16%)

Note. * Mean (and range) for the catchment area municipalities in 2015

Table 9. Characteristics of the municipality-level mental health service DESDE-LTC factors in Finland as means (with standard deviation)

	All municipalities	Urban municipalities	Semi-urban municipalities	Rural municipalities	Statistical significance [d]
All mental health services (MHS)					
FTE resources per 1 000 inhabitants [a]	3.13 (1.28)	3.12 (0.91)	2.96 (1.33)	3.23 (1.43)	p = 0.688
Service richness [b]	15.67 (6.09)	21.4 (6.38)	14.81 (4.28)	12.56 (3.82)	p < 0.001
Service diversity [c]	0.88 (0.04)	0.91 (0.02)	0.88 (0.05)	0.86 (0.04)	p < 0.001
Outpatient Care (DESDE-LTC code O)					
FTE resources per 1 000 inhabitants [a]	1.30 (0.58)	1.27 (0.34)	1.27 (0.57)	1.34 (0.69)	p = 0.843
Service richness [b]	5.57 (1.90)	7.00 (2.16)	5.35 (1.42)	4.79 (1.36)	p < 0.001
Service diversity [c]	0.70 (0.10)	0.74 (0.07)	0.72 (0.15)	0.67 (0.07)	p = 0.009
Local services without gatekeeping					
FTE resources per 1 000 inhabitants [a]	0.63 (0.54)	0.61 (0.52)	0.68 (0.48)	0.61 (0.57)	p = 0.871
Service richness [b]	3.80 (2.08)	5.57 (2.24)	3.81 (1.36)	2.69 (1.44)	p < 0.001
Service diversity [c]	0.54 (0.26)	0.71 (0.09)	0.60 (0.21)	0.40 (0.28)	p < 0.001
Local services with gatekeeping					
FTE resources per 1 000 inhabitants [a]	0.90 (0.67)	0.89 (0.46)	0.78 (0.67)	0.97 (0.76)	p = 0.515
Service richness [b]	5.15 (2.27)	7.03 (2.82)	4.58 (1.67)	4.29 (1.24)	p < 0.001
Service diversity [c]	0.71 (0.13)	0.77 (0.07)	0.66 (0.18)	0.69 (0.11)	p = 0.002
Centralized services					
FTE resources per 1 000 inhabitants [a]	1.60 (0.79)	1.62 (0.52)	1.50 (0.82)	1.65 (0.91)	p = 0.757
Service richness [b]	6.72 (2.78)	8.80 (2.87)	6.42 (2.31)	5.58 (2.18)	p < 0.001
Service diversity [c]	0.74 (0.13)	0.80 (0.06)	0.73 (0.16)	0.72 (0.14)	p = 0.028

Note. [a] Resources as the number of personnel in full-time equivalents (FTE) allocated by municipality population, per 1 000 inhabitants. [b] Richness as all the different DESDE-LTC classes available for the municipality's inhabitants. [c] Diversity as the Gini-Simpson Diversity Index (GSDI), calculated with service richness and the available units for the municipalities. [d] Statistical significances to detect whether the mean values of the urban, semi-urban and rural municipalities were different were computed with the one-way ANOVA test

Means and SD are reported for the calculated MHS types and their factors in Table 9. In all MHS types, the municipality groups were statistically significantly different concerning service richness and diversity, but did not differ regarding FTE resources per 1 000 inhabitants. The mean number of all MHS FTE in all municipalities was 3.13 per 1 000 inhabitants (SD: 1.28). The mean for service richness of all MHS was 15.67 distinct DESDE-LTC classes offering services to a single municipality's residents (SD: 6.09). The mean value of GSDI for all MHS diversity was 0.88 (SD: 0.04) between all municipalities. Concerning the municipality groups and MHS types, service richness and diversity were highest in urban municipalities, lower in semi-urban and typically lowest in rural municipalities. Only

in local services with gatekeeping did rural municipalities have a higher GSDI (0.69, SD: 0.11) than semi-urban municipalities (0.66, SD: 0.18).

When studying the MHS factors with negative binomial regression modelling adjusted based on the compositional factors of gender and age, noticeable differences between MHS factors and mood disorder DP associations were observed (Table 10). The relationship between MHS factors and DP appears also to be affected by the degree of urbanicity and the context of the municipalities.

When all municipalities were studied together, higher service richness and diversity in all MHS, outpatient care and local services with gatekeeping were associated with lower DP risk. Concerning urban municipalities, service richness was associated with lower DP in all five studied MHS types and with service diversity in local services without gatekeeping. Uniquely in semi-urban municipalities, a higher FTE per 1 000 inhabitants indicated a lower DP risk in all MHS, outpatient care, local services with gatekeeping and centralized services, but not in local services without gatekeeping. Furthermore, in the semi-urban context of outpatient care we found a lower risk of DP associated with higher service diversity, and in local services with gatekeeping, a lower DP risk with higher service richness and diversity. Thus, all studied MHS factors were associated with lower DP risk in semi-urban local services with gatekeeping, but not in local services without gatekeeping. Interestingly, we found no associations between the rural municipalities' MHS and DP risk.

Table 10. Associations of mental health service DESDE-LTC factors with mood disorder (F30-39) DP in Finland by incidence rate ratio (IRR) and 95% confidence interval (95% CI)

	All municipalities (N = 104)	Urban municipalities (n = 30)	Semi-urban municipalities (n = 26)	Rural municipalities (n = 48)
	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)
All mental health services (MHS)				
FTE resources per 1 000 inhabitants [a]	0.997 (0.965–1.030)	1.026 (0.970–1.085)	0.941 (0.897–0.988) *	1.046 (0.993–1.102)
Service richness [b]	0.995 (0.991–0.998) **	0.993 (0.988–0.998) **	0.998 (0.981–1.014)	0.996 (0.978–1.013)
Service diversity [c]	0.396 (0.185–0.850) *	0.211 (0.035–1.284)	0.373 (0.121–1.155)	0.555 (0.070–4.388)
Outpatient Care (DESDE-LTC code O)				
FTE resources per 1 000 inhabitants [a]	0.991 (0.918–1.070)	1.091 (0.962–1.237)	0.818 (0.726–0.922) **	1.109 (0.984–1.251)
Service richness [b]	0.978 (0.966–0.990) **	0.976 (0.962–0.990) **	0.961 (0.918–1.006)	0.985 (0.933–1.040)
Service diversity [c]	0.687 (0.511–0.924) *	0.679 (0.423–1.092)	0.644 (0.442–0.940) *	1.053 (0.408–2.716)
Local services without gatekeeping				
FTE resources per 1 000 inhabitants [a]	1.021 (0.953–1.094)	0.988 (0.901–1.084)	0.948 (0.824–1.091)	1.124 (0.995–1.270)
Service richness [b]	0.990 (0.979–1.001)	0.985 (0.970–1.000) *	1.019 (0.967–1.074)	1.007 (0.958–1.058)
Service diversity [c]	0.905 (0.778–1.054)	0.428 (0.258–0.711) **	0.925 (0.660–1.298)	1.083 (0.845–1.387)
Local services with gatekeeping				
FTE resources per 1 000 inhabitants [a]	0.974 (0.914–1.038)	1.050 (0.946–1.165)	0.881 (0.792–0.980) *	0.997 (0.890–1.116)
Service richness [b]	0.980 (0.970–0.990) **	0.982 (0.971–0.994) **	0.943 (0.913–0.975) **	0.943 (0.887–1.001)
Service diversity [c]	0.641 (0.500–0.821) **	0.865 (0.489–1.531)	0.544 (0.398–0.743) **	0.673 (0.327–1.383)
Centralized services				
FTE resources per 1 000 inhabitants [a]	0.997 (0.947–1.050)	1.038 (0.945–1.140)	0.925 (0.859–0.996) *	1.058 (0.976–1.147)
Service richness [b]	0.994 (0.985–1.003)	0.986 (0.974–0.998) *	1.021 (0.989–1.054)	1.008 (0.977–1.040)
Service diversity [c]	0.821 (0.613–1.099)	1.079 (0.548–2.126)	0.756 (0.500–1.145)	0.898 (0.546–1.477)

Note. Negative binomial regression model adjusted based on the compositional factors of gender and age.
[a] Resources as the number of personnel in full-time equivalents (FTE) allocated by municipality population, per 1000 inhabitants. [b] Richness as all the different DESDE-LTC-classes available for the municipality's inhabitants.
[c] Diversity as the Gini-Simpson Diversity Index (GSDI), calculated with service richness and the available units for the municipalities.
* Statistical significance at the 0.05 level. ** Statistical significance at the 0.01 level

5.2.3 MHS provision and mood disorder DP at the hospital district level (Study IV)

In Study IV, we performed a standard comparison of Finland's three most populous hospital districts (HUS, Southwest Finland and Pirkanmaa) with known mood disorder DP risk differences detected in Study II (Table 5). The characteristics of these three hospital districts with the whole of Finland as a comparison are shown in Table 11. HUS had a population aged 18 to 65 over three times higher compared to either Southwest Finland or Pirkanmaa, as well as the highest population density. HUS was also characterised by the lowest rate of unemployment, number of households with only one person, population aged 65 and over, and correspondingly the lowest demographic dependency ratio. In addition, HUS had the highest rate of higher education qualifications but also the highest rate of young people aged 17-24 not in education or training.

Southwest Finland and Pirkanmaa had more similar characteristics compared to HUS. Of the three districts, Pirkanmaa had the highest rates of unemployment and population aged 65 and over, and the lowest rate of population density but also the lowest rate of young people aged 17-24 not in education or training. Southwest Finland had the highest rate of households with one person and the lowest rate of higher education qualifications. Interestingly, Southwest Finland had the highest number of mental health outpatient visits per 1 000 persons aged 18 and over, and Pirkanmaa by contrast the lowest number. The demographic dependency ratio was similar between Southwest Finland and Pirkanmaa.

Table 11. Sociodemographic characteristics for the three most populous hospital districts and for the whole of Finland as a comparison (2015)

	Helsinki and Uusimaa (HUS)	Southwest Finland	Pirkanmaa	Finland
First-time mood disorder F30-39 disability pension (DP) receivers 2010-2015	6 706	2 197	2 553	24 132
Total population aged 18 to 65	1 045 309	291 768	323 532	3 348 683
Mental health outpatient visits per 1000 persons aged 18 and over	450.8	578.6	346.7	496.2
Mental health index, not age-standardised	81.40	93.20	112.60	106.4
Unemployment rate, as % of labour force	11.3%	13.2%	15.3%	13.4%
Household/dwelling units with one person, as % of all household/dwelling units	41.6%	43.5%	42.9%	42.2%
Population density, population/km^2	184.7	43.3	36.4	18.1
Population aged 65 and over as % of the total population	16.5%	20.6%	21.7%	20.5 %
Demographic dependency ratio, as the number of people aged under 15 and over 64 per hundred working-age people aged 15-64	50.0	58.9	58.3	58.2
Higher education qualifications, as % of the total population aged 20 and over	36.9%	29.4%	30.7%	30%
Not in education or training aged 17-24, as % of the total population of the same age	10.3%	8.5%	6.9%	8.3%

Evident distinctions between the three hospital districts were observed regarding overall DESDE-LTC service class distribution. The differences between the MHS factors are shown in Table 12 and the differences in the patterns concerning outpatient care allocation in Figure 10. Regarding all MHS, HUS with the largest population and lowest DP risk, had approximately twice as many MTCs but three times the number of FTE as Southwest Finland and Pirkanmaa. HUS had the highest service richness and the highest service diversity. HUS also had the highest service diversity in outpatient care and local services without gatekeeping.

Table 12. Characteristics of the DESDE-LTC mental health service factors in the three largest Finnish hospital districts

	Helsinki and Uusimaa (HUS)	Southwest Finland	Pirkanmaa	Statistical significance
All mental health services (MHS)				
MTC units	416	215	179	
MTC per 100 000 inhabitants	39.8	74.2	55.5	p < 0.001 [d]
FTE resources [a]	3107.4	1023.7	936.9	
FTE per 100 000 inhabitants	297	353.4	290.6	p < 0.001 [d]
Share of all FTE	100%	100%	100%	p = 1 [e]
Service richness [b]	54	40	31	p < 0.001 [d]
Service diversity [c]	0.94	0.89	0.91	
Outpatient Care (DESDE-LTC code O)				
MTC units	145	89	72	
MTC per 100 000 inhabitants	13.9	30.7	22.3	p < 0.001 [d]
FTE resources [a]	1286	456.2	366	
FTE per 100 000 inhabitants	122.9	157.5	113.5	p < 0.001 [d]
Share of all FTE	41%	45%	39%	p = 0.044 [e]
Service richness [b]	16	12	10	p = 0.025 [d]
Service diversity [c]	0.80	0.65	0.64	
Local services without gatekeeping				
MTC units	168	117	83	
MTC per 100 000 inhabitants	16.1	40.4	25.7	p < 0.001 [d]
FTE resources [a]	342.7	324.7	244.6	
FTE per 100 000 inhabitants	32.8	112.1	75.9	p < 0.001 [d]
Share of all FTE	11%	32%	26%	p < 0.001 [e]
Service richness [b]	15	13	7	p = 0.01 [d]
Service diversity [c]	0.80	0.68	0.67	
Local services with gatekeeping				
MTC units	136	48	42	
MTC per 100 000 inhabitants	13	16.6	13	p < 0.001 [d]
FTE resources [a]	1130.2	206.3	171	
FTE per 100 000 inhabitants	108	71.2	53	p < 0.001 [d]
Share of all FTE	36%	20%	18%	p < 0.001 [e]
Service richness [b]	19	13	10	p = 0.038 [d]
Service diversity [c]	0.85	0.86	0.86	
Centralized services				
MTC units	112	50	54	
MTC per 100 000 inhabitants	10.7	17.3	16.7	p < 0.001 [d]
FTE resources [a]	1634.4	492.7	521.3	
FTE per 100 000 inhabitants	156.2	170	161.7	p < 0.001 [d]
Share of all FTE	53%	48%	56%	p = 0.003 [e]
Service richness [b]	20	14	14	p = 0.011 [d]
Service diversity [c]	0.89	0.90	0.89	

Note. Inhabitants calculated from the population aged 18 to 65.
[a] Resources as the number of personnel in full-time equivalents (FTE). [b] Richness as all the different DESDE-LTC-codes for Main Types of Care (MTC) available in the hospital district. [c] Diversity as the Gini-Simpson Diversity Index calculated with service richness and MTCs. [d] Statistical differences analysed with Poisson regression, population used as exposure. [e] Statistical differences analysed with the Chi-squared test

Additionally, HUS was characterised by a strong emphasis on local services with gatekeeping, comprising 36% of all available FTE and the highest rate of FTE per 100 000 inhabitants, but it also had the lowest share of FTE in local services without gatekeeping, which accounted for only 11% of all FTE and the lowest FTE per 100 000 inhabitants. Overall, HUS had the highest service richness but the lowest rate of MTCs per 100 000 inhabitants of all the MHS types considered. There was a strong focus on outpatient care in medium-intensity outpatient clinic services (O9), with mainly an outpatient care visit frequency of at least once in two weeks, and more home-delivered, mobile high-intensity care (O5) compared to other districts.

With a DP risk corresponding to the Finnish national average, Southwest Finland had the most MTCs and FTE per 100 000 inhabitants in all MHS. It had the strongest emphasis on outpatient care, with 45% of all FTE, and on local services without gatekeeping, with 32% of all FTE, respectively. Overall, Southwest Finland had the highest number of MTCs per 100 000 inhabitants in all MHS types, and the highest rate of FTE in all but local services with gatekeeping. Southwest Finland's psychiatric outpatient services were mainly classified as low intensity services (O10), with care visits mainly less often than once every two weeks. However, Southwest Finland also had the most resourced high intensity outpatient services (O8), with care visits mainly at least three times a week.

Pirkanmaa, with the highest mood disorder DP risk, had the lowest overall number of MTCs and FTE in all but centralized services. It also had the lowest FTE per 100 000 inhabitants in all MHS, outpatient care and local services with gatekeeping. Pirkanmaa had a strong emphasis on centralized services, with 56% of all FTE. It also had the lowest service richness in all except centralized services, where it had the same number of different MTC classes as Southwest Finland with 14 different classes. Similarly to Southwest Finland, Pirkanmaa's psychiatric outpatient services were mainly comprised of low intensity services (O10) but with approximately only two-thirds of the FTE per 100 000 inhabitants. In our analysis, Pirkanmaa lacked acute mobile services (O1-O2) and mobile high intensity outpatient care (O5).

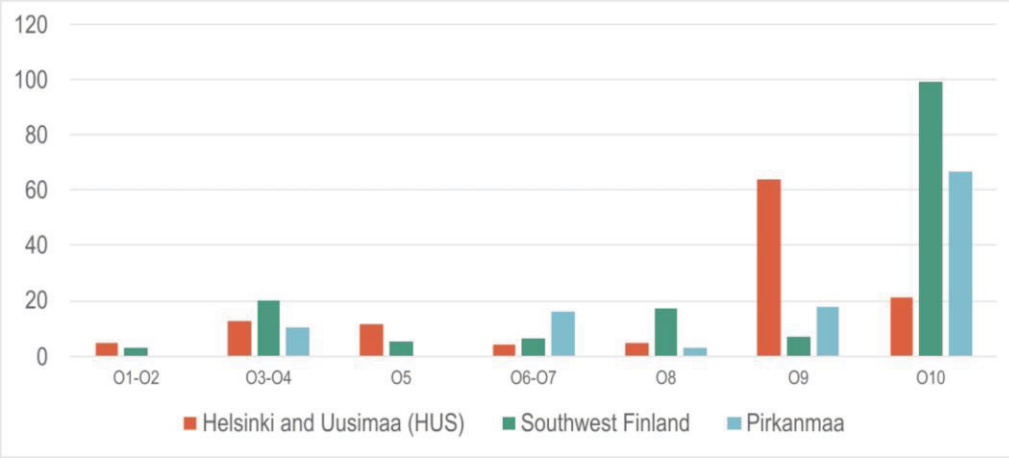


Figure 10. The distribution of resources in outpatient care (O) as the number of personnel in full-time equivalents (FTE) per 100 00 inhabitants.
Note. O1-O2: Acute, home & mobile
O3-O4: Acute, non-mobile
O5: Non-acute, home & mobile, high intensity
O6-O7: Non-acute, home & mobile, medium, and low intensity
O8: Non-acute, non-mobile, high intensity
O9: Non-acute, non-mobile, medium intensity
O10: Non-acute, non-mobile, low intensity

6 DISCUSSION

6.1 Summary of the main findings

In this series of studies, we found several differences related to social and regional determinants, as well as to MHS utilisation and provision, concerning the risk for disability pensioning due to mental disorders. These findings contribute to our understanding of the factors and mechanisms at the different levels of mental health ecosystems affecting meso- and macro-level early retirement for mental disorders.

Study I examined the role of socioeconomic disparities as significant epidemiological risk factors for premature psychiatric retirement at the macro-level. Overall, mental disorder DP appeared to be associated with lower SES, including shorter formal education and lower income, and a more frequent status of living alone. As a novel finding, we reported that individuals holding white-collar occupational positions exhibited an elevated risk of mental disorder-related DP, particularly prominent in mood disorders, after adjusting for education, income and family type. We also found that among SES, students had the highest risk associated with mental and mood disorder DP.

Study II identified notable differences in mental disorder DPs among Finnish hospital districts, even after adjusting for the compositional background differences of the respective district populations. We identified several contextual and MHS utilisation factors that exhibited significant associations with the identified variation, while interestingly some did not. The compositional and contextual differences did not alone explain the observed regional differences. This, along with the observed associations with the population's MHS use and DP risk, points towards the role of structural and functional disparities in regional service systems and processes in explaining part of the reported regional discrepancy.

In Study III, we adopted the Mental Health Ecosystems approach to further investigate the associations between MHS and DP. In this study, we identified a connection between the service resourcing, richness, and diversity of MHS and mood disorder DP risk. This study also revealed discernible disparities regarding the association of MHS factors and mood disorder DP risk across different municipality contexts by the degree of urbanity. A novel approach to using the GSDI enabled us

to identify an association of higher service diversity with lower DP risk, especially in all MHS, outpatient care and local services with gatekeeping.

The three most populous Finnish hospital districts have previously been reported to have equal rates of mood disorder prevalence (Markkula et al., 2015; Pirkola et al., 2005), but distinct mood disorder DP risk differences were nonetheless identified in Study II. Therefore, Study IV conducted a standard assessment and comparison of the local MHS between these three hospital districts. Our findings indicated significant variation in the patterns regarding MHS resourcing and resource allocation, service richness and service diversity between these districts. The findings in Studies III-IV reinforce the premise that the organisation, structure, and different functional capabilities of regional MHS play a crucial role in influencing the incidence of psychiatric disability pensioning in their respective mental health ecosystems.

6.2 Findings in relation to prior research literature

6.2.1 How social determinants are associated with mental disorder DP risk

Our findings concerning the negative trend of educational and income level effects on DP risk is in congruence with the results of previous studies (Ahola et al., 2011; Ervasti et al., 2013; Gustafsson et al., 2014; Mattila-Holappa, Joensuu, Ahola, Vahtera, et al., 2016). Several theories can be used to explain and understand these findings, including the social causation and social selection hypotheses (Dohrenwend et al., 1992; Hakulinen et al., 2023). Additionally, the cultural-behavioural hypothesis highlights that certain unhealthy behaviours may be more socially acceptable or common in lower SES, suggesting that health behaviour is one of the pathways mediating the connection between SES and mental health.

The more complex sociological approaches considering the possibility of several overlapping mechanisms of SES and mental health associations include the life-course approach, Fundamental Cause Theory and Giddens' Structuration theory (Compton & Shim, 2015; Øversveen et al., 2017; World Health Organization & Calouste Gulbenkian Foundation, 2014). These theories include the aspects of the accumulation of biopsychosocial advantages and disadvantages over time, stress SES as a meta-mechanism where the exact effecting mechanism in an individual's life can change at different points of life and people's habits and behaviours producing and reproducing the environments and structures in which they live and work. Thus,

these findings are suggested to be interpreted in the context of several interacting mechanisms and processes of causality, structure and agency. Concerning the Mental Health Ecosystems approach, these findings and interpretative theories are relevant to its second and third domains, the wider determinants of health and health behaviours and lifestyles, contributing to the understanding of different mental health outcomes in the macro-level health ecosystem of Finland.

6.2.2 White-collar work and mental disorder DP

Prior research has consistently reported an association between manual work and an elevated risk of mental disorder-related DP (Ervasti et al., 2013; Halonen et al., 2017; Samuelsson et al., 2012; Virtanen et al., 2011). Our study builds upon this existing knowledge by increasing the understanding of the association of SES and DP by showing that after controlling for SES and family type, the risk level in lower and upper white-collar occupations surpassed those observed for blue-collar workers.

Especially in non-manual professions during the beginning of the 21st century, working life has witnessed a shift towards increased autonomy for individual workers (Väänänen & Toivanen, 2018). Paradoxically, this greater autonomy has introduced greater interdependence and structural demands among workers, increasing the psychosocial strain in non-manual work. Other changes in working life have also included elevated competency and education requirements, the need for resilience in high-paced changes, uncertainty and complex environments, and continuous occupational learning and development requirements (Kokkinen, 2020; Vorma et al., 2020). Prior research has indicated several work-related factors to be associated with loss of working ability, for example job strain and control, high job demands, effort-reward imbalance of the workplace as well as inadequate possibilities for work content and context adjustments (de Vries et al., 2018; Joosen et al., 2022; Juvani, 2018; Leinonen et al., 2011; Nieuwenhuijsen et al., 2004).

Our findings indicated that white-collar occupations are associated with an increased risk of psychiatric early retirement, especially for mood disorders, after accounting for education, income and family factors. Considering the above prior research, mood disorders could be seen as affecting one's mental working ability in non-manual work in a psychosocially more demanding, strenuous and uncontrollable environment and thus more compellingly lead to a DP. By contrast, blue-collar workers could experience depressive symptoms or diagnosed depression

without necessarily facing critical impairments in their physical working ability, thus not resulting in DP.

Upper and lower white-collar workers' higher risk of DP due to mood disorders was also higher than for non-affective psychotic disorders. Conversely, agriculture and forestry entrepreneurs and the unemployed had a higher risk of DP due to non-affective psychotic disorders than mood disorders. In addition to the effects of the primary conditions, these findings support the interpretation that white-collar workers may face an elevated risk of DP in their psychosocially demanding work environments. Moreover, the high-level education requirements usually associated with white-collar professions may contribute to a reduction in the number of individuals at risk for non-affective psychotic DP in this population, as the onset of psychotic disorders usually taking place earlier in the life course can hinder the progression of studies and thus of employment in white-collar working positions.

6.2.3 Students and mental disorder DP

Our findings indicated that student status was associated with the highest levels of risk in all mental and mood disorder DPs, although higher educational levels were associated with a lower risk of mental disorder DP. When entering DP, the students were three years older than those in the control group and even five years older in the case of mood disorder DP. In mood disorders, half of the retired students had already completed their secondary upper-level education, and thus it can be speculated that they were most probably students in universities or universities of applied sciences. In non-affective psychotic disorder DP, most of the students had completed only primary education, thus implying high school or vocational school studies at the moment of entering DP.

It is possible that in the case of these students retired for psychiatric reasons we are witnessing the accumulation of several simultaneous risk factors during their life course (Halonen et al., 2017; Paananen et al., 2013; World Health Organization & Calouste Gulbenkian Foundation, 2014), resulting in severe mental health problems with a subsequent DP. Because retired students were on average older than control students, one possible interpretation is that they had been struggling with mental health problems for many years before retiring, which had also considerably delayed their studies. This consequently prevented them from graduating and moving on to higher educational, occupational and income levels. Another interpretation of the

data is that the retired students included more people starting or continuing their studies at an older age, or participating in vocational rehabilitation.

6.2.4 Regional determinants and differences in mental disorder DP risk

Our findings indicated that several Finnish hospital districts have differences in mental disorder DP compared to the Finnish national mean risk. We also identified hospital districts with an opposite pattern of mood/non-affective psychotic disorder DP in their respective region. Because prior research has not indicated significant regional differences in mental disorder prevalence between Finnish regions (Markkula et al., 2015; Pirkola et al., 2005; Suokas et al., 2023), the primary reasons for the reported DP differences can be hypothesised to lie elsewhere than disorder prevalence. According to the Mental Health Ecosystems approach, these regional differences could stem from differences in regional determinants (the places and communities the population resides in, as well as the wider determinants of health) and the health service system characteristics. Our findings regarding regional differences were similar to those of two prior Finnish studies on mental disorder DP risk (Kiviniemi et al., 2011; Laaksonen & Gould, 2013), but some differences were included. One possible explanation for this is the different time frame of these studies compared to ours, with Study II in this dissertation using the most recent data.

Concerning the regional determinants, we focused on the effects of contextual factors while controlling for the compositional factors of age, gender and occupational level of the population, and limiting collective factors outside the scope of this study. Our findings indicated that several contextual factors were associated with regional mental disorder DP risk differences. Higher regional socioeconomic level indicators were associated with lower regional all mental and mood disorder DP risk: these included districts with low poverty rates and exceptionally high employment rates. The hospital districts of the capital area HUS and western Vaasa were prominent in these factor groups, which could partly explain their lower risk of mental disorder DP. HUS and Vaasa also had the highest rates of Swedish-speaking and foreign background population, associated with a lower DP risk. There is prior literature attesting to the health advantages of the Swedish-speaking minority in Finland, with possible explanations suggesting cultural differences and a high degree of social capital (Hyyppä & Mäki, 2001; Laaksonen & Gould, 2013; Sipilä & Martikainen, 2009).

In addition, there are well-documented Finnish regional differences in overall health, and prior research has identified that geographical differences in socioeconomic and sociodemographic structure are associated with differences in regional health, health behaviour and mortality in Finland (Blomgren et al., 2004; Hyyppä & Mäki, 2001; Kauppinen & Karvonen, 2009; Kestilä et al., 2019; Pirkola et al., 2009). Thus, the regional differences stemming from the mental health ecosystem domain of health behaviours and lifestyles could also indirectly contribute to the above associations of DP and regional socioeconomic differences. Regional differences in health behaviours could also independently moderate the relationship between disorder prevalence and DP rates. Although this is important to note in order to understand health ecosystem totality, it is ultimately outside of the scope of this thesis. As one indicator of health behaviour, however, the sale of alcoholic beverages per capita appeared to have no clear association with mental disorder DP, which was unexpected. This result may, however, be due to the regional rate of alcohol sales not being equal to alcohol consumption, as the regional consumed alcohol could be imported from other districts or from abroad. Thus, the health behaviour of alcohol consumption cannot be precisely measured with this variable.

Because the regional variation in mental disorder DP did not disappear after adjusting for the compositional effects and was not solely explained through contextual factors, contributing factors to these DP risk differences can also be suspected to lie elsewhere. Thus, our focus finally turns towards the role of the health service system regarding DP risk differences.

6.2.5 The role of MHS in mental disorder DP risk

The efficiency of the service system in responding to the population's MHS needs with effective and timely treatment can be seen as a crucial element in preventing work disability and DPs, especially in the case of mood disorder DP. The regional DP risk variance may reflect the differences in mental health service systems and local treatment practices (Furst et al., 2020; Kiviniemi et al., 2011; Rosen & Salvador-Carulla, 2022). Firstly, we will discuss the findings regarding the association between DP and the use of MHS by the local population, and then the results concerning the organisation and provision of the MHS systems.

Regarding public outpatient services, our findings indicated an association between all adult mental health outpatient visits and regional mental and mood disorder DP risk. Unexpectedly, both the regionally highest and lowest numbers of

outpatient visits showed a higher risk of DP compared to the national average of the number of outpatient visits. A possible explanation for the highest visit rate's higher risk could include inefficient functioning in the local service systems or a higher prevalence of (and more severe) mental disorders in those districts; although as stated before, there are no significant epidemiologically indicated regional differences between mood disorder prevalence in Finland, making the higher prevalence-explanation less likely (Markkula et al., 2015; Pirkola et al., 2005). Possible explanations for the association between the lowest number of outpatient visits and high regional risk of DP could be that the regional outpatient services are lacking in resourcing or functioning, thus resulting in a lower output of visits and a failure to meet the population's needs. Another possible explanation for this finding could be that these are more rural districts with fewer work opportunities for the people, therefore making it a more frequent practice to grant DP in these districts rather than to prescribe rehabilitation related to work. However, the three hospital districts with the lowest number of outpatient visits per inhabitants are Kymenlaakso, Pirkanmaa and North Ostrobothnia, which are not particularly rural nor do they have a particularly low employment rate, which points towards the service system-hypothesis.

We also investigated the relationship of DP with outpatient visits in psychiatric special health care and primary health care. The highest number of both visits was associated with a more elevated mood disorder DP risk. However, a significant difference found between them was that while the lowest regional number of special health care visits was associated with a higher DP risk, the lowest rate of primary health care visits was associated with a lower risk of DP for all mental and mood disorders compared to the national mean. Because HUS and Vaasa were the hospital districts with the lowest numbers of primary health care visits, a note of caution is due here: the reasons for the low DP risk of these two hospital districts most probably include complex interactions between the contextual factors and MHS and should not be explicitly explained by the low number of primary health care visits.

An essential source of psychotherapy in Finland is officially provided through national rehabilitation services as rehabilitative psychotherapy by private services and publicly reimbursed by the Social Insurance Institution. These services have seen a vast surge in new recipients during the last two decades, with the number increasing over fivefold from less than 10 000 in 2005 to over 50 000 in 2019 (Leppänen et al., 2022). Our findings indicated no clear association or trend between mental disorder DP and the regional number of recipients of rehabilitative psychotherapy. This is to some degree in contrast to previous studies, which have indicated that participating

in rehabilitative psychotherapy is associated with a decline in work disability and an improvement in labour market outcomes on the Finnish populational level (Kausto et al., 2022; Peutere et al., 2023). This raises questions about the organisational proficiency of the provision of rehabilitative psychotherapy in Finland. As rehabilitative psychotherapy's primary purpose is to improve and uphold rehabilitation clients' ability to work and study, its rate of recipients in the population would also be expected to be associated with regional DP risk (Leppänen et al., 2022, 2023; Patana, 2014). One possible reason behind this may be that Finnish rehabilitative psychotherapy may be focused on the people or districts not in the highest DP risk, as there is known to be substantial socioeconomic and regional variation in the use and availability of rehabilitative psychotherapy services (Leppänen et al., 2022; Linnaranta et al., 2023; Selinheimo, Gluschkoff, Kausto, et al., 2023; Selinheimo, Gluschkoff, Turunen, et al., 2023).

Regarding psychiatric inpatient care, our findings indicated that the highest involuntary referral rates were associated with a higher non-affective psychotic disorder DP risk. This result is consistent with previous research demonstrating an increased regional risk of psychotic disorder DP with high involuntary treatment rates (Kiviniemi et al., 2011). Furthermore, the lowest regional number of inpatient treatment periods was associated with a lower risk of mental disorder DP in all three diagnostic categories compared to the national mean of treatment periods. The lowest number of individual patients in inpatient care was also associated with a lower regional DP risk for all mental and mood disorders, and the highest regional number of patients with a higher risk of non-affective psychotic disorder DP. These findings suggest two possible interpretations. Firstly, they could indicate that districts with more severe disorders requiring inpatient care also naturally have a higher regional DP risk. Alternatively, regional service systems with a greater focus on inpatient and hospital treatment might be associated with a higher risk of DP than hospital districts with a stronger focus on outpatient services. Both explanations could be expected also to be reflected through a higher regional number of care days: however, we found no noteworthy association with the number of care days in inpatient care with DP risk.

6.2.6 The relationship of MHS provision and organisation with mood disorder DP

In this thesis, we extensively investigated the relationship between MHS provision and mood disorder DP risk on both the municipality and hospital district levels. These studies utilised the Mental Health Ecosystems approach with a comprehensive standardised classification and description of catchment areas' local MHS with DESDE-LTC data (Furst et al., 2020; Salvador-Carulla et al., 2013).

One novel finding in the present study identified a connection between higher service richness and diversity on the one hand and lower mood disorder DP on the other. This was the case in the studied seven hospital districts, their urban and semi-urban municipalities and with HUS compared to Southwest Finland and Pirkanmaa. There are several possible explanations for this finding. The higher variation in service provision might indicate a high-quality, well-developed service system with higher effectiveness in treating mood disorders and thus preventing work disability. Higher diversity in MHS could also allow services to respond more broadly to different population needs and have fewer gaps in service provision (Pirkola et al., 2009). Ergo, lower service richness and diversity might result in critical systemic gaps in the provision of MHS as well as care pathways. Prior research has already identified some of these gaps in different service systems using the DESDE-LTC taxonomy (Ala-Nikkola et al., 2014; Fernandez et al., 2017; Gutiérrez-Colosía R. et al., 2019; J. Salinas-Perez et al., 2020; Salvador-Carulla et al., 2008).

Our findings indicated apparent differences between DP risk and MHS provision associations in urban, semi-urban and rural contexts. The semi-urban municipality context showed the clearest association between MHS and mood disorder DP. In urban and rural municipalities, other contextual factors might significantly affect mood disorder DP rates and populational needs for the MHS, confounding the effects. The urban municipalities in our study had, on average, a lower dependency ratio in the population and a higher rate of higher education qualifications. It is also important to note that the MHS included more MTCs in urban municipalities which need to be interconnected. MHS comprise complex dynamic systems, and the (un)successful organisation of this complexity for effective patient care pathways might be one confounding factor in the provision of large urban area MHS systems (Cohen, 2017; Furst et al., 2020, 2023; Rock & Cross, 2020).

Interestingly, we did not find significant associations between MHS provision and DP risk in rural municipalities. This surprising finding might be attributed to possible confounding contextual factors, as stated above. Rural municipalities had

the lowest rates of higher education qualifications and population density, which associates with longer distances to the physical service location and those outside of education or training at age 17 to 24. In addition, other confounding effects might include a higher average population age, higher unemployment rate, and emphasis on blue-collar occupations often associated with rural contexts. Indeed, our findings in Study II regarding population density indicated its significant association with mental and mood disorder DP risk, but not with non-affective psychotic disorder DP risk. This might be explained by the easier accessibility of MHS and the effects of more diverse MHS with a higher population size of the area, contributing to better treatment outcomes regarding mood disorders and working ability (Ala-Nikkola et al., 2014). One other explanation for this finding might be that if the local MHS have been applied urbanely based, top-down and not based on populational needs, this may result in instability and system fragility that might be amplified in rural settings more than in an urban context (Salinas-Perez et al., 2023).

6.2.7 Standard comparison of the MHS provision between Finland's three most populous hospital districts

The present study identified significant differences in mood disorder DP risk and major variation in the overall patterns regarding MHS resourcing and resource allocation even between Finland's most populous hospital districts. Because these districts, HUS, Southwest Finland and Pirkanmaa, have somewhat similar sociocultural contexts, they are all situated in southernmost, urban Finland and they have all been subjected to the same national regulatory legislation and regional steering actions, these findings provide further support for the role of organisation and structure of regional MHS in the incidence of psychiatric DP for mood disorders. It is, however, also sensible to assume that the reasons for the detected dissimilarities include historical, socioeconomic and administrative factors outside the scope of this study (Keskimäki et al., 2019; Patana, 2014; Pirkola et al., 2009). Although differences in MHS organisation may indicate different populational needs in complex systems, they may also produce just such disparity and inequality that the current national Finnish service structure reform aims to suppress.

Among the three hospital districts analysed, HUS, as the hospital district with the lowest mood disorder DP risk, was characterised by higher rates of socioeconomic prosperity and high service richness and diversity. This might indicate that the population of HUS has a higher rate of material resources and welfare compared to

Finnish citizens on average, and they also have access to more diverse services that meet the population's needs and have fewer gaps in MHS provision. Previous research has highlighted that a substantial proportion (84%) of service variation is explained by the size of the catchment area (Ala-Nikkola et al., 2014), which at least partly explains HUS's approximately 1.5- to 2-fold higher service richness compared to Pirkanmaa.

Interestingly, HUS only had the highest FTE per 100 000 inhabitants in local services with gatekeeping, where most of its FTE were allocated to medium-intensity polyclinic services (DESDE-LTC class O9). By contrast, outpatient resources of Southwest Finland and Pirkanmaa were mainly classified as low-intensity services (O10), indicating intervals of over two weeks between most care visits for patients. The MTCs in DESDE-LTC taxonomy are classified corresponding to the actual interval between most of the provided outpatient care visits. Therefore, this might point to the importance of the services being able to respond to treatment needs with sufficient appointment frequency regardless of whether the services have gatekeeping. Interestingly, HUS also had the lowest MTC per 100 000 inhabitants in all MHS types, but the high FTE per 100 000 inhabitants indicated that these MTC were more prominent on average FTE-wise compared to Southwest Finland and Pirkanmaa.

When comparing Southwest Finland and Pirkanmaa, two hospital districts with almost equal population bases, Southwest Finland had a higher overall FTE and higher service richness in all studied MHS types except centralized services. Conversely, Pirkanmaa had the lowest FTE per 100 000 inhabitants of the three districts in all MHS, outpatient care and local services with gatekeeping. Study II also indicated that Pirkanmaa had one of the lowest rates of outpatient visits among the Finnish population. These observations suggest that possible factors connected to Pirkanmaa's higher DP risk might include the regional MHS being under-resourced and unable to produce an adequate level of outpatient care to meet the needs of the population. Furthermore, the lower variation in services pointed to some vital treatment gaps in service provision, with a lack of acute mobile services (O1-O2) and mobile high-intensity outpatient care (O5) and more of the FTE allocated to centralized services compared to the MHS of HUS or Southwest Finland. Previously, an expert committee has noted these same concerns and development needs in Pirkanmaa (THL, 2020).

6.3 Societal implications

Mental health problems and resulting DPs are among the highest societal expenses in many high-income countries. In Study I, we initially identified over 50 000 people in Finland with a first-time mental disorder DP in only a six-year timeframe. Social determinants of mental health play a significant role in the incidence of mental disorders and thus mental disorder DPs, as also seen in Study I (Compton & Shim, 2015; A. Macintyre et al., 2018; World Health Organization & Calouste Gulbenkian Foundation, 2014). Preventive efforts and processes should accordingly be targeted on a population level.

Working life and non-manual work have experienced significant changes with increasing requirements for more autonomy as well as psychosocial demands for individual workers than previously. These can create harmful circumstances that increase individual and collective risks for developing mental health problems and disorders. This should be acknowledged with national efforts striving to promote a healthy and sustainable working life in order to decrease the risk of mental and mood disorder DP in the long term. Work content- and work context adjustments regarding white-collar workers with reduced working ability could be one possibility to aid them in better retaining and strengthening their capability to work in their workplace (Joosen et al., 2022). The targeting of early recognition and preventive consideration is especially indicated for students, because of their high risk of mental disorder DP and their young age.

The Finnish Mental Health Strategy 2020–2030 promotes broad-based MHS that meet people's needs, highlighting the requirement that the services be of high accessibility, effectivity, quality, availability, flexibility and compatibility, and that they should support continuity (Vorma et al., 2020). Several such programmes in Finland aim to elevate the contents and care pathways of regional MHS (Linnaranta et al., 2023; Saarni et al., 2022). This implementation work and the ongoing health and social service structure reform create a productive basis for such MHS to meet people's needs. This dissertation adds to the knowledge concerning MHS by indicating that the diversity and totality of service provision should be accounted for in MHS planning by experts and stakeholders in order to offer services matching population needs.

Despite the prior national-level regulatory legislation and regional steering, this thesis addressed notable divergence in MHS organisation, possibly contributing partially to the differences in mental disorder DP risk between the different regions of Finland. These are to be recognised as potential sources of significant regional

inequality in mental health outcomes. In the ongoing reform work, national cooperation and joint service development are strongly suggested to ensure equal, high-quality services for all. Otherwise, we might end up making the same past mistakes of creating fragmented services not able to serve the population to their full potential.

6.4 Strengths and limitations

The strengths of the present dissertation and the RETIRE – research project include the use of comprehensive, high-coverage national-level data registers together with a large-scale case-control setting. In an international context, Finnish population registers are valued as high-quality data sources that have allowed the detailed research of different social and regional determinants in this thesis (Gissler & Haukka, 2004; Sund, 2012; Sund et al., 2014). To the best of our knowledge, no such extensive studies regarding mental disorder DP have previously been conducted. Another strength was the use of the DESDE-LTC mapping tool for clear hierarchical taxonomy-based coding of the local MHS and the consideration of the regional MHS provision context in line with the Mental Health Ecosystems approach. Both are essential in researching complex MHS systems (Furst et al., 2019, 2020; Johnson et al., 2000). DESDE-LTC provides an internationally approved set of systems indicators, classification of services and terminology (Furst et al., 2019; Gutierrez-Colosia et al., 2022; Salinas-Perez et al., 2020; Salvador-Carulla et al., 2013). DESDE-LTC data collection and analysis included obtaining the MHS information through interviews with local organisation supervisors, which has been indicated to have higher validity than using only the official services listings (Romero-López-Alberca et al., 2019; Salinas-Perez et al., 2020).

This dissertation also includes several limitations. One major limitation in Study I was that due to the study design, we could not calculate ORs for age or gender. Furthermore, temporal assumptions cannot be made considering the changes in the SES factors affecting DP risk or the exact effects of changing working life. Furthermore, as our study is epidemiological and associative in nature, our data and analyses do not allow us to make presumptions about which pathways and mechanisms are behind the associations between SES and mental health in our study population. Theoretical frameworks for these mechanisms have been discussed in the light of the previous literature in order to allow the reader to understand these findings related to SES.

One major limitation in Study II was that due to the correlative nature of the used factors, they could only be added to the statistical models one at a time. Furthermore, we could not adjust the hospital district DP risks with the contextual and MHS factors in addition to the compositional factors to study their effects on individual hospital district risks. It is also important to note that because of the small number of hospital districts in the analyses, it is possible that some higher or lower risk levels in regional factor groups could be attributed to specific hospital districts causing the different levels of risk as data artefacts. This would mean that in those assumed cases, the differences in the contextual and MHS utilisation factors in question would not be directly responsible for the different risk levels, but that the hospital district would be acting as a mediator in the model and the actual factors affecting the risk levels would lie elsewhere.

The study settings in Studies III-IV include several limitations. One major hurdle in Study III was that because of the variation in multicollinearity between the municipality groups and different MHS types, the MHS factors could not be entered and adjusted in the same model. Secondly, in Study III, some MTCs provided services to several municipalities, which could involve regional dynamics that could not be comprehensively considered in this study. In these MTCs, the FTE was allocated to municipalities based on the relative share of each municipality's inhabitants and the population receiving services from the said MTC. This factor was based on the assumption that all the municipalities used the MHS available to them equally. Thirdly, the MTCs could be of different sizes, which did not affect the FTE but could affect GSDIs, which were calculated with the available MTCs in the municipality and the hospital district and therefore reflected the number of components in the complex MHS system rather than the components' size. Fourthly, the used DESDE-LTC data did not include information concerning the cooperation between the services or pathways of care between them, or on whether the psychosocial treatment provided was grounded in evidence-based psychosocial treatment models and a specific philosophy/culture of psychosocial treatment provision. Without this information, some aspects of the complex dynamics in these MHS ecosystems are undoubtedly outside the scope of this thesis.

It is important to note that the DESDE-LTC classification tool is not all-inclusive, and there may have been subtle features of the classified MTC that are not recognised in the analysis. The DESDE-LTC data in this study only included public services, and it excluded Finnish occupational health care, private services or rehabilitative psychotherapy imbursed by the Social Insurance Institution of Finland. However, previous studies have indicated a lower mental disorder DP risk in

occupational health care users compared to population statistics (Reho et al., 2020) and a higher rate of sick leaves for mental disorders in public service users compared to occupational health or private service users (Perhoniemi & Blomgren, 2021). These findings imply that the public MHS have a crucial populational role in treating and preventing mental disorders and disability in Finland.

Regarding the use of GSDI, it should be noted that the index values are comparable only if the catchment areas are on the same spatial scale (Magurran, 2021). This means that the hospital district-level and municipality-level GSDI values in this dissertation are not straightforwardly comparable.

6.5 Direction for future research

There are several implications for future research indicated by the present dissertation. Concerning the social determinants, further research is required to assess whether changes have occurred before or after our study's time frame regarding the DP risk associated with social determinants. This could help better understand the effects that changing working life has on the white-collar workers' working ability. Moreover, a broad range of services, including local social, education, housing, justice and employment services as well as employment opportunities in different work and industrial sectors presumably play a role in regional DP outcomes in the case of people on the verge of DP. Considering these services and differences would be an interesting topic for further mental health ecosystem research.

Regarding MHS research, future studies should integrate the regional treatment contents and cultures with the DESDE-LTC classification research, which could yield a more complex but insightful picture of MHS ecosystems and their functioning concerning mental disorder treatment and DP prevention. This would include collecting and analysing information on the dynamics and care pathways between different regional MTCs and services, whether evidence-based treatment models are habitually used in the services and whether the regional treatment organisation is founded on, for example, models of stepped care, collaborative care, or open dialogue approach. These could be reported with the other MHS ecosystem information.

To our knowledge, the present dissertation is the first to use GSDI as an indicator of service diversity in MHS and Mental Health Ecosystems research. This study suggests that although service richness is required as an indicator to understand the

overall variation in regional MHS provision, GSDI and other diversity indices are indicated as an important complementary part of future MHS research for exploring the effects of mental health ecosystem service diversity and evenness. Future studies could also evaluate and compare the feasibility and efficacy of different diversity indices for MHS diversity measurement and research.

7 CONCLUSIONS

The overarching aim of this dissertation was to explore, identify and describe the different risk factors and dynamics affecting the mental disorder-based DP process. We began this thesis from the social and regional determinants of mental health. After exploring and accounting for these factors and contexts, the further objective of this dissertation was to identify and describe the association between MHS and mental disorder DP, especially in the case of mood disorders, which account for two-thirds of all DPs due to mental disorders and where the role of MHS can be seen as central in preventing work disability with timely and effective treatment. Previous research literature needs to be combined with more information linking MHS utilisation and provision to population and service-level effectiveness indicators. This thesis begins the closing of this gap in knowledge with these studies regarding mental disorder DP.

In the current dissertation, our findings strengthen previous research evidence indicating that individual and regional SES is associated with mental disorder DP risk. Regarding individual educational and income levels, this association exhibited a negative trend. After accounting for other SES and sociodemographic variables, our results indicated a novel finding of higher mental and mood disorder DP risk for white-collar workers compared to blue-collar workers. This might be attributed to the psychosocial demands of contemporary working life. This raises questions concerning our working life culture: in the case of people with (temporarily) reduced psychosocial working ability, are work adjustments socially acceptable and possible, or is the rest of the person's working ability decimated by the demands and requirements of working life? This study also indicated that students have the highest risk associated with mental and mood disorder DP, possibly implying an accumulation of risks on their part and the importance of early recognition and preventive efforts to combat students' mental health problems.

This dissertation confirmed significant regional variation in mental disorder DP risk in Finland. The DP risk variation was associated with, but not altogether explained by, sociodemographic and -economic differences. This implied that the role of structural and functional differences in service systems and rehabilitative processes might partly explain these DP differences. This was explored by adopting

the Mental Health Ecosystems approach. Accordingly, our findings highlight the potential role and importance of the organisation and provision of MHS in affecting the regional mood disorder-based DP risk. Greater diversity of MHS, especially in outpatient and community-based settings, was associated with lower mood disorder DP risk. Therefore, the diversity of MHS can be seen as an indicator of a well-developed and -balanced, high-quality service system that is more effective in preventing mood disorder DP and meeting the different needs of the population. Our findings regarding outpatient service utilisation and organisation also point to the role of sufficient resourcing in all MHS and outpatient services, so that essential outpatient clinics can provide timely and adequate psychosocial treatment that answers both individual and populational needs.

In Finland, the ongoing health and social service structure reform and the work to implement The Finnish Mental Health Strategy 2020–2030 establishes a productive basis for promoting and developing broad, effective and accessible MHS that meet people's needs. However, despite the prior national-level regulatory legislation and regional steering, notable differences in MHS organisation have arisen, acting as a potential source of significant regional inequality in mental health outcomes. In the ongoing work, both the need to consider the local context and local conditions, as well as national cooperation and joint service development, are of paramount importance to avoid past mistakes of creating fragmented services, and to ensure equal, high-quality services for all.

8 REFERENCES

Agovino, M., & Parodi, G. (2015). Human development and the determinants of the incidence of civilian disability pensions in Italy: A spatial panel perspective. *Social Indicators Research*, *122*(2), 553–576. https://doi.org/10.1007/s11205-014-0705-8

Ahola, K., Virtanen, M., Honkonen, T., Isometsä, E., Aromaa, A., & Lönnqvist, J. (2011). Common mental disorders and subsequent work disability: A population-based Health 2000 Study. *Journal of Affective Disorders*, *134*(1), 365–372. https://doi.org/10.1016/j.jad.2011.05.028

Ala-Nikkola, T., Pirkola, S., Kaila, M., Joffe, G., Kontio, R., Oranta, O., Sadeniemi, M., Wahlbeck, K., & Saarni, S. I. (2018). Identifying local and centralized mental health services-The development of a new categorizing variable. *International Journal of Environmental Research and Public Health*, *15*(6), 1131. https://doi.org/10.3390/ijerph15061131

Ala-Nikkola, T., Pirkola, S., Kaila, M., Saarni, S. I., Joffe, G., Kontio, R., Oranta, O., Sadeniemi, M., & Wahlbeck, K. (2016). Regional correlates of psychiatric inpatient treatment. *International Journal of Environmental Research and Public Health*, *13*(12), 1204. https://doi.org/10.3390/ijerph13121204

Ala-Nikkola, T., Pirkola, S., Kontio, R., Joffe, G., Pankakoski, M., Malin, M., Sadeniemi, M., Kaila, M., & Wahlbeck, K. (2014). Size matters—Determinants of modern, community-oriented mental health services. *International Journal of Environmental Research and Public Health*, *11*(8), 8456–8474. https://doi.org/10.3390/ijerph110808456

Ala-Nikkola, T., Sadeniemi, M., Kaila, M., Saarni, S., Kontio, R., Pirkola, S., Joffe, G., Oranta, O., & Wahlbeck, K. (2016). How size matters: Exploring the association between quality of mental health services and catchment area size. *BMC Psychiatry*, *16*(1), 289. https://doi.org/10.1186/s12888-016-0992-5

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (5th ed.)*. https://doi.org/10.1176/appi.books.9780890425596

Andersson, L., Nyman, C. S., Spak, F., & Hensing, G. (2006). High incidence of disability pension with a psychiatric diagnosis in western Sweden. A population-based study from 1980 to 1998. *Work*, *26*(4), 343.

Andersson, L., Wiles, N., Lewis, G., Brage, S., & Hensing, G. (2006). Disability pension for psychiatric disorders: Regional differences in Norway 1988-2000. *Nordic Journal of Psychiatry*, *60*(4), 255–262. https://doi.org/10.1080/08039480600790010

Andersson, L., Wiles, N., Lewis, G., Brage, S., & Hensing, G. (2007). Can access to psychiatric health care explain regional differences in disability pension with

psychiatric disorders? *Social Psychiatry and Psychiatric Epidemiology*, *42*(5), 366–371. https://doi.org/10.1007/s00127-007-0176-1

Beecham, J., & Johnson, S. (2000). The European Socio-Demographic Schedule (ESDS): Rationale, principles and development. *Acta Psychiatrica Scandinavica. Supplementum*, *405*, 33–46.

Bergström, T. (2023). From treatment of mental disorders to the treatment of difficult life situations: A hypothesis and rationale. *Medical Hypotheses*, *176*, 111099. https://doi.org/10.1016/j.mehy.2023.111099

Bivand, R., Keitt, T., & Rowlingson, B. (2020). rgdal: Bindings for the "geospatial" data abstraction library. *R Package Version 1.5-10*. https://cran.r-project.org/package=rgdal

Bivand, R., & Lewin-Koh, N. (2020). maptools: Tools for handling spatial objects. *R Package Version 1.0-1*. https://cran.r-project.org/package=maptools

Blank, L., Peters, J., Pickvance, S., Wilford, J., & MacDonald, E. (2008). A systematic review of the factors which predict return to work for people suffering episodes of poor mental health. *Journal of Occupational Rehabilitation*, *18*(1), 27–34. https://doi.org/10.1007/s10926-008-9121-8

Blomgren, J., Jäppinen, S., Rahkonen, O., Pekkala, J., & Lahelma, E. (2019). Pitkien sairauspoissaolojen alue-erot selittyvät vain osin väestörakenteella ja sairastavuudella. *Suomen Lääkärilehti*, *74*(47), 2734–2739.

Blomgren, J., Martikainen, P., Mäkelä, P., & Valkonen, T. (2004). The effects of regional characteristics on alcohol-related mortality—A register-based multilevel analysis of 1.1 million men. *Social Science & Medicine*, *58*(12), 2523–2535. https://doi.org/10.1016/j.socscimed.2003.09.027

Bolton, D., & Gillett, G. (2019). *The biopsychosocial model of health and disease: New philosophical and scientific developments*. Springer Nature. https://doi.org/10.1007/978-3-030-11899-0

Bratberg, E., Gjesdal, S., & Mæland, J. G. (2009). Sickness absence with psychiatric diagnoses: Individual and contextual predictors of permanent disability. *Health and Place*, *15*(1), 308–314. https://doi.org/10.1016/j.healthplace.2008.06.004

Brown, J., Hanlon, P., Turok, I., Webster, D., Arnott, J., & Macdonald, E. B. (2009). Mental health as a reason for claiming incapacity benefit—A comparison of national and local trends. *Journal of Public Health*, *31*(1), 74–80. https://doi.org/10.1093/pubmed/fdn098

Carstensen, B., Plummer, M., Laara, E., & Hills, M. (2022). *Epi: A package for statistical analysis in epidemiology*. https://CRAN.R-project.org/package=Epi

Cattrell, A., Harris, E. C., Palmer, K. T., Kim, M., Aylward, M., & Coggon, D. (2011). Regional trends in awards of incapacity benefit by cause. *Occupational Medicine*, *61*(3), 148–151. https://doi.org/10.1093/occmed/kqr008

Cetrano, G., Salvador-Carulla, L., Tedeschi, F., Rabbi, L., Gutiérrez-Colosía, M. R., Gonzalez-Caballero, J., Park, A.-L., McDaid, D., Sfetcu, R., Kalseth, J., Kalseth, B.,

Hope, Ø., Brunn, M., Chevreul, K., Straßmayr, C., Hagmair, G., Wahlbeck, K., & Amaddeo, F. (2018). The balance of adult mental health care: Provision of core health versus other types of care in eight European countries. *Epidemiology and Psychiatric Sciences*, *29*, e6. https://doi.org/10.1017/S2045796018000574

Cohen, M. (2017). A systemic approach to understanding mental health and services. *Social Science & Medicine*, *191*, 1–8. https://doi.org/10.1016/j.socscimed.2017.08.037

Compton, M. T., & Shim, R. S. (2015). *The social determinants of mental health*. American Psychiatric Publishing.

Cornelius, B., van der Klink, J. J. L., Brouwer, S., & Groothoff, J. W. (2014). Under-recognition and under-treatment of DSM-IV classified mood and anxiety disorders among disability claimants. *Disability and Rehabilitation*, *36*(14), 1161–1168. https://doi.org/10.3109/09638288.2013.833310

de Vries, H., Fishta, A., Weikert, B., Rodriguez Sanchez, A., & Wegewitz, U. (2018). Determinants of sickness absence and return to work among employees with common mental disorders: A scoping review. *Journal of Occupational Rehabilitation*, *28*(3), 393–417. https://doi.org/10.1007/s10926-017-9730-1

Dernovšek, M. Z., & Šprah, L. (2008). Assessment of mental health services in Slovenia with the European service mapping schedule. *Psychiatria Danubina*, *20*(3), 439–442.

Dewa, C. S., Goering, P., Lin, E., & Paterson, M. (2002). Depression-related short-term disability in an employed population. *Journal of Occupational and Environmental Medicine*, *44*(7), 628.

Diez-Roux, A. V. (2000). Multilevel analysis in public health research. *Annual Review of Public Health*, *21*(1), 171–192. https://doi.org/10.1146/annurev.publhealth.21.1.171

Dohrenwend, B. P., Levav, I., Shrout, P. E., Schwartz, S., Naveh, G., Link, B. G., Skodol, A. E., & Stueve, A. (1992). Socioeconomic status and psychiatric disorders: The causation-selection issue. *Science*, *255*(5047), 946–952. https://doi.org/10.1126/science.1546291

Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. *Science*, *196*(4286), 129–136. https://doi.org/10.1126/science.847460

Ervasti, J., Vahtera, J., Pentti, J., Oksanen, T., Ahola, K., Kivimäki, M., & Virtanen, M. (2013). Depression-related work disability: Socioeconomic inequalities in onset, duration and recurrence. *PLOS ONE*, *8*(11), e79855. https://doi.org/10.1371/journal.pone.0079855

Ervasti, J., Vahtera, J., Virtanen, P., Pentti, J., Oksanen, T., Ahola, K., Kivimäki, M., & Virtanen, M. (2014). Is temporary employment a risk factor for work disability due to depressive disorders and delayed return to work? The Finnish Public Sector Study. *Scandinavian Journal of Work, Environment & Health*, *40*(4), 343–352. https://doi.org/10.5271/sjweh.3424

Fernandez, A., Gillespie, J. A., Smith-Merry, J., Feng, X., Astell-Burt, T., Maas, C., & Salvador-Carulla, L. (2017). Integrated mental health atlas of the Western Sydney local

health district: Gaps and recommendations. *Australian Health Review*, *41*(1), 38–44. https://doi.org/10.1071/AH15154

Fernandez, A., Salinas-Perez, J., Gutierrez-Colosia, M., Prat-Pubill, B., Serrano-Blanco, A., Molina, C., Jorda, E., Garcia-Alonso, C., & Salvador-Carulla, L. (2015). Use of an integrated atlas of mental health care for evidence informed policy in Catalonia (Spain). *Epidemiology and Psychiatric Sciences*, *24*(6), 512–524. https://doi.org/10.1017/S2045796014000511

Finnish Centre for Pensions. (2021). *Earnings-related pension recipients in Finland 2020*. Finnish Centre for Pensions. https://www.julkari.fi/handle/10024/142990

Finnish Centre for Pensions. (2023). *Number of pension recipients: Earnings-related and national disability pension recipients by disease category*. Finnish Centre for Pensions. https://tilastot.etk.fi/pxweb/en/ETK/ETK__110kaikki_elakkeensaajat__10elakkeensaajien_lkm/elsa_k10_tk_diag.px/table/tableViewLayout1/

Fryers, T., Melzer, D., & Jenkins, R. (2003). Social inequalities and the common mental disorders: A systematic review of the evidence. *Social Psychiatry and Psychiatric Epidemiology*, *38*(5), 229–237. https://doi.org/10.1007/s00127-003-0627-2

Furst, M. A., Bagheri, N., & Salvador-Carulla, L. (2020). An ecosystems approach to mental health services research. *BJPsych International*, *18*(1), 1–3. https://doi.org/10.1192/bji.2020.24

Furst, M. A., Gandré, C., Romero López-Alberca, C., & Salvador-Carulla, L. (2019). Healthcare ecosystems research in mental health: A scoping review of methods to describe the context of local care delivery. *BMC Health Services Research*, *19*(1), 173. https://doi.org/10.1186/s12913-019-4005-5

Furst, M. A., Salinas-Perez, J. A., Gutiérrez-Colosía, M. R., Mendoza, J., Bagheri, N., Anthes, L., & Salvador-Carulla, L. (2023). Patterns of mental health care provision in urban areas: A comparative analysis for local policy in the ACT. *PLOS ONE*, *18*(4), e0284241. https://doi.org/10.1371/journal.pone.0284241

Fusar-Poli, P., Salazar de Pablo, G., De Micheli, A., Nieman, D. H., Correll, C. U., Kessing, L. V., Pfennig, A., Bechdolf, A., Borgwardt, S., Arango, C., & van Amelsvoort, T. (2020). What is good mental health? A scoping review. *European Neuropsychopharmacology*, *31*, 33–46. https://doi.org/10.1016/j.euroneuro.2019.12.105

Galderisi, S., Heinz, A., Kastrup, M., Beezhold, J., & Sartorius, N. (2015). Toward a new definition of mental health. *World Psychiatry*, *14*(2), 231–233. https://doi.org/10.1002/wps.20231

Geyer, S., Hemström, Ö., Peter, R., & Vågerö, D. (2006). Education, income, and occupational class cannot be used interchangeably in social epidemiology. Empirical evidence against a common practice. *Journal of Epidemiology and Community Health*, *60*(9), 804–810. https://doi.org/10.1136/jech.2005.041319

Giddens, A. (1984). *The constitution of society: Outline of the theory of structuration*. University of California Press.

Gini, C. (1912). *Variabilità e mutabilità: Contributo allo studio delle distribuzioni e delle relazioni statistiche.[Fasc. I.]*.

Gissler, M., & Haukka, J. (2004). Finnish health and social welfare registers in epidemiological research. *Norsk Epidemiologi*, *14*(1), 113–120. https://doi.org/10.5324/nje.v14i1.284

Gjesdal, S., Ringdal, P. R., Haug, K., & Mæland, J. G. (2008). Long-term sickness absence and disability pension with psychiatric diagnoses: A population-based cohort study. *Nordic Journal of Psychiatry*, *62*(4), 294–301. https://doi.org/10.1080/08039480801984024

Greenberg, J. A., & Mattiuzzi, M. (2020). gdalUtils: Wrappers for the geospatial data abstraction library (GDAL) utilities. *R Package Version 2.0.3.2*. https://cran.r-project.org/package=gdalUtils

Guevara, M. R., Hartmann, D., Mendoza, M. (2016). diverse: An R package to measure diversity in complex systems. *The R Journal*, *8*(2), 60–78.

Gustafsson, K., Aronsson, G., Marklund, S., Wikman, A., & Floderus, B. (2014). Peripheral labour market position and risk of disability pension: A prospective population-based study. *BMJ Open*, *4*(8), e005230.

Gutierrez-Colosia, M. R., Hinck, P., Simon, J., Konnopka, A., Fischer, C., Mayer, S., Brodszky, V., Roijen, L. H., Evers, S., Park, A., König, H. H., Hollingworth, W., Salinas-Perez, J. A., the PECUNIA Group, & Salvador-Carulla, L. (2022). Magnitude of terminological bias in international health services research: A disambiguation analysis in mental health. *Epidemiology and Psychiatric Sciences*, *31*, e59. https://doi.org/10.1017/S2045796022000403

Gutiérrez-Colosía R., M., Salvador-Carulla, L., Salinas-Pérez A., J., García-Alonso R., C., Cid, J., Salazzari, D., Montagni, I., Tedeschi, F., Cetrano, G., Chevreul, K., Kalseth, J., Hagmair, G., Straßmayr, C., Park, A. L., Sfectu, R., Ala-Nikkola, T., González-Caballero L., J., Rabbi, L., Kalseth, B., & Amaddeo, F. (2019). Standard comparison of local mental health care systems in eight European countries. *Epidemiology and Psychiatric Sciences*, *28*(2), 210–223. https://doi.org/10.1017/S2045796017000415

Hakulinen, C., Komulainen, K., Suokas, K., Pirkola, S., Pulkki-Råback, L., Lumme, S., Elovainio, M., & Böckerman, P. (2023). Socioeconomic position at the age of 30 and the later risk of a mental disorder: A nationwide population-based register study. *Journal of Epidemiology and Community Health*. https://doi.org/10.1136/jech-2022-219674

Halonen, J. I., Kivimäki, M., Vahtera, J., Pentti, J., Virtanen, M., Ervasti, J., & Oksanen, T. (2017). Childhood adversity, adult socioeconomic status and risk of work disability: A prospective cohort study. *Occupational and Environmental Medicine*, *74*(9), 659–666. https://doi.org/10.1136/oemed-2017-104319

Hämmig, O., & Bauer, G. F. (2013). The social gradient in work and health: A cross-sectional study exploring the relationship between working conditions and health inequalities. *BMC Public Health*, *13*(1), 1170. https://doi.org/10.1186/1471-2458-13-1170

Hart, J. T. (1971). The inverse care law. *The Lancet*, *297*(7696), 405–412. https://doi.org/10.1016/S0140-6736(71)92410-X

Haukka, J., Suvisaari, J., Varilo, T., & Lönnqvist, J. (2001). Regional variation in the incidence of schizophrenia in Finland: A study of birth cohorts born from 1950 to 1969. *Psychological Medicine*, *31*(6), 1045–1053. https://doi.org/10.1017/S0033291701004299

Hayes, S. C., & Hofmann, S. G. (2021). "Third-wave" cognitive and behavioral therapies and the emergence of a process-based approach to intervention in psychiatry. *World Psychiatry*, *20*(3), 363–375. https://doi.org/10.1002/wps.20884

Hees, H. L., Koeter, M. W. J., & Schene, A. H. (2012). Predictors of long-term return to work and symptom remission in sick-listed patients with major depression. *The Journal of Clinical Psychiatry*, *73*(8), 15083. https://doi.org/10.4088/JCP.12m07699

Hensing, G., Andersson, L., & Brage, S. (2006). Increase in sickness absence with psychiatric diagnosis in Norway: A general population-based epidemiologic study of age, gender and regional distribution. *BMC Medicine*, *4*(1), 19. https://doi.org/10.1186/1741-7015-4-19

Hjarsbech, P. U., Andersen, R. V., Christensen, K. B., Aust, B., Borg, V., & Rugulies, R. (2011). Clinical and non-clinical depressive symptoms and risk of long-term sickness absence among female employees in the Danish eldercare sector. *Journal of Affective Disorders*, *129*(1), 87–93. https://doi.org/10.1016/j.jad.2010.07.033

Hölting, L., Jacobs, S., Felipe-Lucia, M. R., Maes, J., Norström, A. V., Plieninger, T., & Cord, A. F. (2019). Measuring ecosystem multifunctionality across scales. *Environmental Research Letters*, *14*(12), 124083. https://doi.org/10.1088/1748-9326/ab5ccb

Hultin, H., Lindholm, C., & Möller, J. (2012). Is there an association between long-term sick leave and disability pension and unemployment beyond the effect of health status?–a cohort study. *PLOS ONE*, *7*(4), e35614. https://doi.org/10.1371/journal.pone.0035614

Hyyppä, M., T., & Mäki, J. (2001). Individual-level relationships between social capital and self-rated health in a bilingual community. *Preventive Medicine*, *32*(2), 148–155. https://doi.org/10.1006/pmed.2000.0782

Johnson, S., Kuhlmann, R., Munizza, C., Beecham, J., Salvador-Carulla, L., De Jong, P., Palazzi, C., Stenman, A., Tibaldi, G., Zuccolin, M., Scala, E., Von Cranach, M., & Thornicroft, G. (2000). The European Service Mapping Schedule (ESMS): Development of an instrument for the description and classification of mental health services. *Acta psychiatrica Scandinavica. Supplementum, 405,* 14–23.

Joosen, M. C. W., Lugtenberg, M., Arends, I., van Gestel, H. J. A. W. M., Schaapveld, B., Terluin, B., van Weeghel, J., van der Klink, J. J. L., & Brouwers, E. P. M. (2022). Barriers and facilitators for return to work from the perspective of workers with common mental disorders with short, medium and long-term sickness absence: A longitudinal qualitative study. *Journal of Occupational Rehabilitation*, *32*(2), 272–283. https://doi.org/10.1007/s10926-021-10004-9

Joutsenniemi, K., Martelin, T., Martikainen, P., Pirkola, S., & Koskinen, S. (2006). Living arrangements and mental health in Finland. *Journal of Epidemiology and Community Health (1979-)*, *60*(6), 468–475. https://doi.org/10.1136/jech.2005.040741

Juvani, A. (2018). *Work-related stress and disability pension*. University of Turku.

Karlsson, N. E., Carstensen, J. M., Gjesdal, S., & Alexanderson, K. A. E. (2008). Risk factors for disability pension in a population-based cohort of men and women on long-term sick leave in Sweden. *European Journal of Public Health*, *18*(3), 224–231. https://doi.org/10.1093/eurpub/ckm128

Kauppinen, T., & Karvonen, S. (2009). Kuinka Suomi jakautuu 2000-luvulla? Hyvinvoinnin muuttuvat alue-erot. *Yhteiskuntapolitiikka*, *74*(5), 467−486.

Kausto, J., Gluschkoff, K., Turunen, J., Selinheimo, S., Peutere, L., & Väänänen, A. (2022). Psychotherapy and change in mental health-related work disability: A prospective Finnish population-level register-based study with a quasi-experimental design. *Journal of Epidemiology & Community Health*, *76*(11), 925–930. https://doi.org/10.1136/jech-2022-218941

Keskimäki, I., Tynkkynen, L.-K., Reissell, E., Koivusalo, M., Syrjä, V., Vuorenkoski, L., Rechel, B., & Karanikolos, M. (2019). Finland: Health system review. *Health Systems in Transition*, *21*(2), 1.

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the national comorbidity survey replication. *Archives of General Psychiatry*, *62*(6), 593–602. https://doi.org/10.1001/archpsyc.62.6.593

Kestilä, L., Karvonen, S., & Aalto, A.-M. (2019). *Suomalaisten hyvinvointi 2018*. Terveyden ja hyvinvoinnin laitos.

Kiviniemi, M., Suvisaari, J., Pirkola, S., Läksy, K., Häkkinen, U., Isohanni, M., & Hakko, H. (2011). Five-year follow-up study of disability pension rates in first-onset schizophrenia with special focus on regional differences and mortality. *General Hospital Psychiatry*, *33*(5), 509–517. https://doi.org/10.1016/j.genhosppsych.2011.05.017

Knudsen, A. K., Øverland, S., Hotopf, M., & Mykletun, A. (2012). Lost working years due to mental disorders: An analysis of the Norwegian disability pension registry. *PLOS ONE*, *7*(8), e42567. https://doi.org/10.1371/journal.pone.0042567

Kokkinen, L. (2020). *Hyvinvointia työstä 2030-luvulla – Skenaarioita suomalaisen työelämän kehityksestä*. Työterveyslaitos. https://www.julkari.fi/handle/10024/140712

Krokstad, S., Magnus, P., Skrondal, A., & Westin, S. (2004). The importance of social characteristics of communities for the medically based disability pension. *European Journal of Public Health*, *14*(4), 406–412. https://doi.org/10.1093/eurpub/14.4.406

Laaksonen, M., & Gould, R. (2013). Regional differences in disability retirement: Explaining between-county differences in Finland. *Scandinavian Journal of Work, Environment & Health*, *39*(6), 609–617.

Laaksonen, M., & Gould, R. (2014). The effect of municipality characteristics on disability retirement. *European Journal of Public Health*, *24*(1), 116–121. https://doi.org/10.1093/eurpub/ckt129

Laaksonen, M., & Silventoinen, K. (2011). *Sosiaaliepidemiologia: Väestön terveyserot ja terveyteen vaikuttavat sosiaaliset tekijät*. Gaudeamus.

Lahelma, E., Laaksonen, M., Martikainen, P., Rahkonen, O., & Sarlio-Lähteenkorva, S. (2006). Multiple measures of socioeconomic circumstances and common mental disorders. *Social Science & Medicine*, *63*(5), 1383–1399. https://doi.org/10.1016/j.socscimed.2006.03.027

Lahelma, E., Martikainen, P., Laaksonen, M., & Aittomäki, A. (2004). Pathways between socioeconomic determinants of health. *Journal of Epidemiology and Community Health*, *58*(4), 327–332. https://doi.org/10.1136/jech.2003.011148

Lahtinen, E. (2006). Mental health in Finland. *International Psychiatry*, *3*(1), 12–14.

Lamberg, T., Virtanen, P., Vahtera, J., Luukkaala, T., & Koskenvuo, M. (2010). Unemployment, depressiveness and disability retirement: A follow-up study of the Finnish HeSSup population sample. *Social Psychiatry and Psychiatric Epidemiology*, *45*(2), 259–264. https://doi.org/10.1007/s00127-009-0063-z

Leinonen, T., Martikainen, P., & Lahelma, E. (2012). Interrelationships between education, occupational social class, and income as determinants of disability retirement. *Scandinavian Journal of Public Health*, *40*(2), 157–166. https://doi.org/10.1177/1403494811435492

Leinonen, T., Pietiläinen, O., Laaksonen, M., Rahkonen, O., Lahelma, E., & Martikainen, P. (2011). Occupational social class and disability retirement among municipal employees—The contribution of health behaviors and working conditions. *Scandinavian Journal of Work, Environment & Health*, *37*(6), 464–472. https://doi.org/10.5271/sjweh.3182

Leppänen, H., Kampman, O., Autio, R., Karolaakso, T., Näppilä, T., Rissanen, P., & Pirkola, S. (2022). Socioeconomic factors and use of psychotherapy in common mental disorders predisposing to disability pension. *BMC Health Services Research*, *22*(1), 1–12. https://doi.org/10.1186/s12913-022-08389-1

Leppänen, H., Kampman, O., Autio, R., Karolaakso, T., Rissanen, P., Näppilä, T., & Pirkola, S. (2023). Socioeconomic status, psychotherapy duration, and return to work from disability due to common mental disorders. *Psychotherapy Research*, *0*(0), 1–14. https://doi.org/10.1080/10503307.2023.2229500

Linder, A., Gerdtham, U.-G., Trygg, N., Fritzell, S., & Saha, S. (2019). Inequalities in the economic consequences of depression and anxiety in Europe: A systematic scoping review. *European Journal of Public Health*. https://doi.org/10.1093/eurpub/ckz127

Link, B. G., & Phelan, J. (1995). Social conditions as fundamental causes of disease. *Journal of Health and Social Behavior*, *Spec No*, 80–94.

Linnaranta, O., Strand, T., Suvisaari, J., Partonen, T., & Solin, P. (2023). *Mielenterveysstrategia 2020-2030: Toimeenpanon ensimmäiset vuodet ja yhteisen tekemisen tahto*. Terveyden ja hyvinvoinnin laitos THL. https://urn.fi/URN:ISBN:978-952-343-990-0

Lorant, V., Deliège, D., Eaton, W., Robert, A., Philippot, P., & Ansseau, M. (2003). Socioeconomic inequalities in depression: A meta-analysis. *American Journal of Epidemiology*, *157*(2), 98–112. https://doi.org/10.1093/aje/kwf182

Macintyre, A., Ferris, D., Gonçalves, B., & Quinn, N. (2018). What has economics got to do with it? The impact of socioeconomic factors on mental health and the case for collective action. *Palgrave Communications*, *4*(1). https://doi.org/10.1057/s41599-018-0063-2

Macintyre, S., Ellaway, A., & Cummins, S. (2002). Place effects on health: How can we conceptualise, operationalise and measure them? *Social Science & Medicine*, *55*(1), 125–139. https://doi.org/10.1016/s0277-9536(01)00214-3

Magurran, A. E. (2021). Measuring biological diversity. *Current Biology*, *31*(19), R1174–R1177. https://doi.org/10.1016/j.cub.2021.07.049

Markkula, N., Suvisaari, J., Saarni, S. I., Pirkola, S., Peña, S., Saarni, S., Ahola, K., Mattila, A. K., Viertiö, S., Strehle, J., Koskinen, S., & Härkänen, T. (2015). Prevalence and correlates of major depressive disorder and dysthymia in an eleven-year follow-up – Results from the Finnish Health 2011 Survey. *Journal of Affective Disorders*, *173*(1), 73–80. https://doi.org/10.1016/j.jad.2014.10.015

Mattila-Holappa, P., Ervasti, J., Joensuu, M., Ahola, K., Pentti, J., Oksanen, T., Vahtera, J., KivimÄki, M., & Virtanen, M. (2017). Do predictors of return to work and recurrence of work disability due to mental disorders vary by age? A cohort study. *Scandinavian Journal of Public Health*, *45*(2), 178–184. https://doi.org/10.1177/1403494816686467

Mattila-Holappa, P., Joensuu, M., Ahola, K., Koskinen, A., Tuisku, K., Ervasti, J., & Virtanen, M. (2016). Psychotherapeutic and work-oriented interventions: Employment outcomes among young adults with work disability due to a mental disorder. *International Journal of Mental Health Systems*, *10*(1), 68. https://doi.org/10.1186/s13033-016-0101-7

Mattila-Holappa, P., Joensuu, M., Ahola, K., Vahtera, J., & Virtanen, M. (2016). Attachment to employment and education before work disability pension due to a mental disorder among young adults. *BMC Psychiatry*, *16*(1), 143. https://doi.org/10.1186/s12888-016-0854-1

Melchior, M., Chastang, J.-F., Head, J., Goldberg, M., Zins, M., Nabi, H., & Younès, N. (2013). Socioeconomic position predicts long-term depression trajectory: A 13-year follow-up of the GAZEL cohort study. *Molecular Psychiatry*, *18*(1), Article 1. https://doi.org/10.1038/mp.2011.116

Miech, R. A., Caspi, A., Moffitt, T. E., Wright, B. R. E., & Silva, P. A. (1999). Low socioeconomic status and mental disorders: A longitudinal study of selection and causation during young adulthood. *American Journal of Sociology*, *104*(4), 1096–1131. https://doi.org/10.1086/210137

Ministry of Social Affairs and Health. (2013). *Characteristics of the social security system in Finland*. Ministry of Social Affairs and Health, Finland. https://julkaisut.valtioneuvosto.fi/handle/10024/69929

Ministry of Social Affairs and Health. (2023). *Reform of healthcare, social welfare and rescue services*. https://soteuudistus.fi/en/frontpage

Murray, E. T., Head, J., Shelton, N., Hagger-Johnson, G., Stansfeld, S., Zaninotto, P., & Stafford, M. (2016). Local area unemployment, individual health and workforce exit: ONS Longitudinal Study. *European Journal of Public Health*, *26*(3), 463–469. https://doi.org/10.1093/eurpub/ckw005

Nielsen, M. B. D., Bültmann, U., Madsen, I. E. H., Martin, M., Christensen, U., Diderichsen, F., & Rugulies, R. (2012). Health, work, and personal-related predictors of time to return to work among employees with mental health problems. *Disability and Rehabilitation*, *34*(15), 1311–1316. https://doi.org/10.3109/09638288.2011.641664

Nieuwenhuijsen, K., Verbeek, J. H. a. M., Boer, A. G. E. M. de, Blonk, R. W. B., & Dijk, F. J. H. van. (2004). Supervisory behaviour as a predictor of return to work in employees absent from work due to mental health problems. *Occupational and Environmental Medicine*, *61*(10), 817–823. https://doi.org/10.1136/oem.2003.009688

OECD. (2022). *Disability, work and inclusion: Mainstreaming in all policies and practices*. OECD Publishing. https://doi.org/10.1787/1eaa5e9c-en

OECD/EU. (2018). *Health at a glance: Europe 2018: State of health in the EU cycle*. OECD Publishing. https://doi.org/10.1787/health_glance_eur-2018-en

Øversveen, E., Rydland, H. T., Bambra, C., & Eikemo, T. A. (2017). Rethinking the relationship between socio-economic status and health: Making the case for sociological theory in health inequality research. *Scandinavian Journal of Public Health*, *45*(2), 103–112.

Paananen, R., Ristikari, T., Merikukka, M., & Gissler, M. (2013). Social determinants of mental health: A Finnish nationwide follow-up study on mental disorders. *Journal of Epidemiology and Community Health*, *67*(12), 1025–1031. https://doi.org/10.1136/jech-2013-202768

Patana, P. (2014). Mental health analysis profiles (MhAPs): Finland. In *OECD Health Working Papers*. OECD Publishing. https://doi.org/10.1787/5jz1591p91vg-en

Patel, V., Burns, J. K., Dhingra, M., Tarver, L., Kohrt, B. A., & Lund, C. (2018). Income inequality and depression: A systematic review and meta-analysis of the association and a scoping review of mechanisms. *World Psychiatry*, *17*(1), 76–89. https://doi.org/10.1002/wps.20492

Perälä, J., Saarni, S. I., Ostamo, A., Pirkola, S., Haukka, J., Härkänen, T., Koskinen, S., Lönnqvist, J., & Suvisaari, J. (2008). Geographic variation and sociodemographic characteristics of psychotic disorders in Finland. *Schizophrenia Research*, *106*(2), 337–347. https://doi.org/10.1016/j.schres.2008.08.017

Perhoniemi, R., & Blomgren, J. (2021). Frequent attenders of three outpatient health care schemes in Finland: Characteristics and association with long-term sickness absences, 2016–2018. *BMC Public Health*, *21*(1). https://doi.org/10.1186/s12889-021-10866-x

Peutere, L., Ravaska, T., Böckerman, P., Väänänen, A., & Virtanen, P. (2023). Effects of rehabilitative psychotherapy on labour market success: Evaluation of a nationwide programme. *Scandinavian Journal of Public Health*, *51*(6), 882–893. https://doi.org/10.1177/14034948221074974

Pickett, K. E., & Wilkinson, R. G. (2010). Inequality: An underacknowledged source of mental illness and distress. *British Journal of Psychiatry*, *197*(6), 426–428. https://doi.org/10.1192/bjp.bp.109.072066

Pirkola, S., Isometsä, E., Suvisaari, J., Aro, H., Joukamaa, M., Poikolainen, K., Koskinen, S., Aromaa, A., & Lönnqvist, J. (2005). DSM-IV mood-, anxiety- and alcohol use disorders and their comorbidity in the Finnish general population: Results from the Health 2000 Study. *Social Psychiatry and Psychiatric Epidemiology*, *40*(1), 1–10. https://doi.org/10.1007/s00127-005-0848-7

Pirkola, S., Nevalainen, J., Laaksonen, M., Fröjd, S., Nurmela, K., Näppilä, T., Tuulio-Henriksson, A., Autio, R., & Blomgren, J. (2020). The importance of clinical and labour market histories in psychiatric disability retirement: Analysis of the comprehensive Finnish national-level RETIRE data. *Social Psychiatry and Psychiatric Epidemiology*, *55*, 1011–1020. https://doi.org/10.1007/s00127-019-01815-6

Pirkola, S., Sund, R., Sailas, E., & Wahlbeck, K. (2009). Community mental-health services and suicide rate in Finland: A nationwide small-area analysis. *The Lancet*, *373*(9658), 147–153. https://doi.org/10.1016/S0140-6736(08)61848-6

Plana-Ripoll, O., Weye, N., Knudsen, A. K., Hakulinen, C., Madsen, K. B., Christensen, M. K., Agerbo, E., Laursen, T. M., Nordentoft, M., Timmermann, A., Whiteford, H., Øverland, S., Iburg, K. M., & McGrath, J. J. (2023). The association between mental disorders and subsequent years of working life: A Danish population-based cohort study. *The Lancet Psychiatry*, *10*(1), 30–39. https://doi.org/10.1016/S2215-0366(22)00376-5

Pulkki-Råback, L., Ahola, K., Elovainio, M., Kivimäki, M., Hintsanen, M., Isometsä, E., Lönnqvist, J., & Virtanen, M. (2012). Socio-economic position and mental disorders in a working-age Finnish population: The health 2000 study. *European Journal of Public Health*, *22*(3), 327–332. https://doi.org/10.1093/eurpub/ckr127

R Core Team. (2020). *R: A language and environment for statistical computing*. https://www.r-project.org/

Reho, T. T. M., Atkins, S. A., Talola, N., Sumanen, M. P. T., Viljamaa, M., & Uitti, J. (2020). Frequent attenders at risk of disability pension: A longitudinal study combining routine and register data. *Scandinavian Journal of Public Health*, *48*(2), 181–189. https://doi.org/10.1177/1403494819838663

Reime, L., & Claussen, B. (2013). Municipal unemployment and municipal typologies as predictors of disability pensioning in Norway: A multilevel analysis. *Scandinavian Journal of Public Health*, *41*(2), 158–165. https://doi.org/10.1177/1403494812472004

Rezvyy, G., Øiesvold, T., Parniakov, A., Ponomarev, O., Lazurko, O., & Olstad, R. (2007). The Barents project in psychiatry: A systematic comparative mental health services study between Northern Norway and Archangelsk County. *Social Psychiatry and Psychiatric Epidemiology*, *42*(2), 131–139. https://doi.org/10.1007/s00127-006-0141-4

Rock, D., & Cross, S. P. (2020). Regional planning for meaningful person-centred care in mental health: Context is the signal not the noise. *Epidemiology and Psychiatric Sciences*, *29*, e104. https://doi.org/10.1017/S2045796020000153

Romero-López-Alberca, C., Gutiérrez-Colosía R., M., Salinas-Pérez A., J., Almeda, N., Furst, M., Johnson, S., & Salvador-Carulla, L. (2019). Standardised description of health and social care: A systematic review of use of the ESMS/DESDE (European Service Mapping Schedule/Description and Evaluation of Services and DirectoriEs). *European Psychiatry*, *61*, 97–110. https://doi.org/10.1016/j.eurpsy.2019.07.003

Rosen, A., Gill, N. S., & Salvador-Carulla, L. (2020). The future of community psychiatry and community mental health services. *Current Opinion in Psychiatry*, *33*(4), 375. https://doi.org/10.1097/YCO.0000000000000620

Rosen, A., & Salvador-Carulla, L. (2022). No service is an island: Towards an ecosystem approach to mental health service evaluation. *World Psychiatry*, *21*(2), 237–238. https://doi.org/10.1002/wps.20963

RStudio Team. (2018). *RStudio: Integrated development for R*. RStudio Inc. http://www.rstudio.com/

Saarni, S. I., Nurminen, S., Mikkonen, K., Service, H., Karolaakso, T., Stenberg, J.-H., Ekelund, J., & Saarni, S. E. (2022). The Finnish Therapy Navigator—Digital support system for introducing stepped care in Finland. *Psychiatria Fennica*, *53*, 120–137.

Sadeniemi, M., Almeda, N., Salinas-Pérez A., J., Gutiérrez-Colosía R., M., García-Alonso, C., Ala-Nikkola, T., Joffe, G., Pirkola, S., Wahlbeck, K., Cid, J., & Salvador-Carulla, L. (2018). A comparison of mental health care systems in northern and southern Europe: A service mapping study. *International Journal of Environmental Research and Public Health*, *15*(6), 1133. https://doi.org/10.3390/ijerph15061133

Sadeniemi, M., Pirkola, S., Pankakoski, M., Joffe, G., Kontio, R., Malin, M., Ala-Nikkola, T., & Wahlbeck, K. (2014). Does primary care mental health resourcing affect the use and costs of secondary psychiatric services? *International Journal of Environmental Research and Public Health*, *11*(9), 8743–8754. https://doi.org/10.3390/ijerph110908743

Salinas-Perez, J. A., Gutierrez-Colosia, M. R., Garcia-Alonso, C. R., Furst, M. A., Tabatabaei-Jafari, H., Kalseth, J., Perkins, D., Rosen, A., Rock, D., & Salvador-Carulla, L. (2023). Patterns of mental healthcare provision in rural areas: A demonstration study in Australia and Europe. *Frontiers in Psychiatry*, *14*. https://www.frontiersin.org/articles/10.3389/fpsyt.2023.993197

Salinas-Perez, J., Gutierrez-Colosia, M., Furst, M. A., Suontausta, P., Bertrand, J., Almeda, N., Mendoza, J., Rock, D., Sadeniemi, M., Cardoso, G., & Salvador-Carulla, L. (2020). Patterns of mental health care in remote areas: Kimberley (Australia), Nunavik (Canada), and Lapland (Finland): Modèles de soins de santé mentale dans les régions

éloignées: Kimberley (Australie), Nunavik (Canada) et Laponie (Finlande). *Canadian Journal of Psychiatry*, *65*(10), 721–730. https://doi.org/10.1177/0706743720944312

Salonen, L., Blomgren, J., & Laaksonen, M. (2020). From long-term sickness absence to disability retirement: Diagnostic and occupational class differences within the working-age Finnish population. *BMC Public Health*, *20*(1), 1078. https://doi.org/10.1186/s12889-020-09158-7

Salonen, L., Blomgren, J., Laaksonen, M., & Niemelä, M. (2018). Sickness absence as a predictor of disability retirement in different occupational classes: A register-based study of a working-age cohort in Finland in 2007–2014. *BMJ Open*, *8*(5), e020491. https://doi.org/10.1136/bmjopen-2017-020491

Salvador-Carulla, L., Alvarez-Galvez, J., Romero, C., Gutiérrez-Colosía, M. R., Weber, G., McDaid, D., Dimitrov, H., Sprah, L., Kalseth, B., Tibaldi, G., Salinas-Perez, J. A., Lagares-Franco, C., Romá-Ferri, M. T., & Johnson, S. (2013). Evaluation of an integrated system for classification, assessment and comparison of services for long-term care in Europe: The eDESDE-LTC study. *BMC Health Services Research*, *13*(1), 218. https://doi.org/10.1186/1472-6963-13-218

Salvador-Carulla, L., Ruiz, M., Romero, C., & Poole, M. (2012). *ESMS-R European Service Mapping Schedule—Revised / Eurooppalainen mielenterveyspalvelujen kartoittamistyökalu*. THL. https://urn.fi/URN:ISBN:978-952-245-714-1

Salvador-Carulla, L., Saldivia, S., Martinez-Leal, R., Vicente, B., Garcia-Alonso, C., Grandon, P., & Haro, J. M. (2008). Meso-level comparison of mental health service availability and use in Chile and Spain. *Psychiatric Services*, *59*(4), 421–428. https://doi.org/10.1176/ps.2008.59.4.421

Samuelsson, Å., Alexanderson, K., Ropponen, A., Lichtenstein, P., & Svedberg, P. (2012). Incidence of disability pension and associations with socio-demographic factors in a Swedish twin cohort. *Social Psychiatry and Psychiatric Epidemiology, 47*(12), 1999–2009. https://doi.org/10.1007/s00127-012-0498-5

Selinheimo, S., Gluschkoff, K., Kausto, J., Turunen, J., Koskinen, A., & Väänänen, A. (2023). The association of sociodemographic characteristics with work disability trajectories during and following long-term psychotherapy: A longitudinal register study. *Social Psychiatry and Psychiatric Epidemiology*. https://doi.org/10.1007/s00127-023-02523-y

Selinheimo, S., Gluschkoff, K., Turunen, J., Mattila-Holappa, P., Kausto, J., & Väänänen, A. (2023). Income gradient in psychotherapy use and psychotropic drug purchases: A longitudinal register study in Finnish employed population. *Journal of Psychiatric Research*, *164*, 133–139. https://doi.org/10.1016/j.jpsychires.2023.06.001

Simpson, E. H. (1949). Measurement of diversity. *Nature*, *163*(4148), 688. https://doi.org/10.1038/163688a0

Sipilä, P., & Martikainen, P. (2009). Language-group mortality differentials in Finland in 1988–2004: Assessment of the contribution of cause of death, sex and age. *European Journal of Public Health*, *19*(5), 492–498. https://doi.org/10.1093/eurpub/ckp074

Stein, D. J., Shoptaw, S. J., Vigo, D. V., Lund, C., Cuijpers, P., Bantjes, J., Sartorius, N., & Maj, M. (2022). Psychiatric diagnosis and treatment in the 21st century: Paradigm

shifts versus incremental integration. *World Psychiatry*, *21*(3), 393–414. https://doi.org/10.1002/wps.20998

Sund, R. (2012). Quality of the Finnish Hospital Discharge Register: A systematic review. *Scandinavian Journal of Public Health*, *40*(6), 505–515. https://doi.org/10.1177/1403494812456637

Sund, R., Gissler, M., Hakulinen, T., & Rosén, M. (2014). Use of health registers. In *Handbook of Epidemiology*. https://doi.org/10.1007/978-0-387-09834-0_5

Sundquist, K., Frank, G., & Sundquist, J. (2004). Urbanisation and incidence of psychosis and depression. *British Journal of Psychiatry*, *184*(4), 293–298. https://doi.org/10.1192/bjp.184.4.293

Suokas, K., Kurkela, O., Nevalainen, J., Suvisaari, J., Hakulinen, C., Kampman, O., & Pirkola, S. (2023). Geographical variation in treated psychotic and other mental disorders in Finland by region and urbanicity. *Social Psychiatry and Psychiatric Epidemiology*. https://doi.org/10.1007/s00127-023-02516-x

Tansella, M., & Thornicroft, G. (1998). A conceptual framework for mental health services: The matrix model. *Psychological Medicine*, *28*(3), 503–508. https://doi.org/10.1017/s0033291796005880

Tennekes, M. (2018). tmap: Thematic maps in R. *Journal of Statistical Software*, *84*(6), 1–39.

The Finnish Institute for Health and Welfare. (2023). *Sotkanet.fi, statistical information on welfare and health in Finland*. https://sotkanet.fi/sotkanet/en/index?

THL. (2020). *Sosiaali- ja terveyspalvelut TAYS-erityisvastuualueella 2019*. THL. https://www.julkari.fi/handle/10024/140638

Thornicroft, G., & Tansella, M. (2004). Components of a modern mental health service: A pragmatic balance of community and hospital care: Overview of systematic evidence. *British Journal of Psychiatry*, *185*, 283–290.

Thornicroft, G., Tansella, M., & Law, A. (2008). Steps, challenges and lessons in developing community mental health care. *World Psychiatry*, *7*(2), 87–92. https://doi.org/10.1002/j.2051-5545.2008.tb00161.x

Tibaldi, G., Munizza, C., Pasian, S., Johnson, S., Salvador-Carulla, L., Zucchi, S., Cesano, S., Testa, C., Scala, E., & Pinciaroli, L. (2005). Indicators predicting use of mental health services in Piedmont, Italy. *The Journal of Mental Health Policy and Economics*, *8*(2), 95–106.

Upmark, M., Lundberg, I., Sadigh, J., Allebeck, P., & Bigert, C. (1999). Psychosocial characteristics in young men as predictors of early disability pension with a psychiatric diagnosis. *Social Psychiatry and Psychiatric Epidemiology*, *34*(10), 533–540. https://doi.org/10.1007/s001270050172

Väänänen, A., & Toivanen, M. (2018). The challenge of tied autonomy for traditional work stress models. *Work & Stress*, *32*(1), 1–5. https://doi.org/10.1080/02678373.2017.1415999

Virtanen, M., Kawachi, I., Oksanen, T., Salo, P., Tuisku, K., Pulkki-Råback, L., Pentti, J., Elovainio, M., Vahtera, J., & Kivimäki, M. (2011). Socio-economic differences in long-term psychiatric work disability: Prospective cohort study of onset, recovery and recurrence. *Occupational and Environmental Medicine*, *68*(11), 791–798. https://doi.org/10.1136/oem.2010.061101

Vorma, H., Rotko, T., Larivaara, M., & Kosloff, A. (2020). *National mental health strategy and programme for suicide prevention 2020–2030. 2020:6*, 1236–2050.

Wickham, H. (2016). *ggplot2: Elegant graphics for data analysis*. Springer-Verlag.

Wittchen, H. U., Jacobi, F., Rehm, J., Gustavsson, A., Svensson, M., Jönsson, B., Olesen, J., Allgulander, C., Alonso, J., Faravelli, C., Fratiglioni, L., Jennum, P., Lieb, R., Maercker, A., van Os, J., Preisig, M., Salvador-Carulla, L., Simon, R., & Steinhausen, H.-C. (2011). The size and burden of mental disorders and other disorders of the brain in Europe 2010. *European Neuropsychopharmacology*, *21*(9), 655–679. https://doi.org/10.1016/j.euroneuro.2011.07.018

World Health Organization. (2016). *International statistical classification of diseases and related health problems 10th Revision*. https://icd.who.int/browse10/2016/en

World Health Organization. (2021). *Comprehensive mental health action plan 2013–2030*. World Health Organization. https://apps.who.int/iris/bitstream/handle/10665/345301/9789240031029-eng.pdf

World Health Organization & Calouste Gulbenkian Foundation. (2014). *Social determinants of mental health*. World Health Organization.

PUBLICATION I

Socioeconomic factors in disability retirement due to mental disorders in Finland

Karolaakso, T., Autio, R., Näppilä, T., Nurmela, K., & Pirkola, S.

European Journal of Public Health, 30(6), 1218–1224.
https://doi.org/10.1093/eurpub/ckaa132

European Journal of Public Health, 1–7

doi:10.1093/eurpub/ckaa132

Socioeconomic factors in disability retirement due to mental disorders in Finland

Tino Karolaakso [1], Reija Autio[1], Turkka Näppilä[2], Kirsti Nurmela [1,3], Sami Pirkola[1,4]

1 Faculty of Social Sciences, Tampere University, Tampere, Finland
2 Tampere University Library, Tampere University, Tampere, Finland
3 Mental Health and Substance Abuse Services, City of Tampere, Tampere, Finland
4 Department of Adult Psychiatry, Tampere University Hospital, Pirkanmaa Hospital District, Tampere, Finland

Correspondence: Tino M. Karolaakso, Faculty of Social Sciences, Tampere University, Arvo Ylpön katu 34, FI- 33520 Tampere, Finland, Tel: +35850 318 2608, e-mail: tino.karolaakso@tuni.fi

Background: Previous research has identified low socioeconomic status (SES) as an epidemiological risk factor for early retirement and disability pension (DP) due to mental disorders. This study aims to examine these associations in greater detail, with separate consideration of the risk factors for mood disorders (F30–39) and non-affective psychotic disorder (F20–29) DP. **Methods:** In this case–control setting the subjects ($N = 36\ 879$) were all those granted DP due to a mental disorder for the first time between 2010 and 2015 in Finland. All the subjects were matched with three controls for their gender, age and hospital district ($N = 94\ 388$). Three measures of dimensions of SES were used: education, income and occupational status, as well as family type as a control factor. Differences between DP recipients and controls, and between diagnostic groups, were studied using calculated characteristics and conditional logistic regression models. **Results:** DP recipients often lived alone and had low educational and income levels. These characteristics were more prominent in non-affective psychotic disorder than in mood disorder DP. In white-collar occupational groups, the risk of DP was greater compared with blue-collar workers. Students were associated with the highest level of risk for all mental and mood disorder DPs. **Conclusions:** We found evidence of SES factors associating with mental disorder-related severe loss of working and studying ability in a disorder-specific way. Notably, white-collar workers had an increased risk of mental disorder DP. This could be related to the psychosocially demanding contemporary working life in non-manual work.

Introduction

Mental disorders are the leading cause of disability retirement in Finland. In 2018, over half (52%, 103 000 people) of all disability pensions (DPs) and over one-third (37%, over 8000 people) of all new DPs in Finland were granted primarily on the basis of a mental disorder diagnosis.[1] In the Finnish DP scheme, the applicant is required to have impaired working ability and sickness benefits for 300 days before applying for DP. The application for temporary or permanent DP is then evaluated nationally by medical insurance specialists.

Previous research has identified low socioeconomic status (SES) and social/income inequality as important epidemiological risk factors for mental disorders.[2–11] Definitions of SES vary and several factors contribute to it, the most common in the literature being education, occupation and income.[12] In addition to SES, a person's living arrangement or type of family can be an important factor affecting mental health. In Finland, people living alone and/or unmarried have been shown to have more psychiatric symptoms and disorders than those who are cohabiting.[8,13,14]

Low SES consequently also predicts a greater risk of mental disorder DP. Studies have found a link between low occupational status,[15–18] unemployment,[19,20] low education[15,21,22] or low income[23] and increased risk of DP. Interestingly, a study by Leinonen *et al.*[24] identified a non-linear link between occupational status and mental disorder DP, whereas in the same study the link was linear in the case of DP for all reasons and due to musculoskeletal diseases. In this study, semi-professionals and routine white-collar employees had a higher risk of mental disorder DP than managers, professionals and blue-collar workers. This may indicate that the association between occupational status and DP might not be as straightforward as in the case of other SES factors.

The effects of individual SES factors on health and DP can to some extent be explained and mediated through the other SES factors, especially because a person's education and occupational status are mediated through their income.[12,25] In Finland, there is evidence that income level and financial difficulties may have a stronger association with mental disorders than education or occupation.[9,26] Despite this, it has been argued that several of the SES factors should always be considered simultaneously when studying the effects of SES, because they are ultimately only partially independent or interdependent determinants of health and cannot be directly replaced with one another.[25,27,28] SES can thus be seen as a multidimensional construct reflecting a person's living and working conditions as well as material, psychological and social resources, which guide peoples' choices and behaviors contributing to their social, environmental and behavioral risks and stress.[2] In this study, we simultaneously utilize several SES factors both separately and together in order to study their connections and risk groups in detail.

Despite the current level of understanding, the research literature still lacks precise information on the role of SES factors in mental disorder DP and their differences between different diagnostic groups. The aim of this study was to examine the interconnected effects of SES factors with mental disorder DP, focusing additionally on the two largest diagnostic groups in mental disorder DP in Finland, ICD-10 classifications F30–39 (mood disorders) and F20–29 (non-affective psychotic disorders).[29] To the best of our knowledge, this study is first to examine the relationship between multiple SES factors and mental disorder DP extensively in a large, high coverage national data set in a case–control setting for the

purposes of risk calculation. This study is part of the RETIRE research project, which aims to study the risk factors and sequences of mental health based disability pensioning and to analyze the effectiveness of service systems in different hospital districts in Finland.[30]

Methods

Study population

The subjects of the study were all Finnish citizens granted either a temporary or permanent DP due to a mental disorder (ICD 10: F04–F69 and F80–F99) for the first time between 2010 and 2015 ($N = 50\ 728$). The utilized data originated from the registers of The National Social Insurance Institution of Finland (SII), The Finnish Centre for Pensions, the National Institute for Health and Statistics Finland. The subjects were matched with three controls based on their gender, age and hospital district from the population registers of Statistics Finland.

The combined database was stored and analyzed on the server of Statistics Finland. The following subjects and controls were omitted from the final dataset: (i) people with previous pensions (residual $N = 160\ 564$); (ii) people aged under 18 or over 65 ($N = 159\ 049$); (iii) people who had moved to a new hospital district during the last three years before DP ($N = 131\ 722$) and (iv) people living in the Åland Islands because of the district's small sample size and divergent sample. The final data set included 36 879 subjects with mental disorder DP and their matched controls (altogether $N = 131\ 267$).

Factors and SES

Based on prior literature, we selected three factors from the data to represent the several dimensions of SES: education, income and occupational status. In addition, we also studied family type because previous studies have indicated its importance for explaining mental health. The values used for subjects and controls were from 1 year before entering DP.

Family type was categorized into four groups: living alone, couple (living together with a partner without children), couple with children (living with a partner and one or more children) and single parent.

Education was categorized into five groups in line with the classification of Statistics Finland. Basic level means at most nine years of education, which is the length of mandatory basic education in Finland. Upper secondary level education means spending 11–12 years in basic education, including high school or vocational school. Short-cycle tertiary education lasts 2–3 years after upper secondary education and includes qualifications which are not polytechnic degrees. Lower degree level tertiary education means 3–4 years of education after upper secondary education and comprises polytechnic degrees and lower university degrees. Higher degree level tertiary education comprises education with a duration of at least 5–6 years after upper secondary education and leading to master's degrees, scientific licentiates and doctorate degrees.

Income was calculated for each subject and control by dividing the income of the person's household (measured by Statistics Finland) with OECD's consumption unit, in which the size of the consumption unit represented by the household dwelling unit is indicated as the sum of the weights of its members. The resulting average income in euros per person per year was divided into five quantiles based on the data: lowest (<14 454e), middle-lower (14 455e–20 468e), middle (20 469e–25 931e), middle-higher (25 932e–33 254e) and highest (more than 33 255e).

Occupational status of subjects and controls was classified into seven groups in accordance with the classification of Statistics Finland: blue-collar worker, lower white-collar worker, upper white-collar worker, entrepreneur, agriculture and forestry entrepreneur, student and unemployed.

Statistical analysis

The differences between the category variables were calculated with χ^2 test, while the differences between the continuous variables were determined with the independent samples *t*-test. A supplementary analysis was calculated for the student category. We used conditional logistic regression to detect the associations between the different exposures, i.e. socioeconomic factors and family type and the outcome DP. We first created crude models, i.e. univariate models for each exposure separately, with which we computed the odds ratios (ORs) and 95% confidence intervals (95% CIs). Further, for controlling confounding factors, we adjusted the model with education, income, occupational status and family type and used a multivariable conditional logistic regression model where these exposures were entered simultaneously. The models were evaluated with Nagelkerke's pseudo-R^2. The collinearity of the exposures was assessed with generalized variance inflation factor (GVIF) adjusted for each exposure based on the degrees of freedom. Since all exposures resulted in a GVIF below 2, there was no indication of issues with collinearity. Furthermore, the interaction between exposures was assessed, but since there were no improvements to the model, the interactions were not included in the final model. There were some SES information missing within the data (table 2). These missing values have been omitted from the regression analysis. Statistical analyses were conducted with SPSS Statistics Version 25 and R package ggplots2.[31]

Results

Descriptive analysis

The distribution of the principal F-diagnostic groups on which basis DP was granted for men, women and both genders is presented in table 1. The mean age for all mental disorder DP recipients was 44 years (SD 13.3). Mood disorders F30–39 accounted for approximately two-thirds of all mental disorder-related DPs, at 65.4% (mean age 47 years, SD 12.1). The second largest DP group were non-affective psychotic disorders F20–29, with 16.7% of DPs (mean age 36 years, SD 12.4). In women and older people, mood disorders were a greater part of their overall retirement, whereas non-affective psychotic disorders were more prominent in the case of DP of men and younger people ($P < 0.001$, age mean difference 10.71, 95% CI 10.37–11.05).

The frequencies and percentages of the sociodemographic and SES characteristics are presented in table 2 for subjects with DP (separately for mood disorders and non-affective psychotic disorders) and their controls: gender, age, family type, education, income and occupation (Supplementary table S1 for other diagnostic groups). Because the controls were matched for gender and age, these factors were omitted from the table. About 55.6% of all DP recipients were women. When compared with controls, the DP recipients were often living alone and had lower educational and income levels ($P < 0.001$), the differences being even clearer in non-affective psychotic disorder than in mood disorder DP ($P < 0.001$). In occupational status, the greatest difference between subjects and controls was in students, in which group the pensioned students were a notably larger portion of all pension receivers than in controls (DP recipients 14.4% vs. controls 6.4%; $P < 0.001$). This difference was also notably higher in non-affective psychotic disorder than in mood disorder DP, in which over one-fourth of all DP recipients were classified as students (F20–29: 27.3% vs. F30–39: 10.9%; $P < 0.001$).

Further, we computed the characteristics of student age and achieved level of education for all mental disorder DPs ($N = 4048$, 14.4% of all occupational groups), mood disorder DPs ($N = 2128$, 10.9%), non-affective psychotic disorder DPs ($N = 1110$, 27.3%) and controls ($N = 5828$, 6.4%) (Supplementary table S2). The mean age of students was higher for mental disorder DP recipients (28 years, SD 9.9) than for controls (26 years, SD 9.5), $P < 0.001$. The students with mood disorder DPs were older (mean 31 years, SD

Table 1 Principal diagnoses of subjects granted disability pension for mental disorders in 2010–15

	All (%), *N* = 36 879	Men (%), *N* = 16 380	Women (%), *N* = 20 499	Stat. significance
Principal diagnosis				
F04–09	475 (1.3)	295 (1.8)	180 (0.9)	$P < 0.001$
F10–19	1318 (3.6)	1014 (6.2)	304 (1.5)	$P < 0.001$
F20–29	6171 (16.7)	3603 (22.0)	2568 (12.5)	$P < 0.001$
F30–39	24 132 (65.4)	9195 (56.1)	14 937 (72.9)	$P < 0.001$
F40–48	2735 (7.4)	1091 (6.7)	1644 (8.0)	$P < 0.001$
F50–59	247 (0.7)	37 (0.2)	210 (1.0)	$P < 0.001$
F60–69	535 (1.5)	276 (1.7)	259 (1.3)	$P < 0.001$
F80–89	1069 (2.9)	734 (4.5)	335 (1.6)	$P < 0.001$
F90–99	197 (0.5)	135 (0.8)	62 (0.3)	$P < 0.001$

F04–09: organic, including symptomatic, mental disorders. F10–19: mental and behavioral disorders due to psychoactive substance use. F20–29: schizophrenia, schizotypal and delusional disorders. F30–39: mood (affective) disorders. F40–48: neurotic, stress-related, and somatoform disorders. F50–59: behavioral syndromes associated with physiological disturbances and physical factors. F60–69: disorders of adult personality and behavior. F80–89: disorders of psychological development. F90–99: behavioral and emotional disorders with onset usually occurring in childhood and adolescence. F90–98: unspecified mental disorder F99.

Table 2 Sociodemographic and socioeconomic characteristics of subjects with disability pension granted for mental disorders in 2010–15

Group	All cases (%) *N* = 36 879	F30–39 (%) *N* = 24 132	F20–29 (%) *N* = 6171	Controls (%) *N* = 94 388
Gender				
Men	16 380 (44.4)	9195 (38.1)	3603 (58.4)	–
Women	20 499 (55.6)	14 937 (61.9)	2568 (41.6)	–
Age				
18–25	5141 (13.9)	2005 (8.3)	1639 (26.6)	–
26–35	5919 (16.0)	3152 (13.1)	1755 (28.4)	–
36–45	6417 (17.4)	4252 (17.6)	1213 (19.7)	–
46–55	10 131 (27.5)	7616 (31.6)	1039 (16.8)	–
56–65	9271 (25.1)	7107 (29.5)	525 (8.5)	–
Family type				
Living alone	16 311 (44.2)	9068 (37.6)	3817 (61.9)	20 628 (21.9)
Couple	9302 (25.2)	7303 (30.3)	733 (11.9)	29 645 (31.4)
Couple with children	7642 (20.7)	5261 (21.8)	1110 (18.0)	37 104 (39.3)
Single parent	3624 (9.8)	2500 (10.4)	511 (8.3)	7011 (7.4)
Education				
Basic level	10 821 (29.3)	5847 (24.2)	2170 (35.2)	16 090 (17.0)
Upper secondary level	17 338 (47.0)	11 527 (47.8)	3016 (48.9)	44 451 (47.1)
Short-cycle tertiary	4192 (11.4)	3377 (14.0)	350 (5.7)	13 229 (14.0)
Lower degree tertiary	2339 (6.3)	1742 (7.2)	353 (5.7)	10 277 (10.9)
Higher degree tertiary	2189 (5.9)	1639 (6.8)	282 (4.6)	10 341 (11.0)
Income[a]				
Lowest	11 906 (33.3)	6308 (26.6)	2757 (48.5)	11 890 (12.7)
Middle-lower	8276 (23.2)	5554 (23.4)	1310 (23.0)	16 143 (17.3)
Middle	6191 (17.3)	4554 (19.2)	794 (14.0)	19 780 (21.2)
Middle-higher	4993 (14.0)	3814 (16.1)	519 (9.1)	21 954 (23.5)
Highest	4341 (12.2)	3526 (14.8)	309 (5.4)	23 627 (25.3)
Occupation[b]				
Blue-collar worker	5849 (20.8)	4088 (21.0)	925 (22.8)	22 248 (24.3)
Lower white-collar worker	8293 (29.5)	6639 (34.1)	668 (16.4)	29 718 (32.5)
Upper white-collar worker	3371 (12.0)	2672 (13.7)	330 (8.1)	15 986 (17.5)
Entrepreneur	1621 (5.8)	1283 (6.6)	144 (3.5)	6610 (7.2)
Agriculture entrepreneur	376 (1.3)	274 (1.4)	63 (1.6)	1 784 (1.9)
Student	4048 (14.4)	2128 (10.9)	1110 (27.3)	5828 (6.4)
Unemployed	4555 (16.2)	2368 (12.2)	824 (20.3)	9320 (10.2)

Separately for all mental disorder cases, mood disorders (F30–39), non-affective psychotic disorders (F20–29) and study controls. Statistical significance was tested with the chi-squared test for the categories family type, education, income, and occupation between all cases and controls; F30–39 and controls; F20–29 and controls and between F30–39 and F20–29. The tests for each category with these comparisons resulted in $P < 0.001$.

a: Some cases had missing information: all cases $N = 35,707$; F30–39 $N = 23\,756$; F20–29 $N = 5689$ and controls $N = 93\,394$.

b: Some cases had missing information: all cases $N = 28\,113$; F30–39 $N = 19\,452$; F20–29 $N = 4064$ and controls $N = 91\,494$.

10.8) than non-affective psychotic disorder DPs (mean 27 years, SD 8.0) ($P < 0.001$). For mood disorder DPs over half of the student pensioners had completed upper secondary level education (51.6%) and for non-affective psychotic disorder DPs most had only basic level education (49.6%).

Risk factors for premature psychiatric retirement

The ORs and 95% CIs were calculated for all mental disorder-related DPs and for mood/non-affective psychotic disorder DPs using conditional logistic regression analysis and are shown in table 3. Based

Table 3 Socioeconomic differences for all mental disorder-related disability pensions (DP), mood disorder (F30–39) disability pensions and non-affective psychotic disorder (F20–29) disability pensions in Finland by odds ratio (OR) and 95% confidence interval (95% CI)

	All mental disorder DP				F30–39 DP				F20–29 DP			
	Crude model		Final model[a]		Crude model		Final model[b]		Crude model		Final model[c]	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Family type												
Couple with children (reference)	1.00		1.00		1.00		1.00		1.00		1.00	
Living alone	3.97	3.84–4.11	2.15	2.06–2.24	3.32	3.18–3.47	2.09	1.99–2.20	6.15	5.64–6.70	2.65	2.37–2.95
Couple	1.55	1.49–1.61	1.53	1.46–1.59	1.66	1.59–1.74	1.72	1.63–1.81	1.13	1.01–1.26	1.00	0.88–1.14
Single parent	2.50	2.38–2.63	1.58	1.49–1.67	2.50	2.36–2.65	1.61	1.50–1.73	2.43	2.14–2.77	1.56	1.33–1.82
Education												
Higher degree tertiary (reference)	1.00		1.00		1.00		1.00		1.00		1.00	
Basic level	3.46	3.28–3.66	1.98	1.84–2.14	2.69	2.52–2.87	1.71	1.57–1.87	5.10	4.40–5.91	2.37	1.90–2.97
Upper secondary level	1.89	1.80–1.99	1.32	1.24–1.42	1.83	1.72–1.94	1.36	1.26–1.48	2.21	1.93–2.54	1.23	1.00–1.51
Short-cycle tertiary	1.51	1.42–1.60	1.29	1.20–1.39	1.52	1.42–1.63	1.32	1.21–1.43	1.47	1.23–1.76	1.15	0.90–1.47
Lower degree tertiary	1.07	1.01–1.15	0.99	0.92–1.07	1.12	1.04–1.21	1.03	0.95–1.13	1.09	0.92–1.30	0.96	0.76–1.21
Income												
Highest (reference)	1.00		1.00		1.00		1.00		1.00		1.00	
Lowest	6.54	6.25–6.85	2.30	2.17–2.45	4.84	4.59–5.11	2.12	1.97–2.28	14.29	12.40–16.47	3.21	2.69–3.83
Middle-lower	3.22	3.07–3.36	2.20	2.08–2.32	2.89	2.74–3.04	2.24	2.10–2.38	5.06	4.39–5.84	2.54	2.15–3.00
Middle	1.88	1.80–1.97	1.65	1.57–1.74	1.79	1.70–1.88	1.67	1.57–1.77	2.76	2.38–3.20	2.10	1.78–2.48
Middle-higher	1.32	1.26–1.38	1.25	1.19–1.31	1.26	1.20–1.33	1.25	1.18–1.32	1.76	1.51–2.06	1.54	1.30–1.82
Occupation												
Blue-collar worker (reference)	1.00		1.00		1.00		1.00		1.00		1.00	
Lower white-collar worker	0.98	0.94–1.02	1.21	1.15–1.26	1.06	1.01–1.11	1.28	1.21–1.35	0.62	0.55–0.70	0.74	0.65–0.85
Upper white-collar worker	0.73	0.70–0.77	1.31	1.23–1.39	0.77	0.72–0.81	1.34	1.24–1.44	0.58	0.50–0.67	1.06	0.88–1.27
Entrepreneur	0.86	0.81–0.92	0.99	0.92–1.06	0.90	0.83–0.97	1.03	0.95–1.12	0.72	0.59–0.89	0.85	0.68–1.06
Agriculture and forestry entrepreneur	0.71	0.63–0.80	0.79	0.70–0.90	0.66	0.58–0.76	0.76	0.66–0.88	1.31	0.95–1.81	1.49	1.05–2.11
Student	3.40	3.20–3.62	2.93	2.74–3.14	3.87	3.56–4.21	3.50	3.20–3.83	3.35	2.94–3.83	2.50	2.16–2.91
Unemployed	1.78	1.70–1.87	1.34	1.27–1.42	1.29	1.21–1.37	1.05	0.98–1.12	2.33	2.06–2.64	1.50	1.30–1.73

Crude model: CLR model for data with controls matched based on gender, age and hospital district. Final model: multivariable CLR model adjusted on the basis of all factors in the table. Nagelkerke pseudo-R: [a]0.235; [b]0.194; [c]0.425.

on the matched case–control design, the crude model was adjusted for age, gender and hospital district. Further, the final model was additionally adjusted for family type, education, income and occupational status.

The highest risk for early pension was associated with the student category in overall mental disorder DP (OR 2.93; 95% CI 2.74–3.14) and in mood disorder DP (OR 3.50; 95% CI 3.20–3.83), and with the lowest income group in non-affective psychotic disorder DP (OR 3.21; 95% CI 2.69–3.83). The overall effects of education and income levels on early retirement appear to follow a negative trend: higher levels of education or income associate with a lower risk of mental disorder DP. Further, within family type, living alone is associated with the highest risk for DP and couples with children with the lowest risk for DP in all models except for non-affective psychotic disorders, in which they are on the same level as couples without children.

Although the ORs in other SES exposures remained consistent in their direction after adjusting for all factors in the final models, in occupational status the risk of mental disorder DP increased in white-collar occupational groups above the reference point of blue-collar workers' risk in all mental disorder and mood disorder DPs. The OR for entrepreneurs increased to the same level as that of blue-collar workers. The OR for agriculture and forestry entrepreneurs remained mostly the same, being even lower than for blue-collar workers, before and after controlling for other factors. The OR for the unemployed also remained mostly the same, rather higher than for blue-collar workers, except in DP for mood disorders, in which it decreased to the same level as in blue-collar workers after controlling for all factors in the model. Figure 1 illustrates the OR and 95% CI of the final statistical models for all mental disorder and mood/non-affective psychotic disorder DPs.

Discussion

In our comprehensive case–control data on mental disorder DP in Finland, we found socioeconomic differences to be major epidemiological risk factors for premature psychiatric retirement. Overall, mental disorder DP appears to be associated with lower SES, including shorter formal education and lower income, in addition to a more frequent status of living alone. As a novel finding, we found that white-collar occupational status involves an increased risk of mental disorder DP, particularly indicated for mood disorders, after adjusting for education, income and family type. We also found that among SES the student category had the highest risk associated with mental disorder DP.

In Europe, low SES is associated with higher rates of absence from work but few studies have been conducted outside the Nordic countries concerning the association of SES and DP.[11] The negative trend of educational and income effects on DP is in line with the results of previous research[15,21–23] and is well documented in the literature. The association of manual work with a greater level of risk has also been reported in previous research.[15–18] However, our study extends the existing knowledge about the association of SES and DP by showing that after controlling for SES and family type, the level of risk in lower and upper white-collar occupations rose above that of blue-collar workers.

Particularly in non-manual professions, working life has probably become more autonomous for individual workers, but at the same time this autonomy has resulted in more interdependences and structural demands between workers than before possibly making non-manual work more psychosocially demanding.[32] One previous study that identified a non-linear (U-shaped) association between occupational status and mental disorder DP also recognized job

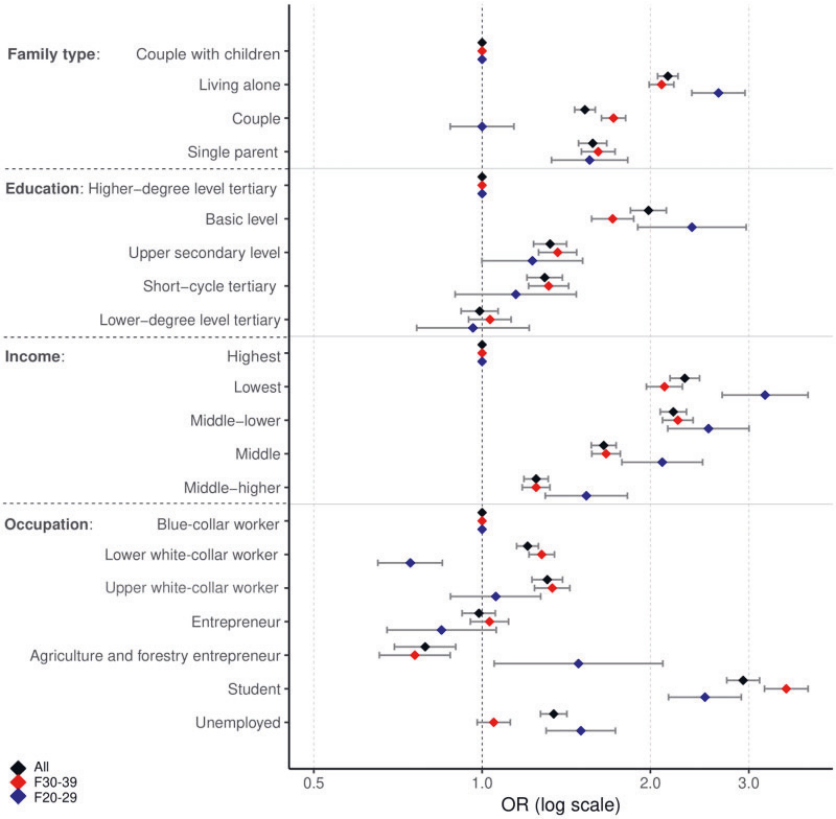


Figure 1 Socioeconomic differences for all mental disorder-related disability pensions (black), mood disorders F30–39 disability pensions (red) and non-affective psychotic disorders F20–29 disability pensions (blue) in Finland by OR and 95% CI as a dot plot figure of final statistical models (adjusted for age, gender, hospital district and all factors in the figure). Reference groups for each factor are marked as 1.0

control as a mediator between this association, as well as identifying strenuous desktop work and high job demands as factors exacerbating the SES differences.[24] Our results indicate that white-collar occupations are associated with an increased risk of premature retirement because of mental disorders, or more accurately because of mood disorders, after accounting for education, income and family. In non-manual work, mood disorders could affect one's mental working ability in a psychosocially more demanding, strenuous and uncontrollable environment and thus more compellingly lead to a DP. In contrast, blue-collar workers could possibly have depressive symptoms or diagnosed depression without having their physical working ability critically compromised, thus not necessarily resulting in DP.

Furthermore, although this study indicates that higher educational levels are associated with a lower risk of mental disorder DP, it is important to note that being a student was associated with the highest levels of risk in all mental and mood disorder DPs. Our supplementary analysis indicated that at the point of early retirement the students were still mainly young but three years older than the control group's students and even 5 years older in the case of mood disorder DP recipients. In the case of mood disorders, half of the retired students had already completed their secondary upper level education and thus were most probably students in universities or universities of applied sciences. In non-affective psychotic disorder DP, most of the students were probably in high school or vocational school, having completed only basic level education.

It is possible that in this sub-population in our data, we see a clustering of several simultaneous risk factors,[16,33] the result of which are mental health problems so severe that they result in premature pensioning for these students. Because retired students are older than controls, it is possible that student DP recipients have struggled with mental disorders for many years before they apply for a DP, which has greatly delayed their studies. This has also prevented them from graduating and moving on to higher educational, occupational and income levels. It is also possible that the retired students include more people who have not started their studies until adult age or people participating in vocational rehabilitation.

Concerning the two major diagnostic groups, women and older people had a higher rate of DP due to mood disorders, whereas men and younger people were more prominent in DP for non-affective psychotic disorders, partly in convergence with the epidemiology of these disorders. The incidence of depression has been found to be approximately 2-fold higher in women than in men.[34,35] However, in our data the difference between genders in mood disorder DP was lower. This could indicate a higher threshold for seeking help or more difficulties for men themselves or for our diagnosis system to identify depression in men and/or greater severity of mood disorders among men receiving DP for mental disorders.[36,37]

Couples without children had a higher risk of DP for mood disorders than for non-affective psychotic disorders. Regarding

occupational status, upper and lower white-collar workers had a higher risk of DP due to mood disorders than non-affective psychotic DP and agriculture and forestry entrepreneurs and the unemployed had a higher risk of DP due to non-affective psychotic disorders. In addition to the effects of the primary disorders, this may support the above interpretation concerning the heightened level of risk for white-collar workers in their demanding working life. Furthermore, the high level of education usually required by white-collar professions can reduce the number of people at risk for non-affective psychotic DP in this population, as the onset of psychotic disorders usually earlier in life hinders the progression of studies and employment in white-collar working positions.

Societal implications

Mental health problems and resulting DPs are one of the highest societal expenses in many high-income countries. In our study we originally identified over 50 000 people with a first-time mental disorder DP in only a 6-year timeframe. Available preventive efforts are welcomed in the social determinants of mental health, which play a major role in the societal incidence of mental disorders and thus mental disorder DPs, as was also seen in this study.[2,5,10]

Non-manual work has become more autonomous and psychosocially demanding than previously, which can be a cause of great stress and pressure for many. This should be acknowledged in any national efforts striving to promote a healthy and sustainable working life in the long term in order to decrease the risk of mental and mood disorder DP in the trends and processes of occupational life. White-collar workers with decreased working ability could perhaps better retain and strengthen their capability to work in an adapted workplace and working community, as well as through vocational activity. Early recognition and preventive consideration should be targeted to students because of their high risk of mental disorder DP. Although outside the scope of this study, it is probable that temporary pensions are more common in younger people and students, and therefore their return to work should be supported by appropriate actions.

Strengths and limitations

The strengths of this study include the use of comprehensive, high coverage national-level data registers together with a large-scale case–control setting. In an international context, Finnish registers are of high quality allowing the detailed and extensive research of different socioeconomic factors and their interrelationships in this study.[38,39] To our knowledge, there has not previously been any such extensive study of mental disorder DP.

Due to the study design one limitation is that we could not calculate ORs for age or gender. Furthermore, temporal assumptions considering the changes in factors affecting DP rates or the exact effects of changing working life cannot be made. These changes could be an important subject of further research.

Conclusions

We found evidence in a comprehensive case–control setting that several SES factors known to contribute to mental disorders also contributed to the loss of working and studying ability in a disorder-specific way and resulted in premature psychiatric pensioning. In particular, white-collar workers may currently be at a heightened risk of mental and mood disorder DP. Focusing on the mental health and well-being of students also appears to be indicated.

Supplementary data

Supplementary data are available at *EURPUB* online.

Funding

This work was supported by the Finnish National Research Fund through the Pirkanmaa Hospital District, grant number 9V052.

Conflicts of interest: None declared.

Key points

- DP recipients due to mental disorders often had low educational and income levels and lived alone.
- In terms of occupational status white-collar workers had an increased risk for DP, particularly due to mood disorders, after controlling for education, income and family.
- Students had the single highest risk for all mental and mood disorder DPs.
- Women and older people had a higher rate of DP due to mood disorders, whereas men and younger people were more prominent in DP for non-affective psychotic disorders.

References

1 Finnish Centre for Pensions. *Statistical Yearbook of Pensioners in Finland 2018, Finnish Centre for Pensions*; 2019. Available at : http://www.julkari.fi/bitstream/handle/10024/138809/statistical-yearbook-of-pensioners-in-finland-2018.pdf (20 february 2020, date last accessed).

2 Compton MT, Shim RS. *The Social Determinants of Mental Health*, 1st edn. Washington, DC: American Psychiatric Publishing; 2015.

3 Fryers T, Melzer D, Jenkins R. Social inequalities and the common mental disorders: a systematic review of the evidence. *Soc Psychiatry Psychiatr Epidemiol* 2003;38:229–37.

4 Lorant V, Deliège D, Eaton W, et al. Socioeconomic inequalities in depression: a meta-analysis. *Am J Epidemiol* 2003;157:98–112.

5 Macintyre A, Ferris D, Gonçalves B, Quinn N. What has economics got to do with it? The impact of socioeconomic factors on mental health and the case for collective action. *Palgrave Commun* 2018;4:

6 Patel V, Burns JK, Dhingra M, et al. Income inequality and depression: a systematic review and meta-analysis of the association and a scoping review of mechanisms. *World Psychiatry* 2018;17:76–89.

7 Pickett KE, Wilkinson RG. Inequality: an underacknowledged source of mental illness and distress. *Br J Psychiatry* 2010;197:426–8.

8 Pirkola SP, Isometsɹ E, Suvisaari J, et al. DSM-IV mood-, anxiety- and alcohol use disorders and their comorbidity in the Finnish general population: results from the Health 2000. *Soc Psychiatry Psychiatr Epidemiol* 2005;40:1–10.

9 Pulkki-Råback L, Ahola K, Elovainio M, et al. Socio-economic position and mental disorders in a working-age Finnish population: the health 2000 study. *Eur J Public Health* 2012;22:327–32.

10 World Health Organization, Calouste Gulbenkian Foundation. *Social Determinants of Mental Health*. Geneva: World Health Organization; 2014.

11 Linder A, Gerdtham U, Trygg N, et al. Inequalities in the economic consequences of depression and anxiety in Europe: a systematic scoping review. *Eur J Public Health* 2019:1–11.

12 Leinonen T, Martikainen P, Lahelma E. Interrelationships between education, occupational social class, and income as determinants of disability retirement. *Scand J Public Health* 2012;40:157–66.

13 Joutsenniemi K, Martelin T, Martikainen P, et al. Living arrangements and mental health in Finland. *J Epidemiol Community Health* 2006;60:468–75.

14 Markkula N, Suvisaari J, Saarni SI, et al. Prevalence and correlates of major depressive disorder and dysthymia in an eleven-year follow-up – results from the Finnish Health 2011 Survey. *J Affect Disord* 2015;173:73–80.

15 Ervasti J, Vahtera J, Pentti J, et al. Depression-related work disability: socioeconomic inequalities in onset, duration and recurrence. *PloS One* 2013;8:e79855.

16 Halonen JI, Kivimäki M, Vahtera J, et al. Childhood adversity, adult socioeconomic status and risk of work disability: a prospective cohort study. *Occup Environ Med* 2017;74:659–66.

17 Virtanen M, Kawachi I, Oksanen T, et al. Socio-economic differences in long-term psychiatric work disability: prospective cohort study of onset, recovery and recurrence. *Occup Environ Med* 2011;68:791–8.

18 Samuelsson Å, Alexanderson K, Ropponen A, et al. Incidence of disability pension and associations with socio-demographic factors in a Swedish twin cohort. *Soc Psychiatry Psychiatr Epidemiol* 2012;47:1999–2009.

19 Hultin H, Lindholm C, Möller J. Is there an association between long-term sick leave and disability pension and unemployment beyond the effect of health status? A cohort study. *PloS One* 2012;7:e35614.

20 Lamberg T, Virtanen P, Vahtera J, et al. Unemployment, depressiveness and disability retirement: a follow-up study of the Finnish HeSSup population sample. *Soc Psychiat Epidemiol* 2010;45:259–64.

21 Ahola K, Virtanen M, Honkonen T, et al. Common mental disorders and subsequent work disability: a population-based Health 2000 Study. *J Affect Disord* 2011; 134:365–72.

22 Mattila-Holappa P, Joensuu M, Ahola K, et al. Attachment to employment and education before work disability pension due to a mental disorder among young adults. *BMC Psychiatry* 2016;16:143.

23 Gustafsson K, Aronsson G, Marklund S, et al. Peripheral labour market position and risk of disability pension: a prospective population-based study. *BMJ Open* 2014;4:e005230.

24 Leinonen T, Pietiläinen O, Laaksonen M, et al. Occupational social class and disability retirement among municipal employees—the contribution of health behaviors and working conditions. *Scand J Work Environ Health* 2011;37:464–72.

25 Lahelma E, Martikainen P, Laaksonen M, Aittomäki A. Pathways between socioeconomic determinants of health. *J Epidemiol Community Health* 2004;58: 327–32.

26 Lahelma E, Laaksonen M, Martikainen P, et al. Multiple measures of socioeconomic circumstances and common mental disorders. *Soc Sci Med* 2006;63:1383–99.

27 Laaksonen M, Silventoinen K. Sosiaaliepidemiologia: väestön terveyserot ja terveyteen vaikuttavat sosiaaliset tekijät. Helsinki: Gaudeamus Helsinki University Press; 2011.

28 Geyer S, Hemström Ö, Peter R, Vågerö D. Education, income, and occupational class cannot be used interchangeably in social epidemiology. Empirical evidence against a common practice. *J Epidemiol Community Health* 2006;60:804–10.

29 World Health Organization. International Statistical Classification of Diseases and Related Health Problems 10th Revision, 2016. Available at: https://icd.who.int/browse10/2016/en (20 February 2020, date last accessed).

30 Pirkola S, Nevalainen J, Laaksonen M, et al. The importance of clinical and labour market histories in psychiatric disability retirement: analysis of the comprehensive Finnish national-level RETIRE data. Soc Psychiatry Psychiatr Epidemiol 2019;1-10.

31 Wickham H. *ggplot2: Elegant Graphics for Data Analysis*.New York: Springer-Verlag; 2016.

32 Väänänen A, Toivanen M. The challenge of tied autonomy for traditional work stress models. *Work Stress* 2018;32:1–5.

33 Paananen R, Ristikari T, Merikukka M, Gissler M. Social determinants of mental health: a Finnish nationwide follow-up study on mental disorders. *J Epidemiol Community Health* 2013;67:1025–31.

34 Cochran SV, Rabinowitz FE. Men and Depression: Clinical and Empirical Perspectives. San Diego: Academic Press; 2000.

35 Koskinen S, Lundqvist A, Ristiluoma N. Terveys, toimintakyky ja hyvinvointi Suomessa 2011, 2012.

36 Gjesdal S, Ringdal PR, Haug K, Gunnar Mæland J. Long-term sickness absence and disability pension with psychiatric diagnoses: a population-based cohort study. *Nordic J Psychiat* 2008;62:294–301.

37 Kilmartin C. Depression in men: communication, diagnosis and therapy. *J Mens Health Gend* 2005;2:95–9.

38 Sund R, Gissler M, Hakulinen T, Rosén M. Use of health registers. *Handbook Epidemiol* 2014;707–30.

39 Sund R. Quality of the Finnish Hospital Discharge Register: a systematic review. *Scand J Public Health* 2012;40:505–15.

PUBLICATION II

Contextual and mental health service factors in mental disorder-based disability pensioning in Finland - a regional comparison

Karolaakso, T., Autio, R., Näppilä, T., Leppänen, H., Rissanen, P., Tuomisto, M. T., Karvonen, S., & Pirkola, S.

BMC Health Services Research, 21(1), 1081–1081.
https://doi.org/10.1186/s12913-021-07099-4

Karolaakso et al. BMC Health Services Research (2021) 21:1081
https://doi.org/10.1186/s12913-021-07099-4

BMC Health Services Research

RESEARCH Open Access

Contextual and mental health service factors in mental disorder-based disability pensioning in Finland – a regional comparison

Tino Karolaakso[1*], Reija Autio[2], Turkka Näppilä[3], Helena Leppänen[4], Päivi Rissanen[2], Martti T. Tuomisto[1], Sakari Karvonen[5] and Sami Pirkola[2,6]

Abstract

Background: We investigated the regional differences in all mental disorder disability pensions (DP) between 2010 and 2015 in Finland, and separately in mood disorders and non-affective psychotic disorder DP. We also studied the contribution of several district-level contextual and mental health service factors to mental disorder DP.

Methods: Subjects were all those granted mental disorder DP for the first time between 2010 and 2015 in Finland ($N = 36,879$). Associations between the district-level contextual and mental health service factors and regional DP risks collected from the year 2015 were studied with negative binomial regression analysis in the Finnish hospital districts. The population number on the age (18 to 65 years), gender, occupational status and residential hospital district of the Finnish population from 2015 was used as exposure in the model.

Results: Significant differences in the regional mental disorder DP risks between and within hospital districts did not appear to follow the traditional Finnish health differences. A lower risk of DP was associated with contextual indicators of higher regional socioeconomic level. Furthermore, population density as a proxy for access to mental health services indicated a higher regional DP risk for lower density in all mental (IRR 1.10; 95% CI 1.06–1.14) and mood disorder (IRR 1.12; 95% CI 1.08–1.16) DP. Both the highest and the lowest regional numbers of all mental health outpatient visits were associated with a higher DP risk in all mental and mood disorder DP, whereas particularly low regional numbers of inpatient treatment periods and of patients were associated with a lower risk of DP.

Conclusions: In this comprehensive population-level study, we found evidence of significant regional variation in mental disorder DP and related district-level factors. This variation may at least partly relate to differences in regional mental health service systems and treatment practices. Adapting to the needs of the local population appears to be indicated for both regional mental health service systems and treatment practices to achieve optimal performance.

Keywords: Mental disorders, Disability pension, Regional differences, Contextual factor, Compositional factor, Mental health services

* Correspondence: tino.karolaakso@tuni.fi
[1]Faculty of Social Sciences (Psychology), Tampere University, Arvo Ylpön katu 34, FI-33520 Tampere, Finland
Full list of author information is available at the end of the article

Background

It is estimated that in the EU, approximately 38% of the adult population is affected every year by at least one mental disorder. There is little evidence of significant inter-country variation [1]. The economic burden of mental health problems is considerable. Total costs in EU are estimated by the OECD at around 4% of gross domestic product (GDP), meaning more than 600 billion euros annually [2]. One economically and humanely most expensive mental disorder outcome is loss of one's working ability, resulting in a disability pension (DP).

Significant regional differences in many Western countries have been reported in overall DP [3–9] and in mental disorder-related sickness absence and DP [10–14]. Factors contributing to the regional differences in health and DP can be categorized to 1) individual-level compositional factors, for example age- and socioeconomic status distribution of the region's population, 2) district-level contextual sociodemographic and socioeconomic factors, such as minority- and employment rates and economic prosperity, and 3) district-level health care service factors, for example number of outpatient visits and patients in inpatient care [15, 16];. Previous research has suggested local area unemployment [3, 7, 8] and socioeconomic gradient [17] as important contextual factors for overall DP, but compositional factors have mostly been identified as more significant for mental disorder sickness absence and DP rates than contextual factors [16, 18]. However, studies concerning regional differences in the Nordic countries have found associations between mental disorder DP rates and urban/rural environments [11, 12]. Access to mental health services and rehabilitation, the screening and recognition of mental disorders, local treatment practice, and the different effects of social fragmentation, migration, unemployment, and alcohol dependence on DP rates in different geographical settings have been suggested as possible explanations. A higher population density also appears to be connected with an overall increased risk of psychosis and mood disorders in the Swedish population [19]. However, one Norwegian study did not find associations between the provision of psychiatric care (represented by the number of staff and availability of beds) and regional differences in mental disorder DP [20].

Finland has greater sociodemographic and -economic differences between larger regions than between smaller residential neighborhoods [21, 22]. Distances are also long both between and within regions. There are well documented regional differences in health, and prior research in Finland has identified that geographical differences in sociodemographic and -economic structure are associated with differences in regional health, health behavior and mortality [22–26]. The more disadvantaged regions have poorer health outcomes, lower population density, longer distances between population centers as well as older average age and lower socioeconomic population distribution. These regions are centered in the eastern and northern parts of the country. The capital area, the southern regions and the western region of Ostrobothnia have traditionally better health outcomes, higher population density and an overall higher socioeconomic distribution [22, 25, 27–29]. Furthermore, the southern and western regions have a higher proportion of the Swedish-speaking minority, also associated with better health outcomes and lower DP as well as mortality rates. This health inequality has been explained by cultural differences as well as higher social capital in the Swedish-speaking minority [26, 28]. However, there is no significant regional variation reported in mental disorder prevalence in Finland, except in the case of psychotic disorders, which follow the previously mentioned differences [27, 30].

Finnish public health care services are divided into 21 hospital districts with a high degree of autonomy in providing the services in their area. Some districts arrange mental health outpatient visits in primary health care and some mainly in psychiatric special health care [31]. Rehabilitative psychotherapy has been available for most people within the scope of private services and is publicly reimbursed by the Social Insurance Institution of Finland. There is however substantial regional variation in the availability of rehabilitative psychotherapy services, as they are for the most part concentrated in the university hospital areas [31]. Previous studies have identified that the variation in diversity of mental health and substance abuse services is 84% explained by the area's population size [32]. The hospital districts' population size is not however directly related to the geographical size of the area. Notably, almost one third of the population of Finland is situated in the capital area, the hospital district of Helsinki and Uusimaa (HUS), whereas only about 1 % of the population lives in the smallest hospital district of East Savo. The hospital district of Lapland has the largest surface area of all the districts, but only a little over 2 % of the Finnish population reside in it.

In the Finnish DP system, the applicant is generally required to have had reduced working capacity and sickness benefits for 300 days before applying for DP. Medical insurance specialists then evaluate the application for temporary or permanent DP. The evaluation process is centralized nationally. Regarding mental disorder DP in Finland, research about its regional variance and district-level factors is scarce. One study found different regional mental disorder DP rates, with mood disorder DP having a greater regional variance than other mental disorder DP [28]. In the case of non-affective psychotic disorder DP, differences in regional DP rates have been reported which differ from regional differences in lifetime prevalence of psychotic disorders

[27, 33]. These differences appear not to be explained by the region's social indicators, for example the unemployment rate or health care spending. However, higher DP rates were associated with high involuntary treatment rates. This may reflect the influence of differences in regional treatment practices, which may be considered a source of regional inequality putting people living in different parts of Finland in unequal positions [33].

The current research literature lacks information on the contemporary regional mental disorder DP rate differences and the role of contextual and mental health service factors in this DP variation. The aim of this study was to investigate factors behind the regional differences in all mental disorder DP and separately in its two largest diagnostic groups in Finland, ICD-10 classifications F30–39 (mood disorders) DP and F20–29 (non-affective psychotic disorders) DP [34]. Our hypothesis was that regional differences would approximately follow the previously reported east-north – south-west divide in Finnish health outcomes [22, 25]. We also hypothesized that the district-level factors in the form of socioeconomic deprivation, employment, access to mental health services and local treatment practice would be associated with different regional DP risks. In this unique research setting we studied the regional effects of a wide range of contextual and mental health service factors on mental disorder DP using sophisticated statistical methods, while controlling for the compositional factors of the population. This study is part of the RETIRE – research project, which aims to study the risk factors and sequences of mental health-based disability pensioning and examine the effectiveness of service systems in different hospital districts in Finland [35, 36].

Methods

Data

The study subjects were all Finnish citizens granted a temporary, permanent, full or partial DP due to a mental disorder (ICD 10: F04-F69, F80-F99) for the first time between 2010 and 2015 ($N = 50{,}728$) [35]. The utilized data was gathered from the registers of the Social Insurance Institution of Finland, The Finnish Centre for Pensions, the Finnish Institute for Health and Welfare (THL) and Statistics Finland. The following subjects were omitted from the final data: 1) individuals with any previous or primarily somatic pensions; 2) individuals aged under 18 or over 65; 3) individuals who had moved to a new hospital district during the last three years before DP; 4) individuals living in the hospital district of the Åland Islands because of the district's small sample size and divergent sample. The final data set included 36,879 subjects with mental disorder DP. For a more detailed analysis of our data please see our previous study [36]. We used the Finnish population as an exposure in our model: the information on the age, gender, occupational status and residential hospital district of the Finnish population aged 18 to 65 in 2015 was acquired from Statistics Finland ($N = 2{,}991{,}434$).

Explanatory variables

This study's compositional factors included age, gender, occupational status and region of residence by hospital district. Age was classified into five groups: 18–25 years, 26–35 years, 36–45 years, 46–55 years, and 56–65 years. Occupational status was classified into eight groups in line with Statistics Finland's classification: blue-collar workers, lower white-collar workers, upper white-collar workers, entrepreneurs, agriculture and forestry entrepreneurs, students, unemployed and unknown occupational status. For a more detailed analysis of the demographics of DP the receivers please see our previous study [36].

District-level contextual and mental health service factors were collected from the year 2015 from the Sotkanet Indicator Bank, an information portal provided by THL that offers key population welfare and health data [37]. The six contextual sociodemographic and -economic factors studied were Swedish-speaking population as proportion of the total population; persons with foreign background per 1000 persons; general at-risk-of-poverty rate; employed as proportion of the total population; long-term unemployed as proportion of the labor force; and annual sale of alcoholic beverages per capita as liters of pure alcohol.

The nine mental health service factors used in the study were population density as population/km^2 (used as a proxy indicator for the accessibility of mental health services); all mental health outpatient visits of adults per 1000 persons aged 18 and over (including both primary health care and psychiatric special health care visits); outpatient visits per 1000 persons in psychiatric units; mental health visits in primary health care per 1000 persons; recipients of rehabilitative psychotherapy per 1000 persons aged 18–64; involuntary referrals for observation in psychiatric inpatient care per 1000 persons aged 18–64; periods of care in psychiatric inpatient care per 1000 persons aged 18–64; patients in psychiatric inpatient care, per 1000 persons aged 18–64; and the number of care days in psychiatric inpatient care per 1000 persons aged 18–64.

The original continuous variables were transformed into categorical variables with four groups (named highest to lowest) using one standard deviation (SD) of each variable for the categorization. The lowest group included values smaller than one SD subtracted from the mean and the highest larger than one SD added to the mean (i.e. lowest: value < mean - SD; lower: mean - SD < value < mean; higher: mean < value < mean + SD;

highest: value > mean + SD). Each hospital district was assigned to one of the groups in each district-level variable accordingly (Supplementary file 1). Three of the variables (Swedish-speaking population, persons with foreign background and population density) did not have values smaller than one SD subtracted from the mean, so no hospital districts were assigned to the lowest group in those variables.

Statistical analysis

As the dependent variable is the number of events and the data was over-dispersed, we applied negative binomial regression analysis to study the levels of risk for mental disorder DP in the Finnish hospital districts. The negative binomial model was tested against other count models and found to be most suitable for this data. Incidence rate ratios (IRR) and 95% confidence intervals (95% CI) were calculated separately for the hospital districts for all mental disorder DP, mood disorder DP ($N = 24{,}132$) and non-affective psychotic disorder DP ($N = 6171$). The regression analyses were performed by applying robust standard errors, using the Finnish population as an exposure. First, the IRRs were analyzed using crude models to obtain the crude IRR for each hospital district (Supplementary file 2). Second, the compositional factors age, gender and occupational status were added to the analysis to obtain the adjusted IRRs for the hospital districts.

Furthermore, the district-level factors were added to the models in order to detect the associations between the contextual and mental health service factors and the rate of retiring. The models were compared with the Akaike information criterion (AIC) and Bayesian information criterion (BIC) scores and Pseudo R2 to determine the most suitable model. Due to the correlative nature of the district-level factors, they were added to the model one at a time. The correlation between the district-level factors is shown in Supplementary file 3. The models with the district-level factors were also adjusted on the basis of age, gender and occupational status. The crude models for district-level factor IRRs and 95% CI are described in Supplementary file 4. In additional analysis we also created a heatmap of the categorization of district-level factors, in which the district-level factors were clustered with Euclidean distance and Ward linkage. This demonstrates the complex nature and relationships of district-level factors and hospital district DP risk levels. Statistical analyses were conducted with Stata Version 16.0 and the illustration of the IRR in Finland was drawn with R and the packages gdalUtils, rgdal, tmap, and maptools [38–42].

Results

Regional variation in mental disorder DP

Distinct differences between hospital districts in mental disorder DP and regional differences between mood disorder (F30–39) and non-affective psychotic disorder (F20–29) DP were observed. Hospital district differences adjusted for the compositional factors age, gender, and occupational status by IRR and 95% CI for all mental disorder DP, and separately for mood disorder and non-affective psychotic disorder DP, are described in Table 1 and Fig. 1.

A higher risk of overall mental disorder DP compared to the national level of risk was found in the hospital districts of North Savo (IRR 1.17; 95% CI 1.07–1.28), North Ostrobothnia (IRR 1.22; 95% CI 1.13–1.31), South Ostrobothnia (IRR 1.15; 95% CI 1.05–1.25) and Kainuu (IRR 1.19; 95% CI 1.05–1.36). A lower risk of mental disorder DP was found in HUS (IRR 0.85; 95% CI 0.78–0.93), Päijät-Häme (IRR 0.86; 95% CI 0.78–0.95) and Vaasa (IRR 0.76; 95% CI 0.68–0.84). Regarding diagnostic categories, a higher risk for mood disorder DP was found in Pirkanmaa (IRR 1.11; 95% CI 1.03–1.20), North Savo (IRR 1.33; 95% CI 1.21–1.46), North Ostrobothnia (IRR 1.29; 95% CI 1.21–1.39), South Ostrobothnia (IRR 1.19; 95% CI 1.07–1.32) and Kainuu (IRR 1.18; 95% CI 1.02–1.36), and a lower risk in HUS (IRR 0.84; 95% CI 0.78–0.90), Päijät-Häme (IRR 0.78; 95% CI 0.70–0.86), East Savo (IRR 0.70; 95% CI 0.59–0.84) and Vaasa (IRR 0.71; 95% CI 0.63–0.80), as well as a slight indication of lower risk in Kanta-Häme (IRR 0.87; 95% CI 0.77–0.99). In the case of non-affective psychotic disorder DP, a higher risk was found in Päijät-Häme (IRR 1.29; 95% CI 1.10–1.50), North Karelia (IRR 1.19; 95% CI 1.05–1.36) and North Ostrobothnia (IRR 1.27; 95% CI 1.10–1.46). By contrast, a lower risk was found in Vaasa (IRR 0.65; 95% CI 0.53–0.80) and some indications of a lower risk were recorded in Southwest Finland (IRR 0.87; 95% CI 0.77–0.99) and Länsi-Pohja (IRR 0.74; 95% CI 0.55–0.99). Only the hospital district of North Ostrobothnia had a higher risk and the hospital district of Vaasa had a lower risk of DP in all three diagnostic categories compared to the national mean. Notably, the hospital district of Päijät-Häme had a distinct pattern of DP with a higher risk of non-affective psychotic disorder DP (IRR 1.29; 95% CI 1.10–1.50) but a lower risk of mood disorder DP (IRR 0.78; 95% CI 0.70–0.86) compared to the Finnish national mean of DP risk. Furthermore, the hospital districts of HUS, Pirkanmaa, North Savo and North Karelia differed in their risks of mood disorder DP and non-affective psychotic disorder DP: HUS and North Karelia had a higher risk of non-affective psychotic disorder DP than mood disorder DP, whereas Pirkanmaa and North Savo had a higher risk of mood disorder DP than non-affective psychotic disorder DP.

Table 1 Hospital district differences between mental disorder–related disability pensions (DP)

	All mental disorder DP		Mood disorder DP		Non–affective psychotic disorder DP	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
National mean	1.00		1.00		1.00	
Helsinki and Uusimaa (HUS)	0.85	0.78–0.93	0.84	0.78–0.90	1.09	0.93–1.27
Southwest Finland	0.96	0.89–1.04	1.03	0.95–1.11	0.87	0.77–0.99
Satakunta	0.97	0.89–1.06	0.99	0.90–1.09	0.93	0.80–1.08
Kanta–Häme	0.90	0.81–1.01	0.87	0.77–0.99	0.91	0.76–1.09
Päijät–Häme	0.86	0.78–0.95	0.78	0.70–0.86	1.29	1.10–1.50
Kymenlaakso	1.08	0.99–1.18	1.08	0.99–1.17	1.11	0.97–1.28
Pirkanmaa	1.02	0.94–1.11	1.11	1.03–1.20	0.87	0.75–1.00
Central Finland	1.01	0.91–1.11	1.06	0.97–1.16	0.99	0.86–1.15
North Savo	1.17	1.07–1.28	1.33	1.21–1.46	1.00	0.85–1.17
East Savo	0.86	0.72–1.03	0.70	0.59–0.84	0.88	0.65–1.18
South Savo	1.05	0.95–1.16	1.03	0.93–1.15	1.12	0.94–1.33
North Karelia	0.95	0.86–1.04	0.92	0.83–1.02	1.19	1.05–1.36
South Karelia	1.01	0.92–1.11	1.07	0.97–1.17	1.11	0.93–1.32
Vaasa	0.76	0.68–0.84	0.71	0.63–0.80	0.65	0.53–0.80
Länsi–Pohja	0.99	0.85–1.15	1.04	0.89–1.22	0.74	0.55–0.99
North Ostrobothnia	1.22	1.13–1.31	1.29	1.21–1.39	1.27	1.10–1.46
Central Ostrobothnia	1.13	0.95–1.35	1.04	0.93–1.16	1.02	0.81–1.29
South Ostrobothnia	1.15	1.05–1.25	1.19	1.07–1.32	1.09	0.92–1.28
Kainuu	1.19	1.05–1.36	1.18	1.02–1.36	1.16	0.93–1.44
Lapland	1.02	0.91–1.14	1.03	0.92–1.16	0.99	0.80–1.23
Nagelkerke Pseudo–R^2	0.790		0.799		0.668	
AIC	9531.933		7930.831		5375.144	
BIC	9709.399		8108.298		5552.61	

Hospital district differences between all mental disorder–related disability pensions (DP), mood disorder (F30–39) DP and non–affective psychotic disorder (F20–29) DP in Finland, 2010–2015 by incidence rate ratio (IRR) and 95% confidence interval (95% CI).
Negative binomial regression model adjusted based on the compositional factors gender, age and occupational status

District-level factors

The categorization of hospital districts to the district-level factors and the association of district-level factors with hospital districts and DP risk levels can be seen in Fig. 2. The heatmap rows are sorted based on the IRR of the districts. The IRR and 95% CI calculated for district-level contextual factors (adjusted for the compositional factors age, gender and occupational status) are shown in Table 2. The highest rates of Swedish-speaking and foreign background population were associated with a lower level of regional risk for all mental disorder (Swedish-speaking population IRR 0.84; 95% CI 0.78–0.90 and foreign background population IRR 0.90; 95% CI 0.86–0.93) and mood disorder DP (Swedish-speaking population IRR 0.79; 95% CI 0.73–0.86 and foreign background population IRR 0.89; 95% CI 0.85–0.92) compared to the national mean. The Swedish-speaking population's highest rate was also associated with a lower non-affective psychotic disorder DP risk (IRR 0.74; 95% CI 0.63–0.85). Vaasa was however the only hospital district included in the highest rate of the Swedish-speaking population.

The lowest general at-risk-of-poverty rates were associated with a lower regional risk of all mental (IRR 0.90; 95% CI 0.85–0.95) and mood (IRR 0.85; 95% CI 0.81–0.89) disorder DP compared to the national mean. In the case of non-affective psychotic disorder DP, a lower general at-risk-of-poverty rate indicated a lower risk (IRR 0.89; 95% CI 0.84–0.95). In all three diagnostic categories the higher, but interestingly not the highest, general at-risk-of-poverty rate indicated a higher risk of DP compared to the national mean. The hospital districts HUS, Kanta-Häme, Vaasa and Central Ostrobothnia had the lowest at-risk-of-poverty rates.

With the highest employment rate, the hospital districts HUS and Vaasa had lower regional risk levels in all mental (IRR 0.84; 95% CI 0.80–0.90) and mood (IRR 0.82; 95% CI 0.78–0.87) disorder DP compared to the

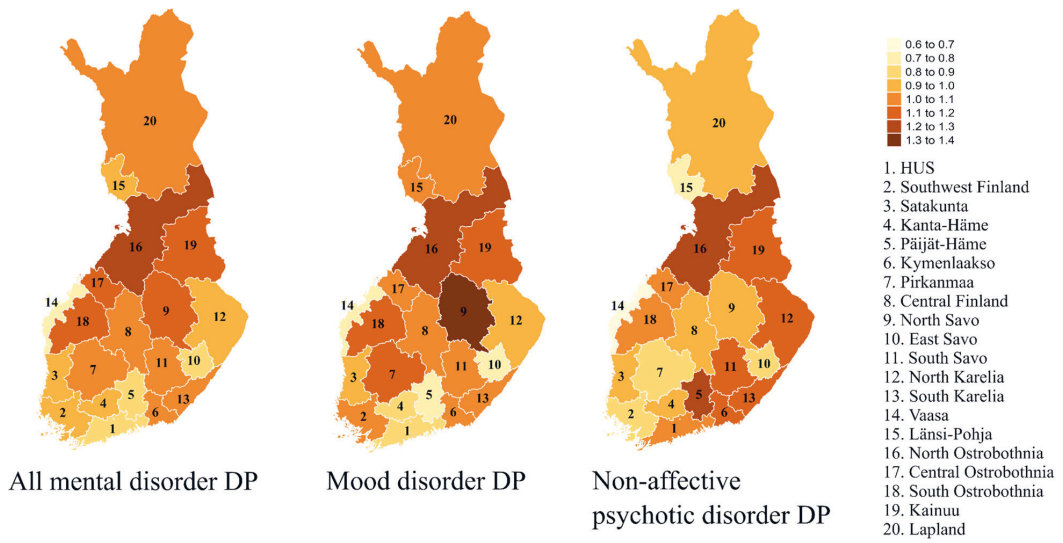


Fig. 1 Hospital district differences in all mental disorder-related disability pensions (DP), mood disorder (F30–39) DP and non-affective psychotic disorder (F20–29) DP in Finland, 2010–2015 by incidence rate ratio (IRR). Negative binomial regression model adjusted based on the compositional factors gender, age and occupational status

national mean. The highest rates of long-term unemployment were associated with a higher regional risk of non-affective psychotic disorder DP compared to the national mean(IRR 1.11; 95% CI 1.03–1.20). Furthermore, the lowest rates of long-term unemployment were associated with a lower regional non-affective psychotic disorder DP risk (IRR 0.89; 95% CI 0.81–0.98). Concerning the regional alcoholic beverage sale rate there was a higher risk of mood (IRR 1.08; 95% CI 1.03–1.13) and non-affective psychotic disorder DP (IRR 1.10; 95% CI 1.02–1.19) associated with the higher, but not the highest, regional sale rate compared to the national mean.

The IRR and 95% CI calculated for mental health service factors (adjusted for the compositional factors age, gender and occupational status) are shown in Table 3. In the case of population density, (a proxy for the accessibility of mental health services), there was a lower risk associated with the highest population density rate in all mental disorder DP (IRR 0.89; 95% CI 0.84–0.96) and mood disorder DP (IRR 0.87; 95% CI 0.83–0.92), as well as a higher risk of DP associated with a lower population density in all mental disorder DP (IRR 1.10; 95% CI 1.06–1.14) and mood disorder DP (IRR 1.12; 95% CI 1.08–1.16) compared to the national mean. It is noteworthy that HUS was the only hospital district that was accounted as having the highest ratio of population density, with half of the other districts categorized as having the lower population density rate. No hospital district was categorized as having the lowest rate of population density, as none had values smaller than one SD subtracted from the mean.

In all adult mental health outpatient visits (including both visits in psychiatric units and in primary health care), the highest and lowest numbers of visits were associated with a higher regional risk of DP in all mental (highest: IRR 1.14; 95% CI 1.07–1.21; lowest: IRR 1.07 95% CI 1.02–1.12) and mood disorders (highest: IRR 1.20; 95% CI 1.13–1.28; lowest: IRR 1.10 95% CI 1.05–1.14). North Savo and Kainuu had the highest numbers of visits, and Kymenlaakso, Pirkanmaa and North Ostrobothnia had the lowest. The same association of higher regional risk with the lowest number of visits was also discernable in outpatient visits in psychiatric units in all three diagnostic categories, but the highest number of visits was associated only with a higher risk of mood disorder DP (IRR 1.13; 95% CI 1.07–1.19) compared to the national mean. In primary health care mental health visits, the lowest rate of visits, in HUS and Vaasa, showed a lower risk of all mental (IRR 0.84; 95% CI 0.79–0.89) and mood disorder DP (IRR 0.81; 95% CI 0.77–0.86), while the highest rate of visits, in South Karelia and Kainuu, was associated with a higher risk. There was no association between the regional risk of all mental disorder DP and the number of recipients of rehabilitative psychotherapy. However, in the case of mood disorder DP the higher number of recipients was associated with a higher regional risk (IRR 1.09; 95% CI 1.03–1.16) and the lower number with a lower risk (IRR 0.93;

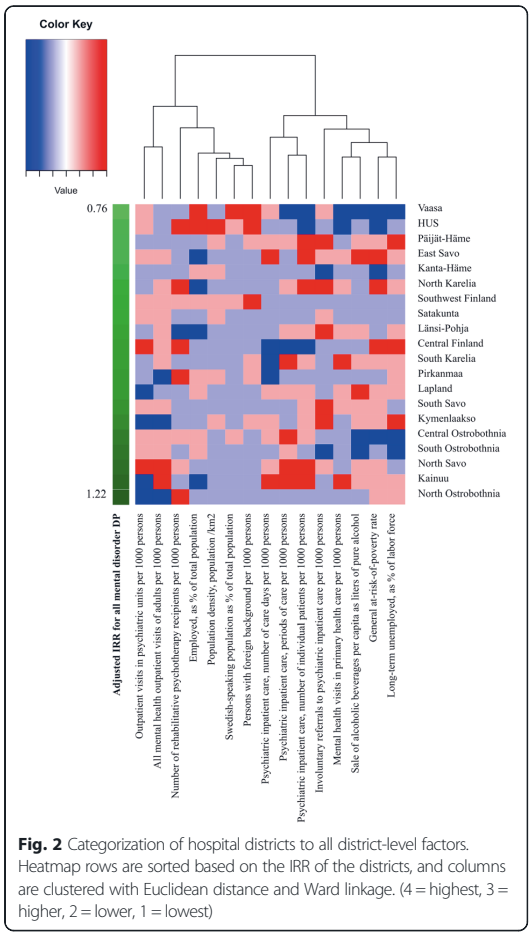


Fig. 2 Categorization of hospital districts to all district-level factors. Heatmap rows are sorted based on the IRR of the districts, and columns are clustered with Euclidean distance and Ward linkage. (4 = highest, 3 = higher, 2 = lower, 1 = lowest)

95% CI 0.88–0.97), and in non-affective psychotic disorder DP the highest number of recipients was associated with a higher risk (IRR 1.15; 95% CI 1.04–1.27) and the lowest number showed some indication of lower risk (IRR 0.79; 95% CI 0.62–0.99).

In terms of psychiatric inpatient care, involuntary referrals for inpatient care showed no association with regional all mental disorder DP risk. In mood disorder DP, the highest numbers of involuntary referrals had a slight indication of a lower DP risk (IRR 0.95; 95% CI 0.90–0.99) compared to the national mean, and in non-affective psychotic disorder DP the highest number of referrals was associated with a higher DP risk (IRR 1.13; 95% CI 1.05–1.21) compared to the national mean. In the case of hospitalization periods, a lower regional risk of DP for all three diagnostic categories was associated with the lowest number of care periods and a higher risk was associated with the highest number of care periods in all mental (IRR 1.13; 95% CI 1.07–1.19) and mood disorders (IRR 1.16; 95% CI 1.11–1.22) compared to the national mean. The lowest numbers of inpatient care patients were also associated with a lower regional risk of DP in all mental (IRR 0.88; 95% CI 0.84–0.93) and mood disorder DP (IRR 0.87; 95% CI 0.83–0.91) compared to the national mean, and the highest numbers of individual patients with a higher risk of DP for non-affective psychotic disorders (IRR 1.10; 95% CI 1.02–1.18). There was no association between the regional risk of DP and the number of days in psychiatric inpatient care.

Discussion

In this comprehensive population-level study, we found significant differences between Finnish hospital districts in disability pensioning for mental disorders even after adjusting for the compositional background differences in the populations of the different districts. The hospital districts with the lowest all mental disorder DP risk were HUS, which includes and surrounds the capital area; Vaasa in the west and Päijät-Häme in the south. A higher regional risk of DP was found in the North Savo and Kainuu hospital districts in the east and in the Ostrobothnia districts in the north-western regions (excluding the Vaasa and Central Ostrobothnia hospital districts). We identified several district-level factors that were associated with these differences, and some that surprisingly were not. Overall, the regional differences in mental disorder DP do not appear to completely follow the traditional north-east – south-west -division of health differences described in the earlier research literature [22, 25, 27, 29]. Furthermore, the regional differences were not explained purely by sociodemographic and -economic differences. This points towards the role of structural or functional differences in service systems and rehabilitative processes.

Compared to the mental disorder DP risks described in two prior Finnish studies [28, 33], our results were similar but with some regional differences, which were probably due to the different time frame of these studies. As a novel finding, we reported several hospital districts with differences in mood disorder DP compared to the national mean and hospital districts, with an opposite pattern of mood/non-affective psychotic disorder DP in their district. Because the regional differences in mental disorder DP did not disappear after adjusting for compositional effects, the reason for these differences can be suspected to be elsewhere, most probably in the service system. One possibility proposed by Kiviniemi et al. (2011) is that the regional DP variance reflects differences in mental health service systems and local treatment practices. The effectiveness of the service system in responding to the population's mental health service needs with effectual and timely treatment can be seen as

Table 2 Associations of regional differences in contextual factors for mental disorder-related disability pensions (DP)

	All mental disorder DP		Mood disorder DP		Non-affective psychotic disorder DP	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Swedish-speaking population as % proportion of total population	$p < 0.001$		$p < 0.001$		$p < 0.001$	
Highest	0.84	0.78–0.90	0.79	0.73–0.86	0.74	0.63–0.85
Higher	1.04	0.99–1.11	1.05	1.00–1.11	1.14	1.03–1.26
Lower	1.14	1.09–1.20	1.20	1.14–1.26	1.19	1.09–1.29
Lowest	–NA		–NA		–NA	
Persons with foreign background per 1000 persons	$p < 0.001$		$p < 0.001$		$p = 0.115$	
Highest	0.90	0.86–0.93	0.89	0.85–0.92	0.93	0.86–1.00
Higher	1.03	0.99–1.07	1.03	0.99–1.07	1.05	0.98–1.12
Lower	1.09	1.05–1.12	1.10	1.06–1.13	1.03	0.98–1.09
Lowest	–NA		–NA		–NA	
General at-risk-of-poverty rate	$p < 0.001$		$p < 0.001$		$p < 0.001$	
Highest	0.98	0.92–1.03	0.96	0.91–1.02	1.04	0.96–1.13
Higher	1.10	1.06–1.14	1.12	1.08–1.17	1.13	1.06–1.20
Lower	1.04	1.00–1.08	1.09	1.04–1.13	0.89	0.84–0.95
Lowest	0.90	0.85–0.95	0.85	0.81–0.89	0.95	0.88–1.03
Employed, as proportion% of total population	$p < 0.001$		$p < 0.001$		$p = 0.003$	
Highest	0.84	0.80–0.90	0.82	0.78–0.87	0.96	0.87–1.06
Higher	1.05	1.01–1.10	1.08	1.04–1.13	0.92	0.86–0.99
Lower	1.09	1.05–1.13	1.13	1.08–1.17	1.09	1.03–1.16
Lowest	1.03	0.98–1.09	1.00	0.94–1.06	1.03	0.95–1.13
Long-term unemployed, as proportion% of labor force	$p = 0.056$		$p = 0.003$		$p = 0.017$	
Highest	0.98	0.93–1.03	0.96	0.92–1.01	1.11	1.03–1.20
Higher	1.05	1.01–1.09	1.08	1.04–1.12	1.04	0.97–1.11
Lower	0.97	0.94–1.01	1.00	0.96–1.04	0.98	0.91–1.04
Lowest	1.00	0.94–1.06	0.97	0.91–1.03	0.89	0.81–0.98
Sale of alcoholic beverages per capita, as liters of pure alcohol	$p = 0.102$		$p = 0.014$		$p = 0.038$	
Highest	0.96	0.89–1.04	0.92	0.85–1.00	0.97	0.84–1.11
Higher	1.05	1.00–1.10	1.08	1.03–1.13	1.10	1.02–1.19
Lower	0.99	0.95–1.03	1.02	0.98–1.07	1.03	0.96–1.10
Lowest	1.00	0.94–1.07	0.98	0.92–1.04	0.91	0.82–1.01

Associations of regional differences in contextual factors for all mental disorder-related disability pensions (DP), mood disorder (F30–39) DP and non-affective psychotic disorder (F20–29) DP in Finland by incidence rate ratio (IRR) and 95% confidence interval (95% CI) (national mean as reference: 1.00).
Negative binomial regression model adjusted based on the compositional factors gender, age and occupational status

a crucial element in preventing work disability and DPs, especially in the case of mood disorder DP.

Contextual factors

We found several district-level contextual factor groups associated with regional mental disorder DP risk differences. Indicators of higher regional socioeconomic level, such as particularly low poverty rates and high employment rates, were associated with lower regional all mental and mood disorder DP risk. The hospital districts of the capital area HUS and western Vaasa were prominent in these factor groups, which could partly explain their lower risk of mental disorder DP. HUS and Vaasa also had the highest rates of Swedish-speaking and foreign background population, which was also associated with a lower DP risk. There is prior literature attesting to the health advantages of the Swedish speaking minority in Finland. Explanations suggested earlier have been cultural differences and a high quantity of social capital, but the reasons are complex and our results in this study

Table 3 Associations of regional differences in mental health service factors for mental disorder-related disability pensions (DP)

	All mental disorder DP		Mood disorder DP		Non-affective psychotic disorder DP	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Population density, population/km^2 (proxy for the accessibility of treatment)	$p < 0.001$		$p < 0.001$		$p = 0.200$	
Highest	0.89	0.84–0.96	0.87	0.83–0.92	1.06	0.95–1.18
Higher	1.02	0.98–1.06	1.03	0.99–1.07	0.94	0.88–1.01
Lower	1.10	1.06–1.14	1.12	1.08–1.16	1.00	0.94–1.07
Lowest	NA–		NA–		NA–	
All mental health outpatient visits of adults per 1000 persons	p < 0.001		p < 0.001		$p = 0.628$	
Highest	1.14	1.07–1.21	1.20	1.13–1.28	1.01	0.91–1.12
Higher	0.97	0.94–1.01	0.96	0.93–1.00	0.97	0.91–1.03
Lower	0.84	0.81–0.88	0.79	0.75–0.82	0.99	0.92–1.07
Lowest	1.07	1.02–1.12	1.10	1.05–1.14	1.04	0.96–1.12
Outpatient visits in psychiatric units per 1000 persons	$p < 0.001$		$p < 0.001$		$p = 0.014$	
Highest	1.05	1.00–1.11	1.13	1.07–1.19	0.96	0.88–1.05
Higher	0.93	0.89–0.97	0.89	0.86–0.92	0.94	0.88–1.00
Lower	0.93	0.89–0.97	0.91	0.88–0.95	0.99	0.93–1.06
Lowest	1.10	1.05–1.15	1.09	1.05–1.14	1.12	1.04–1.21
Mental health visits in primary health care per 1000 persons	$p < 0.001$		$p < 0.001$		$p = 0.471$	
Highest	1.12	1.05–1.19	1.13	1.06–1.21	1.09	0.97–1.22
Higher	1.00	0.95–1.06	0.98	0.93–1.04	0.99	0.91–1.08
Lower	1.07	1.03–1.11	1.10	1.06–1.14	0.99	0.93–1.05
Lowest	0.84	0.79–0.89	0.81	0.77–0.86	0.94	0.84–1.04
Number of rehabilitative psychotherapy recipients per 1000 persons	$p = 0.125$		$p < 0.001$		$p = 0.027$	
Highest	0.99	0.94–1.05	0.99	0.94–1.05	1.15	1.04–1.27
Higher	1.06	1.00–1.13	1.09	1.03–1.16	1.01	0.90–1.12
Lower	0.97	0.92–1.02	0.93	0.88–0.97	1.09	1.00–1.20
Lowest	0.98	0.87–1.10	1.00	0.88–1.13	0.79	0.62–0.99
Involuntary referrals to psychiatric inpatient care per 1000 persons	$p = 0.145$		$p = 0.010$		$p < 0.001$	
Highest	0.98	0.94–1.02	0.95	0.90–0.99	1.13	1.05–1.21
Higher	0.96	0.92–1.01	0.98	0.93–1.04	0.87	0.80–0.94
Lower	1.03	0.99–1.07	1.05	1.01–1.09	1.03	0.96–1.09
Lowest	1.03	0.97–1.09	1.02	0.96–1.10	1.00	0.90–1.10
Psychiatric inpatient care, periods of care per 1000 persons	$p < 0.001$		$p < 0.001$		$p = 0.004$	
Highest	1.13	1.07–1.19	1.16	1.11–1.22	1.06	0.97–1.15
Higher	0.99	0.95–1.04	0.97	0.92–1.02	1.11	1.03–1.19
Lower	1.00	0.96–1.04	1.00	0.96–1.04	1.01	0.95–1.08
Lowest	0.89	0.84–0.95	0.89	0.83–0.95	0.84	0.76–0.93
Psychiatric inpatient care, number of individual patients per 1000 persons	$p < 0.001$		$p = 0.004$		$p = 0.048$	
Highest	1.02	0.98–1.07	1.01	0.96–1.06	1.10	1.02–1.18
Higher	1.06	1.01–1.10	1.05	1.01–1.09	1.01	0.94–1.08
Lower	1.05	1.01–1.09	1.09	1.05–1.13	0.96	0.90–1.02
Lowest	0.88	0.84–0.93	0.87	0.83–0.91	0.95	0.87–1.03

Table 3 Associations of regional differences in mental health service factors for mental disorder-related disability pensions (DP) *(Continued)*

	All mental disorder DP		Mood disorder DP		Non-affective psychotic disorder DP	
	IRR	95% CI	IRR	95% CI	IRR	95% CI
Psychiatric inpatient care, number of care days per 1000 persons	$p = 0.806$		$p = 0.082$		$p = 0.484$	
Highest	1.04	0.95–1.13	0.96	0.87–1.06	1.03	0.89–1.19
Higher	0.98	0.94–1.03	0.98	0.93–1.03	1.00	0.92–1.08
Lower	0.98	0.94–1.03	1.00	0.96–1.04	1.03	0.96–1.10
Lowest	1.00	0.95–1.05	1.06	1.01–1.12	0.94	0.87–1.03

Associations of regional differences in mental health service factors for all mental disorder-related disability pensions (DP), mood disorder (F30–39) DP and non-affective psychotic disorder (F20–29) DP in Finland by incidence rate ratio (IRR) and 95% confidence interval (95% CI) (national mean as reference: 1.00)
Negative binomial regression model adjusted based on the compositional factors gender, age and occupational status

most probably reflect on the interrelations between different contextual factors [26, 28].

The sale of alcoholic beverages per capita appeared to have no clear association with mental disorder DP, which was unexpected. However, it is worthy of note that the regional rate of alcohol sales is not equivalent to alcohol consumption rates, because some alcohol may have been sold in a different hospital district area or brought from abroad. Thus, the possible associations between accurate alcohol consumption, the possible prevalence of alcohol dependence and mental disorder DP are not necessarily registered by the regional sales figures of alcoholic beverage rates per capita included in this study.

Mental health service factors

Firstly, highest and lower population density showed an association with regional overall mental and mood disorder DP risk, but not with non-affective psychotic disorder DP risk. This may be related to easier accessibility of mental health services and better treatment outcomes regarding working ability with mood disorders. There is also evidence of more diverse mental health and substance abuse services with increasing population size of the area [32].

Concerning outpatient services, we identified an indication of a connection between all mental health adult outpatient visits (including both visits in psychiatric units and in primary health care) and regional all mental disorder and mood disorder DP risk: both the regionally highest and lowest numbers of outpatient visits showed an association with a higher risk of DP compared to numbers of outpatient visits closer to the national average. Possible explanations for the highest rate of visits' higher risk could include inefficient district service systems or worse mental health circumstances, but because of the complexity of the multicausal relations associated with regional DP risk (as seen in Fig. 2), it is not possible to deduce this in the scope of this study. However a previous study has shown that there are no clear regional differences between mood disorder prevalence in Finland [30]. On the other end of the spectrum, possible explanations for the high regional risk of DP for the lowest number of outpatient visits could include a regional relative lack of adequate outpatient services or more rural districts with less working opportunities, therefore making it a more frequent practice to grant DP in these districts rather than rehabilitation related to work. Interestingly the three hospital districts with the lowest visits (Kymenlaakso, Pirkanmaa and North Ostrobothnia) are not particularly rural nor do they have a particularly low employment rates.

We also studied psychiatric special health care and primary health care visits separately. A major difference in primary health care compared to special health care was that the regional lowest number of visits was however associated with a lower regional risk of mental disorder and mood disorder DP compared to the national mean. HUS and Vaasa were the two low-risk hospital districts with the lowest numbers of primary health care visits. The reasons for the low DP risk of these hospital districts most probably include complex interactions between the contextual and mental health service factors and cannot be unambiguously explained with the low number of primary health care visits. Nonetheless, different hospital districts have organized their mental health outpatient services differently between psychiatric special care and primary health care [31]. The service systems of HUS and Vaasa, with a higher rate of psychiatric special care-level services, might be more efficient in preventing mental disorder DP in their respective population.

The number of recipients of rehabilitative psychotherapy appeared to have no clear association with mental disorder DP in this study. This raises concerns about the efficiency of the provision of rehabilitative psychotherapy in Finland. Because its primary purpose is to improve and uphold rehabilitation clients' ability to work and study, one would expect it to be associated with regional DP risk [31]. A possible reason may be that rehabilitative psychotherapy in Finland is not successfully used as preventive rehabilitation:

it could begin too late to prevent a first time DP. It could also be focused on the people or districts not in the highest DP risk, as there is substantial regional variation in the availability of rehabilitative psychotherapy services.

In terms of psychiatric inpatient care, prior research has identified that the increased risk for non-affective psychotic disorder DP is associated with high involuntary treatment rates [33]. Our study gave an indication towards this same finding with the highest rate of involuntary referrals to psychiatric inpatient care. The lowest regional number of treatment periods was associated with a lower regional risk of mental disorder DP in all three diagnostic categories compared to the national mean. In addition, the lowest number of individual patients had an association with a lower regional DP risk in all mental and mood disorders, and in non-affective psychotic disorder DP the highest number of patients with a higher risk. This could indicate on the one hand that districts with an incidence of more severe disorders requiring inpatient care also naturally have a higher regional DP risk, or on the other hand that more inpatient- and hospital treatment-centered service systems are associated with a higher risk of DP compared to hospital districts with a stronger focus on outpatient services. However, we found no association with the number of care days in inpatient care. A higher number of care days may be expected to be associated with a higher rate of more severe mental disorders or less efficient mental health services and thus DP, but this appeared not to be the case in this study.

Strengths, limitations and future research

The strengths of this study include the use of comprehensive, high coverage national-level data registers together with whole-population data. Finnish registers are of high quality, allowing the detailed and extensive research of different compositional and district-level factors and their associations with DP in this study [43, 44]. To our knowledge, there has not previously been any such extensive study of mental disorder DP concerning this broad range of different compositional, contextual, and mental health service factors in regional research of mental disorder DP.

One major limitation in this study was that due to the correlative nature of the district-level factors, they could only be added to the statistical models one at a time. Furthermore, we could not adjust the hospital district DP risks with the contextual and mental health service factors in addition to the compositional factors in order to study their effects on individual hospital district risks. In addition, because of the small number of hospital districts in the analyses, it is possible that some higher or lower risk levels in district-level factor groups could be attributed to specific hospital districts causing the different levels of risk as a data artefact. This would mean that in those assumed cases the differences in the contextual and mental health service factors in question would not be directly responsible for the different risk levels, but the hospital district would be acting as a mediator in the model and the true factors affecting the risk level would be elsewhere. In future research it would be important to study in greater depth the effects that mental health service systems and treatment practices have on regional mental disorder DP outcomes.

Conclusions

In this comprehensive population-level study, we found evidence of significant regional variation and disparity in mental disorder DP and related contextual and mental health service factors, even when controlled for compositional factors. This variation appears not to be fully convergent with the traditional health differences in Finnish regions and may partly relate to differences in mental health service systems and local treatment practices. This may be considered as a source of regional inequality. A focus on the regional differences and the supply of mental health services appears to be indicated as one way to decrease mental disorder DP: regional mental health service systems and local treatment practices should adapt to the needs of the local population for optimal performance.

Abbreviations

AIC: Akaike information criterion; BIC: Bayesian information criterion; CI: Confidence Interval; DP: Disability pension; GDP: Gross domestic product; HUS: Hospital district of Helsinki and Uusimaa; IRR: Incidence rate ratio; SD: Standard deviation; THL: Finnish Institute for Health and Welfare

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12913-021-07099-4.

Additional file 1: Appendix 1. The categorization of hospital districts to district-level contextual and mental health service factors using one standard deviation (SD) of each variable for the categorization.

Additional file 2: Appendix 2. Hospital district differences between all mental disorder–related disability pensions (DP), mood disorder (F30–39) DP and non–affective psychotic disorder (F20–29) DP in Finland, 2010–2015 by incidence rate ratio (IRR) and 95% confidence interval (95% CI). Crude model: Negative binomial regression model for hospital districts only.

Additional file 3: Appendix 3. The correlation between the district-level factors.

Additional file 4: Appendix 4. Associations of regional differences in contextual and mental health service factor for all mental disorder-related disability pensions (DP), mood disorder (F30–39) DP and non-affective psychotic disorder (F20–29) DP in Finland by incidence rate ratio (IRR) and 95% confidence interval (95% CI) (national mean as reference: 1.00)

Acknowledgements

Not applicable.

Authors' contributions

TK, RA, TN and SP conceptualized and designed the study. RA and TN were responsible for transcribing, coding and preliminary data analysis. TK and RA analyzed and interpreted the final data. SP, HL, PR, MTT and SK substantially contributed to the interpretation and discussion of data in their respective

research fields alongside overseeing the study conduct. TK and SP were major contributors in drafting the initial manuscript and all authors made substantial revisions to the manuscript. All authors read and approved the final manuscript.

Funding
This work was supported by the Finnish National Research Fund through the Pirkanmaa Hospital District [grant number 9 V052]. The funding source had no involvement in the study design, in the writing of the report, in the decision to submit the article for publication or in the collection, analysis and interpretation of data.

Availability of data and materials
The used DP recipient and population datasets are available from the Social Insurance Institution of Finland, The Finnish Centre for Pensions, THL and Statistics Finland but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. The district-level factors are publicly available from the Sotkanet Indicator Bank, an information portal provided by THL, and the datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The RETIRE – study has the approval of the Finnish Institute for Health and Welfare (THL) Ethics Committee, including a privacy statement, which has performed a careful ethical consideration of this study paying particular attention to voluntariness-, consent- and data protection issues. During the study, the subjects of the register data were not contacted personally, and no individual people can be identified from the processed register data. According to Finnish legislation, and in accordance with the appraisal and approval of the THL Ethics Committee, individual informed consent was not required, because no individual could be identified due to the size of the study's population. Licenses were obtained for the registers from each of the registrars. All study methods were carried out in accordance with ethical and privacy protection guidelines and regulations.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

Author details
[1]Faculty of Social Sciences (Psychology), Tampere University, Arvo Ylpön katu 34, FI-33520 Tampere, Finland. [2]Faculty of Social Sciences (Unit of Health Sciences), Tampere University, Tampere, Finland. [3]Tampere University Library, Tampere University, Tampere, Finland. [4]Faculty of Medicine and Health Technology, Tampere University, Tampere, Finland. [5]Public Health and Welfare Division, Finnish Institute for Health and Welfare, Helsinki, Finland. [6]Department of Adult Psychiatry, Tampere University Hospital, Pirkanmaa Hospital District, Tampere, Finland.

Received: 26 March 2021 Accepted: 23 September 2021
Published online: 11 October 2021

References

1. Wittchen HU, Jacobi F, Rehm J, Gustavsson A, Svensson M, Jönsson B, et al. The size and burden of mental disorders and other disorders of the brain in Europe 2010. Eur Neuropsychopharmacol. 2011;21(9):655–79. https://doi.org/10.1016/j.euroneuro.2011.07.018.
2. OECD, European Union. Health at a Glance: Europe 2018: State of Health in the EU Cycle 2018.
3. Reime L, Claussen B. Municipal unemployment and municipal typologies as predictors of disability pensioning in Norway: a multilevel analysis. Scand J Public Health. 2013;41(2):158–65. https://doi.org/10.1177/1403494812472004.
4. McVicar D. Why do disability benefit rolls vary between regions? A review of the evidence from the USA and the UK. Reg Stud. 2006;40(5):519–33. https://doi.org/10.1080/00343400600757635.
5. McVicar D. Local level incapacity benefits rolls in Britain: correlates and convergence. Regional Stud. 2013;47(8):1267–82. https://doi.org/10.1080/00343404.2011.607807.
6. Krokstad S, Westin S. Disability in society—medical and non-medical determinants for disability pension in a Norwegian total county population study. Soc Sci Med. 2004;58(10):1837–48. https://doi.org/10.1016/S0277-9536(03)00409-X.
7. Agovino M, Parodi G. Human development and the determinants of the incidence of civilian disability pensions in Italy: a spatial panel perspective. Soc Indic Res. 2015;122(2):553–76. https://doi.org/10.1007/s11205-014-0705-8.
8. Murray ET, Head J, Shelton N, Hagger-Johnson G, Stansfeld S, Zaninotto P, et al. Local area unemployment, individual health and workforce exit: ONS longitudinal study. Eur J Pub Health. 2016;26(3):463–9. https://doi.org/10.1093/eurpub/ckw005.
9. Myhr A, Haugan T, Lillefjell M, Halvorsen T. Non-completion of secondary education and early disability in Norway: geographic patterns, individual and community risks. BMC Public Health. 2018;18(1):682–15. https://doi.org/10.1186/s12889-018-5551-1.
10. Hensing G, Andersson L, Brage S. Increase in sickness absence with psychiatric diagnosis in Norway: a general population-based epidemiologic study of age, gender and regional distribution. BMC Med. 2006;4(1):19. https://doi.org/10.1186/1741-7015-4-19.
11. Andersson L, Wiles N, Lewis G, Brage S, Hensing G. Disability pension for psychiatric disorders: regional differences in Norway 1988-2000. Nordic Journal of Psychiatry. 2006;60(4):255–62. https://doi.org/10.1080/08039480600790010.
12. Andersson L, Nyman CS, Spak F, Hensing G. High incidence of disability pension with a psychiatric diagnosis in western Sweden. A population-based study from 1980 to 1998. Work. 2006;26(4):343.
13. Cattrell A, Harris EC, Palmer KT, Kim M, Aylward M, Coggon D. Regional trends in awards of incapacity benefit by cause. Occup Med (Lond). 2011;61(3):148–51. https://doi.org/10.1093/occmed/kqr008.
14. Samuelsson Å, Alexanderson K, Ropponen A, Lichtenstein P, Svedberg P. Incidence of disability pension and associations with socio-demographic factors in a Swedish twin cohort. Soc Psychiatry Psychiatr Epidemiol. 2012;47(12):1999–2009. https://doi.org/10.1007/s00127-012-0498-5.
15. Macintyre S, Ellaway A, Cummins S. Place effects on health: how can we conceptualise, operationalise and measure them? Soc Sci Med. 2002;55(1):125–39. https://doi.org/10.1016/S0277-9536(01)00214-3.
16. Bratberg E, Gjesdal S, Mæland JG. Sickness absence with psychiatric diagnoses: individual and contextual predictors of permanent disability. Health Place. 2009;15(1):308–14. https://doi.org/10.1016/j.healthplace.2008.06.004.
17. Krokstad S, Magnus P, Skrondal A, Westin S. The importance of social characteristics of communities for the medically based disability pension. Eur J Pub Health. 2004;14(4):406–12. https://doi.org/10.1093/eurpub/14.4.406.
18. Laaksonen M, Gould R. The effect of municipality characteristics on disability retirement. Eur J Pub Health. 2014;24(1):116–21. https://doi.org/10.1093/eurpub/ckt129.
19. Sundquist K, Frank G, Sundquist J. Urbanisation and incidence of psychosis and depression. Br J Psychiatry. 2004;184(4):293–8. https://doi.org/10.1192/bjp.184.4.293.
20. Andersson L, Wiles N, Lewis G, Brage S, Hensing G. Can access to psychiatric health care explain regional differences in disability pension with psychiatric disorders? Soc Psychiat Epidemiol. 2007;42(5):366–71. https://doi.org/10.1007/s00127-007-0176-1.
21. Laaksonen M, Silventoinen K. Sosiaaliepidemiologia: väestön terveyserot ja terveyteen vaikuttavat sosiaaliset tekijät. Helsinki: Gaudeamus; 2011.
22. Kestilä L, Karvonen S, Aalto A. Suomalaisten hyvinvointi 2018. Helsinki: Terveyden ja hyvinvoinnin laitos; 2019.
23. Blomgren J, Martikainen P, Mäkelä P, Valkonen T. The effects of regional characteristics on alcohol-related mortality—a register-based multilevel analysis of 1.1 million men. Soc Sci Med. 2004;58(12):2523–35. https://doi.org/10.1016/j.socscimed.2003.09.027.
24. Pirkola S, Sund R, Sailas E, Wahlbeck K. Community mental-health services and suicide rate in Finland: a nationwide small-area analysis. Lancet. 2009;373(9658):147–53. https://doi.org/10.1016/S0140-6736(08)61848-6.
25. Kauppinen T, Karvonen S. Kuinka Suomi jakautuu 2000-luvulla? Hyvinvoinnin muuttuvat alue-erot. Yhteiskuntapolitiikka. 2009;74(5):467–86.

26. Hyyppä M. T., Mäki J. individual-level relationships between social capital and self-rated health in a bilingual community. Prev Med. 2001;32(2):148–55. https://doi.org/10.1006/pmed.2000.0782.
27. Perälä J, Saarni SI, Ostamo A, Pirkola S, Haukka J, Härkänen T, et al. Geographic variation and sociodemographic characteristics of psychotic disorders in Finland. Schizophr Res. 2008;106(2):337–47. https://doi.org/10.1016/j.schres.2008.08.017.
28. Laaksonen M, Gould R. Regional differences in disability retirement: explaining between-county differences in Finland. Scand J Work Environ Health. 2013;39(6):609–17. https://doi.org/10.5271/sjweh.3373.
29. Blomgren J, Jäppinen S, Rahkonen O, Pekkala J, Lahelma E. Pitkien sairauspoissaolojen alue-erot selittyvät vain osin väestörakenteella ja sairastavuudella. Suomen lääkärilehti. 2019;74(47):2734–9.
30. Pirkola S, Isometsä E, Suvisaari J, Aro H, Joukamaa M, Poikolainen K, et al. DSM-IV mood-, anxiety- and alcohol use disorders and their comorbidity in the Finnish general population: results from the health 2000 study. Soc Psychiatry Psychiatr Epidemiol. 2005;40(1):1–10. https://doi.org/10.1007/s00127-005-0848-7.
31. Patana P. Mental health analysis profiles (MhAPs): Finland. 2014.
32. Ala-Nikkola T, Pirkola S, Kontio R, Joffe G, Pankakoski M, Malin M, et al. Size matters — determinants of modern, community-oriented mental health services. Int J Environ Res Public Health. 2014;11(8):8456–74. https://doi.org/10.3390/ijerph110808456.
33. Kiviniemi M, Suvisaari J, Pirkola S, Läksy K, Häkkinen U, Isohanni M, et al. Five-year follow-up study of disability pension rates in first-onset schizophrenia with special focus on regional differences and mortality. Gen Hosp Psychiatry. 2011;33(5):509–17. https://doi.org/10.1016/j.genhosppsych.2011.05.017.
34. World Health Organization. International Statistical Classification of Diseases and Related Health Problems 10th Revision. 2016; Available at: https://icd.who.int/browse10/2016/en.
35. Pirkola S, Nevalainen J, Laaksonen M, Fröjd S, Nurmela K, Näppilä T, et al. The importance of clinical and labour market histories in psychiatric disability retirement: analysis of the comprehensive Finnish national-level RETIRE data. Soc Psychiatry Psychiatr Epidemiol. 2019;55(8):1011–20. https://doi.org/10.1007/s00127-019-01815-6.
36. Karolaakso T, Autio R, Näppilä T, Nurmela K, Pirkola S. Socioeconomic factors in disability retirement due to mental disorders in Finland. Eur J Public Health 2020:ckaa132.
37. The Finnish Institute for Health and Welfare. Sotkanet. Available at: https://sotkanet.fi/sotkanet/en/index. Accessed Accessed 20 June, 2020.
38. R Core Team. R: A language and environment for statistical computing. . Vienna, Austria: R Foundation for Statistical Computing; 2020.
39. Greenberg JA, Mattiuzzi M. gdalUtils: Wrappers for the Geospatial Data Abstraction Library (GDAL) Utilities. . R package version 2.0.3.2. 2020.
40. Bivand R, Lewin-Koh N. maptools: Tools for Handling Spatial Objects . R package version 1.0–1 2020.
41. Bivand R, Keitt T, Rowlingson B. rgdal: Bindings for the 'Geospatial' Data Abstraction Library . R package version 1.5–10. 2020.
42. Tennekes M. Tmap: thematic maps in R. J Stat Softw. 2018;84(6):1–39. https://doi.org/10.18637/jss.v084.i06.
43. Sund R. Quality of the Finnish hospital discharge register: a systematic review. Scand J Public Health. 2012;40(6):505–15. https://doi.org/10.1177/1403494812456637.
44. Sund R, Gissler M, Hakulinen T, Rosén M. Use of health registers. Handbook Epidemiol. 2014:707–30. https://doi.org/10.1007/978-0-387-09834-0_5.

Publisher's Note

PUBLICATION III

Mental health service diversity and work disability: associations of mental health service system characteristics and mood disorder disability pensioning in Finland

Karolaakso, T., Autio, R., Suontausta, P., Leppänen, H., Rissanen, P., Näppilä, T., Tuomisto, M. T., & Pirkola, S.

Social Psychiatry and Psychiatric Epidemiology, 1-12.
https://doi.org/10.1007/s00127-023-02481-5

Social Psychiatry and Psychiatric Epidemiology
https://doi.org/10.1007/s00127-023-02481-5

RESEARCH

Mental health service diversity and work disability: associations of mental health service system characteristics and mood disorder disability pensioning in Finland

Tino Karolaakso[1,2] · Reija Autio[3] · Petra Suontausta[3] · Helena Leppänen[4] · Päivi Rissanen[3] · Turkka Näppilä[5] · Martti T. Tuomisto[1] · Sami Pirkola[3,6]

Received: 19 February 2023 / Accepted: 17 April 2023

Abstract

Purpose Public mental health services (MHS) are crucial in preventing psychiatric disability pensions (DP). We studied the associations between mood disorder DP risk and the characteristics of Finnish municipalities' MHS provision using the ESMS-R mapping tool and Finnish population registers, based on first-time granted mood disorder DPs between 2010 and 2015.

Methods The final data set included 13,783 first-time mood disorder DP recipients and 1088 mental health service units in 104 municipalities. We focused on five different MHS types: all MHS, outpatient care provision, local services without and with gatekeeping, and centralized services. Three factors for each MHS type were studied: service resources, richness, and diversity index. Negative binomial regression models were used in the analysis.

Results In all the municipalities, higher service richness and diversity regarding all MHS, outpatient care and local services with gatekeeping were associated with a lower DP risk. In urban municipalities, service richness was mainly associated with lower DP risk, and in semi-urban municipalities service diversity and resources were primarily associated with lower DP risk in outpatient care and local services with gatekeeping. In rural municipalities, DP risk indicated no association with MHS factors.

Conclusion The organization and structure of MHS play a role in psychiatric disability pensioning. MHS richness and diversity are associated with lower mood disorder DP in specific societal contexts indicating their role as quality indicators for regional MHS. The diversity of service provision should be accounted for in MHS planning to offer services matching population needs.

Keywords Mood disorder · Disability pension · Mental health services · Service resources · Service richness · Service diversity

✉ Tino Karolaakso
tino.karolaakso@tuni.fi

1 Faculty of Social Sciences (Psychology), Tampere University, Arvo Ylpön katu 34, 33520 Tampere, Finland

2 Psychiatry, University of Helsinki and Helsinki University Hospital, Helsinki, Finland

3 Faculty of Social Sciences (Unit of Health Sciences), Tampere University, Tampere, Finland

4 Faculty of Medicine and Health Technology, Tampere University, Tampere, Finland

5 Tampere University Library, Tampere University, Tampere, Finland

6 Department of Adult Psychiatry, Tampere University Hospital, Tampere, Finland

Introduction

Mental disorders are one of the most common health problems globally. In the EU, approximately 38.2% of the population suffers from a mental or neurological disorder any given year, with no substantial variation in between-country prevalence [1]. In Finland, mental and behavioral disorders are the most extensive diagnostic group from which people enter early disability retirement. In 2021, approximately 101,000 persons were on disability pension (DP) for mental disorders, which accounted for 54% of all Finnish DPs [2]. The Finnish mental disorder DPs consist mainly of depression and other mood affective disorders (F30-39) as the leading cause of early retirement (38%

Published online: 28 April 2023

of all mental disorder DPs). A recent study in a similar Nordic country, Denmark, estimated that approximately 7.87 working years are lost for those with mood disorders compared to the general population [3].

Public mental health services (MHS) have a crucial role in preventing psychiatric DPs, especially for mood disorders, with timely and effective treatment. From the perspective of the health service system, a DP can be seen as a failure of the MHS to promote a person's mental health or pre-empt and treat manifesting mental health problems. As such, the regional rate of DP recipients can be seen as one outcome indicator for the quality of services and service structure, when other regional contextual factors have been considered. The development of MHS in Finland and worldwide during recent decades has been characterized by decentralization and dehospitalization of services [4–7]. The focus of service provision has been shifted from inpatient and hospital treatment to outpatient and local community-based care since the 1980s. As a part of this shift, the provision of MHS was almost entirely transferred from the central government to municipalities in 1993, which unfortunately coincided with the severe national economic recession of the early 1990s [6, 8]. This resulted in unintended municipal divergence in the provision of MHS related to the different economic circumstances of the municipalities.

To study and implement MHS solutions successfully, it is essential to understand the health ecosystem in which they operate. Different levels and determinants of the complex system of environment and context affect regional health and mental health outcomes. Therefore consideration of the sociodemographic, -economic and -cultural contexts of the studied catchment area is essential when considering regional MHS solutions [9–14]. Previously, we have studied the Finnish district-level contextual and MHS-use related factors associated with mental disorder DP in all Finnish hospital districts [15].

To study the features of the MHS provision, a standardized description of local care delivery context comparable across different regions is required. One standardized classification system for mental health services is the European Service Mapping Schedule Revised (ESMS-R) mapping tool [9, 16]. ESMS-R provides a standardized taxonomy for describing, classifying and measuring MHS and its resources [11, 16, 17]. ESMS-R (and DESDE-LTC developed from ESMS for the similar assessment of health and social care systems) has previously been applied to compare the service systems of different countries [11, 12, 18–22] and to study the MHS within a single country or smaller regions to support evidence-informed policy making and development of the MHS [23–28]. These studies have found significant variations in care availability, capacity and gaps in care provision across geographic areas, highlighting the importance of informed MHS and policy planning for the population's needs.

Previous research in Finland with ESMS-R data has identified that the number of different types of MHS (as different ESMS-classes, service richness) is positively associated with catchment area population size, which explains up to 84% of the service variation [23, 29]. Furthermore, studies on the characteristics of outpatient and inpatient treatment seem to refer to at least partly regionally fragmented MHS [27, 30]. A previous study has also identified that well-developed, high-quality MHS with a wider variety and higher rate of outpatient and 24 h emergency services are associated with decreased suicide rates in Finland [8]. However, the current research literature needs more information on the associations of the features of MHS structure with the risk of mood disorder DP in different municipality settings as a context. Previous studies have also focused on MHS richness, naming it service diversity but without implementing statistical diversity indices regularly used in other similar fields of study. With a more profound understanding of these associations and service diversity, regional MHS provision could be developed to prevent mental disorder-based disability more efficiently.

The aim of this study was thus to investigate the associations between mental health service system characteristics and municipal mood disorder DP risk (ICD-10 classification F30-39) in municipalities pooled to larger areas by urbanity (meso to macro level) [10, 31, 32]. We studied the effects of MHS resources, service richness and diversity, outpatient care, and local community-based and centralized services on mood disorder DP in this unique research setting, while controlling for the compositional factors of age and gender of the population. We primarily aimed to explore which MHS factors in which municipality context might be associated with mood disorder DP to produce new relevant information and research questions to promote further contextual MHS research. As a preliminary hypothesis we hypothesized that a higher rate of diversity in MHS, especially in outpatient care and community-based service, would mainly contribute to lower mood disorder DP risk, which the municipality context could moderate.

This study is part of the RETIRE – research project, which aims to study the risk factors and sequences of mental health-based disability pensioning and examine the effectiveness of service systems [15, 33–36]. The study contributes to the accumulating body of scientific knowledge needed to plan MHS to prevent work disability for mood disorders effectively.

Methods

Disability pension data

The study data consisted of three integrated data sets: (1) data on Finnish DP for mental disorders; (2) ESMS-R data on regional MHS from 113 Finnish municipalities within seven hospital districts; and (3) demographic information for the Finnish municipalities. The original mental disorder DP study data included all Finnish citizens granted either a temporary or permanent DP due to a mental disorder (ICD 10: F04-F69, F80-F99) for the first time between 2010 and 2015 ($N = 50{,}728$). The study data was collected from the registers of Statistics Finland, the Social Insurance Institution of Finland, the Finnish Centre for Pensions and the Finnish Institute for Health and Welfare (THL). During preliminary data analysis, we excluded the following subjects from the data: (1) individuals with any previous DP; (2) individuals aged under 18 or over 65; (3) individuals who had moved to a new hospital district during the last three years before receiving DP. After this exclusion process, the data included 36 879 subjects with a mental disorder DP. For a more detailed data analysis, see our previous study [33]. Lastly, for this study, we excluded the DP recipients who had been granted their DP for other than F30-39 mood disorder as their primary diagnosis and recipients living in other municipalities than those in the study area. Thus, the final data set included 13 783 first-time mood disorder DP recipients. The municipalities' demographic characteristics were collected for 2015 from the Sotkanet Indicator Bank, an information portal provided by THL that offers essential population health and welfare data [37].

Mental health service ESMS-R data (explanatory variables)

The seven hospital districts comprising the study area were Helsinki and Uusimaa (HUS), Kymenlaakso, South Karelia, Southwest Finland, Pirkanmaa, Kainuu and Lapland (Fig. 1). These hospital districts included 113 municipalities from which we excluded those with a population less than 2000 inhabitants, with the final data set having 104 municipalities. These municipalities cover approximately 60% of all Finnish citizens aged 18–64. The DP risk of these regions was reported in a previous study, which indicated that these districts are a representative sample of different Finnish regions with mostly stable DP risk [15].

The MHS of the study area were analyzed using the ESMS-R -tool [16, 17]. The ESMS-R's hierarchical taxonomy-based coding tree is described in Online Resource 1. The MHS data from HUS, Kymenlaakso, South Karelia and Southwest Finland was collected during 2012–2013 for the REFINEMENT project (Research on Financing Systems' Effect on the Quality of Mental Health Care in Europe; for example [19, 29]). MHS in the Pirkanmaa, Lapland and Kainuu hospital districts were analyzed retrospectively for the years 2013 and 2014. These years 2012–2014 correspond with the DP data timespan of 2010–2015 in this study, as no major alterations were made to these municipal MHS during these years. This ESMS-R data is the most comprehensive available data concerning MHS system characteristics and resources in Finland.

The classification of local vs. centralized services is not initially coded in the ESMS-R taxonomy. We used a categorizing variable designed by Ala-Nikkola et al. [38] to identify local services with and without gatekeeping and centralized services, which were reclassified from the existing ESMS-R data. The Local Service variable was created using a modified Delphi panel procedure. Thus, five different MHS types from the ESMS-R -data were studied: (1) all MHS, (2) outpatient care (ESMS-R class O), (3) local services without gatekeeping, (4) local services with gatekeeping, and (5) centralized services. Outpatient services included only those services where patients were seen in an outpatient setting without the services being residential or day care services. Local services without gatekeeping included three service classes for outpatient care and four classes for day care. It also included almost all the information for care, accessibility to care and self-help and voluntary care services. Local services with gatekeeping included most of the outpatient care services, but also five classes of day care services, one information for care and one self-help and voluntary care service class. Centralized services mainly comprised day care and residential care and one type of regionally concentrated special outpatient care service class. For further details, see [38].

For these five different types of MHS, three different ESMS-R -service system characteristic factors were used in the analysis: (1) service resources as the number of personnel in full-time equivalents (FTE) allocated by municipality population, per 1000 inhabitants, (2) service richness as all the different ESMS-R classes available for the municipality's inhabitants and (3) service diversity as the Gini-Simpson Diversity Index (GSDI) calculated with service richness and the available units for the municipalities [39, 40]. The formulation of MHS types and factors from the ESMS-R data is displayed in Fig. 2.

We first calculated the sum of FTE for each municipality to evaluate the effect of the number of personnel in the MHSs. In cases where the same MHS unit provided services to inhabitants in several municipalities, the unit's FTE was divided and allocated based on the proportion of the population in each municipality (for example, MHS X provided services with an FTE of Y to four municipalities, one of them being municipality Z. Municipality Z's inhabitants

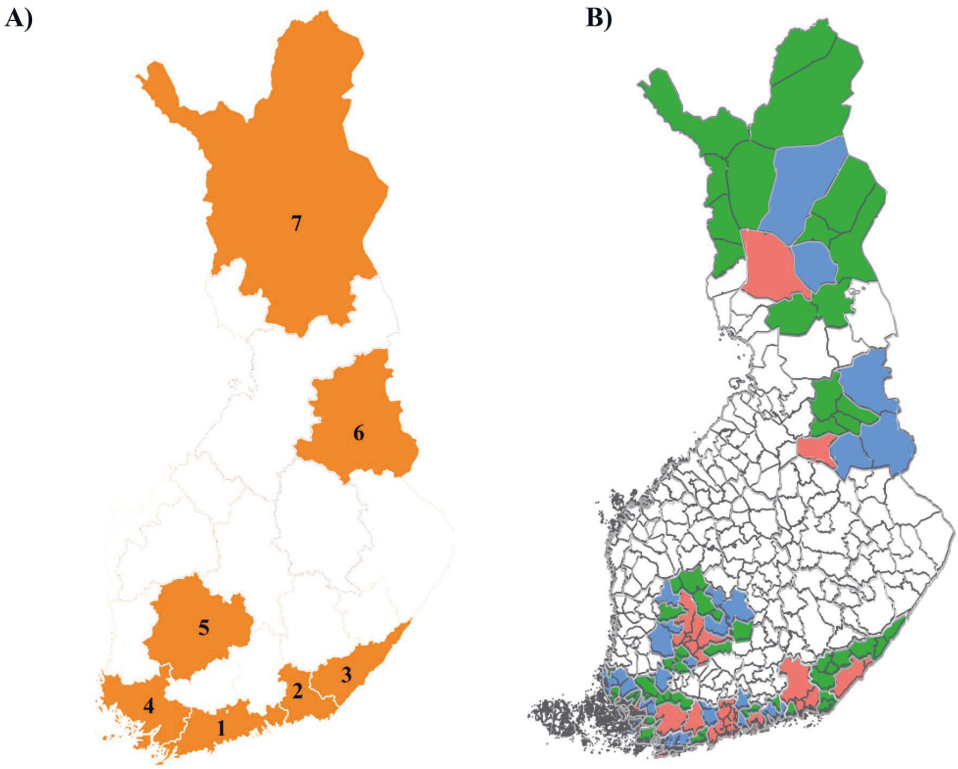


Fig. 1 Map of the study area, comprising seven hospital districts and 113 municipalities in Finland: **A** Hospital districts 1. Helsinki and Uusimaa HUS (1 046 365 inhabitants), 2. Kymenlaakso (101 580 inhabitants), 3. South Karelia (78 248 inhabitants), 4. Southwest Finland (289 656 inhabitants), 5. Pirkanmaa (322 436 inhabitants), 6. Kainuu (43 847 inhabitants) and 7. Lapland (69 129 inhabitants). **B** Municipalities. Red: urban municipalities; Blue: semi-urban municipalities; Green: rural municipalities. Figure created with R and Inkscape

consisted of 20% of all the persons of the area to whom MHS X provided services. Thus 20% of the Y was allocated to the municipality Z's FTE.) Secondly, we divided the sum of FTE for each municipality by 1000 inhabitants.

Although service richness can be used as a simple way to indicate diversity, it only reflects the number of service classes reported, regardless of the number of different available service points provided for the municipalities' inhabitants. GSDI and similar diversity indices are commonly used for example in ecological and ecosystem service research to calculate species or class diversity in a given environment or area [41]. By combining and weighing service richness with the number of available units in the ESMS-R class, the GSDI defines an index of 0 to 1 for the municipalities' MHS diversity, with a higher GSDI signifying higher diversity. The calculation of GSDI and an example are given in Online Resource 2. The GSDI gives a more multifaceted approach to diversity of services, considering evenness between service provision rather than the mere number of ESMS-R classes commonly used in previous MHS research and named service richness in this study. To our knowledge this study is the first to examine MHS diversity using the GSDI, made possible by the ESMS-R classification of MHS classes.

Services classified as 24 h service housing without a fixed term (ESMS-R classes R11-13) were excluded from the study. These residential services presumably do not affect the disability pensioning process, as they are targeted primarily to people already on a disability pension. Furthermore, the person-years of staff information was missing from 174 services, which were excluded from the analysis regarding the service resources. However, the services with missing person-years of staff information consisted mostly of 71.3% self-help and volunteer care services (ESMS-R class S), with only 6.9% outpatient care (O) services. The final mental health service data set included 1 088 MHS units in 104 municipalities.

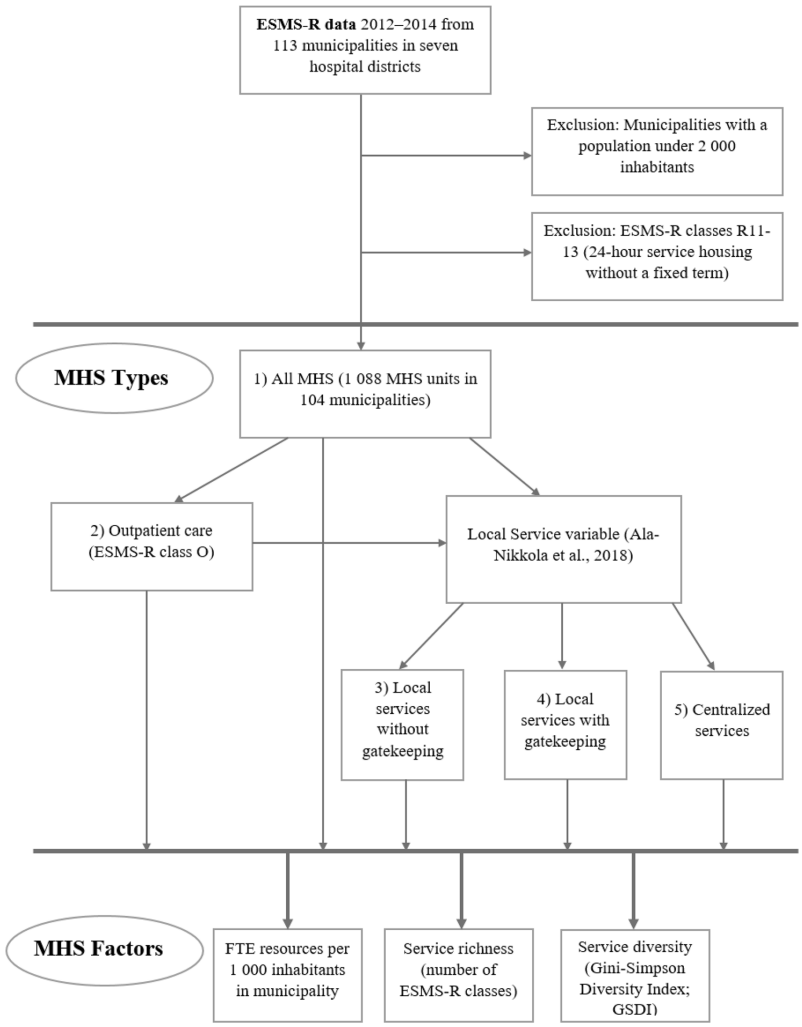


Fig. 2 Flowchart of ESMS-R data management, the formulation of five MHS types and their three MHS factors. MHS factors were calculated for all municipalities and all MHS types. Figure created with Microsoft Office

Statistical analysis

The municipalities were divided into three groups based on the 2015 classification by Statistics Finland for describing the degree of urbanization of their residence: urban, semi-urban and rural. Urban municipalities included those in which at least 90% of the population lived in urban settlements or where the population of the largest urban settlement was at least 15,000. In semi-urban municipalities, at least 60% but less than 90% of the population lived in urban settlements, and the population of the largest urban settlement was between 4000 and 15,000 inhabitants. In rural municipalities, less than 60% lived in urban settlements, and the population of the largest settlement was less than 15,000 inhabitants, or between 60 and 90% of the population lived in urban settlements, and the largest settlement was less than 4000 inhabitants.

Means and standard deviations were calculated for the MHS factors to characterize the data. One-way ANOVA test was used to determine whether the municipality groups had statistically significant differences concerning the MHS factors. The associations of MHS factors with mood disorder DP were analyzed using negative binomial regression models. The regression analyses were performed by applying robust standard errors, using the Finnish population data within each municipality as an exposure and with adjustment based on the compositional factors gender and

age. The information on the municipality population aged 18 to 65 and their age and gender distribution in 2015 was acquired from Statistics Finland ($N = 1{,}950{,}205$) for the 104 municipalities.

Incidence rate ratios (IRR) and 95% confidence intervals (95% CI) were calculated for the models. Because of varying multicollinearity between the different MHS types and municipality groups, the analysis for each MHS factor was modeled separately. The correlation between the municipality groups MHS factors and demographic characteristics are shown in Online Resource 3. In all statistical analyses, P values < 0.05 were considered statistically significant. GSDI values were calculated for the MHS factors with R version 4.0.1 [42], RStudio [43] and the R-package diverse [44]. The statistical analyses were performed with SPSS version 28.0.

Results

Study area and MHS factor characteristics

Characteristics of the study's catchment area and municipality groups on the macro-level are reported in Table 1. Urban municipalities comprised 29% of all the municipalities, but 79% of all DP recipients and 81% of all the catchment area population resided in them. Urban municipalities also had a lower ratio of mood disorder DP, mental health index and dependency ratio in the population, as well as a higher rate of higher education qualifications and population density. The characteristics of the semi-urban and rural municipalities were primarily similar, although semi-urban municipalities had lower unemployment rates. Rural municipalities also had the lowest rates of population density and higher education qualifications, but also the lowest rate of those not in education or training at age 17–24.

Means and standard deviations are reported for the MHS types and their factors in Table 2 and Online Resource 4. In all MHS types the municipality groups were statistically significant concerning service richness and diversity, but did not differ regarding FTE resources per 1000 inhabitants. The mean number of MHS FTE in all municipalities was 3.13 per 1000 inhabitants (SD 1.28). The mean for service richness of all MHS was 15.67 distinct ESMS-R classes offering services to a single municipality's residents (SD 6.09). The mean value of GSDI for all MHS diversity was 0.88 (SD 0.04) between all municipalities. Concerning the municipality groups and MHS types, service richness and diversity were highest in urban municipalities, while being lower in semi-urban and typically lowest in rural municipalities (Table 2). Only in local services with gatekeeping did rural municipalities have a higher GSDI (0.69; SD 0.11) than semi-urban (0.66; SD 0.18).

Mood disorder disability pensioning and mental health services

Noticeable differences between MHS factors and mood disorder DP associations were observed (Table 3). The relationship between MHS factors and DP appears to be associated with the degree of urbanicity and the context of

Table 1 Demographic characteristics of the municipalities in the study (2015)

	All municipalities	Urban municipalities	Semi-urban municipalities	Rural municipalities
Municipalities included in study	104	30	26	48
First time mood disorder F30-39 DP receivers 2010–2015	13 783	10 943	1 872	968
Total population aged 18 to 65, end of 2015	1 951 261	1 584 015	240 458	126 788
Ratio of mood disorder DP, % of population aged 18 to 65	0.71%	0.69%	0.78%	0.76%
Mental health index, not age-standardized*	98.8 (39.7–184)	94.5 (52.7–126.9)	100.4 (52.8–136.9)	100.7 (39.7–184)
Unemployment rate, as % of total population*	12.8% (6.8–22.9%)	13.1% (7.6–19.9%)	12.1% (6.8–20.1%)	13.0% (7–22.9%)
Household-dwelling-units with one person, as % of all household/dwelling-units*	38.9% (22.2–51.2%)	39.8% (29.9–51.1%)	38.5% (23.9–45.8%)	38.6% (22.2–51.2%)
Population density, population/km^2*	47.4 (0.5–2936.6)	407.4 (8.2–2936.6)	31.2 (0.8–115.8)	11 (0.5–48.1)
Demographic dependency ratio, as the number of people aged under 15 and over 64 per hundred working-age people aged 15–64*	67.3 (44–102.8)	58.9 (44–72.3)	67.6 (57–79.9)	72.4 (55.2–102.8)
Higher education qualifications, as % of total population aged 20 and over*	25.0% (13.8–57.1%)	31.7% (21–57.1%)	24.8% (16–35%)	21% (13.8–34.4%)
Not in education or training aged 17–24, as % of total population of same age*	8.6% (3.5–16%)	8.9% (5.5–15%)	9% (5.4–14.3%)	8.1% (3.5–16%)

*Mean (and range) for the municipalities

Table 2 Characteristics of the municipality-level mental health service ESMS-R factors in Finland as means (with standard deviation)

	All municipalities	Urban municipalities	Semi-urban municipalities	Rural municipalities	Statistical significance[d]
All mental health services (MHS)					
FTE resources per 1000 inhabitants[a]	3.13 (1.28)	3.12 (0.91)	2.96 (1.33)	3.23 (1.43)	$p=0.688$
Service richness[b]	15.67 (6.09)	21.4 (6.38)	14.81 (4.28)	12.56 (3.82)	$p<0.001$
Service diversity[c]	0.88 (0.04)	0.91 (0.02)	0.88 (0.05)	0.86 (0.04)	$p<0.001$
Outpatient care (ESMS-R code O)					
FTE resources per 1000 inhabitants[a]	1.30 (0.58)	1.27 (0.34)	1.27 (0.57)	1.34 (0.69)	$p=0.843$
Service richness[b]	5.57 (1.90)	7.00 (2.16)	5.35 (1.42)	4.79 (1.36)	$p<0.001$
Service diversity[c]	0.70 (0.10)	0.74 (0.07)	0.72 (0.15)	0.67 (0.07)	$p=0.009$
Local services without gatekeeping					
FTE resources per 1000 inhabitants[a]	0.63 (0.54)	0.61 (0.52)	0.68 (0.48)	0.61 (0.57)	$p=0.871$
Service richness[b]	3.80 (2.08)	5.57 (2.24)	3.81 (1.36)	2.69 (1.44)	$p<0.001$
Service diversity[c]	0.54 (0.26)	0.71 (0.09)	0.60 (0.21)	0.40 (0.28)	$p<0.001$
Local services with gatekeeping					
FTE resources per 1000 inhabitants[a]	0.90 (0.67)	0.89 (0.46)	0.78 (0.67)	0.97 (0.76)	$p=0.515$
Service richness[b]	5.15 (2.27)	7.03 (2.82)	4.58 (1.67)	4.29 (1.24)	$p<0.001$
Service diversity[c]	0.71 (0.13)	0.77 (0.07)	0.66 (0.18)	0.69 (0.11)	$p=0.002$
Centralized services					
FTE resources per 1000 inhabitants[a]	1.60 (0.79)	1.62 (0.52)	1.50 (0.82)	1.65 (0.91)	$p=0.757$
Service richness[b]	6.72 (2.78)	8.80 (2.87)	6.42 (2.31)	5.58 (2.18)	$p<0.001$
Service diversity[c]	0.74 (0.13)	0.80 (0.06)	0.73 (0.16)	0.72 (0.14)	$p=0.028$

[a]Resources as the number of personnel in full-time equivalents (FTE) allocated by municipality population, per 1000 inhabitants

[b]Richness as all the different ESMS-R -classes available for the municipality's inhabitants

[c]Diversity as the Gini-Simpson Diversity Index (GSDI), calculated with service richness and the available units for the municipalities

[d]Statistical significances to detect whether the mean values of the urban, semi-urban and rural municipalities were different were computed with the one-way ANOVA test

the municipalities. When all municipalities were studied together, a higher service richness and diversity in all MHS (richness IRR 0.995; 95% CI 0.991–0.998, and GSDI IRR 0.396; 95% CI 0.185–0.850), outpatient care (richness IRR 0.978; 95% CI 0.996–0.990, and GSDI IRR 0.687; 95% CI 0.511–0.924) and local services with gatekeeping (richness IRR 0.980; 95% CI 0.970–0.990, and GSDI IRR 0.641; 95% CI 0.500–0.821) were associated with lower DP risk.

In urban municipalities service richness was associated with lower DP in all five studied MHS types (all MHS IRR 0.993; 95% CI 0.988–0.998, outpatient care IRR 0.976; 95% CI 0.962–0.990, local services without gatekeeping IRR 0.985; 95% CI 0.970–1.000, with gatekeeping IRR 0.982; 95% CI 0.971–0.994, and centralized services IRR 0.986; 95% CI 0.974–0.998), as well as with service diversity in local services without gatekeeping (IRR 0.428; 95% CI 0.258–0.711).

Uniquely in semi-urban municipalities, a higher FTE per 1000 inhabitants indicated a lower DP risk in all MHS (IRR 0.941; 95% CI 0.897–0.988), outpatient care (IRR 0.818; 95% CI 0.726–0.922), local services with gatekeeping (IRR 0.881; 95% CI 0.792–0.980) and centralized services (IRR 0.925; 95% CI 0.859–0.996), but not in local services without gatekeeping. Furthermore, in outpatient care we found a lower risk of DP associated with higher service diversity (IRR 0.644; 95% CI 0.442–0.940), and in local services with gatekeeping a lower DP risk with higher service richness (IRR 0.943; 95% CI 0.913–0.975) and diversity (IRR 0.544; 95% CI 0.398–0.743). Thus, all studied MHS factors showed an association with lower DP risk in local services with gatekeeping, but not in local services without gatekeeping. Interestingly, we found no associations between rural municipalities' DP risk and MHS factors.

Discussion

In this comprehensive population-level study, we found significant associations between the resourcing, service richness and diversity of MHS and the level of mood disorder DP. Our associations illustrate differences in distinct

Table 3 Associations of mental health service ESMS-R factors with mood disorder (F30-39) DP in Finland by incidence rate ratio (IRR) and 95% confidence interval (95% CI)

	All municipalities ($N=104$)	Urban municipalities ($n=30$)	Semi-urban municipalities ($n=26$)	Rural municipalities ($n=48$)
	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)
All mental health services (MHS)				
FTE resources per 1000 inhabitants[a]	0.997 (0.965–1.030)	1.026 (0.970–1.085)	0.941 (0.897–0.988)*	1.046 (0.993–1.102)
Service richness[b]	0.995 (0.991–0.998)**	0.993 (0.988–0.998)**	0.998 (0.981–1.014)	0.996 (0.978–1.013)
Service diversity[c]	0.396 (0.185–0.850)*	0.211 (0.035–1.284)	0.373 (0.121–1.155)	0.555 (0.070–4.388)
Outpatient Care (ESMS-R code O)				
FTE resources per 1000 inhabitants[a]	0.991 (0.918–1.070)	1.091 (0.962–1.237)	0.818 (0.726–0.922)**	1.109 (0.984–1.251)
Service richness[b]	0.978 (0.966–0.990)**	0.976 (0.962–0.990)**	0.961 (0.918–1.006)	0.985 (0.933–1.040)
Service diversity[c]	0.687 (0.511–0.924)*	0.679 (0.423–1.092)	0.644 (0.442–0.940)*	1.053 (0.408–2.716)
Local services without gatekeeping				
FTE resources per 1000 inhabitants[a]	1.021 (0.953–1.094)	0.988 (0.901–1.084)	0.948 (0.824–1.091)	1.124 (0.995–1.270)
Service richness[b]	0.990 (0.979–1.001)	0.985 (0.970–1.000)*	1.019 (0.967–1.074)	1.007 (0.958–1.058)
Service diversity[c]	0.905 (0.778–1.054)	0.428 (0.258–0.711)**	0.925 (0.660–1.298)	1.083 (0.845–1.387)
Local services with gatekeeping				
FTE resources per 1000 inhabitants[a]	0.974 (0.914–1.038)	1.050 (0.946–1.165)	0.881 (0.792–0.980)*	0.997 (0.890–1.116)
Service richness[b]	0.980 (0.970–0.990)**	0.982 (0.971–0.994)**	0.943 (0.913–0.975)**	0.943 (0.887–1.001)
Service diversity[c]	0.641 (0.500–0.821) **	0.865 (0.489–1.531)	0.544 (0.398–0.743)**	0.673 (0.327–1.383)
Centralized services				
FTE resources per 1000 inhabitants[a]	0.997 (0.947–1.050)	1.038 (0.945–1.140)	0.925 (0.859–0.996)*	1.058 (0.976–1.147)
Service richness[b]	0.994 (0.985–1.003)	0.986 (0.974–0.998)*	1.021 (0.989–1.054)	1.008 (0.977–1.040)
Service diversity[c]	0.821 (0.613–1.099)	1.079 (0.548–2.126)	0.756 (0.500–1.145)	0.898 (0.546–1.477)

Negative binomial regression model adjusted based on the compositional factors gender and age

[a]Resources as the number of personnel in full-time equivalents (FTE) allocated by municipality population, per 1000 inhabitants

[b]Richness as all the different ESMS-R -classes available for the municipality's inhabitants

[c]Diversity as the Gini-Simpson Diversity Index (GSDI), calculated with service richness and the available units for the municipalities

*Statistical significance at the 0.05 level

**Statistical significance at the 0.01 level

municipality contexts. These findings suggest that the organization and structure of available MHS are associated with the incidence of psychiatric disability pensioning.

A novel approach to using the GSDI enabled us to identify an association of higher service richness and diversity with lower DP risk, especially in all MHS, outpatient care and local services with gatekeeping. Higher service richness and diversity in these MHS types may be indicators of a well-developed, high-quality service system with higher effectiveness in the pre-emption of disability due to mood disorders. Higher diversity in MHS could also result in services responding more broadly to different population demands and having fewer gaps in service provision for the needs of the population [8]. This was evident in the semi-urban municipality context and when examining all municipalities together, and might also be partly conveyed in urban municipalities by service richness, but interestingly not by service diversity. Lower service richness and diversity might result in critical systemic gaps in the provision of MHS and care pathways. Prior studies have identified some of these gaps using ESMS-R or DESDE-LTC taxonomies [19, 21, 22, 26, 29].

In a high-income Nordic country such as Finland, there are clear differences between the urban, semi-urban and rural contexts of MHS provision. On average, the diversity of MHS is higher, and mood disorder DP risk is lower in larger municipalities, which may reflect the historical and economic background in the provision and organization of MHS by Finnish municipalities. The effects of MHS factors appear to be most clearly associated with mood disorder DP in a semi-urban context. This might indicate that other contextual factors do not affect mood disorder DP differences to the extent that changes in regional service provision would have the potential to be essential or main contributors. In urban and rural municipalities, other sociodemographic and contextual economic factors might significantly affect

mood disorder DP rates and populational needs for the MHS. The urban municipalities in our study had, on average, a lower dependency ratio in the population and a higher rate of higher education qualifications. It is also important to note that in urban municipalities the MHS includes more service units and system components which need to be interconnected. MHS comprise complex dynamic systems, and the (un)successful organization of this complexity for effective patient care pathways might be one confounding factor in the provision of large urban area MHS systems [10, 13, 14].

Interestingly, rural municipalities did not have significant associations with MHS factors. Possible related contextual factors might be that rural municipalities had the lowest rates of population density (which associates with longer distances to the physical location of service provision [15]) and of higher education qualifications but also of those not in education or training at age 17–24. In addition, a higher average age of population, higher unemployment rate, and emphasis on blue-collar occupations was often associated with a rural context, which might have confounding effects on regional mood disorder DP risk.

Strengths, limitations and future research

The strengths of this study include the use of comprehensive national-level data registers. Finnish population registers have high coverage and quality, allowing detailed and extensive epidemiologic research for MHS associations with mood disorder DP in this study [45, 46]. To our knowledge, there has not previously been a comprehensive study of the relationship between MHS types and factors, and mood disorder DP in different municipality contexts. The ESMS-R mapping tool was used for clear hierarchical taxonomy-based coding of MHS. This study also included an examination of the MHS context of service provision. Both are essential in researching complex MHS systems [9, 10, 16].

Our study setting includes some important limitations. One major limitation in this study was that because of the varying multicollinearity between the different MHS types and municipality groups, not all the MHS factors could be entered and adjusted in the same model. The correlation between the municipality groups MHS factors and demographic characteristics are provided in Online Resource 3. Secondly, the MHS units could be of different sizes, which does not affect the FTE but could affect GSDIs, which were calculated with the available units in the municipality and therefore reflected the number of components in the complex MHS system rather than the components' size. Thirdly, some MHS units provided services to several municipalities, which could involve regional dynamics that were not comprehensively considered in this study. In these MHSs, the FTE resources were allocated to municipalities on the basis of their relative share of inhabitants. This factor is based on the assumption that all the municipality's inhabitants used the MHS available to them in equal amounts. However, this might not be the case, although this was the best available estimate in this study. Fourthly, the MHS data does not include information about the co-operation of the services or pathways of care between them, or on whether the psychosocial treatment provided was grounded in evidence-based psychosocial treatment models and a specific philosophy/culture of psychosocial treatment provision. In future research, the treatment contents and cultures should be integrated to ESMS-R classification research, which could yield a more complex but truthful picture of MHS ecosystems and functioning concerning mood disorder treatment and DP prevention.

It is important to note that the ESMS-R classification tool is not all-encompassing, and there may have been subtle features of the classified MHS units that are not included in the analysis. The ESMS-R data in this study only includes public services, and it excludes Finnish occupational health care, private services or rehabilitative psychotherapy imbursed by the Social Insurance Institution of Finland. However, previous studies have indicated a lower mental disorder DP rate in occupational health care users compared to population statistics [47], and a higher rate of sick leaves for mental disorders in public service users compared to occupational health or private service users [48]. These findings indicate that public MHS have a crucial populational role in treating and pre-empting mental disorders and disability for most of the population.

Conclusions

Our findings of significant associations between MHS factors, especially service richness and diversity, with mood disorder DP in Finnish municipalities highlight the importance of organizational factors for the effectiveness of services. Higher service richness and diversity in all MHS, outpatient care and community-based services may be indicators of a well-developed high-quality service system with a higher effectiveness in pre-emption of mood disorder DP. Higher diversity of MHS could support a broader response to different populational needs and leave fewer gaps in treatment provision. There are also differences between the urban, semi-urban and rural contexts of the MHS provision, which might be connected to other confounding contextual factors, especially in many urban or rural environments.

The Finnish Mental Health Strategy 2020–2030 promotes broad-based MHS that meet people's needs, highlighting the requirement that the services should be of high accessibility, effectivity, quality, availability, flexibility, and

compatibility and that they should support continuity [49]. There are already several such programs and initiatives in Finland, aiming to elevate the contents and care pathways of regional MHS [50, 51]. The diversity of service provision should be accounted for in MHS planning by experts and stakeholders to offer services matching population needs.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00127-023-02481-5.

Acknowledgements The authors thank Taina Ala-Nikkola for her help and expertise in utilizing the Local Service-variable for the ESMS-R data in the analyses of this study, and Marjut Vastamäki for all her support in analyzing the ESMS-R data.

Author contributions RA and TN prepared the original data with preliminary data analysis. TK, RA, PS and SP designed the research setting with all authors commenting and contributing to it along the way. TK and RA performed the statistical analyses for this study. TK and RA wrote the main manuscript text with all authors commenting and contributing to it. TK, RA and PS prepared figures 1-2. All authors reviewed and accepted the manuscript.

Funding Open access funding provided by Tampere University including Tampere University Hospital, Tampere University of Applied Sciences (TUNI). The Finnish National Research Fund supported this work through the Pirkanmaa Hospital District [grant number 9V052]. The funding source had no involvement in the study design, in the writing of the report, in the decision to submit the article for publication or in the collection, analysis and interpretation of data.

Data availability The used DP recipient and population datasets are available from Statistics Finland, the Social Insurance Institution of Finland, the Finnish Centre for Pensions and the Finnish Institute for Health and Welfare. Restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. ESMS-R data is available from the Finnish Institute for Health and Welfare. The municipality-level factors are publicly available from the Sotkanet Indicator Bank, an information portal provided by THL, and the datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Conflict of interest The authors declare no conflict of interest.

Ethical approval This study is based on register data collected for administrative, development, and evaluation purposes. No individuals were contacted, and none will be recognizable from the data or results. The Ethical Committee of the Finnish National Institute of Welfare and Health gave its approval of the plan of the research project.

References

1. Wittchen HU, Jacobi F, Rehm J, Gustavsson A, Svensson M, Jönsson B, Olesen J, Allgulander C, Alonso J, Faravelli C, Fratiglioni L, Jennum P, Lieb R, Maercker A, van Os J, Preisig M, Salvador-Carulla L, Simon R, Steinhausen H-C (2011) The size and burden of mental disorders and other disorders of the brain in Europe 2010. Eur Neuropsychopharmacol 21:655–679. https://doi.org/10.1016/j.euroneuro.2011.07.018
2. Finnish Centre for Pensions (2022) Statistical Yearbook of Pensioners in Finland 2021
3. Plana-Ripoll O, Weye N, Knudsen AK, Hakulinen C, Madsen KB, Christensen MK, Agerbo E, Laursen TM, Nordentoft M, Timmermann A, Whiteford H, Øverland S, Iburg KM, McGrath JJ (2023) The association between mental disorders and subsequent years of working life: a Danish population-based cohort study. Lancet Psychiatry 10:30–39. https://doi.org/10.1016/S2215-0366(22)00376-5
4. Keskimäki I, Tynkkynen L-K, Reissell E, Koivusalo M, Syrjä V, Vuorenkoski L, Rechel B, Karanikolos M (2019) Finland: health system review. Health Syst Transit 21:1
5. Lahtinen E (2006) Mental health in Finland. Int Psychiatry 3:12–14
6. Patana P (2014) Mental health analysis profiles (MhAPs): Finland. OECD Publishing, Paris
7. Thornicroft G, Tansella M (2004) Components of a modern mental health service: a pragmatic balance of community and hospital care: overview of systematic evidence. Br J psychiatry 185:283–290
8. Pirkola S, Sund R, Sailas E, Wahlbeck K (2009) Community mental-health services and suicide rate in Finland: a nationwide small-area analysis. Lancet 373:147–153. https://doi.org/10.1016/S0140-6736(08)61848-6
9. Furst MA, Gandré C, Romero López-Alberca C, Salvador-Carulla L (2019) Healthcare ecosystems research in mental health: a scoping review of methods to describe the context of local care delivery. BMC Health Serv Res 19:173. https://doi.org/10.1186/s12913-019-4005-5
10. Furst MA, Bagheri N, Salvador-Carulla L (2020) An ecosystems approach to mental health services research. BJPsych Int 18:1–3. https://doi.org/10.1192/bji.2020.24
11. Romero-López-Alberca C, Gutiérrez-Colosía RM, Salinas-Pérez AJ, Almeda N, Furst M, Johnson S, Salvador-Carulla L (2019) Standardised description of health and social care: a systematic review of use of the ESMS/DESDE (European Service Mapping Schedule/Description and Evaluation of Services and DirectoriEs). Eur Psychiatry 61:97–110. https://doi.org/10.1016/j.eurpsy.2019.07.003
12. Sadeniemi M, Almeda N, Salinas-Pérez AJ, Gutiérrez-Colosía RM, García-Alonso C, Ala-Nikkola T, Joffe G, Pirkola S, Wahlbeck K, Cid J, Salvador-Carulla L (2018) A comparison of mental health care systems in northern and southern Europe: a service mapping study. Int J Environ Res Public Health 15:1133. https://doi.org/10.3390/ijerph15061133
13. Cohen M (2017) A systemic approach to understanding mental health and services. Soc Sci Med 191:1–8. https://doi.org/10.1016/j.socscimed.2017.08.037
14. Rock D, Cross SP (2020) Regional planning for meaningful person-centred care in mental health: context is the signal not the noise. Epidemiol Psychiatr Sci 29:e104. https://doi.org/10.1017/S2045796020000153
15. Karolaakso T, Autio R, Näppilä T, Leppänen H, Rissanen P, Tuomisto MT, Karvonen S, Pirkola S (2021) Contextual and mental health service factors in mental disorder-based disability

pensioning in Finland—a regional comparison. BMC Health Serv Res 21:1–1081. https://doi.org/10.1186/s12913-021-07099-4
16. Johnson S, Kuhlmann R, Munizza C, Beecham J, Salvador-Carulla L, De Jong P, Palazzi C, Stenman A, Tibaldi G, Zuccolin M, Scala E, Von Cranach M, Thornicroft G (2000) The European Service Mapping Schedule (ESMS): Development of an instrument for the description and classification of mental health services. Acta Psychiatr Scand Suppl 102:14–23. https://doi.org/10.1111/j.0902-4441.2000.t01-1-acp28[dash]03.x
17. Salvador-Carulla L, Salvador-Carulla L, Ruiz M, Romero C, Poole M (2012) ESMS-R European Service Mapping Schedule - Revised / Eurooppalainen mielenterveyspalvelujen kartoittamistyökalu
18. Cetrano G, Salvador-Carulla L, Tedeschi F, Rabbi L, Gutiérrez-Colosía MR, Gonzalez-Caballero J, Park A-L, McDaid D, Sfetcu R, Kalseth J, Kalseth B, Hope Ø, Brunn M, Chevreul K, Straßmayr C, Hagmair G, Wahlbeck K, Amaddeo F (2018) The balance of adult mental health care: provision of core health versus other types of care in eight European countries. Epidemiol Psychiatr Sci 29:e6. https://doi.org/10.1017/S2045796018000574
19. Gutiérrez-Colosía RM, Salvador-Carulla L, Salinas-Pérez AJ, García-Alonso RC, Cid J, Salazzari D, Montagni I, Tedeschi F, Cetrano G, Chevreul K, Kalseth J, Hagmair G, Straßmayr C, Park AL, Sfectu R, Ala-Nikkola T, González-Caballero LJ, Rabbi L, Kalseth B, Amaddeo F (2019) Standard comparison of local mental health care systems in eight European countries. Epidemiol Psychiatr Sci 28:210–223. https://doi.org/10.1017/S2045796017000415
20. Rezvyy G, Øiesvold T, Parniakov A, Ponomarev O, Lazurko O, Olstad R (2007) The Barents project in psychiatry: a systematic comparative mental health services study between Northern Norway and Archangelsk County. Soc Psychiatry Psychiatr Epidemiol 42:131–139. https://doi.org/10.1007/s00127-006-0141-4
21. Salinas-Perez J, Gutierrez-Colosia M, Furst MA, Suontausta P, Bertrand J, Almeda N, Mendoza J, Rock D, Sadeniemi M, Cardoso G, Salvador-Carulla L (2020) Patterns of Mental Health Care in Remote Areas: Kimberley (Australia), Nunavik (Canada), and Lapland (Finland): Modèles de soins de santé mentale dans les régions éloignées: Kimberley (Australie), Nunavik (Canada) et Laponie (Finlande). Can J psychiatry 65:721–730. https://doi.org/10.1177/0706743720944312
22. Salvador-Carulla L, Saldivia S, Martinez-Leal R, Vicente B, Garcia-Alonso C, Grandon P, Haro JM (2008) Meso-level Comparison of Mental Health Service Availability and Use in Chile and Spain. Psychiatr Serv 59:421–428. https://doi.org/10.1176/ps.2008.59.4.421
23. Ala-Nikkola T, Sadeniemi M, Kaila M, Saarni S, Kontio R, Pirkola S, Joffe G, Oranta O, Wahlbeck K (2016) How size matters: exploring the association between quality of mental health services and catchment area size. BMC Psychiatry 16:289. https://doi.org/10.1186/s12888-016-0992-5
24. Dernovšek MZ, Šprah L (2008) Assessment of mental health services in Slovenia with the European service mapping schedule. Psychiatr Danub 20:439–442
25. Fernandez A, Salinas-Perez J, Gutierrez-Colosia M, Prat-Pubill B, Serrano-Blanco A, Molina C, Jorda E, Garcia-Alonso C, Salvador-Carulla L (2015) Use of an integrated Atlas of Mental Health Care for evidence informed policy in Catalonia (Spain). Epidemiol Psychiatr Sci 24:512–524. https://doi.org/10.1017/S2045796014000511
26. Fernandez A, Gillespie JA, Smith-Merry J, Feng X, Astell-Burt T, Maas C, Salvador-Carulla L (2017) Integrated mental health atlas of the Western Sydney Local Health District: Gaps and recommendations. Aust Heal Rev 41:38–44. https://doi.org/10.1071/AH15154
27. Sadeniemi M, Pirkola S, Pankakoski M, Joffe G, Kontio R, Malin M, Ala-Nikkola T, Wahlbeck K (2014) Does primary care mental health resourcing affect the use and costs of secondary psychiatric services? Int J Environ Res Public Health 11:8743–8754. https://doi.org/10.3390/ijerph110908743
28. Tibaldi G, Munizza C, Pasian S, Johnson S, Salvador-Carulla L, Zucchi S, Cesano S, Testa C, Scala E, Pinciaroli L (2005) Indicators predicting use of mental health services in Piedmont, Italy. J Ment Health Policy Econ 8:95–106
29. Ala-Nikkola T, Pirkola S, Kontio R, Joffe G, Pankakoski M, Malin M, Sadeniemi M, Kaila M, Wahlbeck K (2014) Size matters—determinants of modern, community-oriented mental health services. Int J Environ Res Public Health 11:8456–8474. https://doi.org/10.3390/ijerph110808456
30. Ala-Nikkola T, Pirkola S, Kaila M, Saarni SI, Joffe G, Kontio R, Oranta O, Sadeniemi M, Wahlbeck K (2016) Regional correlates of psychiatric inpatient treatment. Int J Environ Res Public Health 13:1204. https://doi.org/10.3390/ijerph13121204
31. World Health Organization (2016) International Statistical Classification of Diseases and Related Health Problems 10th Revision
32. Tansella M, Thornicroft G (1998) A conceptual framework for mental health services: the matrix model. Psychol Med 28:503–508. https://doi.org/10.1017/s0033291796005880
33. Karolaakso T, Autio R, Näppilä T, Nurmela K, Pirkola S (2020) Socioeconomic factors in disability retirement due to mental disorders in Finland. Eur J Public Health ckaa132. https://doi.org/10.1093/eurpub/ckaa132
34. Pirkola S, Nevalainen J, Laaksonen M, Fröjd S, Nurmela K, Näppilä T, Tuulio-Henriksson A, Autio R, Blomgren J (2019) The importance of clinical and labour market histories in psychiatric disability retirement: analysis of the comprehensive Finnish national-level RETIRE data. Soc Psychiatry Psychiatr Epidemiol. https://doi.org/10.1007/s00127-019-01815-6
35. Leppänen H, Kampman O, Autio R, Karolaakso T, Näppilä T, Rissanen P, Pirkola S (2022) Socioeconomic factors and use of psychotherapy in common mental disorders predisposing to disability pension. BMC Health Serv Res 22:983. https://doi.org/10.1186/s12913-022-08389-1
36. Rissanen P, Autio R, Näppilä T, Fröjd S, Pirkola S (2021) Factors associated with returning to work after long term absence due to mental disorders. Humanit Soc Sci Commun 8:263. https://doi.org/10.1057/s41599-021-00952-1
37. The Finnish Institute for Health and Welfare (2022) Sotkanet.fi, Statistical information on welfare and health in Finland. https://sotkanet.fi/sotkanet/en/index. Accessed 6 Oct 2022
38. Ala-Nikkola T, Pirkola S, Kaila M, Joffe G, Kontio R, Oranta O, Sadeniemi M, Wahlbeck K, Saarni SI (2018) Identifying Local and Centralized Mental Health Services-The Development of a New Categorizing Variable. Int J Environ Res Public Health 15:1131. https://doi.org/10.3390/ijerph15061131
39. Gini C (1912) Variabilità e mutabilità: contributo allo studio delle distribuzioni e delle relazioni statistiche.[Fasc. I.]. Tipogr. di P. Cuppini.
40. Simpson EH (1949) Measurement of diversity. Nature 163:688. https://doi.org/10.1038/163688a0
41. Hölting L, Jacobs S, Felipe-Lucia MR, Maes J, Norström AV, Plieninger T, Cord AF (2019) Measuring ecosystem multifunctionality across scales. Environ Res Lett 14:124083. https://doi.org/10.1088/1748-9326/ab5ccb
42. R Core Team (2020) R: A language and environment for statistical computing
43. RStudio Team (2018) RStudio: Integrated Development for R
44. Guevara MR, Hartmann D, Mendoza M (2016) diverse: an R package to measure diversity in complex systems. R J 8:60–78
45. Gissler M, Haukka J (2004) Finnish health and social welfare registers in epidemiological research. Nor Epidemiol 14:113–120. https://doi.org/10.5324/nje.v14i1.284

46. Sund R, Gissler M, Hakulinen T, Rosén M (2014) Use of health registers. In: Ahrens W, Pigeot I (eds) Handbook of epidemiology. Springer, New York, pp 707–730
47. Reho TTM, Atkins SA, Talola N, Sumanen MPT, Viljamaa M, Uitti J (2020) Frequent attenders at risk of disability pension: a longitudinal study combining routine and register data. Scand J Public Health 48:181–189. https://doi.org/10.1177/1403494819838663
48. Perhoniemi R, Blomgren J (2021) Frequent attenders of three outpatient health care schemes in Finland: characteristics and association with long-term sickness absences, 2016–2018. BMC Public Health. https://doi.org/10.1186/s12889-021-10866-x
49. Vorma H, Rotko T, Larivaara M, Kosloff A (2020) National mental health strategy and programme for suicide. Prevention 2020–2030:1236–2050
50. Saarni SI, Nurminen S, Mikkonen K, Service H, Karolaakso T, Stenberg J-H, Ekelund J, Saarni SE (2022) The Finnish Therapy Navigator—digital support system for introducing stepped care in Finland. Psychiatr Fenn 53:120–137
51. Linnaranta O, Strand T, Suvisaari J, Partonen T, Solin P (2023) Mielenterveysstrategia 2020–2030: Toimeenpanon ensimmäiset vuodet ja yhteisen tekemisen tahto. Terveyden ja hyvinvoinnin laitos THL, Helsinki

PUBLICATION IV

Patterns of mental health services and mood disorder disability pensions: a standard comparison of Finland's three largest hospital districts

Karolaakso, T., Autio, R., Suontausta, P., Leppänen, H., Suokas, K., Rissanen, P., Tuomisto, M. T., & Pirkola, S.

BMC Psychiatry, 23(1), 1–828.
https://doi.org/10.1186/s12888-023-05342-2

BMC Psychiatry

RESEARCH Open Access

Patterns of mental health services and mood disorder disability pensions: a standard comparison of Finland's three largest hospital districts

Tino Karolaakso[1,2*], Reija Autio[3], Petra Suontausta[3], Helena Leppänen[4], Kimmo Suokas[3], Päivi Rissanen[3], Martti T. Tuomisto[1] and Sami Pirkola[3,5]

Abstract

Introduction Mental disorders are one of the most common and disabling health conditions worldwide. There is however no consensus on the best practice of system level mental health services (MHS) provision, in order to prevent e.g. mood disorder disability pensions (DPs). We analyzed the MHS provision between Finland's three largest hospital districts Helsinki and Uusimaa (HUS), Southwest Finland and Pirkanmaa, with known differences in mood disorder DP risk but presumably equal rates of mood disorder prevalence.

Methods We used public MHS data analyzed with the standardized DEscription and Evaluation of Services and DirectoriEs for Long Term Care (DESDE-LTC) mapping tool, focusing on all MHS, outpatient care provision, local services without and with gatekeeping, and centralized services. We also collected demographic data based on the European Socio-Demographic Schedule (ESDS). As a novel approach, the Gini-Simpson Diversity Index (GSDI) was calculated for the districts.

Results Evident differences were observed regarding the districts' MHS factors. As the hospital district with lower DP risk, HUS was characterized by the highest level of regional socioeconomic prosperity as well as high service richness and diversity. With a nationally average DP risk, Southwest Finland had the highest number of MHS personnel in full-time equivalents (FTE) per 100 000 inhabitants. Pirkanmaa, with a higher DP risk, had overall the lowest service richness and the lowest FTE of the three districts in all MHS, outpatient care and local services with gatekeeping.

Conclusions Our findings indicate that greater richness and diversity of MHS, especially in outpatient and community-based settings, may serve as indicators of a balanced, high-quality service system that is more effective in preventing mood disorder DP and meeting the different needs of the population. In addition, the need for sufficient resourcing in all MHS and outpatient services is indicated. We suggest using diversity indices to complement the measuring and reporting of regional service variation.

Keywords Mental health services, Outpatient care, Disability pensions, Mood disorders, Service diversity, DESDE-LTC

*Correspondence:
Tino Karolaakso
tino.karolaakso@tuni.fi

Full list of author information is available at the end of the article

Background

Mental disorders are among the world's most common and disabling health conditions. Every year over one third of the EU's population suffers from a mental disorder [1]. In OECD countries, there is evidence that mood disorders are the fastest-growing cause of disability among all mental health disorders, especially among young people [2]. In Finland, mental and behavioral disorders, especially mood disorders, are among the most significant diagnostic groups from which people enter early disability pension (DP) [3].

Current mental health policies have guided MHS system development focusing on outpatient care and community-based care over hospital-focused care systems [4–7]. However, there is no consensus among experts and stakeholders on the best practice of mental health services (MHS) provision on a system level in different contexts (local health area as the meso-level of service organization) [8, 9]. Research literature still lacks information linking MHS characteristics to indicators of service-level effectiveness, for example on the risk of regional DP for mental disorders. In Finland, recent research has identified differences in mood disorder-related disability pensioning risk between the three largest hospital districts: the hospital district of Helsinki and Uusimaa (HUS) had a lower mood disorder DP risk compared to the Finnish national mean, the hospital district of Southwest Finland had a risk level corresponding to the Finnish national average, and the hospital district of Pirkanmaa had a higher risk of DP during 2010–2015 [10]. These risk levels were adjusted based on regional gender, age, and occupational status differences. Previous research has not identified differences in the prevalence of mood disorders between these regions, so the DP differences may partly relate to differences in mental health service systems and local treatment practices [10–12].

In order to study MHS system effects and translate research findings into policy and practice, one must consider the totality of circumstances and context in which the MHS are provided: the local mental health ecosystem. The Mental Health Ecosystems approach is an emerging discipline which takes a whole-systems approach to mental healthcare, enabling the analysis of the complex environment and context of mental health systems, and guiding the translation of this information into policy and practice [9, 13, 14]. In addition to understanding the contextual needs of the population for MHS, a shared language for describing and coding local care delivery context comparable across different regions is required in order to study and compare the features of MHS. Some frequently used and highly sophisticated standardized classification systems for mental health services include the European Service Mapping Schedule (ESMS) and the DEscription and Evaluation of Services and DirectoriEs for Long Term Care (DESDE-LTC; developed from ESMS for the broader assessment of health and social care systems) mapping tools [15–17]. DESDE-LTC has also been called ESMS-R in the original Finnish translation [18–20]. DESDE-LTC provides a standardized taxonomy for describing, classifying, and measuring MHS and their resources. DESDE-LTC has demonstrated high feasibility, consistency, inter-rater reliability and face, content and construct validity [17]. Previously it has been applied to both compare MHS provision between countries and to study the MHS within countries between meso-level regions [21–32]. These studies have found significant variation and critical gaps in MHS provision between both regions and countries. This emphasizes the importance of continuing MHS research to identify and monitor indicators of high-quality services and provide information for experts, policy makers and stakeholders to help organize MHS for the needs of the population and to identify and fill the gaps in MHS provision.

Until 2022, the Finnish municipalities were responsible for organizing public MHS, either by themselves or together via 21 hospital districts [4, 33, 34]. This created significant regional variation and heterogeneity in the Finnish MHS, which unfortunately also relates to the different financial conditions of the municipalities, creating regional inequality and disintegration of MHS provision [20, 34]. At the beginning of 2023, the national reform of healthcare, social welfare and rescue services shifted public MHS provision from the municipalities to the newly founded wellbeing services counties [35]. The wellbeing services counties' boundaries follow for the most part the boundaries of the old hospital districts. This transfer in organizational responsibility has the potential to support better coordination and integration of regional MHS provision and system development.

This study applies the Mental Health Ecosystems approach in studying the relationship between disability pensioning and MHS provision [13]. The aim of this study was to provide a standard assessment and comparison between these meso-level MHS ecosystems and to analyze their contextual and MHS characteristics in relation to their known differences in mood disorder DP risk (ICD-10 classification F30-39). As the three largest hospital districts in Finland, these study areas provide a representative naturalistic setting in a Nordic welfare country to assess regional MHS with known DP risk differences. We explored the variation in MHS resources and resource allocation as well as service richness and diversity in all MHS, outpatient care, and local community-based and centralized services. As a preliminary hypothesis we hypothesized that lower MHS resources, richness, and diversity, especially in outpatient care and community-based services, could result in critical gaps in service provision which could affect the regional DP

risk. Thus, a lower rate of service diversity and resources would be found in higher DP risk regions. To our knowledge there is no prior study assessing MHS ecosystem characteristics on this scale in regard to the regional DP risk differences.

This study is part of the RETIRE – research project, which aims to study the risk factors and sequences of mental health-based disability pensioning and examine the effectiveness of MHS systems in Finland [10, 19, 36–39]. It contributes to the accumulating body of scientific research needed to coordinate and plan MHS and their provision in order to effectively prevent work disability due to mood disorders.

Methods

The study catchment area and data collection

The study's catchment area consisted of the three most populous hospital districts in the southern, most urban area of Finland, HUS, Southwest Finland and Pirkanmaa (the Tampere Region). The study area is shown in Fig. 1. HUS includes the southern capital area of Finland, along with several other urban cities and semi-urban areas. It is the largest area by population, and produces approximately 40% of the Finnish gross domestic product with the business structure being largely service-oriented. Southwest Finland is situated by the Archipelago Sea, and has a long history of being the most important Finnish trading center from the Middle Ages until the 19th century. Pirkanmaa is one of the fastest-growing regions in the Finnish inland territory. It was mostly a rural region until the 18th century, after which it became one of the main centers of Finnish industrial production. The study areas had a total population of 1 658 457 inhabitants aged 18 to 65 at the end of 2015, and 11 456 first-time mood disorder DP receivers in 2010–2015 as indicated by the data of previous studies [10, 36].

We employed the Mental Health Ecosystems approach to identify and analyze specific sociodemographic and MHS factors relevant in the scope of this study [13]. The hospital districts' sociodemographic characteristics were

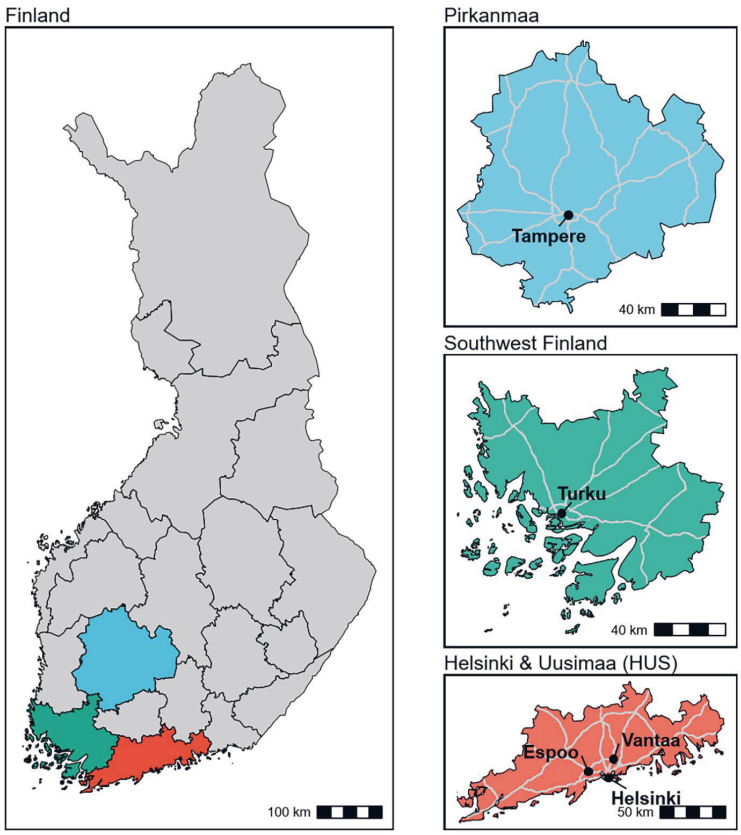


Fig. 1 Map of the study's catchment area

collected based on the European Socio-Demographic Schedule (ESDS) for 2015 in order to be congruent with the previously available DP data [40]. ESDS guides which sociodemographic factors from national registers to include into a study. These factors provide the possibility of standardized comparison between areas and countries, they have a studied association with psychiatric disorder rates and service utilisation, and they are similarly collected in several European countries with easy accessibility. The information was gathered from Statistics Finland and the Sotkanet Indicator Bank, an information portal provided by the Finnish Institute for Health and Welfare (THL) that offers essential population health and welfare data [41].

Using the DESDE-LTC-tool [17], the HUS and Southwest Finland MHS were analyzed during 2012–2013 by the REFINEMENT project (Research on Financing Systems' Effect on the Quality of Mental Health Care in Europe) [20, 28, 42]. The MHS for Pirkanmaa were analyzed retrospectively for the year 2013. These years correspond with the DP data timespan of 2010–2015 in previous studies [10], as no major alterations were made to these districts' MHS during these years. The outline and main classes of the DESDE-LTC's hierarchical taxonomy-based coding tree are presented in Fig. 2. A detailed presentation of the classes is shown in Additional File 1. Although DESDE-LTC has also been called ESMS-R in Finland, we use the internationally more established DESDE-LTC name in this study. The DESDE-LTC data is the most comprehensive available dataset concerning MHS system characteristics and resources in Finland. For more information on DESDE-LTC taxonomy, see for example [17, 28, 30, 43].

DESDE-LTC processing and analysis

We focused on five different MHS types from the DESDE-LTC -data: (1) all MHS, (2) outpatient care (DESDE-LTC class O), (3) local services without gatekeeping (no referral required), (4) local services with gatekeeping (referral or other specialist assessment required), and (5) centralized services. As prior research has indicated several advantages of local, community-based services, and given the global reforms in MHS that emphasize shifting focus from hospital-centered systems to community-based service systems [5, 7], we used a categorizing variable designed to identify local services with and without gatekeeping and centralized services from the existing DESDE-LTC data [43].

For these five different types of MHS, seven DESDE-LTC-service system characteristic factors were calculated for the hospital districts: (1) number of units as main types of care (MTC), (2) MTC per 100 000 inhabitants, (3) service resources as the number of personnel in full-time equivalents (FTE), (4) FTE per 100 000 inhabitants, (5) share of resources, calculated as the personnel FTE percentage of all FTE, (6) service richness as all the different MTC classes in the district, and (7) service diversity as the Gini-Simpson Diversity Index (GSDI) calculated with service richness and the available units for the hospital districts [19, 44, 45]. The flowchart of DESDE-LTC data management is shown in Fig. 3.

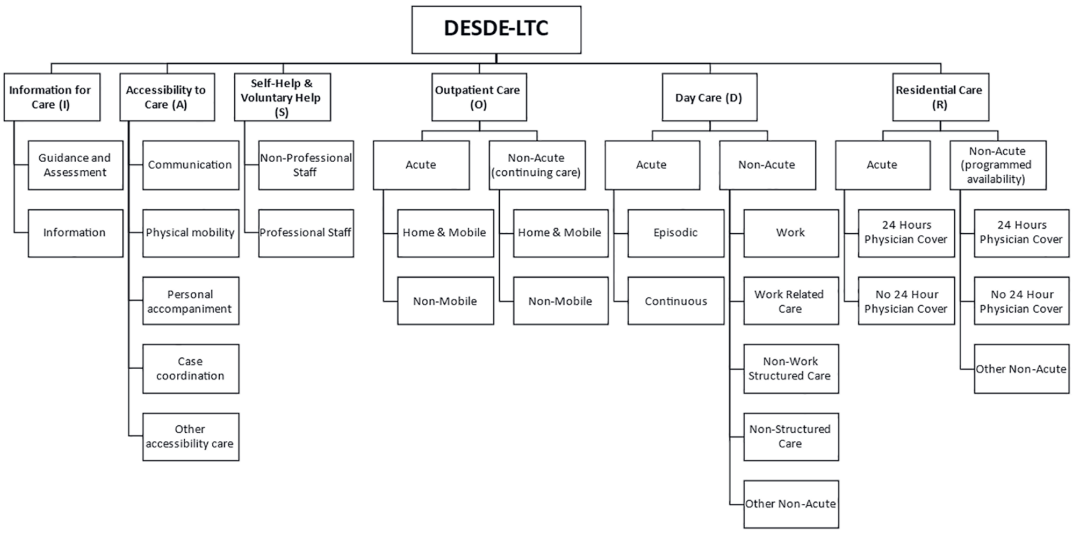


Fig. 2 DESDE-LTC classification mapping tree

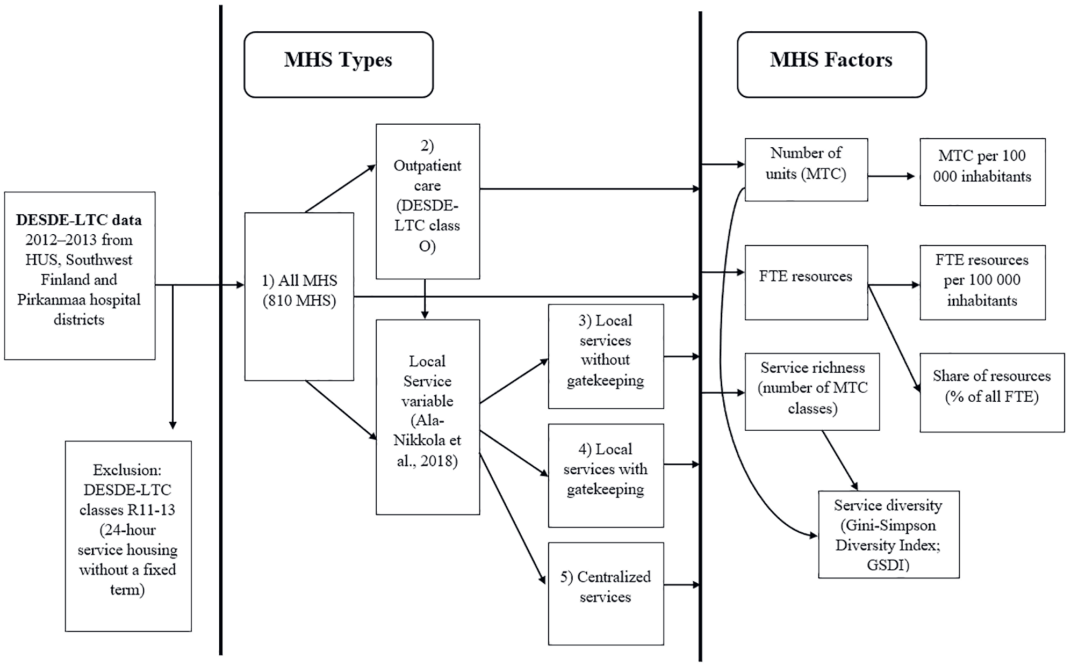


Fig. 3 Flowchart of DESDE-LTC data management

Although service richness may seem like a straightforward way to measure service diversity, it only considers the number of reported service classes, rather than the number and evenness of MTC available in the district. Ecological ecosystem service research typically uses the GSDI and similar diversity indices to calculate species or class diversity in a given area [46, 47]. The GSDI, which combines service richness with the number of available MTC in the DESDE-LTC class, enables a different view of MHS diversity by factoring in the evenness of MHS provision in the district's mental health ecosystem. This approach contrasts with most of the previous studies, which have relied on the number of DESDE-LTC/ESMS-R classes alone (referred to as service richness in this study). A higher GSDI value indicates greater diversity, ranging from 0 to (1) The formulation of GSDI values in this study is shown in Additional File (2) Previously GSDI has been used on a lower spatial scale to calculate a diversity index for municipalities [19]. Here we are using it to measure the service diversity and evenness of larger meso-level districts. To our knowledge this study is the first to assess the applicability of GSDI to the evaluation of MHS diversity in a meso-level regional MHS ecosystem, made possible by the DESDE-LTC taxonomy of MHS.

Services classified as 24-hour supported housing services without a fixed term (DESDE-LTC classes R11-13) are not included in this study, as they are targeted primarily to people already on a DP. With the assistance of a DESDE-LTC specialist, no other services in the DESDE-LTC taxonomy were identified to primarily consist of DP recipients. Furthermore, the FTE information was missing from 111 services, which were excluded from the analysis. The services with missing FTE were predominantly found in the DESDE-LTC main branches of self-help and volunteer care (76.6%), day care (14.4%), outpatient care (4.5%), residential care (3.6%) and information for care (0.9%). When categorized into local services with and without gatekeeping, as well as centralized services, 82% of the services lacking FTE information were local services without gatekeeping, 9.9% were local services with gatekeeping and 8.1% were centralized services. The statistical analyses were performed with R using EpiR packages [48, 49]. The GSDI values were calculated with R version 4.0. [49], RStudio [50] and the R-package *diverse* [51]. Chi-squared-tests and Poisson regression with the number of inhabitants as an exposure were used for obtaining the statistical differences between the hospital districts. The final MHS data in the study area included 810 MHS units with FTE of 5068 and an overall service richness of 63 different MTCs.

Results

Study area characteristics

The hospital districts' demographic characteristics and mood disorder DP differences with the whole of Finland as a comparison, are reported in Table 1. HUS had a population base aged 18 to 65 over three times higher compared to either Southwest Finland or Pirkanmaa, as well as the highest population density. HUS was also characterized by the lowest rate of unemployment, number of households with only one person, population aged 65 and over, and correspondingly the lowest demographic dependency ratio. In addition, HUS had the highest rate of higher education qualifications but also the highest rate of young people aged 17–24 not in education or training.

Southwest Finland and Pirkanmaa were more similar compared to HUS. Pirkanmaa had the highest rate of unemployment as well as population aged 65 and over, and the lowest rate of population density but also the lowest rate of young people aged 17–24 not in education or training. Pirkanmaa had the highest rate of mood disorder DPs, but also interestingly the lowest number of mental health outpatient visits per 1000 persons aged 18 and over. Southwest Finland had the highest rate of households with one person and the lowest rate of higher education qualifications. Demographic dependency ratio was similar between Southwest Finland and Pirkanmaa. Southwest Finland had the highest number of mental health outpatient visits per 1000 persons.

MHS characteristics

Evident differences between hospital districts were observed regarding the MHS factors (Table 2), as well as variation in the patterns regarding outpatient care allocation (Fig. 4) and DESDE-LTC service class distribution (Additional File 3). In all MHS, HUS (with the largest population and lowest DP risk) had approximately twice as many units but three times the number of FTE than Southwest Finland and Pirkanmaa. HUS had the highest service richness (54 different MTC classes) and the highest service diversity (GSDI of 0.94). HUS also had the highest service diversity in outpatient care (GSDI of 0.80) and in local services without gatekeeping (GSDI of 0.80). HUS was also characterized by a strong emphasis on local services with gatekeeping, comprising 36% of all available FTE and the highest rate of FTE per 100 000 inhabitants (108), but it also had the lowest share of FTE in local services without gatekeeping, which only had 11% of all FTE and the lowest FTE per 100 000 inhabitants (32.8). Overall, HUS had the highest service richness but the lowest rate of MTCs per 100 000 inhabitants in all the MHS types considered. In outpatient care there was a strong emphasis on medium-intensity outpatient clinic services, which mostly had a higher outpatient care visit frequency of at least once in two weeks (class O9: 63.84 FTE per 100 000 inhabitants) and more home delivered, mobile high intensity care (O5) compared to other districts.

Southwest Finland, with a DP risk corresponding to the Finnish national average, had the highest number of units (74.2) and FTE (353.4) per 100 000 inhabitants in all MHS. It had the strongest emphasis on outpatient care (45% of all FTE and 157.5 FTE per 100 000 inhabitants) and on local services without gatekeeping (32% of all FTE and 112.1 FTE per 100 000 inhabitants). Overall, Southwest Finland had the highest number of units per 100 000 inhabitants in all MHS types, and the highest rate of

Table 1 Sociodemographic characteristics for the study area hospital districts and for the whole of Finland as a comparison (2015)

	Helsinki and Uusimaa (HUS)	Southwest Finland	Pirkanmaa	Finland
First time mood disorder F30-39 disability pension (DP) receivers 2010–2015	6 706	2 197	2 553	24 132
Total population aged 18 to 65	1 045 309	291 768	323 532	3 348 683
Hospital district differences between mood disorder–related disability pensions DP 2010–2015 by incidence rate ratio (and 95% confidence interval) [1]	0.84 (0.78–0.90)	1.03 (0.95–1.11)	1.11 (1.03–1.20)	1.00
Mental health outpatient visits per 1000 persons aged 18 and over	450.8	578.6	346.7	496.2
Mental health index, not age-standardized	81.40	93.20	112.60	106.4
Unemployment rate, as % of labour force	11.3%	13.2%	15.3%	13.4%
Household/dwelling-units with one person, as % of all household/dwelling-units	41.6%	43.5%	42.9%	42.2%
Population density, population/km^2	184.7	43.3	36.4	18.1
Population aged 65 and over as % of total population	16.5%	20.6%	21.7%	20.5%
Demographic dependency ratio, as the number of people aged under 15 and over 64 per hundred working-age people aged 15–64	50.0	58.9	58.3	58.2
Higher education qualifications, as % of total population aged 20 and over	36.9%	29.4%	30.7%	30%
Not in education or training aged 17–24, as % of total population of the same age	10.3%	8.5%	6.9%	8.3%

[1] Adjusted based on regional gender, age and occupational status – source: Karolaakso T, Autio R, Näppilä T, Leppänen H, Rissanen P, Tuomisto MT, Karvonen S, Pirkola S (2021) Contextual and mental health service factors in mental disorder-based disability pensioning in Finland – a regional comparison. BMC Health Serv Res 21:1–13 https://doi.org/10.1186/s12913-021-07099-4

Table 2 Characteristics of the DESDE-LTC mental health service factors in the three largest Finnish hospital districts. Inhabitants calculated from the population aged 18 to 65

	Helsinki and Uusimaa (HUS)	Southwest Finland	Pirkanmaa	Statistical significance
All mental health services (MHS)				
MTC units	416	215	179	
MTC per 100 000 inhabitants	39.8	74.2	55.5	$p < 0.001$ [4]
FTE resources [1]	3107.4	1023.7	936.9	
FTE per 100 000 inhabitants	297	353.4	290.6	$p < 0.001$ [4]
Share of all FTE	100%	100%	100%	$p = 1$ [5]
Service richness [2]	54	40	31	$p < 0.001$ [4]
Service diversity [3]	0.94	0.89	0.91	
Outpatient Care (DESDE-LTC code O)				
MTC units	145	89	72	
MTC per 100 000 inhabitants	13.9	30.7	22.3	$p < 0.001$ [4]
FTE resources [1]	1286	456.2	366	
FTE per 100 000 inhabitants	122.9	157.5	113.5	$p < 0.001$ [4]
Share of all FTE	41%	45%	39%	$p = 0.044$ [5]
Service richness [2]	16	12	10	$p = 0.025$ [4]
Service diversity [3]	0.80	0.65	0.64	
Local services without gatekeeping				
MTC units	168	117	83	
MTC per 100 000 inhabitants	16.1	40.4	25.7	$p < 0.001$ [4]
FTE resources [1]	342.7	324.7	244.6	
FTE per 100 000 inhabitants	32.8	112.1	75.9	$p < 0.001$ [4]
Share of all FTE	11%	32%	26%	$p < 0.001$ [5]
Service richness [2]	15	13	7	$p = 0.01$ [4]
Service diversity [3]	0.80	0.68	0.67	
Local services with gatekeeping				
MTC units	136	48	42	
MTC per 100 000 inhabitants	13	16.6	13	$p < 0.001$ [4]
FTE resources [1]	1130.2	206.3	171	
FTE per 100 000 inhabitants	108	71.2	53	$p < 0.001$ [4]
Share of all FTE	36%	20%	18%	$p < 0.001$ [5]
Service richness [2]	19	13	10	$p = 0.038$ [4]
Service diversity [3]	0.85	0.86	0.86	
Centralized services				
MTC units	112	50	54	
MTC per 100 000 inhabitants	10.7	17.3	16.7	$p < 0.001$ [4]
FTE resources [1]	1634.4	492.7	521.3	
FTE per 100 000 inhabitants	156.2	170	161.7	$p < 0.001$ [4]
Share of all FTE	53%	48%	56%	$p = 0.003$ [5]
Service richness [2]	20	14	14	$p = 0.011$ [4]
Service diversity [3]	0.89	0.90	0.89	

[1] Resources as the number of personnel in full-time equivalents (FTE)

[2] Richness as all the different DESDE-LTC-codes for Main Types of Care (MTC) available in the hospital district

[3] Diversity as the Gini-Simpson Diversity Index calculated with service richness and MTCs

[4] Statistical differences analyzed with Poisson regression, population used as exposure

[5] Statistical differences analyzed with Chi-squared test

FTE in all but local services with gatekeeping (71.2 FTE). Southwest Finland's psychiatric outpatient clinic services were mainly classified as O10 low intensity services with care visits mainly less often than once every two weeks (99.33 FTE per 100 000 inhabitants). However, Southwest Finland also had the most resourced O8 high intensity outpatient services with care visits mainly at least three times a week (17.33 FTE per 100 000 inhabitants).

Pirkanmaa, with the highest mood disorder DP risk had the lowest number of units and FTE in all but centralized

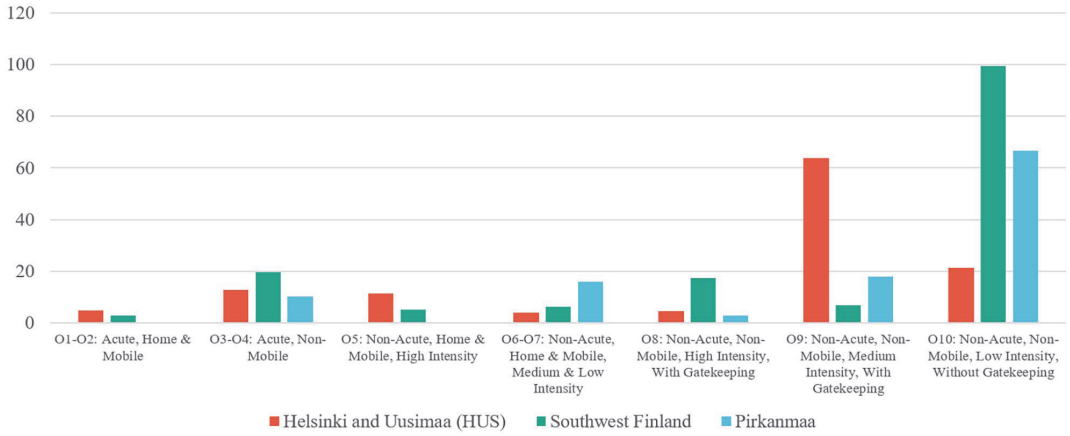


Fig. 4 The distribution of resources in outpatient care (O) as the number of personnel in full-time equivalents (FTE) per 100 00 inhabitants

services. It also had the lowest FTE per 100 000 inhabitants in all MHS (290.6), outpatient care (113.5) and local services with gatekeeping (53). Pirkanmaa had the strongest emphasis on centralized services (56%). It had the lowest service richness in all except centralized services where it had the same number of different MTC classes as Southwest Finland (14 different MTC classes). Pirkanmaa's psychiatric outpatient services were focused on O10 low intensity services, similarly to Southwest Finland, but with approximately two thirds of the FTE per 100 000 inhabitants compared to Southwest Finland (66.68 FTE per 100 000 inhabitants). The data that indicated Pirkanmaa lacked acute mobile services (O1-O2) and mobile high intensity outpatient care (O5) altogether.

Discussion

In this study we applied the Mental Health Ecosystems approach with comprehensive standardized classification and description of local MHS to provide a standard assessment and comparison between the three largest Finnish hospital districts with known mood disorder DP risk differences but presumably equal rates of mood disorder prevalence [13]. We found major variation in the patterns regarding MHS resourcing and resource allocation, service richness as well as service diversity. These findings point towards the role of organization and structure of regional MHS on the incidence of psychiatric DP for mood disorders. To our knowledge this is the first study to perform a standard comparison between meso-level health care ecosystems examining them related to their previously reported differences in DP risk for mood disorders.

It is important to note that despite national level regulatory legislation and regional steering actions, we found notable dissimilarity in MHS organization in the three largest Finnish hospital districts with rather similar sociocultural contexts, all situated in southernmost, urban Finland. The reasons for this are probably multiple, including historical, socioeconomic and administrative contextual factors [4, 33, 34]. Although the differences in MHS organization may indicate different needs in complex systems, they may also serve as a source of such disparity or inequality that the current, ongoing Finnish service structure reform aims to overcome.

HUS, as the hospital district with the lowest mood disorder DP risk, was characterized by the highest rates of socioeconomic prosperity as well as by high service richness and diversity. This might indicate that the population associated with HUS already has a higher rate of material resources and welfare than on average in Finland, but also has access to diverse services with better possibilities to meet the needs of the population, as well as fewer gaps in MHS provision. Previous research has revealed that 84% of service variation is explained by the size of the catchment area [20], which partly explains HUS's approximately 1.5- to 2-fold higher service richness compared to Pirkanmaa. Interestingly, HUS only had the highest FTE per 100 000 inhabitants in local services with gatekeeping, where most of its outpatient care resources were allocated to O9 medium intensity polyclinic services. This contrasted with Southwest Finland and Pirkanmaa, where most of the outpatient resources were classified as O10 low intensity services, implying an interval longer than two weeks between most of the care visits for patients. It is important to note that because these MTCs are classified corresponding to the true interval between most of the provided outpatient care visits, this might point to the importance of the services being able to respond to treatment needs with sufficient appointment frequency regardless of whether the

services have gatekeeping or not. Interestingly, HUS also had the lowest MTC per 100 000 inhabitants in all MHS types, but the high FTE per 100 000 inhabitants indicates that these MTC are larger on average FTE-wise compared to Southwest Finland and Pirkanmaa.

Regardless of these considerations, higher FTE per 100 000 inhabitants appear not necessarily to indicate a lower regional DP risk, as Southwest Finland had a higher FTE per 100 000 inhabitants in most of the studied MHS types compared to HUS. The number of FTE and outpatient visits per 1000 inhabitants did show a similar pattern, with Southwest Finland having the highest and Pirkanmaa the lowest numbers of both parameters. Nevertheless, comparing Southwest Finland and Pirkanmaa, two hospital districts with almost equal population bases, Southwest Finland clearly had a higher overall FTE as well as higher service richness in all studied MHS types except centralized services. Pirkanmaa also had the lowest FTE per 100 000 inhabitants of the three districts in all MHS, outpatient care and local services with gatekeeping. In addition, prior research has identified Pirkanmaa as having one of the lowest rates of outpatient visits per Finnish population rate [10]. These observations suggest that possible factors connected to Pirkanmaa's higher DP risk might include the regional MHS being under-resourced and therefore unable to produce an adequate level of outpatient care to meet the needs of the population. Furthermore, the lower service richness pointed to some vital treatment gaps in service provision, with a lack of acute mobile services (O1-O2) and mobile high intensity outpatient care (O5) and most of the resources allocated to centralized services compared to the MHS systems of HUS or Southwest Finland. Previously, an expert committee has voiced these same concerns and the need for MHS system development in Pirkanmaa [52].

In this study we also applied GSDI as a service diversity indicator in meso-level districts. GSDI implied a significantly higher service diversity for HUS in outpatient care and local services without gatekeeping, and a slightly higher diversity in all MHS. Because the GSDI considers service richness but gives more weight to service evenness of MTC units, this implies a more even distribution of MTCs over more MHS classes in HUS compared to Southwest Finland or Pirkanmaa in all MHS, outpatient care and local services without gatekeeping. However, in local services with gatekeeping and centralized services, the three hospital districts had approximately the same GSDI, but HUS had a distinctly higher service richness. These observations imply that GSDI can work as an important complementary indicator for service diversity and evenness, but that service richness is also needed to understand the overall variation in regional MHS provision.

Strengths, limitations, and future research

One of strengths of this study was the use of DESDE-LTC tool to analyze MHS provision. DESDE-LTC provides an internationally approved set of systems indicators, classification of services and terminology [15, 17, 30]. DESDE-LTC data collection and analysis included obtaining the MHS information through interviews with local organization supervisors, which has been indicated to have higher validity than using only the official services listings [27, 30].

Our study setting includes some limitations. One central limitation was that our MHS data did not include information concerning the pathways of care or connections between the different mental health service points, or on the treatment culture or customs of the local MHS. Without this information, some aspects of the complex dynamics in these MHS ecosystems are missing. In future research, it would be important to collect information on the dynamics and care pathways between different regional MHS, as well as treatment contents (for example whether evidence-based treatment models are habitually used) and treatment cultures, which could be reported with the other MHS ecosystem information.

It is also important to note that some features of the MTC might be outside the scope of the DESDE-LTC classification tool and might not be included in the analysis. The regional MHS data for the districts only consists of public services, and information on private services, Finnish occupational health care and rehabilitative psychotherapy imbursed by the Social Insurance Institution of Finland was not collected. Earlier research suggests, however, that compared to these other services, the public MHS plays an essential role in addressing and preventing mental disorders and disabilities among the majority of the population [53, 54]. Furthermore, a broad range of other services, including local social, education, housing, justice and employment services as well as employment opportunities in different work and industrial sectors presumably play a role in regional DP outcomes in the case of people on the verge of DP. Considering these services and differences would be an important topic for further research.

Regarding the use of GSDI, the index values are comparable only if the catchment areas are on the same spatial scale [47]. This means that for example district-level and municipality-level GSDI values are not comparable. This must be kept in mind when comparing different study results with different scales. Nevertheless, GSDI and other diversity indices can be an important complementary part of future MHS research when comparing the service provision and diversity of different MHS ecosystems on the same spatial scale.

Conclusions

Our findings highlight the potential role and importance of the organization and provision of MHS in affecting the regional mood disorder-based DP risk. Greater richness and diversity of MHS, especially in outpatient, and community-based settings, may serve as an indicator of a well-developed and -balanced, high-quality service system that is more effective in preventing mood disorder DP and meeting the different needs of the population. Our findings also point to the role of sufficient resourcing in all MHS and outpatient services, so that essential outpatient clinics can provide psychosocial treatment answering to individual and populational needs.

To understand MHS ecosystems, the use of several different demographic and MHS indicators is essential. We present the possibility of using diversity indices to complement the measuring and reporting of regional service variation in addition to service richness. The diversity and richness of MHS provision should be accounted for in the development of MHS by experts and stakeholders to offer services matching population needs.

In Finland, the ongoing health and social service structure reform and the work to implement The Finnish Mental Health Strategy 2020–2030 create a productive basis to promote broad, effective, and accessible MHS that meet people's needs [6, 55, 56]. However, despite the prior national-level regulatory legislation and regional steering, notable differences in MHS organization have arisen even between the three largest hospital districts in Finland, acting as a potential source of significant regional inequality in mental health outcomes. In the ongoing work, national cooperation and joint service development is of paramount importance in order to avoid past mistakes creating fragmented services and to ensure equal, high-quality services for all.

Abbreviations

DP	Disability pension
DESDE-LTC	DEscription and Evaluation of Services and DirectoriEs for Long Term Care
ESDS	The European Socio-Demographic Schedule
ESMS-R	European Service Mapping Schedule-Revised
FTE	Full-time Equivalents
GSDI	Gini-Simpson Diversity Index
HUS	Helsinki and Uusimaa Hospital District
MHS	Mental health services
MTC	Main Types of Care
REFINEMENT	Research on Financing Systems' Effect on the Quality of Mental Health Care in Europe
THL	Finnish Institute for Health and Welfare

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12888-023-05342-2.

Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

Acknowledgements

The authors thank Taina Ala-Nikkola for her help and expertise in utilizing the Local Service-variable for the DESDE-LTC data in the analyses of this study, and Marjut Vastamäki for all her support in analyzing the DESDE-LTC data.

Author contributions

TK, RA, PS and SP designed the research setting with all authors commenting and contributing to it along the way. TK performed the analysis on the DESDE-LTC data. TK and RA performed the statistical analyses and the calculation of Gini-Simpson Diversity Index values. TK wrote the main manuscript text and prepared the Figs. 2, 3 and 4 with all authors commenting and contributing to them. KS and TK prepared Fig. 1. All authors reviewed and accepted the manuscript.

Funding

The Finnish National Research Fund supported this work through the Pirkanmaa Hospital District [grant number 9V052]. The funding source had no involvement in the study design, in the report's writing, in the decision to submit the article for publication, or in the data collection, analysis, and interpretation.

Open access funding provided by Tampere University (including Tampere University Hospital).

Data Availability

DESDE-LTC data regarding the hospital districts is available from the Finnish Institute for Health and Welfare. The demographic factors are publicly available from the Sotkanet Indicator Bank, an information portal provided by THL. The aggregated data used and analyzed during the current study is available in Additional File 3. The original DESDE-LTC dataset used is available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The RETIRE – study has the approval of the Finnish Institute for Health and Welfare (THL) Ethics Committee, including a privacy statement, which has performed a careful ethical consideration of this study paying particular attention to voluntariness-, consent- and data protection issues. According to Finnish legislation, and in accordance with the appraisal and approval of the THL Ethics Committee, individual informed consent was not required, because no individual could be identified due to the size of the study's population. Licenses were obtained for the registers from each of the registrars. All study methods were carried out in accordance with ethical and privacy protection guidelines and regulations.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Faculty of Social Sciences (Psychology), Tampere University, Arvo Ylpön katu 34, Tampere FI- 33520, Finland
[2]Psychiatry, University of Helsinki and Helsinki University Hospital, Helsinki, Finland
[3]Faculty of Social Sciences (Unit of Health Sciences), Tampere University, Tampere, Finland
[4]Faculty of Medicine and Health Technology, Tampere University, Tampere, Finland
[5]Department of Adult Psychiatry, Tampere University Hospital, Tampere, Finland

Received: 5 May 2023 / Accepted: 2 November 2023
Published online: 13 November 2023

References

1. Wittchen HU, Jacobi F, Rehm J, et al. The size and burden of mental disorders and other disorders of the brain in Europe 2010. Eur Neuropsychopharmacol. 2011;21:655–79.
2. OECD. (2022) Disability, Work and Inclusion: Mainstreaming in All Policies and Practices.
3. Finnish Centre for Pensions. (2023) Number of pension recipients: Earnings-related and national disability pension recipients by disease category.
4. Keskimäki I, Tynkkynen L-K, Reissell E, Koivusalo M, Syrjä V, Vuorenkoski L, Rechel B, Karanikolos M. Finland: Health System Review. Health Syst Transit. 2019;21:1.
5. Thornicroft G, Tansella M, Law A. Steps, challenges and lessons in developing community mental health care. World Psychiatry. 2008;7:87–92.
6. Vorma H, Rotko T, Larivaara M, Kosloff A. (2020) National Mental Health Strategy and Programme for Suicide Prevention 2020–2030. 1236–2050.
7. World Health Organization. Comprehensive mental health action plan 2013–2030. Geneva: World Health Organization; 2021.
8. Rock D, Cross SP. Regional planning for meaningful person-centred care in mental health: context is the signal not the noise. Epidemiol Psychiatr Sci. 2020;29:e104.
9. Rosen A, Gill NS, Salvador-Carulla L. The future of community psychiatry and community mental health services. Curr Opin Psychiatry. 2020;33:375.
10. Karolaakso T, Autio R, Näppilä T, Leppänen H, Rissanen P, Tuomisto MT, Karvonen S, Pirkola S. Contextual and mental health service factors in mental disorder-based disability pensioning in Finland – a regional comparison. BMC Health Serv Res. 2021;21:1–13.
11. Markkula N, Suvisaari J, Saarni SI, et al. Prevalence and correlates of major depressive disorder and dysthymia in an eleven-year follow-up – results from the Finnish Health 2011 Survey. J Affect Disord. 2015;173:73–80.
12. Pirkola S, Isometsä E, Suvisaari J, Aro H, Joukamaa M, Poikolainen K, Koskinen S, Aromaa A, Lönnqvist J. DSM-IV mood-, anxiety- and Alcohol Use Disorders and their comorbidity in the Finnish general population: results from the Health 2000 study. Soc Psychiatry Psychiatr Epidemiol. 2005;40:1–10.
13. Furst MA, Bagheri N, Salvador-Carulla L. An ecosystems approach to mental health services research. BJPsych Int. 2020;18:1–3.
14. Rosen A, Salvador-Carulla L. No service is an island: towards an ecosystem approach to mental health service evaluation. World Psychiatry. 2022;21:237–8.
15. Furst MA, Gandré C, Romero López-Alberca C, Salvador-Carulla L. Healthcare ecosystems research in mental health: a scoping review of methods to describe the context of local care delivery. BMC Health Serv Res. 2019;19:173.
16. Johnson S, Kuhlmann R, Munizza C et al. (2000) The European Service Mapping schedule (ESMS): development of an instrument for the description and classification of mental health services. Acta Psychiatr Scand Suppl 14–23.
17. Salvador-Carulla L, Alvarez-Galvez J, Romero C, et al. Evaluation of an integrated system for classification, assessment and comparison of services for long-term care in Europe: the eDESDE-LTC study. BMC Health Serv Res. 2013;13:218.
18. Salvador-Carulla L, Ruiz M, Romero C, Poole M. ESMS-R European service mapping schedule - revised / eurooppalainen mielenterveyspalvelujen kartoittamistyökalu. Helsinki: THL; 2012.
19. Karolaakso T, Autio R, Suontausta P, Leppänen H, Rissanen P, Näppilä T, Tuomisto MT, Pirkola S. (2023) Mental health service diversity and work disability: associations of mental health service system characteristics and mood disorder disability pensioning in Finland. Soc Psychiatry Psychiatr Epidemiol 1–12.
20. Ala-Nikkola T, Pirkola S, Kontio R, Joffe G, Pankakoski M, Malin M, Sadeniemi M, Kaila M, Wahlbeck K. Size matters — determinants of Modern, Community-Oriented Mental Health Services. Int J Environ Res Public Health. 2014;11:8456–74.
21. Ala-Nikkola T, Sadeniemi M, Kaila M, Saarni S, Kontio R, Pirkola S, Joffe G, Oranta O, Wahlbeck K. How size matters: exploring the association between quality of mental health services and catchment area size. BMC Psychiatry. 2016;16:289.
22. Cetrano G, Salvador-Carulla L, Tedeschi F, et al. The balance of adult mental health care: provision of core health versus other types of care in eight European countries. Epidemiol Psychiatr Sci. 2018;29:e6.
23. Dernovšek MZ, Šprah L. Assessment of mental health services in Slovenia with the European service mapping schedule. Psychiatr Danub. 2008;20:439–42.
24. Fernandez A, Salinas-Perez J, Gutierrez-Colosia M, Prat-Pubill B, Serrano-Blanco A, Molina C, Jorda E, Garcia-Alonso C, Salvador-Carulla L. Use of an integrated Atlas of Mental Health Care for evidence informed policy in Catalonia (Spain). Epidemiol Psychiatr Sci. 2015;24:512–24.
25. Fernandez A, Gillespie JA, Smith-Merry J, Feng X, Astell-Burt T, Maas C, Salvador-Carulla L. Integrated mental health atlas of the Western Sydney Local Health District: gaps and recommendations. Aust Health Rev. 2017;41:38–44.
26. Rezvyy G, Øiesvold T, Parniakov A, Ponomarev O, Lazurko O, Olstad R. The Barents project in psychiatry: a systematic comparative mental health services study between Northern Norway and Archangelsk County. Soc Psychiatry Psychiatr Epidemiol. 2007;42:131–9.
27. Romero-López-Alberca C, Gutiérrez-Colosía RM, Salinas-Pérez AJ, Almeda N, Furst M, Johnson S, Salvador-Carulla L. Standardised description of health and social care: a systematic review of use of the ESMS/DESDE (European Service Mapping Schedule/Description and Evaluation of Services and DirectoriEs). Eur Psychiatry. 2019;61:97–110.
28. Sadeniemi M, Pirkola S, Pankakoski M, Joffe G, Kontio R, Malin M, Ala-Nikkola T, Wahlbeck K. Does primary care mental health resourcing affect the use and costs of secondary psychiatric services? Int J Environ Res Public Health. 2014;11:8743–54.
29. Sadeniemi M, Almeda N, Salinas-Pérez AJ, et al. A Comparison of Mental Health Care Systems in Northern and Southern Europe: A Service Mapping Study. Int J Environ Res Public Health. 2018;15:1133.
30. Salinas-Perez J, Gutierrez-Colosia M, Furst MA, et al. Patterns of Mental Health Care in Remote areas: Kimberley (Australia), Nunavik (Canada), and Lapland (Finland): Modèles De soins de santé mentale dans les régions éloignées: Kimberley (Australie), Nunavik (Canada) et laponie (Finlande). Can J Psychiatry. 2020;65:721–30.
31. Salvador-Carulla L, Saldivia S, Martinez-Leal R, Vicente B, Garcia-Alonso C, Grandon P, Haro JM. Meso-Level Comparison of Mental Health Service availability and use in Chile and Spain. Psychiatr Serv Wash DC. 2008;59:421–8.
32. Tibaldi G, Munizza C, Pasian S, Johnson S, Salvador-Carulla L, Zucchi S, Cesano S, Testa C, Scala E, Pinciaroli L. Indicators predicting use of mental health services in Piedmont, Italy. J Ment Health Policy Econ. 2005;8:95–106.
33. Patana P. Mental Health Analysis Profiles (MhAPs): Finland. OECD Health Work Pap. 2014. https://doi.org/10.1787/5jz1591p91vg-en.
34. Pirkola S, Sund R, Sailas E, Wahlbeck K. Community mental-health services and Suicide rate in Finland: a nationwide small-area analysis. The Lancet. 2009;373:147–53.
35. Ministry of Social Affairs and Health. (2023) Reform of healthcare, social welfare and rescue services.
36. Karolaakso T, Autio R, Näppilä T, Nurmela K, Pirkola S. Socioeconomic factors in disability retirement due to mental disorders in Finland. Eur J Public Health. 2020;30:1218–24.
37. Leppänen H, Kampman O, Autio R, Karolaakso T, Näppilä T, Rissanen P, Pirkola S. Socioeconomic factors and use of psychotherapy in common mental disorders predisposing to disability pension. BMC Health Serv Res. 2022;22:1–12.
38. Pirkola S, Nevalainen J, Laaksonen M, Fröjd S, Nurmela K, Näppilä T, Tuulio-Henriksson A, Autio R, Blomgren J. The importance of clinical and labour market histories in psychiatric disability retirement: analysis of the comprehensive Finnish national-level RETIRE data. Soc Psychiatry Psychiatr Epidemiol. 2020;55:1011–20.
39. Rissanen P, Autio R, Näppilä T, Fröjd S, Pirkola S. Factors associated with returning to work after long term absence due to mental disorders. Humanit Soc Sci Commun. 2021;8:1–9.
40. Beecham J, Johnson S. The European socio-demographic schedule (ESDS): rationale, principles and development. Acta Psychiatr Scand Suppl. 2000;405:33–46.
41. The Finnish Institute for Health and Welfare. (2023) Sotkanet.fi, Statistical information on welfare and health in Finland. https://sotkanet.fi/sotkanet/en/index?.
42. Gutiérrez-Colosía RM, Salvador-Carulla L, Salinas-Pérez AJ, et al. Standard comparison of local mental health care systems in eight European countries. Epidemiol Psychiatr Sci. 2019;28:210–23.
43. Ala-Nikkola T, Pirkola S, Kaila M, Joffe G, Kontio R, Oranta O, Sadeniemi M, Wahlbeck K, Saarni SI. Identifying local and centralized Mental Health services-the development of a New Categorizing Variable. Int J Environ Res Public Health. 2018;15:1131.
44. Gini C. Variabilità E mutabilità: contributo allo studio delle distribuzioni e delle relazioni statistiche.[Fasc. I.]. Tipogr. di P. Cuppini; 1912.
45. Simpson EH. Measurement of Diversity. Nature. 1949;163:688.
46. Hölting L, Jacobs S, Felipe-Lucia MR, Maes J, Norström AV, Plieninger T, Cord AF. Measuring ecosystem multifunctionality across scales. Environ Res Lett. 2019;14:124083.

47. Magurran AE. Measuring biological diversity. Curr Biol. 2021;31:R1174–7.
48. Carstensen B, Plummer M, Laara E, Hills M. (2022) Epi: A Package for Statistical Analysis in Epidemiology.
49. R Core Team. (2020) R: A language and environment for statistical computing.
50. RStudio T. (2018) RStudio: Integrated Development for R.
51. Guevara MR, Hartmann D, Mendoza M. Diverse: an R Package to measure diversity in Complex systems. R J. 2016;8:60–78.
52. THL. (2020) Sosiaali- ja terveyspalvelut TAYS-erityisvastuualueella 2019.
53. Perhoniemi R, Blomgren J. Frequent attenders of three outpatient health care schemes in Finland: characteristics and association with long-term sickness absences, 2016–2018. BMC Public Health. 2021. https://doi.org/10.1186/s12889-021-10866-x.
54. Reho TTM, Atkins SA, Talola N, Sumanen MPT, Viljamaa M, Uitti J. Frequent attenders at risk of disability pension: a longitudinal study combining routine and register data. Scand J Public Health. 2020;48:181–9.
55. Linnaranta O, Strand T, Suvisaari J, Partonen T, Solin P. Mielenterveysstrategia 2020–2030: Toimeenpanon ensimmäiset vuodet ja yhteisen tekemisen tahto. Helsinki: Terveyden ja hyvinvoinnin laitos THL; 2023.
56. Saarni SI, Nurminen S, Mikkonen K, Service H, Karolaakso T, Stenberg J-H, Ekelund J, Saarni SE. The Finnish Therapy Navigator - digital support system for introducing stepped care in Finland. Psychiatr Fenn. 2022;53:120–37.

Publisher's Note