Department of Public Health
Faculty of Medicine
Doctoral Program in Population Health
University of Helsinki

Smoking Cessation Support in Occupational Health Services

Integrating Interprofessional Collaboration Theory and Self-Determination Theory for Enhanced Outcomes

Maarit Malin

ACADEMIC DISSERTATION
To be presented, with the permission of the Faculty of All Faculties of the University of Helsinki, for public examination in lecture room PIII, Porthania, Yliopistonkatu 3,
on 23 January 2026, at 12 noon.

Helsinki 2026

Julkaisija (Publisher): Helsingin yliopisto
Sarja (Series): Dissertationes Universitatis Helsingiensis 26/2026

ISBN 978-952-84-1826-9 (print)
ISBN 978-952-84-1825-2 (online)
ISSN 2954-2898 (print)
ISSN 2954-2952 (online)

PunaMusta, Joensuu 2026

“Dream, believe in yourself, and succeed”

Alexander Stubb

To Samuli and Aino-Maria

Supervisors

Professor Kari Reijula, MD, PhD
Department of Public Health
University of Helsinki
Helsinki, Finland

Docent Anne Lamminpää, MD, PhD
Department of Public Health
University of Helsinki
Helsinki, Finland

Minna Majuri, MD, PhD
Department of Public Health
University of Helsinki
Helsinki, Finland

Pre-examiners

Professor Tuula Vasankari, MD, PhD
Department of Clinical Medicine, Unit of Pulmonary diseases and Clinical Allergology
University of Turku

Katja Ryynänen, MD, PhD
Research Unit of Population Health
University of Turku

Opponent

Professor Emeritus Pekka Puska, MD, PhD, MPolSc
Director General (emer.) Finnish Institute for Health and Welfare
Helsinki

Abstract

In Finland, smoking still leads to approximately 4300 deaths and around 500 disability pensions annually. In 2020, it was estimated that the direct health care costs caused by smoking amounted to approximately €340 million, and that other direct costs, such as sickness allowance and disability pension expenses, totalled over €300 million. Indirect costs related to smoking, including work time spent on smoking breaks, fire damage caused by cigarettes, and costs related to tobacco control and prevention, amounted to approximately €536-823 million. The estimated costs of occupational health care related to tobacco-related diseases were approximately 6.1 million euros. The tobacco industry is rapidly producing new nicotine products, with the aim of making a significant portion of the population dependent on nicotine from childhood and adolescence, and ensuring lifelong use of nicotine products. Early experimentation with nicotine alters developing brains, making them susceptible to permanent addiction. International studies show that users of new nicotine products are more likely to start smoking traditional cigarettes, and that the concurrent use of different nicotine products is common not only in Finland but globally. The tobacco epidemic is not over.

The fundamental role and expertise of occupational health services (OHS) is to support employees' work capacity and to evaluate workplace exposures and their impact on health through occupational health collaboration. OHS are tasked with early identification of disease-related risks to work capacity. They should also inform patients about the impact of tobacco and nicotine products on disease prognosis and provide support for quitting these products. OHS clients are individual employees and their employers. OHS are unique in the health care sector, and can influence individual health through occupational health collaboration. Support for quitting smoking cessation (SC) and quitting nicotine products should be intensified within OHS and regarded as a key preventive and promotional activity. The prevalence of tobacco product use varies across professions. In vocational schools, tobacco product use, particularly cigarette smoking, is significantly more common than among higher-level employees, and can potentially lead to harmful interactions with other workplace exposures. Smoking is highly polarized, whereas the new nicotine products are used in all social classes. Socioeconomic health disparities among workplace employees should be considered when developing action plans, also from the occupational safety perspective. The attitude and expertise of OHS, alongside organizational support, are crucial elements for ensuring effective interventions. Occupational health (OH) professionals should not only be able to communicate the risks of different products; they should also understand the fundamental principles and frameworks of lifestyle change guidance. A multidisciplinary approach is integral to the culture of OHS. In comprehensive interdisciplinary collaboration, professional roles are flexible, and traditional professional boundaries can be crossed. Role definitions and shared goal-setting are part of good-quality interdisciplinary practice. OHS play a key role in reducing smoking and nicotine product

use, and their interdisciplinary approach offers unique opportunities to improve employee health and well-being.

In this doctoral research project, we examined the attitudes, expertise, motivation, and interprofessional collaboration (IPC) among occupational health professionals in various OHS units. We also aimed to assess users' perspectives and needs, and to investigate their views on SC and the applicability of mobile game applications for SC. The research data on OH professionals in the first two sub-studies covered OH physicians (182), OH nurses (296), and occupational physiotherapists (96). The doctoral study was conducted as a cross-sectional survey. During the research process, potential new tools, such as mobile game applications, were explored as supplementary tools for existing methods. Our investigations revealed that very few theory-based mobile applications have been tested and studied, both in Finland and globally, despite their internationally recognized potential in nicotine cessation and other lifestyle interventions. We developed a mobile game application and conducted a development workshop in which 12 respondents evaluated SC practices and our mobile application's features. The results were qualitatively analysed using theory-driven content analysis based on Self-determination Theory (SDT).

All the OH professionals considered SC important and were highly motivated to develop their expertise. There were clear differences in terms of the professionals' expertise and training on the topic. The occupational physiotherapists' knowledge differed significantly from that of the OH physicians and OH nurses (Sub-study I). Examination of IPC revealed that SC occurred randomly and variably (Sub-study II). Clear process guidelines were lacking, and cessation appeared to rely mostly on individual professionals. There were gaps in team members' awareness of other professionals' expertise and practices. Occupational physiotherapists were felt excluded from interdisciplinary SC measures, despite considering the topic important themselves, and despite the current guidelines and the World Health Organization's (WHO) recommendation that all health care personnel should be involved in cessation measures.

The importance of considering individuals' basic psychological needs was emphasized in the user perspectives. OH and other health care professionals should be able to support the needs for autonomy, competence and relatedness of those seeking help. Of these needs, autonomy was highlighted the most. Evaluations of the features of the mobile game application also included elements based on SDT (Sub-study III).

Our research indicates that OHS' role in smoking and nicotine product inter professional cessation needs to be strengthened. Health practitioners should recognize and address the fundamental psychological needs of autonomy, competence, and relatedness when assisting smokers in their cessation efforts.

Tiivistelmä

Tupakointi johtaa vuosittain Suomessa edelleen noin 4 300 kuolemaan ja noin 500 työkyvyttömyyseläkkeeseen. Vuonna 2020 suoria terveydenhuollon kustannuksia aiheutuu Suomessa noin 340 miljoonaa euroa. Muista suorista kustannuksista, kuten sairauspäiväraha- ja työkyvyttömyyseläkekustannuksista, aiheutui runsaat 300 miljoonaa euroa. Epäsuoria tupakoinnin aiheuttamia kustannuksia, esimerkiksi tupakkataukoihin käytetty työaika, tupakan aiheuttamat tulipalot sekä tupakkavalvonnan ja ehkäisyn kustannukset, olivat arviolta 536–823 miljoonaa euroa. Työterveyshuollon kustannukset olivat tupakkatautien osalta arviolta 6.1 miljoonaa euroa. Tupakkateollisuus tuottaa kiihtyvällä vauhdilla uusia nikotiinituotteita, joiden tavoitteena on saada suuri osa väestöstä nikotiiniriippuvaisiksi jo lapsuudessa ja nuoruudessa varmistaakseen nikotiinituotteiden käytön elinkaaren ajan. Nuorena aloitetuissa kokeiluissa nikotiini muokkaa kehittyviä aivoja, jolloin ne altistuvat pysyvälle riippuvuudelle. Kansainvälisten tutkimusten mukaan uusien nikotiinituotteiden käyttäjät aloittavat herkemmin myös savullisen tupakan käytön, ja erilaisten nikotiinituotteiden yhtäaikaiskäyttö onkin yleinen ilmiö niin Suomessa kuin globaalisti. Tupakkaepidemia ei ole ohitse.

Työterveyshuollon perustehtävä ja erityisosaaminen on tukea työntekijöiden työkykyä ja suojata heitä terveydelle haitallisilta työhön liittyviltä altisteilta työterveysyhteistyössä. Työterveyshuollon tehtävänä on varhain tunnistaa sairauksien aiheuttamat työkyvyn menettämisen riskit. Lisäksi sen tulisi informoida potilasta tupakka- ja nikotiinituotteiden vaikutuksista sairauden ennusteeseen ja tarjota tukea näiden tuotteiden käytön lopettamiseksi. Työterveyshuollon asiakkaina ovat yksittäiset työntekijät sekä heidän työnantajansa. Työterveyshuolto onkin ainoa terveydenhuollon toimija, jolla on yhteys ja vaikutusmahdollisuus yksittäisen henkilön terveyteen työterveysyhteistyön välityksellä. Tupakoinnin ja nikotiinituotteiden lopettamisen tukea tulisi tehostaa työterveyshuollossa ja nähdä se yhtenä keskeisenä preventio- ja promootiotoimena. Tupakkatuotteiden käytön esiintyvyys vaihtelee ammattialojen välillä. Ammattiopistoissa tupakkatuotteiden käyttö, erityisesti savukkeiden, on huomattavasti yleisempää kuin ylemmillä toimihenkilöillä. Tämä voi johtaa haitallisiin yhteisvaikutuksiin muiden työpaikka-altisteiden kanssa. Savullisen tupakan käyttö on voimakkaasti polarisoitunut, kun taas uusien nikotiinituotteiden käyttöä esiintyy kaikissa yhteiskuntaluokissa. Työpaikan työntekijöiden sosioekonomiset terveyserot tulee ottaa huomioon jo siinä vaiheessa, kun laaditaan toimintasuunnitelmaa työpaikkojen kanssa. Työterveyshuollon asenne ja osaaminen ovat organisatorisen tuen ohella keskeisiä elementtejä vaikuttavan toiminnan varmistamiseksi. Työterveyshuollon ammattilaisten tulee paitsi osata kertoa eri tuotteiden riskeistä, myös ymmärtää elintapamuutoksen ohjauksen keskeiset perusteet ja viitekehykset. Moniammatillinen toimintatapa kuuluu olennaisesti työterveyshuollon toimintakulttuuriin. Kokonaisvaltaisessa moniammatillisessa yhteistyössä ammattilaisten roolit ovat joustavia, ja perinteisiä ammatillisia rajoja voidaan rikkoa. Roolien määrittelyt ja yhteinen tavoitteen asettelu kuuluvat laadukkaaseen moniammatilliseen toimintaan. Työterveyshuollolla on keskeinen rooli tupakoinnin ja nikotiinituotteiden käytön

vähentämisessä, ja sen moniammatillinen lähestymistapa tarjoaa ainutlaatuisia mahdollisuuksia parantaa työntekijöiden terveyttä ja hyvinvointia.

Väitöskirjatutkimuksessa tutkittiin työterveyshuollon ammattilaisten asenteita, osaamista, motivaatiota ja moniammatillista toimintatapaa erilaisissa työterveyshuollon yksiköissä. Halusimme kartoittaa myös käyttäjien näkökulmia ja tarpeita ja tutkimme käyttäjien käsityksiä liittyen tupakasta vieroittamiseen ja mobiilipelisovelluksen ominaisuuksien sovellettavuutta tupakasta vieroittamiseen.

Tutkimukseni aineisto koostuu kahden ensimmäisen osatyön osalta työterveyshuollon ammattilaisista seuraavasti: lääkärit (182), hoitajat (296) ja fysioterapeutit (96). Tutkimus toteutettiin kyselytutkimuksena poikkileikkausasetelmalla. Tutkimusprosessin aikana kartoitettiin mahdollisten uusien työkalujen, kuten mobiilipelisovelluksen, käyttömahdollisuuksia lisätyökaluina nykyisten menetelmien rinnalla. Selvitysten jälkeen totesimme, että tutkittuja ja testattuja teoriaan pohjautuvia mobiilisovelluksia on edelleen hyvin vähän sekä Suomessa että globaalisti, vaikka niiden potentiaali nikotiinituotteista vieroittamisessa ja muissa elintapainterventioissa on tunnistettu kansainvälisesti. Kehitimme mobiilipelisovelluksen ja järjestimme kehittämistyöpajan, jossa 12 vastaajaa arvioi tupakasta vieroituksen käytäntöjä ja mobiilisovelluksen ominaisuuksia. Tulokset analysoitiin laadullisesti itsemääräämisteoriaan pohjautuvan teorialähtöisen sisällönanalyysin menetelmin.

Kaikki työterveyshuollon ammattilaiset pitivät tupakoinnin lopettamista tärkeänä ja olivat erittäin motivoituneita kehittämään osaamistaan. Osaamisessa oli selkeitä eroja, samoin kuin aiheen kouluttamisessa. Työterveysfysioterapeuttien tiedot erosivat merkittävästi työterveyslääkäreistä ja -hoitajista (osatutkimus I). Moniammatillista toimintatapaa selvitettäessä kävi ilmi, että tupakasta vieroitus toteutuu sattumanvaraisesti ja vaihtelevasti. (Osatutkimus II). Selkeät toimintaprosessit puuttuivat, ja vieroitus näyttää olevan lähinnä yksittäisten ammattilaisten varassa. Tiimin jäsenten tietoisuudessa oli puutteita muiden ammattilaisten osaamisesta ja toimintatavoista. Työterveysfysioterapeutit kokivat jääneensä sivuun moniammatillisesta tupakasta vieroituksesta, vaikka he itse pitivät aihetta tärkeänä ja nykyinen käypä hoito -suositus sekä WHO suosittelevat kaikkien terveydenhuollon henkilöstön osallistuvan vieroitukseen.

Työpajassa vastanneiden näkökulmaa arvioitaessa korostui ihmisten psykologisten perustarpeiden huomioiminen. Työterveyshuollon ja muiden terveydenhuollon ammattilaisten tulisi osata tukea apua hakevan autonomiaa, pystyvyyden kokemusta ja yhteisöllisyyden tarvetta. Näistä tarpeista autonomian kokemus korostui eniten. Mobiilipelisovelluksen ominaisuuksia arvioitaessa sen tulisi sisältää myös itsemääräämisteoriaan perustuvia elementtejä. (Osatutkimus III)

Tutkimus osoittaa, että työterveyshuollon toimintaa tupakka- ja nikotiinituotteista moniammatillista vieroittamista tulee vahvistaa. Terveydenhuollon ammattilaisten tulisi huomioida psykologiset perustarpeet; autonomia, pystyvyyden kokemus ja yhteisöllisyys toteuttaessaan tupakoinnin lopettamisen tukemista.

Acknowledgements

This endeavour has been a journey not only into science but also into humanity. I have delved deeply into the fundamental needs that drive human motivation: autonomy, belief in one's capabilities, and the need for community.

I would first like to acknowledge the funders of this research: the 'Support for smoking cessation in occupational health care' project of the Ministry of Social Affairs and Health, which I joined when I began my work at the University of Helsinki; the Väinö and Laina Kivi Foundation; and the Finnish Work Environment Fund, whose grant enabled me to take a break from my primary job and focus on completing my dissertation. I would also like to express my gratitude to my employer, the University of Helsinki, and the Department of Public Health/Occupational Health – it has been truly inspiring to work on specialization training for occupational health physicians. My colleagues I thank dearly for their peer support. I am grateful to the Doctoral Programme in Population Health (DocPop) and the Finnish Association of Occupational Health Nurses, whose funding enabled me to participate in conferences in the field and thus connect with the wider scientific community and research networks.

Special thanks go to my supervisors, Professor Kari Reijula, Adjunct Professor Anne Lamminpää, and Minna Majuri, MD, PhD, who have accompanied me on this journey. Kari, you have an incredible ability to make people feel uplifted, to make them believe in their own abilities, and to help them find their inner motivation. Thank you so much for your help and for your camaraderie! Anne, you have consistently encouraged me over the years, and with gentle positivity, brought me back to research when life events have occasionally put it on hold for longer periods. Minna, your remarkable efficiency served as my driving force to bring this research to completion. I will always be grateful for our memorable conference trips and your dedication to my research. It has been a pleasure to learn to know all of you.

I would like to extend my gratitude to my reviewers, Docent Tuula Vasankari and PhD Katja Ryynänen, for their insightful, invaluable comments that helped me greatly improve my thesis. My thanks also go to Professor Pekka Puska, who possesses such a deep understanding and such admirable expertise in public health and tobacco, for agreeing to be my opponent. I thank Alice Lehtinen, BA, for her outstanding language editing, language training, and extraordinary service over all these years. I also thank Statistician Ritva Luukkonen for her excellent collaboration over the years on our various research projects.

I am especially grateful to all my co-authors and partners, and to thesis committee members Antero Heloma and Tellervo Korhonen. Antero and Tellervo, you have constantly supported me throughout this process, and gifted me with your wise advice. A special thank you goes to my co-author PhD Ville Lahtinen. Developing the gamified mobile app with you during the STM project was incredibly exciting! Director of DocPop, Professor Anna-Keski-Rahkonen – I greatly value your writing courses and retreats, which have always immensely inspired me. And PhD Aarni Moisala, I will always appreciate your peer support and wise words during my research journey.

I am fortunate and thankful to have so many friends in my life with whom I have been able to share my feelings about this project. Anita and Virpi – my old friends – I thank you especially for your invaluable support and encouragement during my dissertation research.

Mum and Dad, you have always loved me, spurred me on and been proud of me, and for this I am so very grateful. My dear sister Marjo and your family, thank you dearly for the support you have shown me during this process. Sanna and Juho came so swiftly to my rescue when I had IT problems, which I appreciate greatly!

My children, Samuli and Aino-Maria, you are both the light of my life. I am so proud of the wonderful young adults you have become – stay just as you are! I love you so much. Sami, I am so happy to welcome you into our family through Aino-Maria. And finally, Timo, I am so grateful for all these decades with you – the ups and the downs. Thank you for always being there!

Vaasa, August 2025

Maarit Malin

Abbreviations

AITCS	Assessment of Interprofessional Team Collaboration Scale
ASR	autonomous self-regulation
BCW	Behaviour Change Wheel
BCTs	behaviour change techniques
BI	brief intervention
eHealth	electronic health
ENDS	electronic nicotine delivery systems
ENNDS	electronic non-nicotine delivery systems
GGTC	Global Center for Good Governance for Tobacco Control
HBM	Health Belief Model
HTPs	heated tobacco products
ICT	information and communication technology
IPC	interprofessional collaboration
IPE	interprofessional education
mHealth	mobile health
mCessation	mobile cessation
MM	mixed methods
MMR	mixed-methods research
MI	motivational interviewing
NRT	nicotine replacement therapy
ONPs	oral nicotine pouches
OH	occupational health
OHS	occupational health services
PC	perceived competence
PCS	Perceived Competence Scale
PDAs	personal digital assistants
RCTs	randomized controlled trials
SDT	Self-Determination Theory
SC	smoking cessation
SCT	Cocial Cognitive Theory
SCTS	smoking cessation treatment and support

SES	socioeconomic status
TSRQ	Treatment Self-Regulation Questionnaire
TTM	The Transtheoretical Model
WHO FCTC	WHO Framework Convention on Tobacco Control
WHO	World Health Organization
5As	5 Ask model

Index

Abstract v

Tiivistelmä vii

Acknowledgements ix

Abbreviations xi

List of original publications xv

1 Introduction 16

2 Review of the literature 20

2.1 Use of tobacco and nicotine products and their significance for health and the economy 20

2.1.1 Health hazards of tobacco and nicotine products 20

2.1.2 Statistics on tobacco and nicotine product use 24

2.1.3 Economic costs of tobacco products 27

2.1.4 Prevention strategies for tobacco and nicotine use 29

2.1.5 Nicotine dependence 33

2.1.6 Digital interventions and mCessation 36

2.2 Role of occupational health services in smoking cessation 38

2.2.1 Occupational health services and health prevention 38

2.2.2 Impact of lifestyle factors on work ability and disability 39

2.2.3 Finnish occupational health services 44

2.2.4 Smoking cessation measures of occupational health services 45

2.3 Summary and gaps in previous research 47

2.4 Theoretical framework 49

2.4.1 Interprofessional collaboration (IPC) 49

2.4.2 Self-determination Theory (SDT) 51

2.4.3 Self-determination Theory in smoking cessation treatment and support 54

2.4.4 Comprehensive Frameworks for Behaviour Change 56

2.4.5 Insights from Key Theoretical Models 59

3 Aims of the study 60

4 Materials and methods 62

4.1 Study design 62

4.2 Study population and design (Sub-studies I and II) 63
4.2.1 Questionnaire instruments (Sub-studies I and II) 65
4.2.2 Statistical analyses 66
4.3 Study population and design (Sub-study III) 69
4.3.1 Co-development of the app 70
4.3.2 Co-design 71
4.3.3 Co-design workshop 72
4.3.4 Mixed methods 72
4.3.5 Qualitative analyses 74
4.3.6 Ethics 76

5 Results 77
5.1 Descriptive results 77
5.2 Attitudes, knowledge and motivation of occupational health professionals regarding smoking cessation (Sub-study I) 77
5.3 Role of occupational physiotherapists in supporting smoking cessation alongside occupational health physicians and nurses (Sub-studies I and II) 79
5.3.1 Interprofessional collaboration 79
5.4 Integrating efforts: occupational health service collaboration (Sub-study II) 80
5.4.1 Collaboration among OHS providers 80
5.4.2 Collaboration between employer and OH professionals 81
5.4.3 Differences between OHS providers and OH professionals in terms of smoking cessation 82
5.5 SDT-driven approach to understanding patient perspectives – a qualitative study (Sub-study III) 85
5.5.1 Patient perspective in smoking cessation treatment and support 85
5.5.2 Individual perspective in mCessation and smoking cessation 91

6 Discussion 93
6.1 Main findings 93
6.2 Comparison and interpretation of findings 94
6.2.1 Smoking cessation practices of occupation health professionals 94
6.2.2 Smoking cessation and occupational health services 96
6.2.3 Smoking cessation and individual perception based on SDT 99
6.3 Methodological considerations 100
6.4 Significance of the study 104
6.5 Implications and recommendations for further research 106
6.6 Conclusion and policy implications 107

References 109

List of original publications

This thesis is based on the following publications:

I **Malin M**, Jaakkola N, Luukkonen R, Heloma A, Lamminpää A, Reijula K. Occupational health professionals' attitudes, knowledge, and motivation concerning smoking cessation-Cross-sectional survey. J Occup Health. 2020 Jan;62(1):e12145. DOI: 10.1002/1348-9585.12145. PMID: 32701202; PMCID: PMC7377039.

II **Malin M**, Luukkonen R, Majuri M, Lamminpää A, Reijula K. Collaboration between occupational health professionals in smoking cessation treatment and support. Work. 2024;78(2):419-430. DOI: 10.3233/WOR-230139. PMID: 38160385.

III **Malin M**, Majuri M, Lahtinen V, Reijula K. Understanding perspectives on smoking cessation based on Self-Determination Theory: A qualitative study. Tob. Prev. Cessation 2025;11(December):61. DOI: 10.18332/tpc/211451.

The publications are referred to in the text by their roman numerals.

1 Introduction

The tobacco epidemic is one of the most significant public health threats globally, claiming over 8 million lives annually. More than 7 million of these deaths are due to direct tobacco use, but approximately 1.3 million result from non-smokers' exposure to second-hand smoke. All forms of tobacco use are detrimental, and no level of exposure to tobacco is safe. Cigarette smoking is the most common form of tobacco use worldwide. (World Health Organization, n.d.) The global number of smokers is increasing in tandem with the growth of the population, particularly in low-income nations. However, over the past decade, smoking rates have decelerated in many Western countries (GBD 2019 Tobacco Collaborators., 2021). Since 2021, most countries have witnessed a rapid rise in e-cigarette usage among young people, a trend is continuing (Wang et al., 2024; Eurostat, n.d.; Nordic Welfare Centre, 2025). One in four men under the age of 40 now use oral nicotine pouches (ONP) in Scandinavian and Baltic countries. However, with the advent of such new oral nicotine products, the terminology is evolving among researchers, policy-makers, public health professionals, and the youths who consume these products. (Nordic Welfare Centre, 2025)

On an individual level, lifestyle factors – including diet, physical activity, body mass index and smoking – are recognized for their substantial influence on health. A single individual typically accumulates multiple risk factors. (Hoskins et al., 2019; Pihlajamäki et al., 2019) In the general working population, consistent links have been observed between various lifestyle risk factors and self-reported low work ability. Individuals who smoke or have smoked in the past seem more likely to have poor work ability than those who have never smoked. (Oellingrath et al., 2019; Virtanen et al., 2018) Nicotine addiction continues to be a significant public health issue, resulting in hundreds of thousands of deaths annually. A recent challenge is the rise of various new nicotine-containing products that perpetuate nicotine dependency and draw in new users. Nicotine is recognized as a key contributor to many of the adverse effects of smoking. (Ekblad, 2022; Kim and Picciotto, 2023; Patja, K., 2025) Giving up smoking can be especially difficult, and over 30 attempts are often required to successfully quit (Cobos-Campos et al., 2020). Nicotine dependence is a multifaceted disorder, and research shows that the stronger the dependence, the lower the likelihood of quitting successfully, with motivation being a crucial factor in breaking the habit. As a result, it is becoming increasingly

important to develop and refine behavioural strategies to aid SC. (Cobos-Campos et al., 2020)

The primary task of occupational health services (OHS) is health promotion, which includes supporting employees' work ability, and assessing exposures and health at work. The combined effect of cigarette smoking and occupational exposures has shown to significantly increase the risk of various illnesses, such as idiopathic pulmonary fibrosis (Andersson et al., 2021), lung cancer (Klebe et al., 2019; Behrens et al., 2023) and bladder cancer (Jubber et al., 2023). Tobacco use increases the risk of and number of sickness absence days among the working aged. Health improvements among employees who quit smoking can reduce employers' direct costs from absenteeism and indirect costs from productivity loss, including time used for smoking breaks (Finnish Institute for Health and Welfare, 2022; Miikka Vähänen, 2015).

OHS play a significant role in smoking cessation treatment and support (SCST) and its related treatments (Malin M. and Reijula, K., 2022). OHS also actively support the overall health and well-being of employees through various health promotion activities and preventive measures. Workplaces provide opportunities to promote healthy lifestyles. (Proper and van Oostrom, 2019; Willeke et al., 2024) Collaboration between OHS, employers and workplace health promotion initiatives is essential for maintaining healthy employees (Halonen et al., 2017).

Workplace health initiatives have the potential to reduce employees' smoking rates. Offering financial rewards for quitting smoking can be a cost-effective strategy in the short term, and can potentially help policy-makers and employers to decide whether or not to implement such incentives to encourage SC. (Cahill and Lancaster, 2014; van den Brand et al., 2020) Given that adults often spend a significant portion of their day at work, the workplace serves as an ideal location for SC measures supported by occupational health (OH) professionals. OHS can provide guidance and support to help employees quit smoking. By working together, OHS and workplaces can enhance employee health and work ability, ensure safe work environments, improve the dynamics of the work community, and prevent work-related illnesses and accidents.

Although SC measures have shown to be effective, it seems they are not as highly prioritized in medical activities as might be expected. Many physicians do not routinely inquire about their patients' smoking habits or provide advice on quitting. One simple intervention during a mandatory annual examination was effective in a population of smokers with varying levels of motivation to stop smoking and with different health statuses. (Lang et al., 2000) Receiving guidance from multiple health care providers significantly increases the likelihood of successfully quitting tobacco use (An et al., 2008). The World Health Organization (WHO) and current guidelines on tobacco care advocate that all health professionals consistently apply

the SCTS approach, and highlight the importance of their unique professional contributions to these efforts (Duodecim, 2024; World Health Organization, 2021).

In the realm of OHS, multidisciplinary collaboration is essential, with key professionals such as OH physicians, OH nurses and occupational physiotherapists combining their expertise to tackle patients' health problems. Interprofessional collaboration (IPC) succeeds when professionals from diverse backgrounds share their expertise and work together, bridging gaps and negotiating overlaps in their roles to foster collaborative opportunities (Isoherranen, K., n.d.; Schot et al., 2020).

Self-determination Theory (SDT) provides a framework for understanding human motivation, emphasizing the distinction between autonomous and controlled motivation. Autonomous motivation involves actions aligned with personal values and goals, whereas controlled motivation stems from external pressures. Optimal development and well-being require the fulfilment of three psychological needs: autonomy, competence and relatedness. SDT-based interventions have proven to be effective in addressing tobacco dependence, as fostering autonomy and competence significantly aids the SC process. (Teixeira et al., 2020; Ryan and Deci, 2000; Huang et al., 2022; Niemiec et al., 2023; Choi et al., 2014)

The existing research on SC support in OHS is notably sparse. Although SDT is a prominent framework for understanding human motivation, its application in OH health promotion research is limited. The inter- and multidisciplinary approach, a cornerstone of OH, is similarly underexplored. Lifestyle counselling, an area in which health care professionals frequently perceive their expertise as lacking, is markedly deficient in research that has applied SDT and IPC in OH contexts. Furthermore, the diverse organizational structures and operational cultures of Finnish OHS complicate generalizations, highlighting the need for research to be tailored to specific service types to identify strengths and areas that require improvement. Effective SC interventions in OHS must take user perspectives and expectations into account.

Health apps, when regularly used, enhance personal health (Chong et al., 2023; Mariano B., n.d.; World Health Organization, 2019). They are expected to play a crucial role in future health care, and this will require integrating self-tracked data into medical practice (Iivanainen et al., 2024). Although mobile technologies for SC are increasing, few are scientifically validated or meet high-quality standards (Ortis et al., 2020; Bold et al., 2023; Cobos-Campos et al., 2020). Understanding user experiences is essential for advancing mCessation apps, and this requires collaboration between developers and multidisciplinary teams.

Research data on the cessation of nicotine products is limited. For the cessation of these products, knowledge derived from SC studies is required (Duodecim Current Care Guidelines, n.d.). Therefore, the articles of this doctoral research focused on the concept of 'smoking cessation', although the primary underlying

concept was nicotine addiction and its connection to various tobacco products. The term ‘smoking cessation’ can be equated with ‘tobacco cessation,’ as it encompasses the cessation of all tobacco products and overcoming nicotine addiction. The prevailing term in this study is SCTS, but it is applicable to all tobacco products. This dissertation study investigates SCTS practices within OHS and examines individuals’ experiences and expectations of SCTS, using SDT as a framework and applying IPC. The results offer insights into various developmental patterns of SCTS. The study introduces new knowledge about SCTS, and its findings can be used to develop more effective tobacco cessation strategies within OHS.

2 Review of the literature

2.1 Use of tobacco and nicotine products and their significance for health and the economy

The tobacco epidemic is one of the most significant global public health threats, annually claiming over 8 million lives. More than 7 million of these deaths are due to direct tobacco use, but approximately 1.3 million result from non-smokers' exposure to second-hand smoke. All forms of tobacco use are detrimental, and no level of exposure to tobacco is safe. Cigarette smoking is the most common form of tobacco use worldwide. (World Health Organization. Tobacco 2023., n.d.)

2.1.1 Health hazards of tobacco and nicotine products

Tobacco is the greatest preventable cause of medical diseases worldwide (GBD 2019 Tobacco Collaborators., 2021; Nahhas et al., 2022; Peacock et al., 2018; Woloshin et al., 2008) due to the high prevalence of smokers. In 2020, almost 22% of the world's adult population aged 15 or older used some form of tobacco. (World Health Organization. Tobacco 2023., n.d.) The nicotine found in tobacco is highly addictive, and tobacco use is a significant risk factor for cardiovascular and respiratory diseases, over 20 various types or subtypes of cancer, and numerous other serious health conditions. Smoking is linked to an elevated risk of cardiac, infectious and pulmonary complications, as well as delayed wound healing after surgery (Ofori et al., 2024). Heated tobacco products (HTPs) contain tobacco and emit toxic substances, many of which are carcinogenic and harmful to health. Electronic nicotine delivery systems (ENDS) and electronic non-nicotine delivery systems (ENNDS), commonly known as e-cigarettes, do not contain tobacco and may or may not contain nicotine, but they are still harmful to health and unquestionably unsafe. (Rahman et al., 2023; World Health Organization. Tobacco 2023., n.d.) The extensive body of literature on the health effects of smoking has unequivocally established that smoking is a leading preventable cause of morbidity and mortality. Conditions such as chronic obstructive pulmonary disease (COPD), emphysema, lung cancer and cardiovascular disease remain the most prevalent health issues linked to cigarette smoking. (World Health Organization. Tobacco 2023., n.d.) For instance, smokers exhibit lower respiratory function and higher

levels of carboxyhaemoglobin than non-smokers, which can contribute to airway obstruction (Darabseh M.Z., Selfe J., Morse C.I., Degens H., n.d.). Smoking diminishes exercise capacity, not only by reducing aerobic capacity but also by increasing the metabolic cost of breathing (Salehi et al., 2021). Smoking also raises blood pressure and the heart rate, thereby elevating the risk of atherosclerosis (Lauria et al., 2017).

Smokers are very much aware of these dangers and many of them seek to quit smoking. E-cigarettes are marketed as a healthier alternative to cigarette smoking. However, paradoxically, e-cigarette usage is swiftly increasing among non-smokers, particularly among adolescents and young adults. E-cigarettes have been linked to beginning tobacco cigarette use among adolescents. The use of vaping e-cigarettes by individuals who have not previously smoked appears to elevate their likelihood of starting to smoke traditional tobacco cigarettes within a month (O'Brien et al., 2021). Young non-smokers who use e-cigarettes are approximately three times more likely to begin smoking tobacco and develop a regular smoking habit than those who do not use e-cigarettes (Baenziger et al., 2021).

Vaping has shown to have comparable detrimental effects on pulmonary function to those of cigarette smoking and may thus not be a healthier alternative to smoking (Darabseh M.Z., Selfe J., Morse C.I., Degens H., n.d.; Banks et al., 2023). E-cigarettes also introduce harmful chemicals into the body. These devices contain an e-liquid composed of solvents, nicotine and flavouring agents, which is heated to generate an aerosol. Toxic compounds have been identified in e-liquids, and the heating process elevates their concentrations. E-cigarettes also contain nicotine derivates and heavy metals. Conventional and electronic smoking, along with additional risk factors including environmental pollutants, exposure to arsenic, asbestos, and air pollution, can significantly increase the risk of developing respiratory diseases and other health issues. (Chellian et al., 2023)

Nicotine pouches resemble snus pouches but do not contain tobacco. These products are nicotine-containing sachets that are placed in the oral cavity, similarly to snus. Nicotine pouches may also be referred to as nicotine snus, and in Sweden, they are called white snus. Snus also contains tobacco. Nicotine pouches differ from nicotine replacement therapy sachets in that they have not undergone the sales authorization process required by pharmaceutical regulations. In the EU, very strong nicotine pouches are available on the market, which can contain dangerously high levels of nicotine. Nicotine pouches have recently been introduced globally, and their sales are rapidly increasing. Flavourings enhance their appeal among young people. A comprehensive international study found that young individuals prefer flavoured nicotine pouches, with mint and menthol being the most popular. For the tobacco and nicotine industry, flavourings are a strategy to attract new clients. Some of the ingredients of nicotine pouches, such as alkaline substances that raise pH levels, can also enhance nicotine release. However, nicotine pouch

users' awareness of their health hazards is relatively poor, and the primary reasons for using them are curiosity, enjoyment, flavours, and (mis)perceived reduced harm. (Havermans et al., 2021; Shaikh et al., 2023)

Nicotine has numerous adverse health effects (Sansone et al., 2023). It places stress on the heart by constricting the blood vessels, increasing the heart rate, raising blood pressure, and potentially exposing individuals to arrhythmias (Parmar et al., 2023; Rahman et al., 2023; Shaikh et al., 2023). Nicotine can also diminish the efficacy of antihypertensive medications. Currently, nicotine is not classified as a carcinogen or a cancer-causing substance. (Global Center for Good Governance in Tobacco Control, 2024) However, some evidence suggests that nicotine may increase the risk of cancer by promoting the transformation of cells into cancerous cells, enhancing the proliferation of cancer cells and sustaining the development of cancerous tissue. For individuals with a developing cancer or an elevated cancer risk, nicotine may exacerbate the condition. (Sansone et al., 2023) Moreover, nicotine impairs the body's sensitivity to insulin, which is associated with an increased risk of developing type 2 diabetes (Sun et al., 2020). Nicotine is a toxin, and the lethal dose is 1 mg/kg for adults. Thus, for person who weighs 60 kilograms, the lethal dose of nicotine absorbed into the bloodstream is 60 milligrams (Tjoncke et al., 2020). For children, ingesting even a single cigarette or a snus pouch can lead to dangerous poisoning, and e-cigarette cartridges have also led to fatal poisonings (Crosby, 2025). Studies indicate that 30 millilitres of nicotine liquid with a nicotine concentration of 1.8% contains approximately 1080 milligrams of nicotine. This amount is more than sufficient to kill a person weighing 90 kilograms. For a toddler weighing 10 kilograms, a dose of just 70 milligrams can be lethal. Nicotine poisoning also occurs among workers on tobacco farms, as nicotine can be absorbed through the skin from the leaves of tobacco plants. Nicotine contains pesticide residues, heavy metals, preservatives and nitrosamines. Symptoms of nicotine poisoning include nausea, vomiting, headache, tremors, irregular pulse and difficulty breathing. (Global Center for Good Governance in Tobacco Control, 2024) (Duodecim Current Care Guidelines, n.d.; Tjoncke et al., 2020) Patients who are dependent on nicotine from sources other than tobacco have been found to be more likely to experience complications following surgery. These complications can include infections at the surgical site, deep vein thrombosis, pulmonary embolism, sepsis or infections related to prosthetic joints. These patients also tend to have increased rates of revision surgery within three years (DeShazo et al., 2024; Heloma, A. et al., 2022). Research has shown a correlation between nicotine use and mental health outcomes such as anxiety and depression (Albarrak et al., 2023). Table 1 outlines the various adverse effects of nicotine (Duodecim Current Care Guidelines, n.d.; Savuton Suomi 2030, n.d.).

Table 1 Adverse effects of nicotine (Duodecim 2024, Finnish Tobacco Act)

Nicotine and various body systems	**Adverse effects**
Nicotine and endothelial function	• Indirect impairment of endothelial function • Increase in reactive oxygen species
Nicotine and the sympathetic nervous system	• Increased myocardial contractility and heart rate • Increased vascular tone • Increased platelet aggregation • Increased proliferation of vascular smooth muscle cells
Nicotine and the renin-angiotensin system (RAS)	• An imbalance in the renin-angiotensin system may be caused by the cardiovascular adverse effects of nicotine
Nicotine and metabolic effects	• Development or exacerbation of insulin resistance • Increased risk of metabolic syndrome • Increase in visceral fat accumulation
Nicotine and chemoreflex	• Nicotine may contribute to the higher incidence of sudden infant death syndrome among infants of smoking mothers.
Nicotine and increased cancer risk	• Nicotine is involved in the development of various cancer types: tumour promotion, increased proliferation and angiogenesis, inhibition of apoptosis
Nicotine and foetal effects	• Nicotine has shown to be highly detrimental to foetal development in animal studies, and human studies suggest similar effects. Epidemiological evidence of the impact of nicotine alone on pregnancy and foetal development in humans is currently insufficient.
Nicotine and surgery	• Nicotine is associated with various postoperative complications.
Nicotine and cognitive function	• Nicotine affects cognitive function due to quantitative and qualitative

	changes in acetylcholine nicotinic receptors throughout the brain. The acute effects of nicotine that temporarily enhance alertness are major factors in the development of addiction. As smoking continues over a longer period, smokers begin to experience declines in attention span, working memory and impulse control, beginning in middle age
Nicotine and mental health	• Nicotine is a predisposing factor of anxiety and depression symptoms

2.1.2 Statistics on tobacco and nicotine product use

Despite a decline in smoking rates in numerous developed nations over the past decade, the total number of smokers worldwide continues to increase. In 2019, over 1 billion individuals were regular tobacco users, and smoking was responsible for nearly 8 million deaths. The prevalence of smoking varies significantly across different countries, (GBD 2019 Tobacco Collaborators., 2021) and approximately 80% of tobacco users reside in low- and middle-income nations (World Health Organization, 2023). In 2022, the global age-standardized prevalence of smoking was estimated to be 28.5% among males and 5.96% among females (GBD 2021 Tobacco Forecasting Collaborators, 2024). Exposure to second-hand tobacco smoke results in the deaths of 1.3 million non-smokers annually (World Health Organization, 2023). In Europe, smoking prevalence varies, but in general, Scandinavian countries have a relatively low average of daily smokers (Figure 1.) (Eurostat, n.d.). In the Nordic and Baltic regions, cigarette smoking is generally decreasing among young people, with the exceptions of Latvia and Norway (Nordic Welfare Centre, 2025).

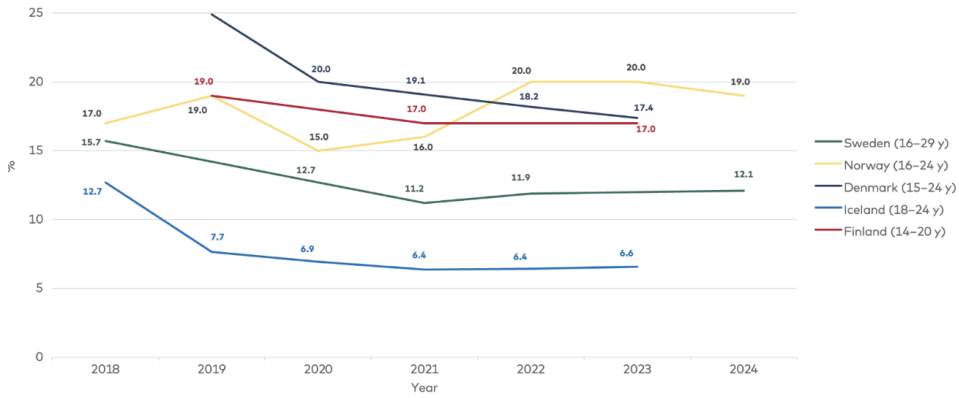

Figure 1 Development of cigarette smoking in Nordic countries since 2018. (Nordic Welfare Centre)

Furthermore, the consumption of alternative tobacco and nicotine products such as vapes, nicotine pouches, and snus has increased exponentially, along with its associated harms and damage (Dinardo and Rome, 2019; Hernández-Pérez et al., 2023; Scala et al., 2025; Samad et al., 2024; Travis et al., 2025; Shaikh et al., 2023; Ye and Rahman, 2023; Valen et al., 2023). The same trend prevails in the Nordic and Baltic countries, and the use of oral nicotine products increased in most Nordic and Baltic countries between 2018 and 2024. The data indicate a growing interest in new nicotine products among young people, with a notable increase in popularity among girls. The swift rise in e-cigarette usage among youths is likely linked to the introduction of disposable e-cigarettes, commonly referred to as vapes, in numerous countries, around 2021 (Figure 2.). Overall, there is a rising trend in the use of oral nicotine products in the Nordic and Baltic nations, which is likely driven by the introduction of nicotine pouches. (Nordic Welfare Centre, 2025)

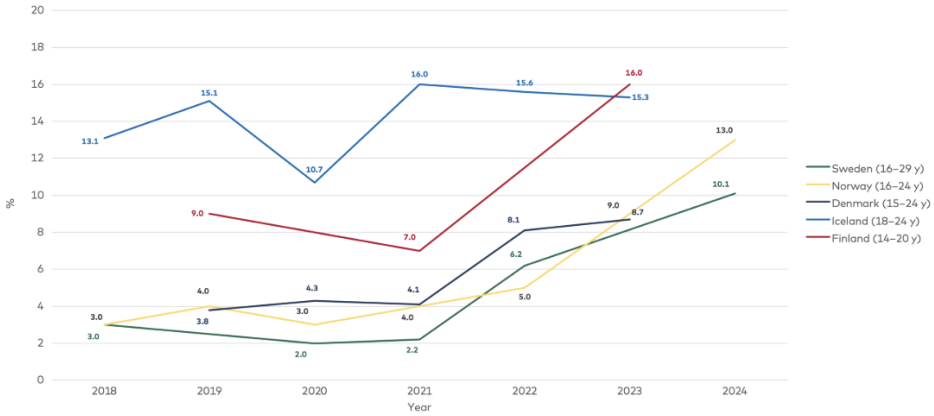

Figure 2 Development of E-cigarette use in Nordic countries since 2018. (Nordic Welfare Centre)

According to recent population studies, Finns' daily smoking has generally decreased in recent years (Figure 3.). However, the use of nicotine pouches and other new nicotine products is relatively common among adolescents and young adults. In 2022, approximately 11% of Finnish individuals aged 20 to 64 smoked daily. Smoking exhibits a marked polarization, with smoking rates being higher among individuals from lower social classes and those employed in occupations with inherent hazards than among those from higher social classes who are not exposed to occupational risks. Daily smoking is significantly more common among vocational school students than high school students. It is also more prevalent among students in universities of applied sciences than among those attending universities. (Finnish Institute for Health and Welfare, n.d.) Socioeconomic status (SES) indicators, including education and income levels, demonstrate that limited educational attainment and poverty significantly influence tobacco consumption and reduce the likelihood of SC (Chen et al., 2019; Pennanen et al., 2014). This means that certain professional fields have a higher number of individuals who smoke, which should be considered in OHS (Bosdriesz et al., 2015; Chen et al., 2019; Sahan et al., 2018; Smith, 2008; Tomioka et al., 2020). The use of nicotine pouches and other new nicotine products is common among adolescents and young adults. Snus use is common among young males in Finland. Between 2008 and 2015, there was a significant rise in daily snus use among boys. This upward trend has persisted since 2015, but only among vocational school students. In 2021, 12% of adolescents in vocational schools reported daily snus use: 16% of boys and 7% of girls. (Danielsson et al., 2021; Finnish Institute for Health and Welfare, 2023)

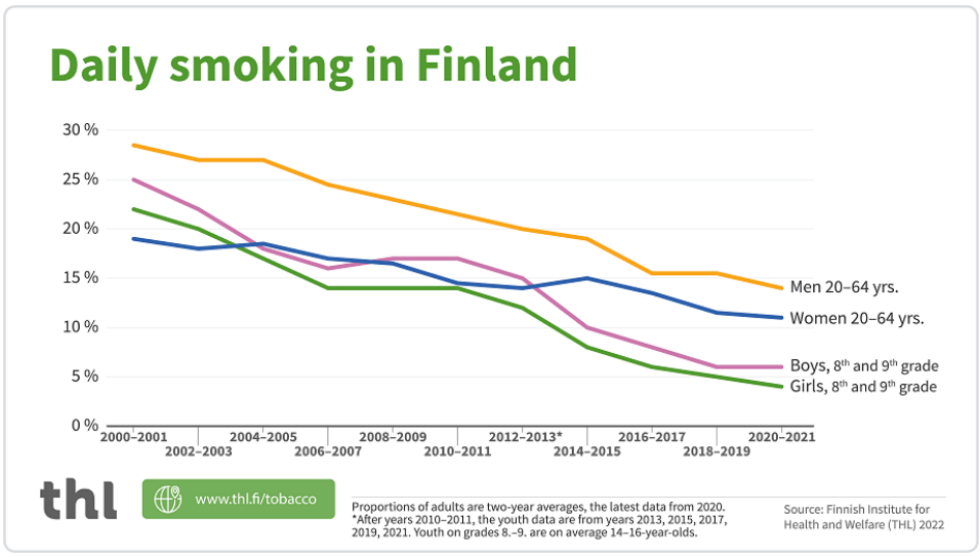

Figure 3 Prevalence of tobacco and nicotine product use. (THL)

In Finland adolescents' use of e-cigarettes decreased until 2021 and was more prevalent among boys. The use of e-cigarettes among young people aged 14–20 doubled in Finland between 2021 and 2023 (Finnish Institute for Health and Welfare, 2025). By the time they reach adulthood, they may have already developed a strong nicotine addiction, and possibly also use other tobacco products (Hernández-Pérez et al., 2023b; O'Brien et al., 2021).

In Finland, the use of nicotine pouches has increased among both working-aged men and women. Adults under the age of 40 are the most frequent users of nicotine pouches, with 24% of men in this age group using them either daily or occasionally. In 2024, 5% of the working-age population used nicotine pouches daily, compared to 2% in 2022. Among men, daily use of nicotine pouches increased from 3% in 2022 to 8% in 2024, and among women, it rose from less than 1% to 2% during the same period. Among men under the age of 40, daily use of nicotine pouches increased from 4% to 13%, and among women, it increased from 1% to 5% between 2022 and 2024. (Finnish Institute for Health and Welfare, 2025)

2.1.3 Economic costs of tobacco products

The tobacco crisis has various consequences, including health hazards, fatalities and escalating expenses to the economy. In 2018, cigarette smoking in the United States was estimated to cost US$ 600 billion, and lost productivity from premature deaths due to second-hand smoke, US$ 7 billion. (World Health Organization. Tobacco 2023., n.d.) The total global economic cost of smoking is estimated to be

around US$ 1.85 trillion, or around 1.8% of global GDP (Vulovic V. Tobacconomics, Health Policy Center, Institute for Health Research and Policy, n.d.). The significant impacts on health and the economy of the worldwide tobacco crisis underscore the necessity to make immediate, effective tobacco control measures the top public health priority (GBD 2019 Tobacco Collaborators., 2021).

Economic costs are categorized into 'direct costs', which include expenses such as hospital fees, and 'indirect costs', which refer to the loss of productivity due to illness and death. Cost of Illness studies typically divide direct costs into health care and non-health care expenses. Health care expenses arise from diagnosing and treating diseases attributable to smoking: hospitalization, physician services and medications. Non-health care expenses occur outside the health system, for example, property loss from fires caused by cigarettes. Indirect costs quantify the economic losses due to increased morbidity and mortality from smoking-related diseases. (Goodchild et al., 2018) The societal costs of smoking are huge, and include direct health care costs and productivity losses associated with premature death, absenteeism and presenteeism (Rissanen et al., 2024). Smoking has been linked to a 31% higher risk of absenteeism and 2.9 more sick days per year than those of non-smokers (Troelstra et al., 2020). On the individual level, the detrimental health effects of smoking negatively impact work capacity and lifetime earnings.

In Finland, smoking was estimated to have caused approximately €1.3 billion in economic costs in 2020. The direct costs attributed to smoking in 2020 were estimated to total around €630 million. The indirect costs of smoking were estimated to range between €536 million and €823 million euros. Smoking is believed to have caused approximately 4,600 deaths and about 500 new disability pension cases in Finland in 2020. (Finnish Institute for Health and Welfare, 2022) In comparison, the estimated costs in 2012 were around €1.5 billion (Miikka Vähänen, 2015). From 2012 to 2020, the costs associated with disability pensions saw the greatest percentage decrease, whereas the costs related to OH saw the greatest percentage increase. (Finnish Institute for Health and Welfare, n.d.; Heloma, A. et al., 2022) The impact of smoking on OHS costs has not been estimated in the same way as the impact on specialized or primary health care costs, due to a lack of disease-specific statistical data from OHS. In the assessment, it is assumed that the proportion of smoking-related costs within occupational health services aligns with the distribution of doctor visits in primary health care that are attributed to smoking. The estimated costs attributed to smoking in 2012 were around €3 million within the context of OHS (Miikka Vähänen, 2015). In 2020, the estimated costs of occupational health care related to tobacco-related diseases were approximately €6.1 million (Finnish Institute for Health and Welfare, 2022).

A large, population-based birth cohort study revealed that individuals who smoked throughout their lives and those with the highest number of pack-years

incurred the greatest productivity costs. This association was not explained by other risky health behaviours, cardiometabolic health or sex. It appears that cumulative exposure to smoking has a greater effect on productivity costs than the timing of smoking. Smoking can impact productivity costs through several mechanisms. Firstly, smoking is linked to poor health, increased mortality and sickness absences. Smoking can also negatively influence work outcomes. Employers may view hiring a smoker as a risk, which can result in reduced opportunities for higher-wage or managerial positions. Given that cumulative exposure to smoking appears to have a more significant impact on productivity costs than the timing of smoking, preventive strategies should focus on individuals with the most pack-years or those at risk of developing tobacco dependence to mitigate productivity losses. (Rissanen et al., 2024)

Smoking creates a substantial economic strain globally, particularly in regions with the most severe tobacco epidemic. This underscores the critical need for nations to adopt more robust tobacco control strategies to mitigate these financial impacts.

2.1.4 Prevention strategies for tobacco and nicotine use

The WHO Framework Convention on Tobacco Control (FCTC) represents a significant advancement in public health advocacy. This treaty, grounded in empirical evidence, underscores individuals' entitlement to optimal health standards. It also establishes legal frameworks for global health collaboration and mandates rigorous compliance criteria. In 2007, WHO launched MPOWER, a practical, cost-effective strategy that aims to enhance the implementation of the demand reduction components of WHO's FCTC. (World Health Organization, n.d.)

The six MPOWER measures are:

1. Monitoring tobacco use and prevention policies.
2. Protecting individuals from tobacco exposure.
3. Offering help to quit tobacco use.
4. Warning users about the health risks associated with tobacco.
5. Enforcing prohibitions on tobacco advertising, promotion and sponsorship.
6. Raising taxes on tobacco products.

Policies impact behaviour primarily through the interventions they facilitate or endorse. Therefore, positioning interventions between policies and behaviour is logical (Michie et al., 2011).

A concise representation of this relationship is the 'behaviour change wheel' (BCW), which consists of three interconnected layers, as illustrated in Figure 4. The

components of the COM-B model are surrounded by nine intervention functions (education, persuasion, incentivization, coercion, training, restriction, environmental restructuring, modeling, and enablement) as well as seven policy categories (communication, guidelines, fiscal measures, regulation, legislation, environmental/social planning, and service provision) within the BCW (Mersha et al., 2020). This model is non-linear, and highlights the interactions among the elements within the behaviour system, the intervention functions and the policy categories. (Michie et al., 2011)

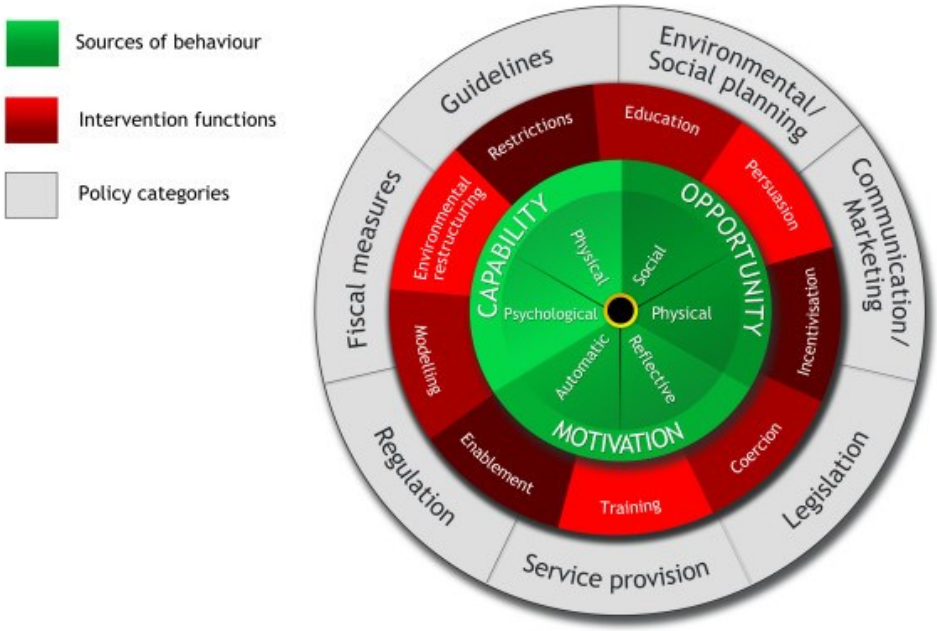

Figure 4 Behaviour Change Wheel. (Michie et al., 2011)

Like many other nations, Finland has enacted legislation aimed at creating a smoke-free society. The government's strategy to achieve this objective is to increase structural measures, which means higher taxes, stricter regulations on outdoor smoking and limiting the availability of cigarettes. The goal of Finland's updated Tobacco Act is to eliminate the use of tobacco and other nicotine products by 2030. To achieve this objective, the percentage of the adult population that consumes tobacco or nicotine products daily must drop to under 5%. (Savuton Suomi 2030, n.d.) The progression of the Finnish tobacco legislation is presented

in Table 2. Creating smoke-free public spaces not only safeguards non-smokers but also contributes to reducing the normalization of smoking within the community. The Tobacco Act:

- prohibits smoking in public places, on public transportation, on beaches, in playgrounds, at workplaces, and in areas surrounding day-care centres and schools.
- prohibits the display of tobacco products and e-cigarettes in sales outlets, except in tobacco shops in which they are not visible from outside.
- prohibits the sale, supply, or provision of tobacco products or nicotine-containing liquids to individuals aged under 18, and prohibits the importing or possession of such products by underaged individuals.
- prohibits the sale of tobacco or nicotine-containing products at day-care centres, schools, educational institutions, and their outdoor areas.
- strictly prohibits all forms of marketing of tobacco or nicotine-containing products.

Table 2 Finnish Tobacco Act (Savuton Suomi 2030):

In 1976, a law was enacted to reduce smoking, and the Tobacco Act came into effect on March 1, 1977.
In 1978, advertising of tobacco products was banned, and health warnings about the dangers of smoking on cigarette packages were introduced.
In 1995, smoking was prohibited in workplaces, although restaurants were exempt from the law. Workplaces were allowed to establish designated smoking areas. The age limit for purchasing tobacco was raised from 16 to 18.
In 2007, restaurants became smoke free, with a transition period until 2009. Restaurants were allowed to establish smoking areas with separate ventilation systems.
In 2010, a goal was set to eliminate the use of tobacco products in Finland.
In 2012, the display of tobacco products in stores and kiosks was banned.
In 2016, the Tobacco Act was completely revised, with the aim of ending the use of tobacco and other nicotine products by 2030.

In 2022, the Tobacco Act was amended, with the most significant change being the standardization of tobacco packaging. Tobacco packages were no longer allowed to feature brand logos and had to be uniform in colour, with health warnings in both images and text.
Smoking was also banned on public beaches and playgrounds. Smoking was prohibited on beaches from the beginning of May to the end of September.
The Tobacco Act was reformed on 1 August 2025. It is prohibited for individuals under the age of 18 to possess any tobacco-related products (nicotine pouches, vaping products and energy snuff). The law also bans the use of smokeless nicotine products in the indoor and outdoor areas of preschools, primary schools, secondary educational institutions, daycare centres and playgrounds. The remote sale and purchase of nicotine pouches is no longer permitted. From 1 February 2026, the sale of nicotine pouches with over 16.6 mg/g of nicotine will be banned.

Primary prevention consists of measures aimed at a susceptible population or individual. As its purpose is to prevent a disease from ever occurring, its target population is healthy individuals. It commonly involves activities that limit risk exposure or increase the immunity of individuals at risk, to prevent a disease from progressing to subclinical disease in a susceptible individual. Immunizations, for example, are a form of primary prevention. (Keyes Daniel et al., 2025) In the context of SC, this entails safeguarding children and adolescents from exposure to the temptation of experimenting with nicotine products. Another significant aspect is that employers are not exposed to passive smoking in the workplace. Smoke-free legislation protects bar and restaurant workers from exposure to tobacco smoke and its associated health risks. (Reijula and Reijula, 2010; Burkhardt et al., 2023). Limiting access to smoking, along with continuous communication about its negative health impacts, has effectively decreased smoking rates across the population.

Secondary prevention emphasizes early disease detection, and its target population is healthy-appearing individuals with subclinical forms of the disease. The subclinical disease consists of pathologic changes but no overt symptoms that are diagnosable during a physician's appointment. Secondary prevention is often in the form of screenings. (Keyes Daniel et al., 2025)

Tertiary prevention targets both the clinical and outcome stages of a disease. It is implemented in symptomatic patients and aims to reduce the severity of the disease as well as any associated sequelae. Whereas secondary prevention seeks to prevent the onset of illness, tertiary prevention aims to reduce the effects of the disease once it is established in an individual. Rehabilitation efforts are common forms of tertiary prevention. (Keyes Daniel et al., 2025) In an occupational context, this may include rehabilitation measures to help exposed and affected individuals

maintain their work ability. Collaboration between OHS and the workplace is essential.

A Cochrane review of 17 randomized controlled trials (RCTs), predominantly from high-income countries, demonstrated that training health professionals to deliver SC interventions enhanced their performance to ask about, counsel on, and assist with SC (Carson et al., 2012). While the majority of physicians and nurses concurred that their responsibilities included providing information to, motivating and helping patients to make lifestyle changes, only over half believed that they possessed adequate skills in lifestyle counselling (Jallinoja et al., 2007). A theoretical understanding of the psychological mechanisms related to behaviour change is essential. Research strongly backs up theories that suggest that the level of efficacy must be high for threatening information to have an impact, (Peters et al., 2013). In addition, preoperative SC interventions are underutilized, primarily because knowledge about them is insufficient (Ofori et al., 2024). Thus, continuous education is essential for all OH professionals.

2.1.5 Nicotine dependence

Tobacco and nicotine dependence is a chronic condition, and its effective management may require multiple treatment sessions and comprehensive support. Tobacco addiction is a syndrome characterized by physical, psychological and social dependence resulting from smoking. Nicotine addiction encompasses a range of symptoms, including the development of tolerance, withdrawal effects, and struggling to manage or reduce tobacco consumption. Nicotine, the primary reinforcing agent in tobacco smoke, affects the brain by interacting with neuronal nicotinic acetylcholine receptors (nAChRs). (Picciotto and Kenny, 2021; Mersha et al., 2023; Muza et al., 2024; Thornberry et al., 2020) Smoking and vaping during adolescence and early adulthood result in nicotine dependence. The cessation of nicotine intake can cause both somatic and affective withdrawal symptoms, which play a significant role in the continuation of smoking and relapse. In humans, common affective withdrawal symptoms from nicotine are cravings for cigarettes, depression, anxiety, anger, headaches, impatience, irritability, increased appetite and weight gain, difficulty concentrating, restlessness, sleep disturbances and cognitive impairments (Chellian et al., 2023; Conti et al., 2020). During the initial phase of SC, anxiety tends to be the most intense symptom that daily smokers face during the acute abstinence period, which can range from 1 to 24 hours. In addition, female smokers typically experience more intense mood disturbances and anxiety symptoms than their male counterparts. (Conti et al., 2020)

Research indicates that withdrawal symptoms play a significant role in relapses. Most individuals attempting to quit smoking experience a relapse within the first

week of abstinence, coinciding with the period when withdrawal symptoms are at their peak: 49%–76% of smokers relapse within one week, 72%–85% in one month, and 80%–90% in three months. (Hughes et al., 2004) Even minimal or light smoking (a few cigarettes per week) can result in signs of dependence, which predicts future smoking habits. Smoking does not have to be daily for dependence to develop; in fact, nearly 40% of smokers exhibit dependence before transitioning to daily smoking (Chellian et al., 2023). Individuals who begin smoking in their teenage years tend to have a stronger dependence on nicotine and are more likely to relapse when attempting to quit than those who start smoking in adulthood (Hu et al., 2020).

Tobacco cessation interventions are one of the most cost-effective health care services and workplace interventions (Le Foll et al., 2022; Ward et al., 2020; van den Brand et al., 2020). Health professionals play a vital role in tobacco cessation interventions (Evenhuis et al., 2023). Smokers who receive guidance from a nursing professional are more likely to successfully quit than those who do not undergo any intervention (Rice et al., 2017). A strong physician–patient relationship is an effective option for both short- and long-term SC programmes (Domić et al., 2024).

More than 60% of the 1.25 billion global adult tobacco users express a desire to quit. However, approximately 70% lack access to comprehensive tobacco cessation services. This is primarily due to the various challenges that health systems face, including insufficient human and financial resources, and limited capacities of tobacco cessation services at the national level. The WHO clinical treatment guideline recommends utilizing behavioural support in both clinical and community environments. It encompasses digital tobacco cessation interventions, pharmacological treatments and system-level strategies and policies designed to improve the adoption and implementation of tobacco cessation measures. (World Health Organization, 2024)

WHO emphatically advocates the training of all health care providers in the delivery of evidence-based cessation interventions, i.e. the 5 A's smoking intervention model which consists of the following five steps: (1) *Ask* all patients if they smoke, (2) *Advise* all tobacco users to quit, (3) *Assess* smokers' willingness to attempt to quit, (4) *Assist* smokers' efforts with treatment and referrals, and (5) *Arrange follow-up* contacts to support cessation efforts (Duodecim, 2024). The training should be integrated into their routine medical practices across all levels of health care settings, and should be accompanied by continuous prompting and feedback (World Health Organization, 2024). When a tobacco user receives advice from two or more health care professionals, the odds of successful cessation double (An et al., 2008; Tremblay et al., 2009).

The proportion of smokers who receive help from health care professionals is too low, and SC practices are poorly implemented (Andrés et al., 2019; Vallata et al., 2021; Ekblad, 2022; Lindson et al., 2021). Several key areas have been identified

that can foster implementation: individual factors such as skills, attitudes, self-efficacy, motivation, training and endorsement, including the perception that SC is not the responsibility of health professionals (Andrés et al., 2019; Ganz et al., 2015; Mersha et al., 2023; Muza et al., 2024; Pignataro et al., 2015; Thornberry et al., 2020). Additional obstacles cited by various health care professionals include organizational structure, resources, support, a shortage of time, infrastructure, patient needs, and cultural factors (Charlesworth et al., 2019). Primary care support for SC is often delivered ineffectively or inconsistently. Health providers may be unsure of the best methods of treatment, have limited time to deliver it, or lack the necessary resources. (Lindson et al., 2021)

Physicians play a key role in SC, and tend to more proactively discuss smoking with their patients than provide practical support or tools for cessation. It is important to recognize that physicians encouraging patients to quit smoking through direct communication has a significant impact. In failing to do so, they undermine the efforts of other health care professionals to help the patient stop smoking. Primary care physicians tend to offer smoking-related consultations more often than those in secondary health care. (Keto et al., 2015; Ilesanmi et al., 2024) Physicians and nurses who smoke traditional tobacco themselves are 17% and 13% less likely, respectively, to provide cessation advice to their patients (Duaso et al., 2017; Duaso et al., 2014; Prijić and Igić, 2021).

Organizational factors, including time constraints, conflicting policies, and insufficient training opportunities, especially those based on theoretical frameworks, have been identified as external negative influences on nurses' attitudes and behaviours when delivering SC interventions. These barriers contribute to the persistence of ineffective practices and uninspiring cessation programmes. According to the theory of self-efficacy, individuals need to be able to manage their environment to feel confident in developing and executing a skill or behaviour. Policies that fail to support SC intervention programmes or to maintain a smoke-free environment can create obstacles and undermine nurses' intentions. (Thornberry et al., 2020)

Although SC guidance has traditionally been given by physicians, numerous other health care professionals are well-positioned to offer counselling to their patients. Expanding counselling efforts to include a variety of health professionals can enhance community-wide initiatives that encourage individuals to quit smoking. The involvement of health care providers, their perceived self-efficacy and their awareness of available resources are strong factors linked to the effectiveness of counselling across different groups of health professionals. (Bodner et al., 2020; Tremblay et al., 2009)

The physical therapy field is committed to addressing the needs of individuals with physical disabilities, but physiotherapists often fail to offer tobacco cessation interventions (Darabseh et al., 2023). This shortcoming is also seen in other health

care professions, highlighting the need for enhanced services to tackle the health issues related to smoking. The lack of interventions has been associated with inadequate education on tobacco cessation counselling among health professions, which may explain the similar shortcomings observed in physiotherapy practice. (Bodner et al., 2020; Lee et al., 2021; Pignataro et al., 2015) Physiotherapists are well-positioned to implement SC guidelines due to their education, broad scope of practice and the trusting relationships they build with patients. However, the impact of physiotherapists demonstrating healthy behaviours and its influence on their patients' health habits has not been extensively researched (Bodner et al., 2020). The public also expects physiotherapists to advocate for SC and healthy lifestyles. However, formal training in SC is notably scarce, which hinders physiotherapists' ability and confidence to engage in cessation efforts, and thus results in the 5A's model being used infrequently. (Luxton and Redfern, 2020)

2.1.6 Digital interventions and mCessation

The application of digital technologies in the health care sector, known as *digital health*, has recently emerged as a crucial area for leveraging both conventional and cutting-edge information and communications technology (ICT) to meet various health-related requirements. Digital health interventions can be utilized to enhance personalized communication with individuals, through reminders and health promotion messages, for example, thereby increasing the demand for health care services and expanding access to essential health information. (World Health Organization, 2019) Mobile wireless technologies, or *mHealth*, play a vital role within the broader scope of eHealth, and involve the efficient and secure utilization of ICT to support health care and its related sectors. Presently, the term 'digital health' is frequently employed as an overarching term that includes eHealth, highlighting how of digital solutions have been comprehensively integrated into the health domain. (World Health Organization, 2021)

The proliferation of mobile devices such as smartphones and tablets has facilitated novel methods for delivering health services through mHealth systems. Broadly, mHealth can be defined as the practice of medicine and public health supported by mobile devices such as mobile phones, patient monitoring devices, personal digital assistants (PDAs), and other wireless devices. (Noorbergen,T. et al., 2021) With their wide reach and low dissemination cost, mHealth solutions represent a cost-effective method of helping people quit smoking. (World Health Organization, 2021)

The pandemic and its aftermath have shifted health service delivery from in-person to virtual appointments, and this may be a permanent change. This highlights the importance of virtual guidance for self-management and lifestyle

modifications for service users (Ball and Rivas, 2021). Rising health care costs also pose a significant social challenge for contemporary welfare states. Health apps and wearable technology could play a key role in reducing these expenses. The continuous use of health apps positively affects personal health. These tools are seen as advantageous in preventive medicine and disease monitoring, as gamifying health-related activities boosts personal motivation and improves co-ordination. In Germany, a digital care Act permits physicians to prescribe health apps and wearable devices to patients, provided these tools are certified and funded by statutory sources. It recommends that physicians should actively suggest and oversee the use of health apps to help individuals who may lack digital or health literacy. (Heidel and Hagist, 2020)

Mobile phone-based SC interventions offer several potential advantages: convenience of use anytime and anywhere, cost-effective delivery, and scalability to large populations irrespective of location (Iivanainen et al., 2024). These interventions can personalize messages on the basis of user characteristics such as age, gender and ethnicity. They can also deliver time-sensitive messages through a device that is always accessible, provide content that helps distract users from cravings and connect them with others for social support. (Whittaker et al., 2016; Zhou et al., 2023)

Although the number of mHealth technologies designed to help smokers quit is increasing, (Bricker et al., 2020; Santiago-Torres et al., 2022; Kwon et al., 2024) only a few have been scientifically validated, (Ortis et al., 2020; Bold et al., 2023). Some have not met eligibility criteria (Cobos-Campos et al., 2020) and many are of low quality (Seo et al., 2022; Bendotti et al., 2022). Research shows that only 4% has suitable scientific support (Haskins et al., 2017). Several mobile apps for SC exist, but most of them are based on extrinsic rather than intrinsic goals (Choi et al., 2014).

The increased utilization of gamification has been linked to higher self-efficacy and motivation to quit after using an app. This may be due to the fact that frequent gamification enhances overall user engagement with the app, which subsequently affects self-efficacy and motivation to quit (Rajani et al., 2021). According to SDT, which is a leading framework for understanding motivation, gamification components such as points and badges provide informational feedback that fosters a sense of intrinsically motivating competence among users. (Wee and Choong, 2019; Wang et al., 2021) It is crucial that a team of app developers, behavioural scientists, and public health experts take part in the creation of mHealth (Edwards et al., 2016; Ball and Rivas, 2021). Incorporating feedback from patients who accurately represent the intended audience is also essential for success. Gaining insights into user experiences is key if successful mCessation applications are to advance in the future. (Bendotti et al., 2022)

2.2 Role of occupational health services in smoking cessation

OHS have the potential to support SCTS and guide preventive health promotion activities for encouraging healthy lifestyles. Through collaboration, OHS and workplaces can enhance employee health and work ability, ensure safe working conditions, improve the functioning of the work community and prevent work-related illnesses and accidents. OH professionals are in a key position to address tobacco use among employees, which can lead to work- and lifestyle-related diseases and disabilities. By help employees quit smoking, employers can achieve cost savings through reduced health care and absenteeism expenses. OHS can also provide valuable advice to employers on implementing effective smoking policies and practices in the workplace. All OH professionals, including physiotherapists are needed to encourage smokers to quit smoking.

2.2.1 Occupational health services and health prevention

The WHO Health Assembly states that employees constitute half of the global population and significantly contribute to global economic development. Factors such as access to health services, workplace hazards and social and individual determinants all play a role in influencing employees' health. (World Health Organization, 2013) Considering that OHS are made up of health professionals who are skilled not only in their specific area of health care but also in addressing broader health concerns, OHS can significantly contribute to the overall health of the general population and to public health initiatives (Sakowski and Marcinkiewicz, 2019). A notable feature of the modern European labour market is the extended duration of working lives, a result of the rising life expectancy across Europe. Although this is a clearly positive development, it also presents certain challenges to societies, as well as to social security and health care systems. People are now expected to remain capable of working for longer than in previous years, which means that strategies in organizations tasked with safeguarding health and social well-being need to be updated. (Sakowski and Marcinkiewicz, 2019) OHS, by emphasizing the prevention of both work-related and non-communicable diseases – especially those associated with lifestyle and affluence – can significantly contribute to the protection of public health. Health promotion and preventive measures should be further integrated into the daily operations of OHS. Most European countries have ratified ILO Convention No. 161 on OHS. (Sakowski and Marcinkiewicz, 2019) Consequently, OHS are mandatory in most European nations.

2.2.2 Impact of lifestyle factors on work ability and disability

The notion of work ability encompasses various models and can be defined as an equilibrium between individual capabilities and job requirements (Gould R. et al., 2008). It incorporates factors such as the workplace and external environments (Gould R. et al., 2008). The term 'work ability' is generally applied in discussions on enhancing and sustaining the capacity to work and effectiveness. (World Health Organization, 2002)

Work disability is frequently assessed through sickness absence, which is characterized and quantified in various manners. Two key concepts concerning individuals of working age describe restrictions due to health or impairments:
(a) Temporary or short-term work disability, commonly referred to as 'sickness absence', and
(b) Permanent work disability, which can be partial or total.
Work disability may involve part-time employment or reliance on benefits such as disability pensions. The distinction between these categories varies internationally. In many European nations, sickness absence pertains to periods compensated by public sickness benefit systems or employer wage payment plans, commonly lasting up to 12 months. If the absence extends and becomes long-term due to a health condition, it is generally referred to as 'permanent work disability'. (Loisel P. and Anema J.R. (eds.), 2013) If work disability last over 12 months, person can apply for disability pension, which can be partial, temporary or permanent. (Työeläke.fi, 2025)

In the field of work disability prevention (Figure 5.) the worker is positioned at the centre, surrounded by four key systems that influence their work-limiting circumstances: 1. The personal system, which encompasses significant dimensions and social relationships; 2. The health care system, which involves the levels of care accessible to the worker and factors that affect the disability; 3. The workplace system, characterized by its socio-technical structures; and 4. The compensation system, governed by local regulations and stakeholders. The model acknowledges that the broader sociopolitical and cultural context are also influential factors in the work disability scenario. (Loisel P. and Anema J.R. (eds.), 2013)

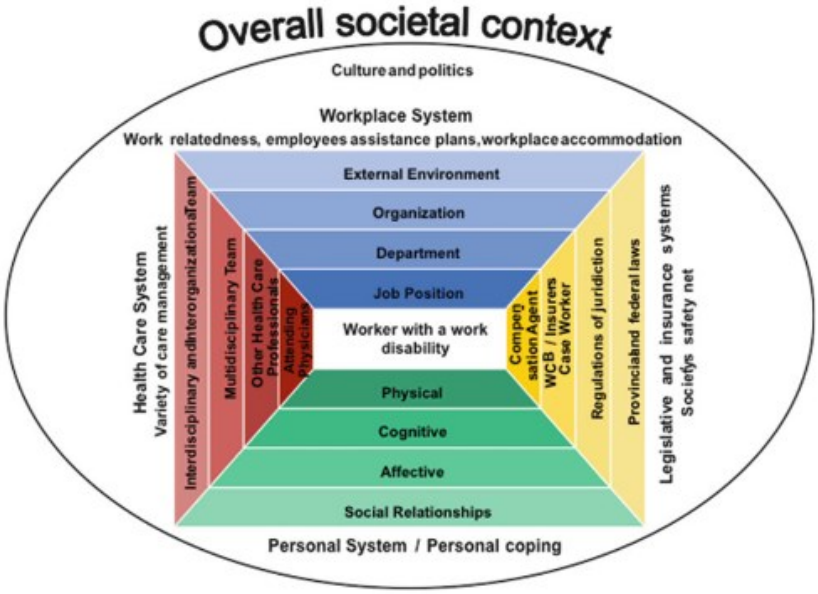

Figure 5 Work disability prevention arena. (Loisel 2013)

The International Classification of Functioning, Disability and Health (ICF) serves as WHO's model for explaining health and disability (Figure 6.) It provides the foundation for defining, measuring and shaping policies related to health and disability. This classification system is designed to be universally applicable in both health and health-related sectors. The ICF is part of WHO's suite of international classifications, which includes the well-known ICD-10 (International Statistical Classification of Diseases and Related Health Problems). Whereas ICD-10 offers a framework for categorizing diseases, disorders and other health issues based on diagnosis, the ICF focuses on classifying the functioning and disability linked to health conditions. These two systems are complementary, and their combined use is recommended for gaining a more comprehensive understanding of health experiences at both individual and population levels. (World Health Organization, 2002)

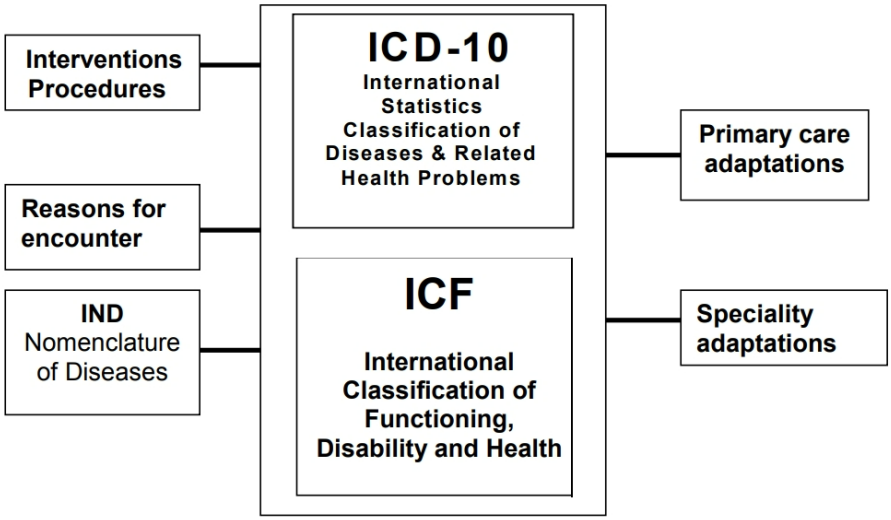

Figure 6 WHO Family of International Classifications. (World Health Organization, 2002)

Disability is a multifaceted phenomenon that encompasses both physical challenges and intricate social dimensions. It emerges from the interaction between individual characteristics and the broader context in which a person lives. Certain aspects of disability are predominantly internal and others are largely external. Thus, both medical and social interventions are essential for addressing the complexities of disability, and neither approach should be entirely dismissed. An improved model of disability integrates the insights of both medical and social frameworks, avoiding the reduction of this intricate concept to a single aspect. This comprehensive approach is known as the biopsychosocial model. The ICF is grounded in this model and thus offers a synthesized perspective that encompasses the biological, individual and social dimensions of health (Figure 7.) (World Health Organization, 2002)

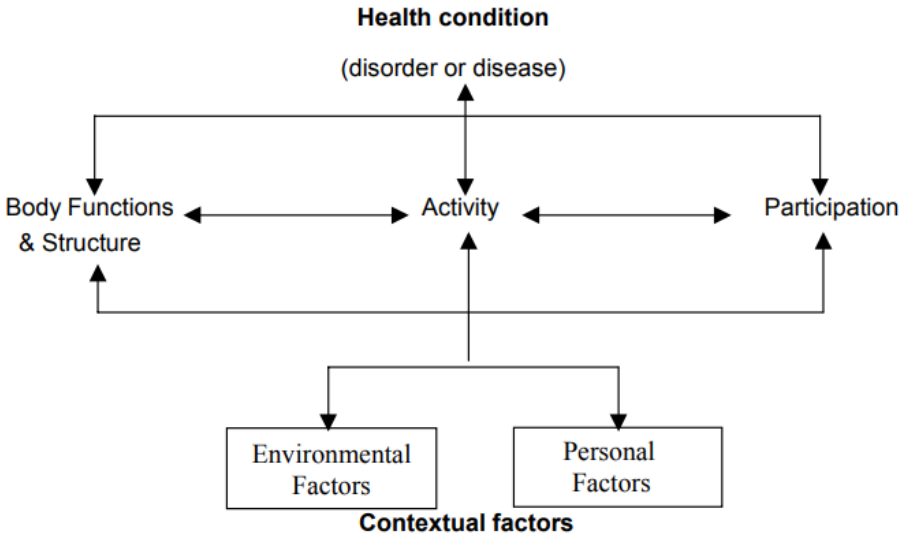

Figure 7 The ICF framework considers disability and functioning to be the results of the interplay between health conditions – such as diseases, disorders, and injuries – and contextual elements. (World Health Organization, 2002)

Behavioural and lifestyle-related choices influence health outcomes and work ability (Hoskins et al., 2019; Kuoppala et al., 2008; Pihlajamäki et al., 2019) and thus, beyond its general adverse health impacts, smoking also contributes to the risk of work-related disability (Airaksinen et al., 2019). Unhealthy lifestyle factors often cluster together (Virtanen et al., 2018). Both smoking and low levels of physical activity contribute to the risk of disability retirement (Lallukka et al., 2015; Airaksinen et al., 2019). Obesity and smoking have been associated with long-term sick leave (De Bortoli et al., 2021). The connection between smoking and obesity and sickness absence due to circulatory diseases is rated as strong or moderate. Similarly, smoking and low levels of physical activity are strongly or moderately associated with sickness absence due to respiratory diseases. (Virtanen et al., 2018) Smoking and alcohol have harmful effects; they damage the atrial myocardium, increasing the risk of atrial fibrillation and stroke (Ohlrogge et al., 2022). Smoking and excessive alcohol intake can lead to the development of stomach cancers. Furthermore, SC eliminates the risk of gastric cancer and gastric intestinal metaplasia after a cessation period of 30 years or more. (Hatta et al., 2024) Smoking is the most significant preventable health risk that impairs the working capacity of individuals at their prime working age (Airaksinen et al., 2017).

Smoking is associated with an increase in sickness absence rates (Troelstra et al., 2020b) and is a relatively strong risk factor for the transition to disability pension after sickness absence spells (Helgadóttir et al., 2019). The occurrence of moderate and long-term sick leave is significantly correlated with both past and present smoking behaviours (De Bortoli et al., 2021). In one study, smokers missed an average of 4.1 hours of work per week due to sick leave, 2.0 hours per week due to short-term disability, and 3.5 hours per week due to decreased productivity (Max, 2001). A patient's inability to quit smoking prior to surgery can prolong their disability, as being smoke free is a crucial requirement for such procedures, due to the risk of complications caused by smoking (Ofori et al., 2024). Moreover, personal lifestyle choices and physical health are linked to work engagement, (Nishi et al., 2017) which is subsequently associated with work ability (Airila et al., 2012).

The synergistic impact of cigarette smoking, second-hand tobacco smoke and occupational exposures to carcinogens has shown to considerably elevate the risk of numerous diseases (Andersson et al., 2021; Klebe et al., 2019; Jubber et al., 2023; d'Errico et al., 2020; Behrens et al., 2023b; Reijula et al., 2012; Lobo et al., 2022; Burkhardt et al., 2023). Smoking habits tend to vary significantly across different social classes. Individuals with lower socioeconomic backgrounds, often working in jobs with occupational risks, are more likely to smoke than those from higher social classes who typically have jobs without such exposures (Finnish Institute for Health and Welfare, n.d.). In the OH context, this means that certain professions predispose workers to both occupational exposures and the harmful effects of smoking. Nonetheless, focusing screening efforts on individuals at high risk – identified by their smoking history or exposure to occupational hazards – could potentially reduce work-related disability and mortality rates. To prevent diseases, quitting smoking is the most crucial step, followed by minimizing exposure to carcinogens at the workplace and in the work environment. (Lobo et al., 2022) Quitting smoking could potentially reduce the hazard ratio for work-related disabilities, such as extended sick leaves (lasting 90 days or more) or disability pensions, by 11%. The benefits of giving up smoking appear to be more pronounced in groups at a higher overall risk of work-related disability. (Airaksinen et al., 2019) In conclusion, primary prevention is vital, and SC is the most significant action.

As mentioned earlier, nicotine addiction meets the classification criteria for a chronic disease and is assigned ICD-10 codes (Table 3) (UW-CTRI, 2015). F17.2 is the specific code for nicotine dependence itself. F17.20 nicotine dependence, unspecified, is used when the specific type of tobacco product is not specified. This code encompasses both physical and psychological dependence on tobacco. In the ICF framework, 'functioning' encompasses all bodily functions, activities and participation. Similarly, 'disability' serves as a broad term that covers impairments, activity limitations and restrictions to participation. The ICF also identifies

environmental factors that interact with these elements. (World Health Organization, 2002)

Table 3 Nicotine dependence ICF codes (UW-CTRI 2015)

F17	**Nicotine Dependence:** for all nicotine dependence conditions
F17.2	**Nicotine dependence:** specific code for nicotine dependence itself
F17.20	**Nicotine dependence, unspecified:** when the type of tobacco products is not specified
F17.21	**Nicotine dependence, cigarettes**
F17.22	**Nicotine dependence, chewing tobacco**
F17.29	**Nicotine dependence, other tobacco products:** e.g., cigars, pipes, nicotine pouches, e-cigarettes

2.2.3 Finnish occupational health services

OHS play a crucial role in promoting and maintaining the health and work ability of employees across various environments. In Finland, collaboration between OHS and employers is statutory in cases of prolonged sickness absence. (Finlex, 2022) In Finland, legislation mandates that employers provide preventive OHS for their employees. These services are designed to pre-emptively address health issues related to workplace conditions and to ensure the overall well-being of the workforce. According to reimbursement data from the Social Insurance Institution of Finland (KELA), 2,035,000 employees, i.e. 89.9% of wage-earners, were covered by employer-provided OHS in 2022, which is a 3% increase from 2021. (Ministry of Social Affairs and Health.STM., 2025) In 2020, OHS covered 89% of employees. Of these, over 94% had access to OHS that provided not only statutory preventive services but also medical care. (Turunen, Jarno (2020)., n.d.) This comprehensive approach illustrates the emphasis that the Finnish labour market places on occupational health and safety.

In Finland, employers originally had the option to obtain OHS from a range of providers, including public health centres, private medical clinics, in-house OHS units and joint OHS for employers (Ministry of Social Affairs and Health., n.d.) However, over the past fifteen years, the provision of OHS has undergone a significant structural transformation (Sauni, R, 2012): outsourcing has increased substantially within the Finnish health care sector, and private OHS has become predominant. In 2023, 85% of OHS were private, 6% were public, 17% were in-house, and 4% were joint services (Nissinen, Sari; Kauranen, Tiina; Lappalainen,

Kirsi; Oikarinen, Tom; Virtanen, Elina, 2023). In contrast, in-house OHS has seen a decline and is now primarily utilized by the industrial sector. Regardless of the provider, all OHS must adhere to the national Occupational Health Care Act, which mandates compliance with the fundamental principles of good occupational health practice. This includes identifying, evaluating and monitoring work-related hazards and risks, and preventing work-related disabilities. (Ministry of Social Affairs and Health., n.d.)

OHS are provided by OH professionals (physicians, nurses and physiotherapists) and experts (psychologists). OH professionals and experts must complete at least fifteen credits of occupational health training within two years of assuming their occupational health duties. During this dissertation study, the classification of occupational physiotherapist changed from 'experts' to 'professionals' (Ministry of Social Affairs and Health, STM., 2021; the Social Insurance Institution of Finland (Kela), 2022). However, for the sake of clarity, this research refers to these three groups collectively as 'professionals'.

2.2.4 Smoking cessation measures of occupational health services

OHS encompass a range of promotion and prevention initiatives aimed at enhancing employees' health and work capacity. A healthy workforce is the foundation of a strong and resilient economy and society. Promoting healthy lifestyles at the workplace can significantly reduce absences, illness episodes, and the incidence of non-communicable diseases (such as cancer, obesity, cardiovascular diseases and diabetes) (European Agency for Safety and Health at Work (EU-OSHA), n.d.). The primary mandate of OHS is the promotion of health and the prevention of disease, enabling OH professionals to assist a larger number of individuals at an early stage, thereby preventing serious smoking-related health complications. (World Health Organization. Tobacco 2023., n.d.) OHS can be a valuable resource for aiding SCTS and steering various preventive measures and health promotion initiatives aimed at fostering healthy living habits (Rantanen J, Lehtinen S., n.d.), and represent a potentially significant avenue for SCTS for several reasons. First, OHS have unique opportunities to engage smokers through collaborations with employers. Second, in Finland, OHS cover 90% of the workforce, providing extensive reach. Third, employers have a vested economic interest in helping their employees quit smoking, given the correlation between smoking and increased sickness-related absences (Troelstra et al., 2020; (Yaman Güncan et al., 2021). OHS can play a dual role: supporting employees directly and advising employers on implementing effective smoking policies and practices. Effective decision-making regarding these promotion and prevention measures

requires active participation from both managerial staff and employees. (Schmidt et al., 2015)

The agreed measures encompass the following: 1. workplace initiatives to achieve a smoke-free environment, 2. workplace assessments, 3. an action plan and 4. interventions carried out by by OHS (including health examinations and medical treatment). The workplace and OHS can also jointly decide on substitution therapy practices, including whether the employer covers the associated costs. (Savuton Suomi 2030, n.d.)

The workplace presents a promising environment for reaching substantial populations to promote SC initiatives (Cahill and Lancaster, 2014; Rice et al., 2017; Yaman Güncan et al., 2021). Given that most adults spend approximately one-third of their day in a work environment, workplaces serve as an ideal setting for employees to attempt to quit smoking with support from OH professionals (Thornberry et al., 2020). Smoking habits exhibit polarization: individuals from lower social classes and those employed in occupations with inherent hazards tend to smoke more frequently than individuals from higher social classes who are not exposed to occupational risks (Finnish Institute for Health and Welfare, 2023). In practice, OH should identify these individuals and workplaces, and together with the employees, incorporate targets into the action plan after the workplace assessment. The revised Tobacco Act of Finland recommends that OH professionals include provisions in the company's OH action plan for assessing the use of tobacco and nicotine products and for providing cessation treatment (Duodecim, 2024). It is essential to implement interventions aimed at subpopulations of adolescents with higher smoking rates to prevent the adverse health effects associated with continued smoking.

OHS measures should be carried out in collaboration with the employer, occupational safety representatives, OH personnel, employees and employee representatives (Occupational Health Care Act, n.d.). Collaboration between OHS and employers is a prerequisite for effective OHS and healthy employees, and the following characteristics are crucial: flexible OHS and contracts, geographical proximity of stakeholders and long-term contracts. Successful partnerships rely on key elements such as the nature of dialogue, which highlights shared goals, reciprocity, frequent communication, and trust. Additionally, it's crucial to clearly define stakeholder roles to ensure effective collaboration. OHS providers are seen as experts capable of delivering high-quality services that are distinct from those provided by employers. The task is expected to shift from curing to prevention.. (Halonen et al., 2017) Relationships and collaboration develop in stages, and confidence and trust build up gradually through the collaborative process and dialogue. This requires effort from both parties (Schmidt et al., 2015).

In 2022, 3.7 million medical appointments and 1.4 million health check-ups were conducted in Finland. Additionally, 1.2 million individual counselling and

guidance sessions took place. Of all these appointments, a total of 1.5 million took place remotely. (Ministry of Social Affairs and Health.STM., 2025) This provides OHS with a unique opportunity to influence patient health behaviour with a multidisciplinary team. OH professionals should be adept at identifying and engaging with patients for whom quitting tobacco products is essential. For example, OH professionals play a pivotal role in supporting SC among patients scheduled for surgery.

Traditionally, OH physicians and OH nurses have been responsible for promoting SC. However, according to the WHO recommendations, all health care professionals should be involved in the cessation of nicotine and tobacco products (World Health Organization. Tobacco 2023., n.d.). However, in practice, physiotherapists, for example, do not adequately address SC counselling or management in their practice. Consequently, it is highly advised that universities and educational physiotherapy colleges globally incorporate SC guidelines into their curricula and integrate SC counselling competencies into the training of the practical and clinical skills deemed crucial for students of physiotherapy. Research has found that the most common barriers to incorporating SC counselling into physiotherapy practice and rehabilitation programmes are a lack of training, time and knowledge. Other barriers that have been identified are a professional role, commitment to, and self-efficacy in providing SC counselling. (Darabseh et al., 2023; Luxton and Redfern, 2020)

2.3 Summary and gaps in previous research

The tobacco epidemic is the most significant preventable health risk worldwide, and causes a loss of 8 million lives annually. On a global level, the use of combustible tobacco products is the most prevalent. Tobacco use is highly polarized: in developing countries, smoking is widespread, whereas in developed countries, the use of new tobacco products has surged, especially among children and adolescents. Various tobacco products are often used concurrently, leading to the development of nicotine addiction at an early age.

Smoking has generally decreased in many Western countries and across Europe, although there are significant differences between European nations in this respect. E-cigarettes have been marketed as a healthier alternative to smoking tobacco, and paradoxically, their use has increased dramatically among young people who have no prior smoking history. Young individuals who use e-cigarettes are three times more likely to start smoking as well. E-cigarettes contain numerous harmful chemicals and heavy metals. The use of nicotine pouches has also increased dramatically worldwide in recent years. These pouches can contain extremely dangerous levels of nicotine, and their use can lead to symptoms of poisoning.

Various flavourings enhance their appeal, and curiosity, enjoyment, flavours, and their perceived harmlessness are the primary reasons why people start to use them.

Nicotine is a toxin that has several detrimental health effects. It strains the heart by constricting blood vessels, increasing the heart rate, raising blood pressure, and potentially exposing individuals to arrhythmias. Furthermore, nicotine impairs the body's insulin sensitivity, which is associated with an increased risk of developing type 2 diabetes. A general threshold for severe poisoning is 1 mg/kg of absorbed nicotine, meaning that severe nicotine poisoning can result from an approximately 60-milligram dose.

The tobacco crisis leads to enormous economic losses, including direct costs from illnesses. Indirect effects include productivity losses due to illness. Employees who smoke tend to have more sick leave than non-smoking employees. Lifestyle choices, particularly smoking, affect work capacity and can lead to premature retirement. In certain industries in which workers are exposed to occupational carcinogens, smoking is particularly harmful.

The tobacco epidemic must be addressed at all levels: macro, meta, and micro. Political decision-making can influence how available products are to citizens. This entails effective utilization of primary, secondary and tertiary prevention measures.

Training health care personnel has shown to increase tobacco cessation interventions. However, only about half of health care professionals feel competent to provide lifestyle counselling.

In Finland, OHS cover 90% of employees, which offers a prime opportunity to promote healthy lifestyles through employer collaboration and personal guidance. The main goal of OHS is to enhance health and prevent illnesses, thereby improving work capacity and reducing premature retirement.

Research on SC support within the context of OH is scarce. Although SDT is a comprehensive theory of human motivation, its use in OH health promotion contexts remains underutilized. Interdisciplinary and multidisciplinary care have been examined in other fields, but research on OH lifestyle counselling is still relatively sparse. No research based on SDT has been conducted on lifestyle counselling within the field of OH, and health care professionals often feel that their skills in this area are weak. In addition, OHS are organized in various ways in Finland, and their operational cultures differ accordingly. Research on the strengths and areas that need improvement in the different OHS systems would be beneficial. In conclusion, when designing effective interventions for SC in OHS, it is essential to consider the users' perspectives and expectations.

Regular use of health apps can positively impact personal health. These apps are expected to play a crucial role in the future, emphasizing the importance of integrating self-tracked data into physicians' daily practices and diagnostic processes. Although the number of mHealth technologies aiming to help smokers quit has risen, only a limited number have been scientifically validated, and many

lack high-quality standards. In addition, many of them are based on extrinsic rather than intrinsic goals. Gaining a deep understanding of user experiences is crucial for enhancing future mCessation apps, and developers should work alongside multidisciplinary teams throughout the development process.

To our knowledge, this study is the first within the OH field to investigate SC support using a mixed-methods approach that is grounded in the key SDT and IPC frameworks.

2.4 Theoretical framework

I chose IPC and SDT as the frameworks for my doctoral research to examine how OH professionals conduct SCTS across various OHS and to investigate patients' expectations of SC practices. I employed a mixed-methods approach, which incorporated both quantitative and qualitative methods, as this scientific inquiry explored the various dimensions of a phenomenon to uncover findings that would have remained inaccessible using a single-method approach. The IPC model served as the conceptual framework for the second sub-study, and SDT functioned as the theoretical framework for the third sub-study. I selected these frameworks because both are well-established and extensively studied, yet their application in the context of smoking cessation within OHS remains underutilized.

OH professionals, that is, physicians, nurses and physiotherapists, form a naturally cohesive team within OHS. IPC among OHS professionals must be effective for optimal services to be delivered to clients. We need a deeper understanding of the phenomenon of IPC within the OH context, particularly in the execution of SCTS. In turn, the SDT framework provides insight into achieving effective smoking cessation, which can enhance the overall effectiveness of OHS initiatives.

2.4.1 Interprofessional collaboration (IPC)

IPC means that professionals from various health care fields exchange information and collaboratively decide on a patient's care using their combined expertise and skills (Carradore et al., 2021). IPC is a health care practice model that aims to enhance the quality of care. Approaches aiming to enhance collaboration between health care and social care professionals can lead to modest improvements in patient functional outcomes, professionals' adherence to recommended practices, and the utilization of health care resources. Communication and interaction issues among these professionals can create challenges in patient care. (Reeves et al., 2017) Following WHO's emphasis on the significance of IPC in 2010, research on this topic has increased substantially. (Wei et al., 2022) In health care, IPC refers to a continuous, dynamic partnership in which professionals from various

backgrounds and distinct professional cultures work together to deliver services that benefit health care users. (Schot et al., 2020) Collaborative practice thrives when health care professionals engage in shared decision-making and hold regular team meetings. This allows them to establish mutual goals and patient care plans, distribute individual and collective responsibilities, and manage shared resources effectively. The implementation of organized information systems, clear communication methods, robust conflict resolution strategies, and ongoing dialogue among team members and the community are crucial for fostering a positive work environment. (Reeves et al., 2018; Sangaleti et al., 2017)

Interprofessional education (IPE) is essential if the health workforce is to be equipped for collaborative practice, and their ability to address local health needs are to be effectively enhanced (Spaulding et al., 2021). A co-operative care setting requires IPE, which offers intentional training for developing skills and understanding the dynamics of collaborative practice (Figure 8.) (Hudson et al., 2017; World Health Organization, 2010)

Figure 8 WHO: Framework for Action on Interprofessional Education and Collaborative Practice

OH professionals offer a diverse set of skills and knowledge, which can be instrumental in helping organizations and workplaces improve their work environments. To fully leverage this expertise, interprofessional teamwork is essential, as it ensures high-quality support and services for occupational safety and health concerns. The terms interprofessional teamwork and IPC both refer to a scenario in which two or more professions work together in mutual respect and with a shared commitment to a common goal. To function effectively as a team, a group needs a unified team identity, mutual respect and trust, clearly defined roles, a shared goal, accountability in decision-making, a collective understanding, and commitment to the mission. Implementing interprofessional rounds and checklists can lead to modest enhancements in the utilization of health care resources. Similarly, interprofessional meetings may help improve adherence to recommended practices and the use of resources. Interprofessional care interventions rooted in practice can enhance health care procedures and results.

(Hudson et al., 2017; Reeves et al., 2017; Sangaleti et al., 2017) When IPC is successful, it can offer advantages to everyone involved: organizations, professionals and patients (Wei et al., 2022).

In OHS, IPC is essential, particularly for targeted projects designed to reduce workplace risks, to enhance ergonomics in the planning and execution of activities to preserve work capacity, and to boost psychosocial wellness at the workplace (Rogers et al., 2014). OH interprofessional teams must be comprehensively qualified to holistically address the work environment, organizational dynamics, and the health and productivity of individuals. They should also engage interactively with their clients. In the OH context, IPC improves the quality of the services provided. Although IPC has been extensively researched, studies conducted specifically in the OH context are globally limited. (Mouazzen et al., 2024) In Sweden, findings have shown that views on IPC vary depending on whether the professionals work for a private or public organization, or whether they are part of an external or in-house OH provider. (Mouazzen et al., 2024)

2.4.2 Self-determination Theory (SDT)

SDT, established by Deci and Ryan, is a key framework for understanding human motivation and personality, which highlights individuals' natural tendencies towards personal growth and fulfilling their psychological needs. SDT provides robust empirical support for the presence of three fundamental psychological needs that are crucial for human well-being and optimal functioning: autonomy (the experience of self-direction and volition), competence (the feeling of mastery, achievement, and effectiveness), and relatedness (the experience of caring and supportive relationships) (Martela and Ryan, 2024; Richard M. Ryan and Edward L. Deci, n.d.). The needs correlated relatively highly with each other (Martela and Ryan, 2024). Numerous research efforts have effectively utilized SDT to comprehend the range of health behaviours in different environments. (Cheung et al., 2020; Ntoumanis et al., 2021)

SDT has been particularly effective in pinpointing the psychological elements and mechanisms that drive motivated actions in various health-related scenarios. Moreover, interventions grounded in SDT have successfully enhanced motivation and encouraged engagement in health-related activities across a wide range of groups, settings and behaviours. Ryan and Deci (2000) emphasize that social settings can either foster or hinder the fulfilment of the three psychological needs, and thus affect the level of autonomous motivation. This, in turn, impacts the positivity of health behaviours and health-related outcomes. (Teixeira et al., 2020)

Motivation is not a single, uniform concept; it varies. People differ in both how strongly they are motivated and the type of motivation they have. The nature

of motivation refers to the core attitudes and goals that drive behaviour, essentially explaining why actions are taken (Ryan and Deci, 2000). For instance, a smoker might be motivated to quit due to incentives from their employer, such as extra pay, or they might want to understand their nicotine addiction and appreciate the benefits of quitting, such as better work performance, participation in sports, or a meaningful hobby. In these instances, although the intensity of motivation may remain constant, the type and direction of the motivation clearly differ.

SDT differentiates between the various types of motivation on the basis of the diverse reasons or objectives that prompt an action. The fundamental distinction lies between intrinsic motivation, which involves engaging in an activity because it is inherently interesting or enjoyable; and extrinsic motivation, which involves performing an activity to achieve a separate outcome. Extensive research over the past thirty years has demonstrated that the quality of an experience and performance can vary significantly depending on whether motivation is intrinsic or extrinsic. This section aims to revisit the classic distinction between intrinsic and extrinsic motivation and to summarize the functional differences between these two broad categories of motivation. (Ryan and Deci, 2000)

Intrinsic motivation

Intrinsic motivation refers to engaging in an activity for the inherent satisfaction and enjoyment it provides, rather than for any external reward or outcome. When a person is intrinsically motivated, they are driven to act by the pleasure or challenge that the activity offers, rather than by external incentives, pressures or rewards. Although intrinsic motivation can be seen as an individual's internal characteristic, it is also shaped by the interaction between and individual and their activities. Some people find certain activities intrinsically motivating, while others do not, and no single task will intrinsically motivate everyone. Ryan & Deci's approach primarily emphasizes psychological needs, specifically the innate needs for competence, autonomy and relatedness. SDT acknowledges that the satisfaction of these basic needs partially arises from engaging in interesting activities. The interpersonal factors and frameworks (such as rewards, communications, and feedback) that foster a sense of competence during an activity can boost intrinsic motivation for that activity by fulfilling the fundamental psychological need for competence. Intrinsic motivation is usually enhanced by elements such as optimal challenges, feedback that promotes effectiveness and the absence of disparaging evaluations. Individuals need to perceive themselves as competent (or self-efficacious) and feel that their behaviour is self-determined to sustain or enhance intrinsic motivation. In other words, a high level of intrinsic motivation requires the needs for both competence and autonomy to be satisfied. Research has largely concentrated on the impact of the immediate contextual factors that either support

or hinder these needs, but it has also acknowledged that individuals' stable inner resources can contribute to their persistent feelings of competence and autonomy.

Extrinsic motivation

To comprehend the motivation behind activities that are not perceived as inherently interesting, we must delve into the characteristics and dynamics of extrinsic motivation. Extrinsic motivation stands in contrast to intrinsic motivation, which involves engaging in an activity purely for the inherent enjoyment of the activity itself, rather than for its instrumental value. Unlike some perspectives that consistently view extrinsically motivated behaviour as non-autonomous, SDT posits that the autonomy of extrinsic motivation can vary. For instance, a health care provider can help individuals trying to quit smoking by presenting them with meaningful options, giving constructive and informative feedback, and showing empathy by acknowledging the patient's point of view. However, a health care practitioner might focus solely on the threats of harm, overlook the individual's ability to progress, and pressure the patient to quit. Communicating threats might lead to increased smoking among individuals who derive their self-esteem from identifying as smokers (Peters et al., 2013). Both scenarios involve goal-oriented actions, but the latter includes personal endorsement and a sense of volition, whereas the former is simply adherence to external pressure. Although both reflect deliberate actions, the two forms of extrinsic motivation differ in the degree of autonomy they encompass. Internalization refers to the process of adopting a value or rule, whereas integration involves individuals more thoroughly, incorporating the rule into their own beliefs and making it a part of their identity. Viewed on a spectrum, internalization illustrates how motivation for an action can vary from a lack of motivation or reluctance, through passive adherence, to active personal dedication (Figure 9).

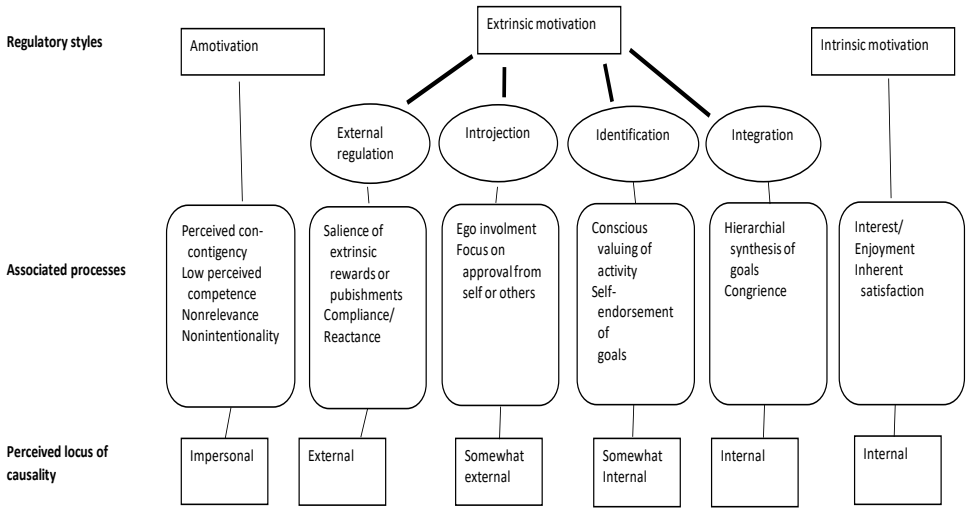

Figure 9 Intrinsic and extrinsic motivations. The different forms of motivation are arranged on the right of amotivation, to represent their varying levels of autonomy or self-determination. Figure adapted and modified from Ryan & Deci 2000.

2.4.3 Self-determination Theory in smoking cessation treatment and support

SDT-informed interventions in the health domain have been associated with significant improvements in satisfying the need for support, competence and autonomy (Sheeran et al., 2020; Ntoumanis et al., 2021; Gillison et al., 2019; Choi et al., 2014). One SDT-informed intervention on tobacco dependence aiming for SC has demonstrated cost-effectiveness (Pesis-Katz et al., 2011).

A tobacco dependence counsellor can help fulfil the fundamental psychological needs for autonomy, competence and relatedness by taking the patient's viewpoint on smoking and medication into account. They can offer clear reasons and effective strategies for change, encourage the patient to make self-driven efforts, and use language that is not controlling. They can also create a patient-focused plan that identifies the obstacles to change and the opportunities to develop skills and solve problems, while also maintaining a non-judgemental and consistently supportive attitude towards the patient. (Niemiec et al., 2023) Ryan & Deci (2018) describe (Figure 10) how autonomy support in the treatment context should increase both autonomous motivation and perceived competence (PC) for health behaviour change. Higher self-efficacy in avoiding smoking is also associated with greater cessation success. (Pardavila-Belio et al., 2019)

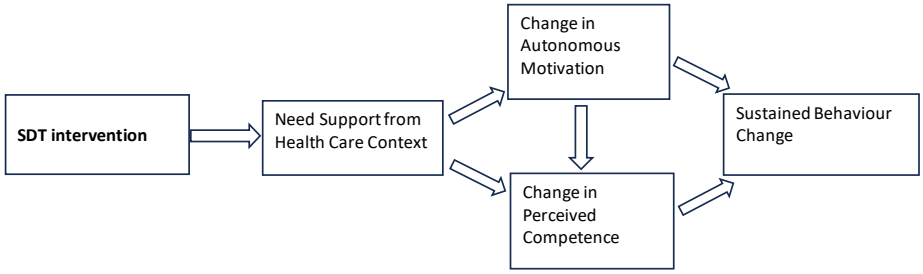

Figure 10 Fundamental components of the SDT framework for health-promoting behaviour change. Figure adapted and modified from Ryan & Deci, 2018.

The need for autonomy comes from an individual's inherent desire to perceive freedom in actions and to have control over their own behaviour. Autonomy pertains to the feeling that one's behaviour is deliberate and personally affirmed, and it can be evaluated using the Treatment Self-regulation Questionnaire (TSRQ), which measures reasons for quitting (Levesque et al., 2007; Williams et al., 2011). A person with a greater need for autonomy may develop more self-determined motivation to quit smoking than someone with a lesser need for autonomy, who in turn might prefer an expert telling them how best to quit. (Altendorf et al., 2021; Li et al., 2020) According to SDT, self-determined motivation mostly comes from a person's own values or interest – in this case, to quit smoking because it has personal value and satisfies the need for autonomy. (Altendorf et al., 2021) A physician's support of autonomy encourages a patient's autonomous motivation, which in turn predicts changes in how competent they feel to quit smoking. (Li et al., 2020) Encouraging patient autonomy, as supported by biomedical ethics, goes beyond simply allowing patients to make decisions independently. It involves guiding them to make informed choices, supplying the necessary information for decision-making, and honouring the decisions they ultimately make. As experts, health care professionals often need to guide patients by supplying essential information about health risks and the link between behaviours and their potential outcomes. For instance, if patients are unaware of the proven connection between tobacco use and heart issues, practitioners should present this information objectively. If patients are resistant to learning about these risks, the reasons behind this reluctance and what might motivate it should be explored. Importantly, the aim should not be to frighten or coerce patients into changing their habits. (Deci and Ryan, 2012)

Smokers' experiences or feelings of being able to successfully quit smoking can potentially be assessed using the Perceived Competence Scale (PCS) (Levesque et al., 2007; Williams et al., 2006b, 2006a). Individuals feel autonomous when their actions are driven by a sense of choice and volition, but they feel controlled when they experience external pressure or coercion to think, feel or act in specific ways. For instance, smokers are autonomously self-regulated (ASR) if they try to quit smoking because it holds personal significance for them (identified regulation) or aligns with their deeply held values and aspirations (integrated regulation). Conversely, smokers are controlled if they attempt to quit due to pressure from a health care provider or spouse (external regulation) or because they feel compelled by guilt or shame (introjected regulation). According to SDT, only individuals who feel they are making a change willingly (autonomously) are likely to gain from support that enhances their competence (Williams et al., 2011): they are more fully committed, persistent and effective than when their motivations are externally controlled (Deci and Ryan, 2012).

Social environments also play a crucial role in either supporting or hindering the fulfilment of psychological needs and the related health behaviours (Ryan and Deci, 2000). Individuals in environments that foster autonomy are more inclined to experience self-directed motivation, whereas those in environments that exert control are likely to feel more externally influenced (Deci and Ryan, 2012). In practice, the smoking group at the workplace may offer an essential sense of belongingness and connectedness, or what SDT refers to as a sense of relatedness. (Ntoumanis et al., 2021; Li et al., 2020) Enhancing employees' capacity to autonomously select smoking cessation programs, bolstering their competence in quitting, and fostering better relationships with both fellow smokers and health services are expected to lead to increased smoking cessation rates (Ross and Barnes, 2018).

2.4.4 Comprehensive Frameworks for Behaviour Change

Motivational Interviewing

Motivational Interviewing (MI), introduced by Miller in 1983, is a goal-oriented, patient-centred counselling approach that facilitates behaviour change by helping individuals address ambivalence (Lindson et al., 2019). Its core principles are empathy, developing discrepancy, rolling with resistance and supporting self-efficacy (Miller & Rollnick, 2013). MI views low motivation as a dynamic state and encourages individuals to reflect on their behaviours. Although initially designed for alcohol misuse, MI may also help smoking cessation. However, comparisons between MI and no smoking cessation intervention are limited. A systematic review of 37 studies found insufficient evidence that MI improves smoking cessation outcomes (Lindson et al., 2019), particularly among those with low baseline

motivation (Kumar et al., 2022). Brief Interventions (BI) aim to motivate changes in high-risk behaviour (World Health Organization, 2025). BIs for tobacco use disorder are designed to strengthen motivation to change, deliver evidence-based support to reduce tobacco consumption or facilitate complete cessation (Kumar et al., 2022).

Transtheoretical Model

The Transtheoretical Model (TTM), developed by Prochaska and DiClemente in the late 1970s describes behaviour change as a progression through six distinct stages, which each have specific processes (Abrash Walton et al., 2022; Prochaska and DiClemente, 1983). These stages are precontemplation, contemplation, preparation, action, maintenance and termination (Cahill et al., 2010; DiClemente et al., 1991; Prochaska and Velicer, 1997). Professionals can motivate smokers to progress during the contemplation stage (Siewchaisakul et al., 2020). Interviewing individuals at each stage can reveal their unique barriers and motivations (Abrash Walton et al., 2022).

COM-B System

The Behaviour Change Wheel (BCW) is a framework for designing behaviour change interventions, centred on the 'COM-B system', which is made up of capability, opportunity and motivation (Michie et al., 2011). Each component encompasses various subcomponents, and their the interactions influence behaviour (Mersha et al., 2020). The BCW helps researchers and policy-makers develop strategies to strengthen adherence to nicotine replacement therapy (NRT) and support smoking cessation (Mersha et al., 2020). Figure 11 illustrates the potential interactions among the system's components. For instance, opportunity can affect motivation, as can capability; engaging in a behaviour can also change capability, motivation and opportunity.

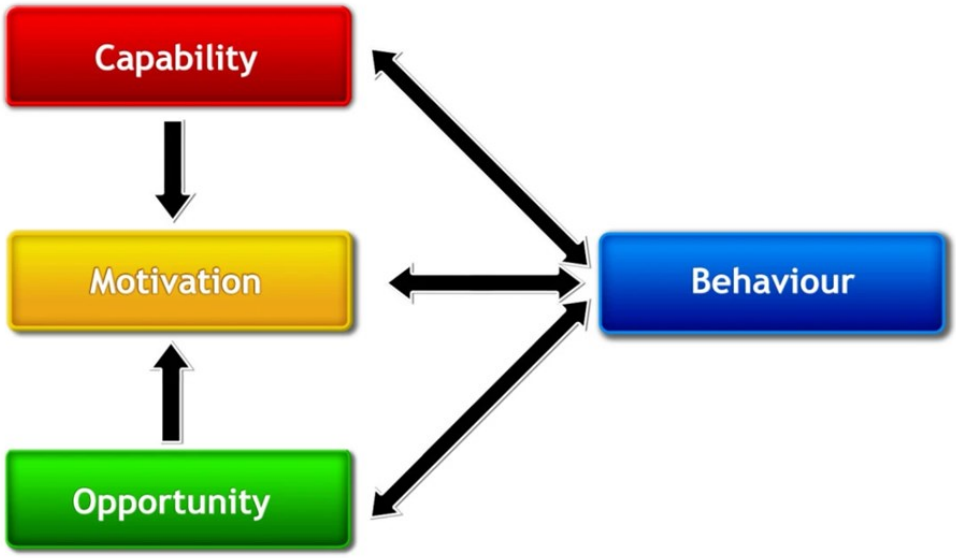

Figure 11 COM-B system – a framework for understanding behaviour. Michie 2011.

Health Belief Model

Developed in 1966, the Health Belief Model (HBM) guides health promotion and disease prevention initiatives, focusing on the personal beliefs that influence health behaviours (Jones et al., 2014). Its key factors are perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy (Rural Health Information Hub, 2025). Eighteen HBM studies showed significant increases in patient adherence, with 83% of patients showing improvement (Jones et al., 2014).

Social Cognitive Theory

Social Cognitive Theory (SCT), established by Bandura in 1977, explains how health behaviours are influenced by experiences, the behaviours of others and environmental factors. SCT promotes behaviour change through social support, expectations and observational learning (Rural Health Information Hub, 2025). Its key components are self-efficacy, behavioural capability, expectations, expectancies, self-control, observational learning and reinforcement (Bandura, 1986). SCT has been applied in various contexts, including clinical settings, health promotion, education, health policy initiatives and environmental education strategies (Manjarres-Posada, N. et al., 2020).

2.4.5 Insights from Key Theoretical Models

Health behaviour models significantly enhance workplace health (Yaman Güncan et al., 2021). Behaviour change techniques (BCTs) for smoking cessation have been highly cost-effective (Lorencatto et al., 2016) and relevant across various disciplines and populations (Michie et al., 2013). The perceived benefits and barriers of HBM align with the outcome expectancies of SCT (Jones et al., 2014). A comprehensive taxonomy of BCTs has recently been created for implementing complex interventions (Michie et al., 2013). HBM and TTM courses have shown to have a practical impact on both smoking cessation and progression between the stages. TTM-based interventions have proven valuable for understanding the various stages that individuals go through to quit smoking. (Ravi et al., 2021) MI and SDT share a similar approach to engaging individuals, and emphasize the importance of change talk in facilitating health-related behaviour shifts (Leino et al., 2020; Miller & Rollnick, 2013). Prioritizing quality over quantity in change talk is essential for effective practice (Deci & Ryan, 2012), as is distinguishing between autonomous and controlled change talk. SDT's support of autonomy is at the heart of all person-centred approaches, including MI, and should remain so (Deci and Ryan, 2012).

3 Aims of the study

In this doctoral research project, I aimed to investigate SC practices in Finnish OH settings and to enhance the toolkit using complementary methods. The findings can be used to inform more effective tobacco cessation strategies within OHS.

This dissertation consists of three sub-studies, which aimed to answer a specific research question. The questions are followed by our related hypotheses.

The sub-studies aimed to answer the following questions:

1. *Research question for Sub-study I: What are occupational health professionals' attitudes, knowledge and motivation regarding smoking cessation treatment and support?*

   Hypothesis: The attitudes, knowledge and motivation of occupational health professionals regarding smoking cessation may vary.

2. *Research question for Sub-study II: What are the perspectives of the various occupational health professionals on interprofessional collaboration within different occupational health service systems?*

   Hypothesis: Perspectives of interprofessional collaboration may vary among different professional groups within various occupational health service systems.

3. *Research questions for Sub-study III: How do individuals experience and perceive various smoking cessation treatment and support methods, including mCessation? How do these methods align with Self-Determination Theory, and which of the basic psychological needs—autonomy, competence, and relatedness—are considered most important for smoking cessation treatment and support?*

Our preliminary understanding was that the basic psychological needs of autonomy, competence, and relatedness might be reflected in the replies. Self Determination Theory guide the analysis.

4 Materials and methods

A current state analysis of OHS was required to achieve the research objectives and to address the research questions. This involved assessing the attitudes, skills and motivation of OH professionals (physicians, nurses and physiotherapists). Their IPC was examined using various OHS frameworks. I also evaluated the collaboration between OHS and workplaces. I began to seek answers to the research questions through professional associations of different specialists, by conducting a cross-sectional survey of samples that were representative of the national population.

The SDT developed by Edward Deci and Richard Ryan is one of the most extensively researched motivation and needs theories today, with hundreds of studies published each year. This extensive body of research underscores the versatility and applicability of SDT across various contexts, making it a compelling choice as the theoretical framework for my study. By leveraging its comprehensive insights into motivation and behavior, I aim to deepen the understanding of how these principles can effectively inform interventions in my area of research.
Collaboration with various OHS units yielded a need for an SC application, particularly one that incorporated gamified features. We thus developed a mobile gaming application based on SDT, and held a co-design workshop to identify user needs.

The research for this dissertation received support from the Ministry of Social Affairs and Health's health promotion funding in 2016–2018: *Support for smoking cessation in occupatioal health services* (Sosiaali- ja terveysministeriön (STM) terveyden edistämisen määräraha 2016–2018: Tupakoinnin lopettamisen tuki työterveyshuollossa).

4.1 Study design

This doctoral research comprised two quantitative sub-studies that utilized a cross-sectional design. These sub-studies examined the SC practices of OH professionals in Finland. The first assessed the current state of OH professionals' attitudes towards, knowledge about and motivation for SC. The next explored the professionals' approach to IPC. One of the sub-studies compared the SC approaches employed by professionals across various OHS. The third sub-study explored the

user perspectives on SCTS and mCessation, guided by SDT. The co-design workshops partially aimed to evaluate the SDT-based mobile game application that we developed, and to assess the various existing SC practices. Figure 12 summarizes the design and population of the individual sub-studies.

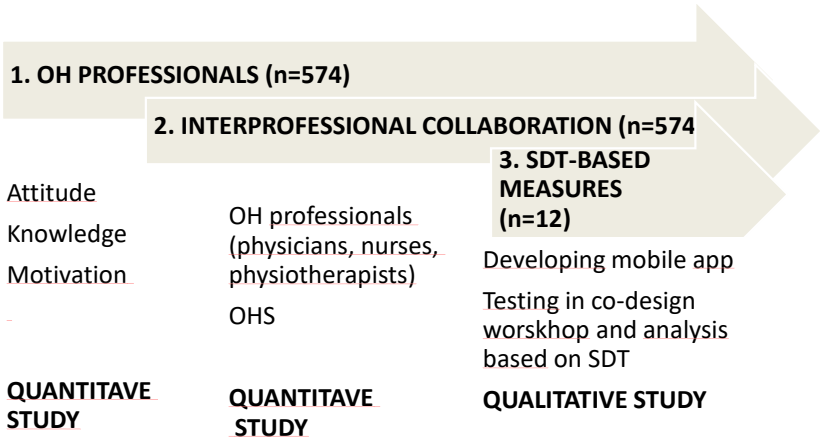

Figure 12 Study design of Sub- studies I, II and III

4.2 Study population and design (Sub-studies I and II)

We conducted a descriptive cross-sectional study of OH professionals. This nationwide survey was administered in Finland over two distinct periods, in 2013 and 2017. In 2013, OH physicians and OH nurses participated by completing an online questionnaire, whereas in 2017, the survey was extended to include occupational physiotherapists. The interprofessional OH teams comprised at least OH physicians, OH nurses and occupational physiotherapists. The study focused on SCTS practices in OHS, which align with the regulatory framework set by Finnish OHS legislation.

The study participants were recruited through partnership with national trade unions representing OH professionals. These unions provided updated registries of active members, encompassing OH physicians, OH nurses, and occupational physiotherapists. An administrative staff member from the trade union distributed an online questionnaire to the OH professionals whose email addresses were accessible for research purposes in the union's membership records. The respondents' confidentiality was strictly maintained, and we ensured that their identities remained undisclosed to the researchers. Individuals engaged solely in

administrative roles, including administrative staff, were excluded from the data analysis. The questionnaire was sent to 1290 OH physicians, 1468 OH nurses, and 490 occupational physiotherapists. In total, 182 OH physicians (response rate 15%), 296 OH nurses (21%), and 96 occupational physiotherapists (19%) participated in this anonymous and voluntary study.

The Finnish Medical Association (FMA) reports that most OH physicians are female, and account for 67.9% of the demographic, but in our study, this figure was slightly lower, at 64.0%. The average age of OH physicians according to FMA is 52, which closely aligns with our study's finding of 51. Similarly, data from the Finnish Association of Occupational Health Nurses indicates a female representation of 99.4%, whereas in our study it was 99.0%. The average age of OH nurses, as per FAOHN, is 50, but was 48 in our study. The Finnish Association of Occupational Physiotherapists reports that women constitute 89.0% of its members, whereas our study found a slightly higher percentage of 91.0%. The mean age of occupational physiotherapists is reported as 52.3, which closely matches our study's result of 52.5 years.

As previously found in 2023, OHS comprised 85% private, 6% public, 17% in-house, and 4% joint service providers. In Sub-study II, the participants represent the diversity of OHS well. The characteristics of the participants in Sub-studies I and II are summarized in Table 4.

Table 4 Baseline characteristics of study population in Sub-studies I and II

	All (n=574)	**OH Physicians (n=182)**	**OH Nurses (n=296)**	**Occupational Physiotherapists (n=96)**
Sex (male/female), %	13/87	36/64	1/99	9/91
Age, years Mean (SD)	49.7(9.2)	51.0(9.1)	48.0(9.6)	52.5(6.8)
Working years Mean (SD)	15.3(9.7)	15.8(10.0)	14.3(9.2)	16.4(10.0)
Smoking				
daily %	0.7	0.5	1.0	0.0
occasionally %	3,7	2.7	5.1	1.0
ex-smoker %	9.4	7.1	11.9	6.3
never %	86.2	89.6	82.0	92.7
OHS provider				
In-house OHS %	27	29	29	16
Public OHS %	27	21	33	23
Private OHS %	34	33	34	33

Note: * Such as entrepreneurs/self-employed individuals

4.2.1 Questionnaire instruments (Sub-studies I and II)

The study questionnaire was a modified version of a previously published questionnaire (Heloma, A., 2003), and was formulated on the basis of studies and material from the Finnish Tobacco Act and the Finnish Current Care Guidelines on Tobacco. The initial data had been collected in 2013 and focused exclusively on OH physicians and nurses, so questions concerning occupational physiotherapists were added. We tested the questionnaire with OH professionals and then validated it. Attitudes, knowledge and motivation regarding SC were addressed using subscales in the broader survey. The questionnaire contained sections on the SC practices of OH professionals, such as whether they engaged in discussions about smoking habits with their patients and whether they allocated sufficient time for such discussions. It also contained questions to assess the current implementation of the Finnish Smoking Cessation guideline. One section of the comprehensive questionnaire focused on the types of methods and measuring equipment in use. The questionnaire also elicited whether the professionals were aware of smoke-free workplace regulations and whether they collaborated with workplaces to promote smoke-free policies. The extent of the collaboration among OH professionals was also examined.

In Sub-study II, we gathered information about the OH professionals' employers and classified them into several categories: public health services, private medical services, in-house OHS (including those provided collaboratively), and other types, such as self-employed individuals. To evaluate the collaboration among OH professionals, we asked the respondents about the clarity and definition of their roles and responsibilities. We inquired about the fluidity of IPC and how well the professionals acknowledged each other's SCTS skills and knowledge. The professionals were asked to assess whether patient follow up was systematically planned and evaluated in the SCTS framework, and to evaluate whether the SCTS process was implemented effectively. Figure 13 presents flowcharts for Sub-studies I and II.

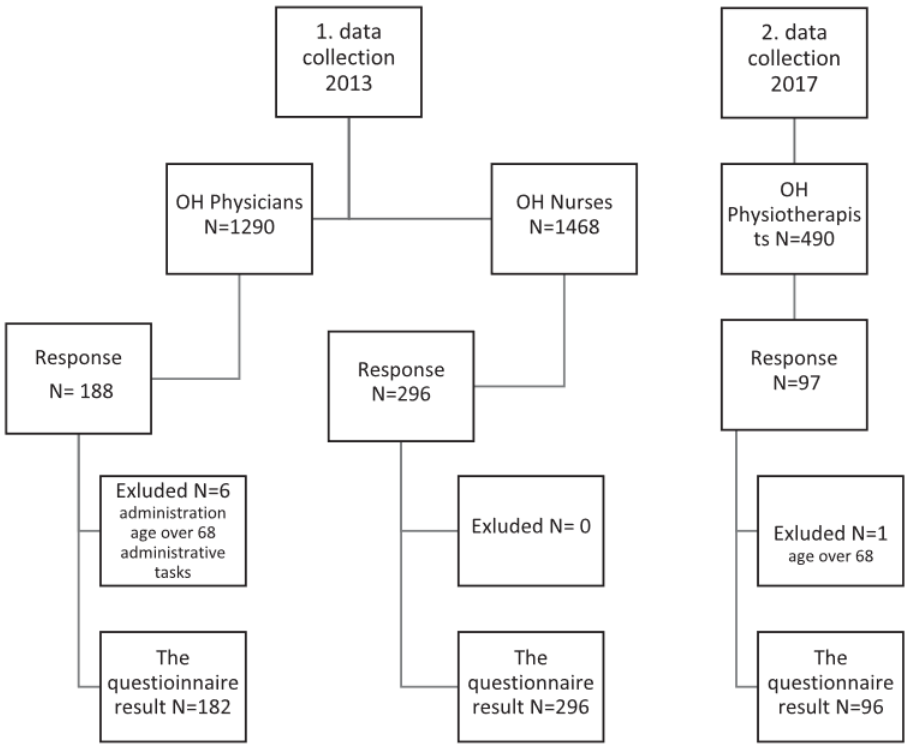

Figure 13 Flowcharts for Sub-studies I and II

4.2.2 Statistical analyses

Sub-study I reported descriptive statistics as mean ± standard deviations for continuous variables and as percentages for categorical variables. To analyse differences among the three OH professional groups, we utilized one-way (ANOVA) for variables with normal distribution, the Kruskal–Wallis test for non-normally distributed continuous variables, and the Chi-square test for categorical variables.

Table 5 presents the statements used to measure attitudes, motivation and collaboration. We used a Likert-type scale to evaluate the variables: 1=completely disagree, 2=somewhat disagree, 3=neither agree nor disagree, 4=somewhat agree, or 5=completely agree. For assessing OH professionals' knowledge, the response options were 'yes' or 'no'. We also elicited perceived current and target levels of knowledge, using a scale of 0 to 10. The questions were: 'How do you rate your current knowledge?' and 'At what level would you like your future knowledge to be'?

The questionnaire encompassed various potential subscales, and we employed exploratory factor analysis to identify potential factors related to attitudes and motivations, given the numerous variables involved. Exploratory factor analysis of

16 statements revealed attitude and motivation subscales. The attitude subscale comprised four statements, whereas the motivation subscale had six statements. Cronbach's alpha was used to assess the reliability of these subscales. For the knowledge subscale, which was measured on a continuous scale, we applied the Mann–Whitney test to compare the OH professionals' perceived current knowledge and their targeted future knowledge.

We first analysed each statement on motivation and attitude individually. We then combined the motivation and attitude statements into two mean scores, ranging from 1 to 5. The mean motivation score was derived from six statements, with a Cronbach's alpha of 0.85. The mean attitude score was based on four statements, with a Cronbach's alpha of 0.756. Based on these composite scores, the Mann–Whitney U test identified the statistically significant differences between OH physicians and OH nurses or occupational physiotherapists.

A p-value of less than 0.005 was considered statistically significant. All analyses were performed using SPSS software (version 25, IBM Corporation, New York).

Sub-study II employed a stratified sampling approach to categorize participants into distinct subgroups. Descriptive statistics were presented as mean ± standard deviations for the continuous variables and as percentages for the categorical variables. Our questionnaire featured multiple subscales, and we utilized exploratory factor analysis to identify the factors related to collaboration. An analysis of 22 statements yielded subscales pertaining to attitude, motivation, organization, smoking and collaboration with OHS. The collaboration subscale comprised six statements, with a Cronbach's alpha of 0.90.

To process the collaboration-related statements, each statement was initially assessed individually. After this, the statements were aggregated into mean scores, ranging from 1 to 5. Using these aggregated scores, we applied the Kruskal–Wallis test to ascertain statistically significant differences among the OH physicians, OH nurses, and occupational physiotherapists. In the post-hoc analysis, Kruskal–Wallis tests with Bonferroni correction were conducted to identify significant differences between OH professional groups. Similar comparisons were performed in different OHS systems.

The aim was to analyse OH professionals and OHS providers collectively. Following the preliminary analyses, we developed statistical models. We applied a generalized linear model, utilizing mean scores as dependent variables and treating employers as factors. Our modelling approach involved constructing separate models for OH professionals (Model 1) and OHS providers (Model 2), using OH physicians or in-house OHS as reference groups. These groups were chosen as references because they had the highest mean collaboration scores, which indicated the smoothest collaboration. To account for the influence of employers on OH professionals, we developed a model that incorporated both factors (Model 3). Finally, we integrated their interaction into the model. All analyses were performed

using SPSS software (version 29, IBM Corp., Armonk, NY, USA). Table 5 describes the questionnaire variables in Sub-studies I and II.

Table 5 Questionnaire variables in Sub-studies I and II

Attitude	In my work, I am committed to promoting smoke-free practices at the workplace I would like to emphasize smoke-free practices in several OHS processes I am likely to emphasize that not smoking enhances well-being at work and that SCTS is a part of every patient's medical treatment plan I would like to emphasize that being smoke-free enhances well-being at the workplace.
Knowledge	I am familiar with the Current Care Guideline on tobacco dependence and cessation I gained my knowledge on smoking cessation through further training I gained my knowledge on smoking cessation during my basic education I gained my knowledge on smoking cessation during my specialization studies I am trained in leading smoking cessation groups I gained my knowledge on smoking cessation on optional courses during my education
Motivation I would gladly participate in training that focuses on:	the theoretical background of SCTS smoking cessation counselling methods (motivational interview) measuring equipment providing information on the availability of SCTS at the workplace

	assessing the general effectiveness of SCTS among patients/at the workplace training that provides smoking cessation expertise
Collaboration OH professionals and OHS providers	The roles and responsibilities of professionals are clear Patients' SCTS follow-up is planned Collaboration between OH professionals is seamless The SCTS model is effective OH professionals acknowledge each other's knowledge and skills OH professionals evaluate SCTS through interprofessional collaboration

4.3 Study population and design (Sub-study III)

This qualitative sub-study was partially connected to the SDT-based mobile game application we developed to support SC (Table 6). It had two phases – co-development of the app and a co-design workshop for potential users. In the co-design workshop, the participants evaluated the features of the application and provided suggestions for improvements. Sub-study III focused on how the respondents' comments reflected SDT (Step 6 in Table 6)

Table 6 Substudy III flowchart in accordance with the Intervention Mapping Protocol.

STEP	TASK
Step 1. Identify the quality and shortcomings of current applications	The planning group discusses initial ideas for the programme and selects a theory. Scientist group (health, medical and social marketing) (N=3)
Step2. Identify the determinants of the health-promoting app and evaluate the collaboration with the stakeholders	Co-creation with stakeholders: OH unit director and OH professionals (n=7)
Step 3. Create an app based on SDT	Co-development of the app by a multidisciplinary scientist group (health, medical and social marketing) (N=3) and game designers and developers (n=7)
Step 4. Assess the app	Testing the usability of the app (OH professionals and their client workplace, workplace leader, (1) HR, (1) and their employees (n=10)
Step 5. Assess the users' needs and perspectives of the application and how well it supports smoking cessation.	Co-design workshop for educational institution teachers and leaders (n=2) and students (n=12)
Step 6. Analyse the results	Qualitative analyses based on SDT

4.3.1 Co-development of the app

The digital game intervention was designed using the Intervention Mapping Protocol (IMP), as outlined by Fernandez et al. (2019) and Saleme et al. (2021). Its main objective was to assess the quality of and to identify the shortcomings of current mCessation apps. Our focus was on developing an app grounded in SDT to stimulate autonomous and intrinsic motivation by addressing the basic psychological needs of autonomy, competence and relatedness. The IMP process began with assessing needs and defining the goals and priorities of the mCessation features. A literature review was conducted to evaluate existing apps and to identify whether consistent theoretical frameworks were lacking. The aim was to develop an app based on SDT. Key stakeholders were involved throughout the process.

The project aimed to co-develop an app through collaboration between OHS and workplaces, incorporating stakeholder input into the digital game solution. The key stakeholders were OH professionals, client companies, employees and employers. These groups provided valuable insights, particularly regarding the need for modern, gamified cessation tools for specific groups such as young people.

Employers who were smokers interested in quitting contributed their opinions and expectations during the development of the app. We evaluated the app

using a two-stage strategy: first, we tested its usability, then we implemented a consumer-driven, co-design approach.

A multidisciplinary team participated in the process, which consisted of health, medical, and social marketing scientists, game designers, OH professionals, workplace leaders, HR professionals, employers, educators and students. Continuous consultation with the Metropolia Game Lab and collaboration with OH professionals and client companies ensured that the app was user-driven, promoted employee health and supported SC.

4.3.2 Co-design

Researchers have highlighted the complexity of designing and developing mHealth systems, often pointing out pitfalls that hinder their adoption and effective use. These challenges arise from limited stakeholder involvement and poor integration with existing health systems. To tackle these issues, scholars advocate co-design in mHealth development. Co-design involves collaboration between designers and non-designers during the design process. The main reasons for employing co-design are: (1) mHealth's complexity necessitates diverse stakeholder involvement: consumers, government representatives, health practitioners, scientists and developers, because co-design fosters essential collaborations; and (2) co-design ensures that mHealth systems are informed by expert insights and best practices. (Noorbergen,T. et al., 2021)

Co-design is a human-centred design methodology employed in research-action projects to develop products or services in which end users, or potential users, collaborate in knowledge creation and generate ideas alongside researchers and designers. By involving users as experts in the use of a product or service, co-design can promote social innovations in our rapidly changing world. (Tremblay et al., 2022) Utilizing a co-design strategy in the creation of mHealth tools can significantly enhance their inclusivity. (Latulippe et al., 2020)

Co-design is gaining popularity in many organizations, particularly when it is expected that the product will deliver specific benefits and achieve the goals of their projects. It is also being increasingly adopted in the development of health care interventions and health care research. Effective co-design involves diverse experts, such as researchers, designers and potential clients and users, collaborating creatively across disciplines. The individuals involved in co-design – researchers, designers, developers, managers, and other stakeholders – work together to identify the desired goals and intended benefits of their co-design activities. A consumer-driven co-design approach is recommended for developing mCessation apps to optimize user acceptability and engagement. The co-design framework has the potential to facilitate IPC at the intersection of information technology and health research. (Bendotti et al., 2022; Noorbergen, T. et al., 2021)

4.3.3 Co-design workshop

The co-design workshop was conducted in 2019. To gather qualitative data, we employed a consumer-driven approach driven by participant engagement. We gave the participants visual cards that illustrated the various SCTS methods currently utilized in Finland and highlighted the features of the mCessation programme that we had developed. The participants were asked to independently pinpoint the three most and least important features of both SCTS and mCessation. Following this, they engaged in brainstorming sessions to propose novel ideas and strategies for SCTS and mCessation. Group discussions were recorded, and the data were anonymized and transcribed.

The study involved 12 students, who were recruited from Business College Helsinki, our collaborating institution. We employed purposive sampling to select participants from a pool of 170 adult students enrolled in the ICT degree programme possesing relevant expertise. We did not exclude non-smokers, as the workshop's primary objective was to evaluate mCessation and to generate insights to inform subsequent research. We anticipated that including them would facilitate the attainment of data saturation. An important exclusion criterion was that participants were required to have a personal interest in the digital applications and were recruited from the program. Two investigators, MaM and ViL, worked alongside the head teacher, HH, and teacher, TT, to collaboratively design the co-design workshop. Together, they established the study's inclusion and exclusion criteria. Table 7 describes the characteristics of the participants in Sub-study III.

Table 7 Respondents' background information. One non-smoker used NRT

	Male	**Female**	**Total**
Age (years)	18–47	20–40	
Participants (n)	8	4	12
Smoking status (n)			
Casual	1	0	1
Current	1	3	4
Former	2	0	2
Non-smoker (n)	4	1	5
NRT	1		1

4.3.4 Mixed methods

Mixed-methods research (MMR) is a methodological approach that systematically collects, analyses and integrates both quantitative and qualitative data. Its philosophical basis is that it highlights the practical application of knowledge and is primarily rooted in pragmatism. It aims to develop a more

comprehensive understanding of a research question than could be achieved using either quantitative or qualitative methods alone. Thus, by integrating qualitative and quantitative research, MMR presents a higher level of complexity than if either approach was used independently. (Stadnick et al., 2021) A fundamental requirement of MMR is that the researcher understands the differences in perspectives arising from various philosophical assumptions, as this enables them to avoid potential biases. Mixed methods can be viewed as a third methodological paradigm alongside qualitative and quantitative research paradigms (Sormunen M. et al., 2013; Nataliya V. Ivankova et al., 2024) The primary objective of MMR is to enhance and broaden the conclusions of a study, thereby enriching the academic literature. The application of mixed methods (MM) should help address the research questions of a study. (Schoonenboom and Johnson, 2017; Kajamaa et al., 2020; Yardley and Bishop, 2015)

The term 'MMR' covers several concepts. Most commonly, it denotes combinations of research methods, though discussions also occur at the methodological level. One of the most well-known related concepts is triangulation, which involves the integration of more than one data source, researcher, theory or method within the same research project. In its narrowest sense, MMR is method triangulation, but broadly interpreted, it encompasses all the forms of triangulation. However, MMR does not consist of the use of two or more research methods within the same qualitative or quantitative research paradigm. The term 'MMR' has no established Finnish translation (Sormunen M. et al., 2013). MMR is closely related to multimethod research (Method combination), which exclusively combines either multiple qualitative approaches or multiple quantitative approaches. The term 'multiple methods' is occasionally used when a single study employs more than one qualitative or quantitative method. It can also refer to the integration of several qualitative or quantitative methods within the same research project. The definitions of MMR are not fixed or universally accepted, as the field is relatively young and continuously evolving.

Deciding whether to employ MM requires careful consideration of how combining methods might enhance the study's overall objectives. Common motivations for using MM include triangulation, the desire for more comprehensive results, the need to clarify initial findings, or the intent to first explore and then assess the consistency of the findings across a wider population.

Consider the following examples:

- Triangulation, frequently utilized in MMR, is chosen when researchers aim to use diverse investigative approaches to counteract biases, thereby corroborating results and strengthening the validity of conclusions.
- Researchers may aim for a deeper, more nuanced understanding or description of a phenomenon. In such cases, they deliberately employ multiple inquiry methods to explore various facets of a phenomenon,

uncovering insights that might be missed using a single-method approach.

- Researchers might use one method to elaborate on or interpret the findings of another. For instance, quantitative methods can reveal relationships between variables, while qualitative methods are adept at providing detailed insights into the contexts or processes underlying these relationships.
- In studies of less familiar phenomena, researchers might begin with an exploratory approach, to identify valuable questions. Subsequently, they may use these findings to broaden the research scope, assessing the consistency of results across a larger population. (Battista and Torre, 2023)

In health services, MMR has experienced substantial growth in recent decades. (Stadnick et al., 2021) MMR has become well established in the scientific community and is gaining traction in health sciences, driven by the variety of research questions that are arising. Employing MM fosters a more profound and nuanced understanding of a phenomenon as it considers multiple viewpoints. (Sormunen M. et al., 2013; Stadnick et al., 2021)

4.3.5 Qualitative analyses

The qualitative, theory-driven analysis of the co-design materials was conducted by MaM (MHS) and MiM (MD, PhD). Sub-study III adopted an exploratory approach to SCTS and mCessation. The team analysed the recorded group session data through the lens of SDT-driven content analysis, adhering to deductive content analysis principles. The respondents' perspectives began to repeat, indicating that data saturation had been achieved (Johnson et al., 2020). Although the sample was limited, the resulting data were sufficiently representative. In cases of coding disagreements, discussions were held to achieve a consensus, involving at least two researchers as necessary. They began by examining whether and how participants articulated the core components of SDT. The analytical framework centred on autonomous and controlled motivation, alongside the three fundamental psychological needs of autonomy, competence and relatedness, which are referred to as the main categories in this article. Our preliminary understanding was that elements of autonomy, competence, and relatedness—the basic psychological needs— might be reflected in the answers.

The transcribed data was read multiple times, and coding was facilitated using ATLAS.ti software. Each sentence was meticulously analysed by two researchers, which resulted in 133 subcategories, which were subsequently grouped

into 12 overarching categories. Throughout the process, the authenticity of the data was consistently verified to ensure accurate coding.

The analysis revealed that the respondents expressed various types of motivation, which were categorized as controlled motivation, autonomous motivation and amotivation. Subsequently, the ten remaining upper codes were organized into main categories that reflected competence, autonomy and relatedness. The subsequent phase delineated how motivation manifested across the ten upper-level categories and their connection to the three primary psychological needs of autonomy, competence and relatedness. At no point in the study were participants provided with information on SDT. Figure 14 illustrates the flowchart for Sub-study III.

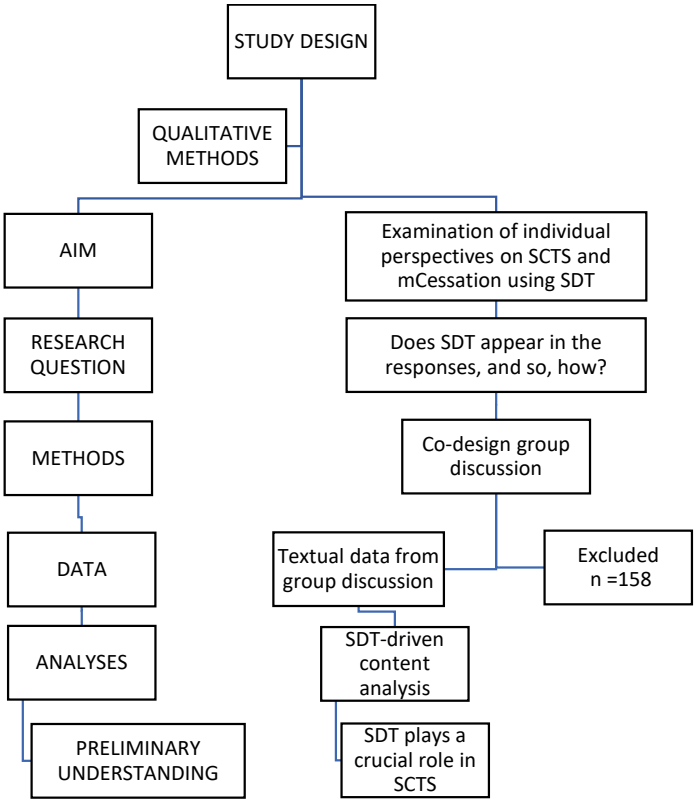

Figure 14 Design of a 2019 qualitative study evaluating participant perspectives on an SDT-based workshop

4.3.6 Ethics

The research plan for Sub-studies I and II was approved by the Ethics Committee of the Faculty of Medicine at the University of Helsinki (05/2017), and the study complied with the Declaration of Helsinki. The Ethics Committee of Helsinki University approved Sub-study III, which was also conducted in accordance with the Declaration of Helsinki. In the co-design workshops, every participant signed their informed consent. None of the three sub-studies collected identifying information on the respondents.

5 Results

5.1 Descriptive results

Providing SCTS is an integral part of OH physicians' and OH nurses' professional responsibilities. They had a positive attitude towards facilitating SC and demonstrated strong motivation to improve their knowledge and skills in this area. The occupational physiotherapists also displayed a high level of motivation, comparable to that of their physician and nurse counterparts, although they perceived their own SC knowledge and skills to be significantly less advanced. IPC in SCTS was sporadic and incomplete, and the occupational physiotherapists were often felt excluded from internal collaborative efforts. In-house OHS presented the most favourable conditions for facilitating interprofessional SCTS.

5.2 Attitudes, knowledge and motivation of occupational health professionals regarding smoking cessation (Sub-study I)

Sub-study I examined OH professional's attitudes, knowledge and motivation. The attitude scores for all the variables were generally high, showing no statistically significant differences between professionals. The standard deviations were minor, and most responses were rated as 4 or 5.

A significant majority, 93.8%, of the respondents believed that SCTS should be part of their job responsibilities. Despite this, 42.7% of the occupational physiotherapists indicated that SCTS was not currently part of their job duties.

The motivation variables (Table 8) illustrated the participants' desire to pursue additional training on various subjects. The OH nurses showed a strong inclination towards further SCTS training. Statistically significant differences were observed between the mean motivation scores of the OH physicians and the OH nurses (P=.001), whereas the differences between OH physicians and occupational physiotherapists were not significant (P=.218). An analysis of individual motivation variables was also conducted to identify the training topics in which the OH professionals were most interested. Across all three groups, the highest motivation

was noted for training in methods such as MI, and in effectiveness and evaluation. Conversely, the motivation to gain expertise in SC was the lowest.

Table 8 Mean values ± standard deviations of motivation variables among OH professionals

	All	**OH physicians**	**OH nurses**	**Occupational physiotherapists**	***P*-value**
	(n=574)	(n=182)	(n=296)	(n=96)	
Mean value of motivation variables	3.7 ± 0.9	3.6 ± 0.9	3.9 ± 0.8	3.4 ± 1.1	<.001
Motivation variables					
Methods (motivational interview)	4.2 ± 1.0	4.1 ± 1.0	4.4 ± 0.9	3.8 ± 1.2	<.001
Effectiveness and evaluation	4.0 ± 1.0	4.0 ± 1.0	4.1 ± 0.9	3.6 ± 1.3	.001
Theoretical background	3.7 ± 1.1	3.5 ± 1.2	3.8 ± 1.1	3.6 ± 1.1	.029
Measuring equipment	3.7 ± 1.2	3.6 ± 1.1	3.9 ± 1.1	3.4 ± 1.3	<.001
Marketing to client's company	3.5 ± 1.2	3.5 ± 1.3	3.7 ± 1.1	3.3 ± 1.3	.036
Obtaining expertise	3.3 ± 1.3	3.1 ± 1.4	3.6 ± 1.2	3.0 ± 1.3	<.001

P-values are for the Kruskal–Wallis test.

The OH physicians and OH nurses evaluated their familiarity with the SCTS information in the existing Finnish Current Care Guidelines as adequate. A larger proportion of OH physicians indicated that their knowledge was supplemented by additional training that they had received at their workplaces, through professional organizations such as trade unions, or from the pharmaceutical industry. Compared to the OH physicians and OH nurses, the occupational physiotherapists had participated in less supplementary training. Across all the groups, the level of training and education during specialization studies was notably low.

All the OH professionals assessed their current knowledge on SCTS and the level at which they would like it to be in the future. The OH physicians rated their current knowledge the highest, with an average score of 7.3 (SD=1.2). This was followed closely by the OH nurses, who had an average score of 7.1 (SD=1.4). The occupational physiotherapists, on the other hand, rated their knowledge lower, with a mean score of 4.3 (SD=2.5). Despite this, all the participants showed a strong desire to improve their skills. Specifically, the occupational physiotherapists aimed to elevate their average knowledge score to 7.2 (SD=2.2).

5.3 Role of occupational physiotherapists in supporting smoking cessation alongside occupational health physicians and nurses (Sub-studies I and II)

For OH physicians and OH nurses, providing SCTS is one of their job responsibilities. Occupational physiotherapists are an underutilized resource, despite having a positive attitude towards SC, like the other OH professionals. Their knowledge differed statistically significantly (Mann–Whitney test, $P<.0001$) from that of the other OH professionals, but at the same time, they were motivated to increase their SC knowledge to a level closer to that of their counterparts. They were less familiar with the Current Care Guidelines on Tobacco dependence and cessation. They also differed from other OH professionals in that they had fewer opportunities to participate in additional SC training, whether through workplace organizations or the pharmaceutical industry. Indeed, they had fewer overall opportunities to obtain sufficient knowledge of SCTS. The occupational physiotherapists were also keen to receive additional training on the links between smoking and spinal diseases.

5.3.1 Interprofessional collaboration

The occupational physiotherapists frequently mentioned finding seamless collaboration difficult and felt excluded from internal teamwork when implementing SCTS, despite their interest in participating alongside OH physicians and OH nurses. The pairwise p-values indicated a significant difference between the occupational physiotherapists and the other OH professionals ($p<0.001$). The OH physicians and OH nurses were pleased with the smoothness of collaboration, whereas the occupational physiotherapists perceived the collaboration to be lacking fluidity. IPC was only partial and occasional in SCTS. In general, all the OH professionals concurred that interprofessional evaluation was rarely conducted (Table 9).

Table 9 Collaboration among OH professionals. Mean values ± standard deviations of collaboration variables among OH professionals. P-values for Kruskall–Wallis tests. Post-Hoc analysis: pairwise comparisons using Kruskall–Wallis tests with Bonferroni correction

					Kruskall-Wallis test	Pairwise comparisons		
	All professionals mean (SD)	OH physicians mean (SD)	OH nurses mean (SD)	OH physiotherapists mean (SD)	p-value	Physicians nurses	Physicians Occupational physiotherapists	Nurses physiotherapists
Mean values of collaboration variables Collaboration variables	**3.1 (1.0)**	**3.2 (1.0)**	**3.2 (0.9)**	**2.7 (0.8)**	**<.001**	1.000	**<.001**	**<.001**
1.Clear roles and responsibilities	**3.6 1.1)**	3.5 (1.1)	3.7 (1.1)	3.3 (1.3)	**0.026**	0.433	0.516	**0.029**
2.Followup planned	3.4 (1.2)	3.2 (1.2)	3.4 (1.2)	3.3 (1.1)	0.103	0.107	1.000	1.000
3.Smooth collaboration	**3.2 (1.2)**	**3.4 (1.1)**	**3.2 (1.1)**	**2.5 (1.1)**	**<.001**	0.336	**<.001**	**<.001**
4.Effective SCTS model	**3.0 (1.1)**	**3.1 (1.1)**	**3.0 (1.1)**	**2.7 (1.0)**	**0.022**	1.000	**0.019**	0.060
5.Identify the field of knowledge tai skills	**2.9 (1.2)**	**3.1 (1.2)**	**2.9 (1.2)**	**2.3 (1.1)**	**<.001**	0.735	**<.001**	**<.001**
6.Interprofessional evaluation	**2.7 (1.2)**	**2.9 (1.2)**	**2.8 (1.2)**	**2.3 (1.0)**	**<.001**	0.911	**<.001**	**0.003**

Note: mean values ± standard deviations of collaboration variables among OH professionals

5.4 Integrating efforts: occupational health service collaboration (Sub-study II)

Sub-study II examined the IPC between the OH professionals and the differences between the OHS providers. I gathered information on the employers of the OH professionals and classified them into several categories: public health services, private medical services, in-house OHS (including those who jointly provided the services), and other categories such as entrepreneurs. We also examined the extent to which the OH professionals were familiar with their employers' smoke-free policies and practices, and the ways in which they worked together with various workplaces.

5.4.1 Collaboration among OHS providers

Using a pairwise comparison test, we discovered that roles and responsibilities were clearer in in-house OHS than in private OHS units. Table 10 shows the results of the post-hoc analysis, which revealed several differences between in-house and

private OHS. In-house OHS had more frequently scheduled follow ups of SCTS, smoother collaboration, a more effective SCTS model, better recognition of skills, and conducted interprofessional evaluations (p<0.001).

Table 10 Collaboration among OHS providers. Mean values ± standard deviations of collaboration variables among OHS providers. P-values for Kruskall–Wallis tests. Post-Hoc analysis: pairwise comparisons using Kruskall–Wallis tests with Bonferroni correction

	Mean values ± standard deviations					Kruskall Wallis test	Pairwise comparisons					
	All OHC	In-house OHC	Public OHC	Private OHC	Other OHC	p-value	In-house Public	In-house Private	In-house Other	Public Private	Public Other	Private Other
Mean value of collaboration variables Collaboration variables	**3.1 (1.0)**	**3.5 (1.0)**	**3.1 (0.9)**	**2.9 (0.9)**	**3.1 (0.8)**	**<.001**	**0.008**	**<.001**	**0.016**	**0.041**	1.000	1.000
1. Clear roles and responsibilities	**3.6 (1.1)**	**3.9 (1.1)**	**3.6 (1.2)**	**3.4 (1.2)**	**3.5 (0.9)**	**<.001**	0.092	**<.001**	**0.028**	0.767	1.000	1.000
2. Followup planned	**3.4 (1.2)**	**3.6 (1.2)**	**3.4 (1.2)**	**3.1 (1.2)**	**3.2 (1.1)**	**<.001**	0.553	**<.001**	0.100	0.138	1.000	1.000
3. Smooth collaboration	**3.2 (1.2)**	**3.6 (1.1)**	**3.2 (1.1)**	**2.9 (1.1)**	**3.1 (1.0)**	**<.001**	**<.001**	**<.001**	**0.011**	0.069	1.000	1.000
4. Effective SCTS model	**3.0 (1.1)**	**3.3 (1.0)**	**3.0 (1.1)**	**2.7 (1.0)**	**2.9 (1.0)**	**<.001**	0.175	**<.001**	**0.035**	**0.053**	1.000	1.000
5. Recognition of field of SCTS skills	**2.9 (1.2)**	**3.3 (1.2)**	**2.9 (1.2)**	**2.6 (1.2)**	**2.8 (1.0)**	**<.001**	**0.060**	**<.001**	**0.029**	**0.021**	1.000	1.000
6. Interprofessional evaluation	**2.7 (1.2)**	**3.1 (1.2)**	**2.6 (1.1)**	**2.5 (1.2)**	**2.9 (1.1)**	**<.001**	**<.001**	**<.001**	0.727	1.000	0.871	0.243

Note: p-values are for the Kruskall–Wallis test.

5.4.2 Collaboration between employer and OH professionals

Table 11 shows the mean values + standard deviations of the collaboration variables among OH professionals and workplaces. We asked the following questions: Do you know if your client companies wish to become smoke free? Does your client have smoke-free campaigns, or are they already smoke free? We also inquired whether OH professionals collaborated with the companies' HR departments, line management, or occupational safety teams regarding smoke-free initiatives. OH nurses bore the primary responsibility for facilitating collaboration between OHS and employers (p<0.001). The HR department of companies appeared to be a natural partner when collaborating on SC and smoke-free initiatives. An interesting finding was that although all the OH professionals were quite aware of companies'

wishes to become smoke-free, they were not very familiar with the companies' actual smoke-free policies.

Table 11 Mean values + standard deviations of collaboration variables among OH professionals and workplaces.

	All (n=574)	OH physicians (n=182)	OH nurses (n=296)	Occupational physiotherapists (n=96)	p-value
Mean value of collaboration variables	3.8 ± 0.9	3.6 ± 0.9	3.9 ± 0.8	3.4 ± 1.1	<.001
Collaboration variables					
Desire to be smoke free	4.1±0.9	4.1±0.8	4.1±0.9	4.2±0.7	0.993
Co-operation with companies' HR department	3.9±1.1	4.0±1.1	4.0±1.0	3.3±1.4	<.001
Companies have non-smoking campaigns	3.6±1.2	3.8±1.1	3.4±1.3	3.7±0.9	0.003
Co-operation with companies' line management	3.6±1.2	3.6±1.1	3.7±1.2	2.9±1.3	<.001
Co-operation with companies'	3.5±1.3	3.5±1.2	3.7±1.2	3.2±1.3	0.016
Companies are smoke free	3.2±1.2	3.2±1.2	3.2±1.3	3.4±1.0	0.773

p-values are for the Kruskall–Wallis test.

5.4.3 Differences between OHS providers and OH professionals in terms of smoking cessation

Table 12 presents the results of the generalized linear model. Models 1 and 2 contained the unadjusted estimates, but Model 3 was adjusted for OH professionals and OHS providers. Either OH physicians or in-house OHS were used as reference groups. The results are very similar to those in Tables 10 and 11. To adjust for the employers of the OH professionals, we estimated a model that included both factors

(see Model 3). The coefficients and standard errors for OH professionals in Models 1 and 3 were very similar, as were those for the OHS providers. We concluded that OH professionals and OHS providers operated independently of each other. The following order was consistent across all the OHS providers: the OH physicians were the most positive, followed by the OH nurses, and the occupational physiotherapists were the most negative.

The analysis showed that collaboration was more seamless in in-house OHS, with a mean score of 3.5 (SD=1.0), than in public OHS (mean 3.1, SD=0.9) and private OHS (mean 2.9, SD=0.9), with a p-value of less than 0.005. Pairwise comparison tests revealed that in comparison to private OHS, in-house OHS had clearer roles and responsibilities, more frequently planned SCTS follow ups, had smoother collaboration, had a more effective SCTS model, had better skill recognition, and conducted interprofessional evaluations, with a p-value of less than 0.001. In-house OH professionals rated their roles and responsibilities as clearly defined, with a mean score of 3.9 (SD=1.1), and considered their SCTS model to be the most effective, with a mean score of 3.3 (SD=1.0). Across all the OHS units, the average scores were 3.6 (SD=1.1) for role clarity and 3.0 (SD=1.1) for SCTS model effectiveness. In contrast, the OH professionals in private OHS felt that collaboration could be improved, giving it a mean score of 2.9 (SD=0.9). In-house OHS differs from that of other providers, as in-house OH professionals and employees share the same employer. Table 12 displays the regression coefficients (B), standard errors (SE), and p-values from the Wald tests, with a p-value of less than 0.05 deemed statistically significant.

Table 12 Collaboration between OH professionals and OHS providers with generalized linear models

Model 1	**Model 2**		**Model 3**			
	Coef. (SE)	**p-value**	**Coef. (SE)**	**p-value**	**Coef. (SE)**	**p-value**
Intercept	3.19 (0.07)	<.001	3.47 (0.08)	<.001	3.52 (0.09)	<.001
Factor						
OH Professionals						
OH Physicians	Reference				Reference	
OH Nurses	-.02 (0.90)	0.819			-.01 (0.09)	0.903
Occupational Physiotherapists	-.47 (0.12)	<.001			-.41 (0.12)	0.001
OHS providers						
In-house OHS			Reference		Reference	
Public OHS			-.37 (0.11)	<.001	-.29 (0.14)	0.042
Private OHS			-.62 (0.10)	<.001	-.59 (0.10)	<.001
Other OHS			-.41 (0.14)	0.003	-.35 (0.10)	0.001

Note: Model 1 included OH occupations only, model 2 OH professionals' employer only, and fully adjusted model 3 includes OH occupations and professional's employer. p-values are for Wald's test.

In conclusion, Sub-studies I and II examined the attitudes, knowledge and motivation of OH professionals, as well as IPC within the various OHS systems. Quantitative analyses in Sub-studies I and II revealed that the attitudes and motivations of OH professionals towards SC are well established. In terms of knowledge, occupational physiotherapists differed significantly from OH physicians and nurses. All the OH professionals recognized the need to enhance their MI skills. Assessment of IPC showed that the occupational physiotherapists felt excluded from the collaboration. The different OHS systems also differed significantly from one another. To improve SC support, the client's perspective must be understood, and other complementary tools are needed. Sub-study III aimed to address these needs by mapping individual user requirements and seeking solutions within the SDT framework.

5.5 SDT-driven approach to understanding patient perspectives – a qualitative study (Sub-study III)

We examined the participants' perceptions of SCTS and mCessation co-design workshop through the lens of SDT. During the workshop, we sought to identify features that could be integrated into both SCTS and mCessation.

5.5.1 Patient perspective in smoking cessation treatment and support

The participants highlighted key features they deemed salient for effective SCTS, which were subsequently organized into ten overarching categories. These categories correlated with the fundamental psychological needs posited by SDT. We identified the main SDT-based categories – autonomy, competence and relatedness – along with the 12 upper-level categories and 133 subcategories derived from the workshop's content analysis. Table 13 shows the key elements that participants identified as essential for supporting SC. We grouped these elements into 12 main categories, each strongly linked to SDT. When categorizing the ten upper-level categories according to SDT and basic psychological needs, we consistently referred to the authentic replies and the SDT literature. Decision-making was grounded in research on SDT and in identifying which psychological basic needs the main categories were most strongly linked to. For example, the main category "aid and appliance" and its associated subcategories are most strongly linked to the basic need for autonomy, as individuals themselves choose the methods they consider most suitable for quitting smoking.

Table 13 Results of theory-driven content analyses of workshop textual data, consisting of three SDT-based main categories, 12 upper-level categories and 133 subcategories.

Main category	Upper category	Subcategories	
Autonomy, Competence	Addiction	Craving for nicotine	Relapse
		Craving for tobacco	Snuff
		Desire	Paying attention to smoking
		Nicotinism	Thinking about smoking
Autonomy	Aids and appliances	Acupuncture	Hypnosis

		Alternative physical activity	Massage
		Casual actions	Medication
		Exercise	Personal messages
		Handbook	Psychoeducation
		Help	Psychoeducation after relapse
		Relaxation and meditation	Reminders
		Replacement therapy	Focusing on smoking
		Weaning off tobacco	Western medicine
Autonomy, Competence Relatedness	Characteristics	Captivating game	Digital support
		Affordable	Distance
		Amusement	Expensive
		Availability	Games
		Concrete	Impractical
		Digital platform	Innovative
		Interactive	Personal matter
		Practicality	Reactionary
		Safety	Self-evident
		Usefulness	
Relatedness, Competence	Collective quitting	Acting in a group	Peer pressure
		Community spirit	Peer support
		Competition	Reference group
		Internet peer support	Indifference
Competence	Expert advice	External help	Professional advice
		Process of quitting	Professional orientation
Autonomy	Follow-up data	Awareness of own progress	Information about experiences
		Continuity	Information about goals
		Control	Information about health, present state
		Health data and progress	Information about own action
		Influence on health	Information about quality of life

		Information on time usage	Life expectancy
Autonomy, Competence	Personal experience	Contradictions Equality Failure Own experience Pain Private matters	Acknowledging feelings Reducing stress Sense Usual manner Time management
Competence, Relatedness	Rewards	Online rewards from games Personal award offline Personal award online Personal reward Team reward	Team reward offline Team reward online Workplace reward for quitting Public reward for quitting Rewards
Competence	Health political decision-making	Allocated help for young people Employee incentives General awareness Harm of smoking Information on the harm of smoking Tobacco tax	Nicotine-free environment Oriental medicine Scientific evidence-based information Smoking ban Making it more difficult to smoke
Relatedness	Way of quitting smoking	Trying something new Experiment in quitting Disruption Goal orientation Process of quitting Quitting as an individual	Quitting as an anonymous person Quitting in a team Quitting seriously Seeking help (from a specialist) Quitting smoking Reducing smoking
Controlled motivation or amotivation		Bypassing information Indifference	External motivation Rebelling against bans
Autonomous motivation		Self-direction Autonomy	Encouragement Interest

		Perseverance Feedback Commitment Positivity Motivation during leisure time Quitting smoking	Efficacy Empowerment Feeling motivated Internal motivation Success

The respondents used several names for the different types of motivation. We sorted the responses into codes, which are shown in Figure 15. Most of the respondents highlighted autonomous motivation, which garnered a total of 64 comments, in contrast to amotivation or controlled motivation, which accumulated only 12 comments. The participants discussed various forms of motivation, revealing distinct levels of controlled motivation and amotivation. Through a qualitative approach grounded in SDT, we pinpointed the primary factors that shape the expectations of SCTS. The respondents indicated that SC was most likely to be successful when the individual had autonomous motivation. Merely relying on external pressure did not suffice for lasting changes.

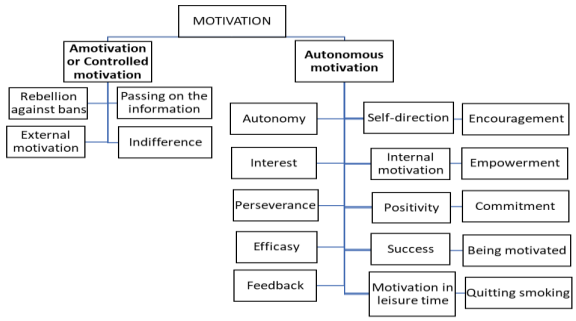

Figure 15 Several types of motivation identified by respondents

The questions' responses prominently displayed the three fundamental psychological needs of autonomy, competence and relatedness, and how they were distributed across the ten upper-level categories. Among these, the need for autonomy was the most frequently mentioned. We quantified the importance of

the ten main categories by counting the number of times the participants mentioned each one (Figure 16).

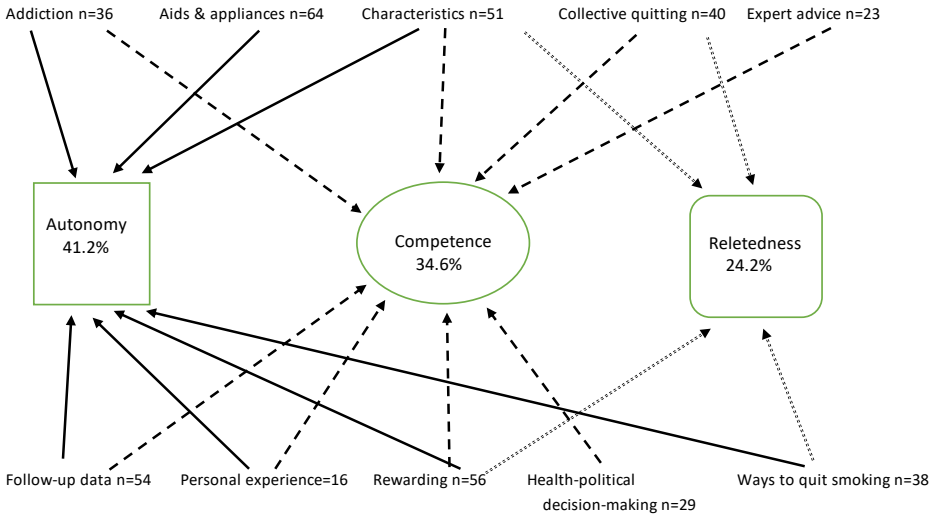

Figure 16 Results of content analysis of textual data from workshop. Numbers of ideas gathered from Finnish workshop held in April 2019

Table 14 analyses the quotations in terms of autonomous motivation, controlled motivation or amotivation. Autonomous motivation can be further specified as autonomy, competence and relatedness. Controlled motivation and amotivation were grouped together because, in both cases, individuals' basic psychological needs are not satisfied.

Table 14 Quotations concerning autonomous motivation, controlled motivation or amotivation, based on SDT

Autonomous motivation	*Seeing these results and how much money has been saved and so on…this helped me find some motivation…* *Quitting in a team for the same reasons. You get clear feedback. I'm trying it, and I can do it.* *It's quite clear that if you get all kinds of health benefits, you'll be more motivated to quit.* *Then there's this support group, so you can talk to different people who might have similar problems and share all kinds of experiences and tips on how to get over it, and this mutual understanding, like helping other people get over it too.*
Controlled motivation or amotivation	*Among teenagers, who want to rebel, if smoking is forbidden, I suppose, it may increase.* *With information on websites, it can just be a long list of information. Nobody will read it.* *These professionals, they know best how to give you instructions to quit smoking, and the smoking process, in what order you should start.* *A smoke-free environment, well it doesn't always work, because, for example, if you're not able to smoke, you can use snus or go and smoke somewhere else.*

The SDT-based content analysis suggested that attention to the basic psychological needs of autonomy, competence, and relatedness is warranted in SCTS. The responses indicated that individuals attempting to quit smoking require a heightened sense of autonomy. It was evident across the responses that individuals must feel able to determine their own courses of action. External compulsion alone is insufficient; successful change requires the experience of intrinsic motivation. The sense of competence emerged in various forms, particularly within the 'health data and advancement' and 'different rewards' codes, which included elements that could motivate individuals to remain smoke free and thereby enhance their sense of competence. Collective quitting was also noted as potentially significant for experiencing success as a group. In this way, the individual's basic need for relatedness is satisfied.

Insights from the discussion indicated that competence can be bolstered at both macro and micro levels. At the macro level, societal support through legislation, such as keeping tobacco products out of sight in stores, can help

individuals with nicotine addiction. At the micro level, employers can support employees trying to quit by establishing nicotine-free work environments. The respondents emphasized the influence of political decisions on public health and the role of employers in these efforts. Opinions on smoking bans were mixed; although bans made smoking more challenging, nicotine addiction could drive smokers to seek alternatives such as snus. Some respondents found quitting easier when smoking was made difficult and uncomfortable, suggesting that distractions such as games or exercise could help manage cravings. They concluded that certain levels of external pressure (i.e., controlled motivation) could have both positive and negative effects on the success of SC.

5.5.2 Individual perspective in mCessation and smoking cessation

The participants ranked mCessation features in order of importance: health data from one's own body, personal awards, stop-the-craving games, offline team awards, data on money and time usage, relapse coaching, quitting in groups, online team awards, OH nurse chats and support, online personal awards, health information, a smoking diary (Figure 17.) They also ranked SC tools in order of importance: nicotine replacement therapy, professional support from health care providers, mCessation apps, smoking-cessation medicines, cessation groups, phone-based psyche education, text message health apps, online peer support groups, nicotine-free environments, online psychoeducation, hypnotism, websites, smoking-cessation guidebooks, acupuncture (Figure 18).

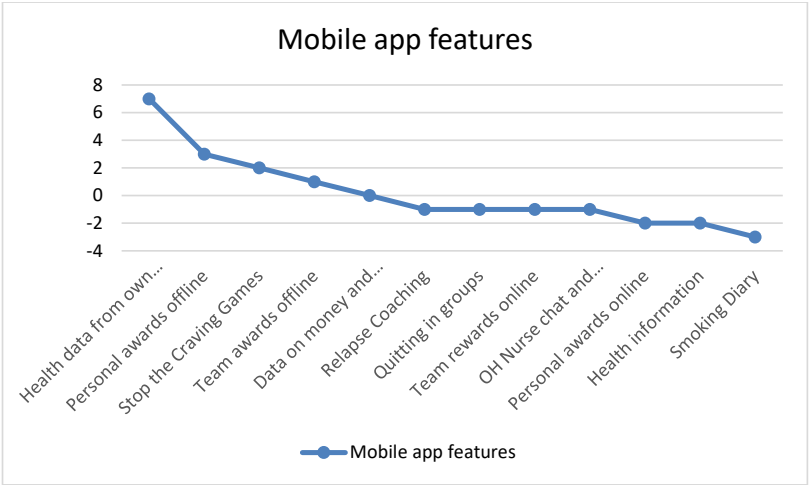

Figure 17 Workshop participants' assessments of mCessation features in order of priority

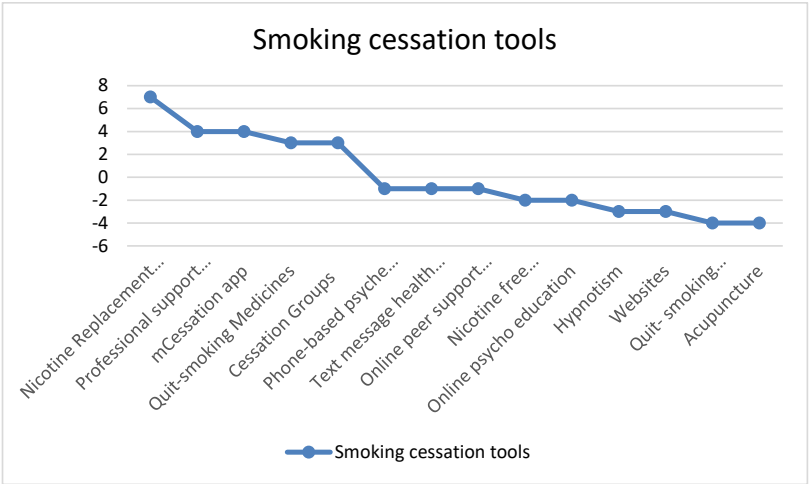

Figure 18 Workshop participants' assessments of various cessation methods in order of priority

In both cases, health information and websites were ranked as almost unnecessary or useless. Personal feedback, action, or treatment in turn were assessed as the most important factors of successful SC.

6 Discussion

6.1 Main findings

1. Research question for Sub-study I: What are OH professionals' attitudes, knowledge and motivation regarding smoking cessation treatment and support?

All the OH professionals had positive attitudes towards and motivation for SCTS, but the level of knowledge of the occupational physiotherapists differed significantly from that of the OH physicians and OH nurses.

2. Research question for Sub-study II: What are the perspectives of the various OH professionals on IPC within different OHS systems?

IPC in SCTS was only sporadic and was limited, with notable differences among OHS systems. Occupational physiotherapists resources are under-used in SCTS.

3. Research question for Sub-study III: How do individuals experience and perceive various smoking cessation treatment and support methods, including mCessation? How do these methods align with Self-Determination Theory, and which of the basic psychological needs—autonomy, competence, and relatedness—are considered most important for smoking cessation treatment and support?

The basic psychological needs—autonomy, competence, and relatedness—were salient throughout the responses. Among these, autonomy surfaced most frequently.

6.2 Comparison and interpretation of findings

6.2.1 Smoking cessation practices of occupation health professionals

Previous studies among OH professionals have predominantly focused on the SC practices of a single professional group and research on SC within OHS in Finland has been limited. (Chatdokmaiprai et al., 2017; Ganz et al., 2015; Heloma, A., 2003; Lee et al., 2023, 2021). Comparative studies focusing on key OH professionals are lacking. Moreover, the application of SDT and IPC theories in the OH sector has been minimal. Earlier research has indicated that evaluating health care providers' behaviours and personal attitudes towards smoking is important (Juranić et al., 2017).

Attitude and motivation. Although all the OH professionals had a very positive attitude towards SC support services, only the expertise of OH doctors and OH nurses were utilized to support SC. Smoking cessation was integrated into the job responsibilities of the OH physicians and OH nurses, and they demonstrated motivation for supporting SC and were eager to improve their understanding and abilities in this area. This is consistent with other studies that have indicated that health care providers have the appropriate attitude, which is crucial for giving meaningful advice. However, cessation practices are not working optimally. (Muza et al., 2024)

The occupational physiotherapists expressed nearly the same level of motivation as their physician and nurse counterparts, but assessed their own knowledge and skills as being considerably poorer. Although 93.8% of the participants felt that SC support should be part of their job duties, 42.7% of the occupational physiotherapists stated that it was not presently part of their job description. Thus, the resources of occupational physiotherapists were underused in the context of SCTS and IPC in this study. WHO and Current Care Guidelines (Duodecim, 2024; World Health Organization, n.d.) recommend that all health care professionals, including physiotherapists, should be involved in SC efforts, based on their expertise. Therefore, excluding occupational physiotherapists might limit the comprehensive approach advocated by these guidelines. If the aim is to adhere to the best practices for SC, it would be beneficial to involve all the relevant professionals, including physiotherapists, in order to leverage their unique perspectives and skills.

Knowledge. Another concerning issue is that the SC training of OH professionals seems to primarily consist of their basic education, except that of the OH physicians, who receive more site-specific training on the topic, often provided by pharmaceutical companies. The level of training and education during specialization studies was minimal in all the groups. Insufficient knowledge about smoking and SC can impact nurses' abilities to effectively promote health (Juranić et al., 2017; Lee et al., 2021). Incorporating cessation training into foundational courses could help health professionals recognize SC counselling as an integral aspect of their responsibilities. A lack of training in tobacco cessation counselling among health care professionals has been linked to fewer interventions, and focused education in tobacco cessation counselling could enhance the application of these guidelines. (Bodner et al., 2020; Lee et al., 2021; Pignataro, 2017; Tremblay et al., 2009) In my doctoral research, the occupational physiotherapists perceived their current knowledge as insufficient, and few had received training in SCTS counselling, which is in line with previous studies' results. When health care providers actively and visibly engage in counselling their patients, or when the organizational framework supports such efforts, it can foster an environment that motivates other colleagues to participate, thereby strengthening the commitment to counselling. (Bodner et al., 2020) The tobacco epidemic seems to be worsening, as the tobacco industry is continuously bringing a variety of nicotine products onto the market (Patja, K., 2025). Ongoing education is key to effectively addressing nicotine addiction (Bobak and Raupach, 2018; Bodner et al., 2020; Muza et al., 2024).

Many OH physicians strongly believed that it was the ethical duty of health care providers to inform smokers about the dangers of smoking. Primary care physicians provided more smoking-related consultations than those in secondary care. (Keto et al., 2015; Ilesanmi et al., 2024) In practice, simply providing information on risks is not sufficient, and can even be harmful. According to the reasoned action approach, a threatening message increases the perceived threat, improving attitude and intention. However, this does not lead to behaviour change unless self-efficacy is strong. Self-esteem also plays a moderating role; research indicates that when individuals who gain self-esteem from risky behaviour encounter threatening information, their intention to partake in the risky behaviour diminishes, but they may still engage in it more frequently. Inducing fear might not be linked to the desired behaviour and could potentially reduce the fear itself. (Peters et al., 2013) In behavioural SC interventions delivered by individuals, certain behaviour changing techniques, as well as groups of these techniques, are linked to higher rates of success (Black et al., 2020). In my research, all the OH professionals felt a need for additional training in behavioural science methods such as MI. This aligns with earlier studies' findings that most OH physicians and OH nurses agree that their duties involve informing, motivating and helping patients to adopt lifestyle

changes. However, only slightly more than half felt confident in their lifestyle counselling skills (Jallinoja et al., 2007). In my study, the OH professionals recognized that merely providing information on risks does not lead to a favourable patient outcome. They all felt a particular need for behavioural science techniques to enable them to effectively support patients.

Self-efficacy is also linked to how OH nurses and physiotherapists implement SC practices (Chatdokmaiprai et al., 2017; Luxton and Redfern, 2020). I did not use the term *self-efficacy* in my study, but it is related to the concept of *competence*. The concept of perceived competence (PC) closely resembles that of self-efficacy (Williams et al., 2006b). Although self-efficacy and competence are related concepts, they have distinct meanings. In SDT, Ryan and Deci define competence as the innate human need to feel effective and capable in one's interactions with the environment. It is the experience of mastery over tasks and a sense of confidence in one's abilities to produce desired outcomes. It is the feeling of being able to manage challenges and achieve goals. When individuals feel competent, it often leads to increased intrinsic motivation, meaning they are more likely to engage in activities for their own enjoyment and interest. SDT focuses on intrinsic motivations and needs such as autonomy, competence and relatedness. It examines how these needs influence motivation and well-being. (Richard M. Ryan and Edward L. Deci, n.d.) Bandura's notion of self-efficacy originates from his social cognitive theory, highlighting the interaction between individual factors, behaviour and the environment. Bandura asserts that self-efficacy involves not only one's actual skills, but also one's belief in one's ability to use these skills effectively. (Bandura A., 1986) In summary, SDT focuses more broadly on motivation and needs, whereas Bandura's self-efficacy emphasizes individuals' beliefs in their capabilities.

Other obstacles to implementing tobacco cessation counselling guidelines are insufficient resources, unclear professional roles and boundaries, scepticism about the effectiveness of SCTS, and the expected reluctance of patients to accept cessation advice (Pignataro et al., 2015).

6.2.2 Smoking cessation and occupational health services

Even though all the OH professionals considered SC important and were motivated to develop their skills, in practice, cessation measures are sporadic and inconsistent. Although IPC has been extensively researched, research in the OH context is limited, both globally and in Finland (and Sweden). OH providers possess multiprofessional expertise and competence (Rossi et al., 2000) and can provide support to organizations and workplaces when they develop work environments (Wachs, 2005). To maximize this expertise and competence, interprofessional teamwork is needed, as it can provide high-quality support and services in occupational safety and health issues. (Isoherranen, K., n.d.; Mouazzen et al.,

2024; Reeves et al., 2018) It encompasses five common elements: a shared identity; clearly defined roles, tasks, and goals; interdependence among members; integration of work; and shared responsibility (Reeves et al., 2018).

IPC practices. In my doctoral research, I was interested in the interprofessional SCTS practices of OH professionals. Previous research on IPC has primarily concentrated on the partnership between physicians and nurses. (Carradore et al., 2021). My research indicates that SCTS has potential that is not utilized by OH professionals and that this impedes IPC. All the OH professionals concurred that interprofessional evaluation was infrequently conducted, with a mean score of 2.7 (SD=1.2). Further analysis showed notable disparities among the OH professionals, particularly concerning smooth collaboration, acknowledgement of SCTS skill areas, and interprofessional evaluation variables. The OH nurses appeared to be the most adept at recognizing their roles and responsibilities in supporting SC. The Occupational physiotherapists played no role in SC. In my study, OH physicians and nurses were more involved in SCTS than other health care workers, which aligns with previous research findings (Carradore et al., 2021). Clearly defining roles – both one's own and those of other professionals – is essential for successful interprofessional SCTS and optimal team performance (Hudson et al., 2017; Reeves et al., 2018). It is concerning that all the professionals regarded interprofessional evaluation of supporting SC as weak. Evaluation, however, is a key step in SC, according to international recommendations such as the 5 A's (Duodecim Current Care Guidelines, n.d.). The occupational physiotherapists were not included in the internal collaboration process during the implementation of SCTS. They had no opportunities to participate in further education. Health care professionals who view support of adherence as part of their responsibilities tend to provide higher levels of support (Mersha et al., 2023). However, interprofessional education is a necessary step in preparing collaborative practices (World Health Organization, 2010). Support for SC relies on the interest and motivation of individual professionals, and clear structures and processes are rarely in place.

OH nurses bear the primary responsibility for co-ordinating OH collaboration with workplaces. Inspiring and motivating clients, including companies, employers, and employees, is central to the role of OH nurses (Rossi et al., 2000). This was also the case in my study, in which OH nurses took the main responsibility for collaborating with employees in SCTS. In my research, the OH professionals were quite aware of whether a workplace was interested in declaring itself smoke free. However, it was intriguing that their awareness of workplaces' actual smoke-free status was significantly poorer. For a project to succeed, it is essential that every team member engages with both the process and the result (Wachs, 2005). The traits of successful co-operation between OHS and employers have three primary themes: 1) the importance of time, space, and contractual elements as foundational

for productive collaboration; 2) the nature of dialogue within effective partnerships; and 3) the necessity of clearly defined roles. (Halonen et al., 2017) My question was: If OH professionals lack clearly defined roles within the OH team, how are the roles of OHS and the employees clarified and established during SCTS collaboration? The research highlighted several underused aspects of IPC, including enhanced relationships, increased information-sharing, continuity in interventions, collaboration, expansion, support, and efficiency through saving time. (Sangaleti et al., 2017)

OHS and IPC. Currently, most OH units (85% in 2023) are privately operated. However, my sample had strong representation from all four groups: in-house OHS, 27%; public OHS, 27%; private OHS, 34%; and other, such as entrepreneurs/self-employed individuals, 12%. Even though in-house OH was not the most represented setting, IPC was nonetheless implemented most effectively there. During my research, the privatization of OHS continued to increase. Even though privatization has brought the share of private providers close to 100%, the field remains diverse, and even among private service providers, models differ from one another. Nevertheless, we often refer to OHS as a single overarching concept, even though the term encompasses a variety of actors with different operational environments. In nations in which OHS activities are overseen by regulatory bodies or employers, the available statistics and surveys are predominantly quantitative. They typically cover metrics such as the number of workplace assessments or health screenings conducted. However, they often lack insights into the quality of these activities or their effects on workplace conditions and the health of employees. (Schmidt et al., 2015) In my opinion, more qualitative research is needed in the OH context.

I was also interested in exploring whether OH units differed from each other. My study revealed that in Finland, although in-house OHS are declining, they have facilitated effective IPC in smoke-free workplace interventions. This finding was consistent with those of other studies of IPC in in-house OHS (Mouazzen et al., 2024). The post-hoc analysis indicated a statistically significant difference (p-value <0.001) between the smoothness of collaboration and interprofessional evaluation in in-house OHS and private OHS. Implementation of SCTS is often successful in heavy industries or environments with harmful exposures. Since 1995, Finnish tobacco legislation has mandated that employers protect their employees from environmental tobacco smoke at work (Reijula and Reijula, 2010; Heloma, A., 2003). As a result of this legislation, a growing number of companies have adopted smoke-free workplace policies. (Savuton Suomi 2030, n.d.) An in-house OHS provider can facilitate successful collaboration due to three main factors: adaptable service agreements, close physical proximity of the involved parties, and enduring partnerships (Halonen et al., 2017). In in-house OH settings, clients' needs are easier to identify. Conversely, when external OHS providers operate in a

competitive market, often facing financial pressures, their ability and drive to conduct effective interprofessional smoke-free campaigns may be challenged. As the focus of my study was on supporting SC, general conclusions cannot be drawn regarding other activities. However, it is important to recognize the operating environments of different service systems and to identify the advantages and disadvantages in various units. Therefore, we cannot consider OHS a single umbrella concept. Outsourcing of OHS has grown exponentially. As a result, OHS units have transformed into multidisciplinary centres that employ representatives from various professions. To date, little ICP research has been conducted within OHS, and more is needed.

6.2.3 Smoking cessation and individual perception based on SDT

I examined individual perceptions of SCTS based on SDT. In summary, I found that successful SCTS was perceived most likely when individuals were internally motivated, as external pressure alone was insufficient for lasting change. The questionnaire responses highlighted three key psychological needs: autonomy, competence and relatedness, which were distributed over ten main categories, with autonomy being the most cited. A low-cost intervention grounded in SDT could be routinely implemented to provide an economical and lasting solution for helping so many smokers quit. Behavioural regulation becomes more autonomous when it is internalized, as opposed to being influenced by external sources such as family, friends or health care providers. Autonomous regulation, as opposed to external regulation, is linked to higher self-efficacy, sustained behaviour, long-term changes and improved health behaviours. Autonomy is highlighted by the ability to make independent choices. (Altendorf et al., 2021; Li et al., 2020) Research has shown a positive correlation between autonomy and competence, suggesting that individuals with greater autonomy tend to more successfully make behavioural changes than those with less autonomy (Williams et al., 2006b). My preliminary understanding was that OH professionals do not consciously use autonomy-supportive language was supported by the finding that all the OH professionals were highly motivated to enhance their behavioural support skills, in MI, for example. Although I did not assess the OH professionals' knowledge of SDT, I examined how SDT was reflected in the individual expectations and perceptions of mCessation and SCTS. This enables conclusions to be drawn on whether the mCessation content we developed was as intended, and how SDT 'needs' generally manifest in relation to mCessation and SCTS.

Overall, SDT was prominently featured in the theory-driven qualitative analysis. Comparison of the elements of both mCessation and SCTS revealed that the less important features were associated with controlled motivation, meaning individuals did not feel a sense of autonomy and competence. The most important

mCessation features – health data from one's own body, personal awards, stop-the-craving games – were linked to SDT. (Choi et al., 2014; Edwards et al., 2016; Latre-Navarro et al., 2024; Rajani et al., 2021; Wang et al., 2021; Wee and Choong, 2019; White et al., 2024). In SCTS, nicotine replacement therapy and psyche education were the most important measures, which is in line with earlier research findings. (Stead et al., 2016) mCessation was also assessed as an important tool alongside other measures.

OH professionals and other health practitioners should recognize and address the basic psychological needs of autonomy, competence and relatedness when assisting smokers in their cessation efforts. By offering meaningful choices to support autonomy, which subsequently enhances the feeling of competence; and by providing positive, informative feedback while also empathizing with the smoker's situation, professionals can improve the effectiveness of SC interventions. To be truly effective, support must be tailored to individual differences and needs (Murriky et al., 2025). Although this study focused on nicotine addiction related to smoking, the same cessation requirements apply to other forms of nicotine addiction.

6.3 Methodological considerations

The strength of this combination of studies is that they examined both OH practices from the perspective of OH professionals in various OHS systems, as well as the perspectives and needs of users. A combination of quantitative and qualitative approaches provides a more comprehensive and broader understanding of the phenomenon than only quantitative or qualitative methods alone. A key strength of this study is that multiple perspectives were examined using diverse methodological approaches. It is advisable to finish and publish the qualitative and quantitative components separately, and subsequently connect the findings in a different publication or format. (Yardley and Bishop, 2015) In my research, I used this approach to capitalize on the characteristic strengths of each component, maximizing the validity of each one. By integrating the qualitative and quantitative findings, I aimed to develop a more comprehensive, nuanced understanding of the phenomenon.

The study employed a diverse range of frameworks and reflected on their application in SC support. These frameworks (SDT and IPC) have rarely been applied in OH research, even though skilled patient guidance is a crucial element for success in any lifestyle guidance area. Multidisciplinary work is a central practice in OHS: internal multidisciplinary OHS activities, collaboration between OHS and various organizations, and partnership between OHS and employers. My research provides additional insights into the application of these frameworks in various OHS activities alongside SC support.

A weakness of my study is the wide-ranging transformation of the field during my research. The surveys did not focus on non-cigarette nicotine products, as many were either not yet on the market or had very limited uptake at the time. Since then, the availability and use of these products have expanded rapidly with successive product launches. The crucial point is that nicotine addiction is the common denominator across all such products. Accordingly, cessation support is applicable to the full range of nicotine products, although my initial focus was specifically on SC. Another potential limitation is that the OH field itself has undergone many changes. As already mentioned at the beginning of the study, the classification of occupational physiotherapists was updated from 'experts' to 'professionals.' This supports my argument that occupational physiotherapists should also be included in processes that support SC. This may also have impacted the IPC culture, and warrants further research. I managed to obtain samples from various OH units. After this, OHS have become significantly privatized and outsourced.

Theoretical background. To our knowledge, this was the first study in Finland to apply the IPC and SDT frameworks (Sub-studies II and III) within SCTS in OH. In Sub-study II, IPC served as the theoretical framework and was the logical choice, when the first sub-study revealed that occupational physiotherapists felt excluded from SCTS practices. Collaboration across professions, despite limited evidence, manifests in three unique ways: by connecting gaps related to the profession, social dynamics, physical presence, and specific tasks; by managing overlaps in roles and responsibilities; and by establishing environments conducive to such interactions (Schot et al., 2020). I chose SDT as the third sub-theory and we developed the mobile application in 2017–2018. SDT is an empirically based, organismic theory of human behaviour, and personality development is a conceptual global framework, which consists of six mini-theories. I chose SDT because, despite being a global mega-theory, according to my experience and understanding, it is still relatively unfamiliar within the context of health care in Finland. I also consider it an excellent theory for developing mCessation. IPC and SDT complement each other, and the narrative continued naturally in Sub-studies II and III. One weakness could be claimed that no single theory runs through this doctoral research; different frameworks are emphasized in different sections. This can be justified by the fact that the study was interdisciplinary and had both quantitative and qualitative components. The Assessment of Interprofessional Team Collaboration Scale (AITCS) could provide more detailed information and more robust evidence of IPC in the OH context, particularly on collaboration in SC efforts. Utilizing various frameworks provides a comprehensive perspective on the phenomenon being studied. However, the challenge lies in the difficulty of delving deeply into any single framework.

Advantages of IPC. A multidisciplinary perspective advocates considering and enhancing autonomy, competence and relatedness (as conceptualized in SDT),

to strengthen participatory, patient-centred care. Having multiple viewpoints facilitates identifying risks and developing contingency plans (e.g., for comorbidities associated with nicotine dependence). IPC (on-site) training is one of the basic prerequisites for the implementation of interdisciplinary activities.

Disadvantages of IPC. Insufficient commitment and a weak IPC culture – due to limited managerial or unit-level support – undermine effectiveness. Evaluating impacts is challenging: without robust study designs, it is difficult to isolate the effects of IPC from other contributing factors.

In conclusion, IPC offers clear benefits in complex health interventions such as SCTS in OHS, but its success depends on having appropriate structures, training and effective communication channels. Whether these benefits are achieved depends on how well IPC is implemented; whether the delineation of roles is clear and goal-setting is shared, and measurable outcomes help minimize drawbacks and strengthen overall effectiveness.

Cross-sectional study. A cross-sectional study is useful for identifying preliminary evidence, such as the prevalence of attitudes and knowledge among health personnel, when planning a future advanced study. The sub-studies did not track individuals over time, and thus it may be beneficial to repeat them and compare the findings. Cross-sectional studies can be categorized as either descriptive or analytical. For analytical purposes, the association between an exposure and an outcome is assessed. In this case, the authors and readers should be careful not to make causal inferences. In health care, descriptive studies primarily focus on estimating the prevalence of diseases, characteristics such as smoking habits, and people's attitudes, knowledge or health-related behaviours. (Kesmodel, 2018; Wang and Cheng, 2020). My descriptive cross-sectional study can be considered an appropriate method for examining the attitudes and knowledge of OH professionals.

Cross-sectional studies typically require a sample to be chosen from a broad, varied study population, and this can pose a risk of sampling bias. (Wang and Cheng, 2020). The primary strength of my study was that the sample was representative, and the survey covered a wide spectrum of OH professionals in Finland. The demographic data on the respondents corresponded to the national state level. Through our systematic sampling approach, we successfully obtained a diverse sample from the target groups that represented all the three types of professionals, and minimal data had to be excluded from the overall sample. Non-response bias was lower than the average. Selection bias arises when the sample selected or acquired for a study fails to accurately reflect the broader population. (Wang and Cheng, 2020).

Selection bias is a potential limitation in Sub-studies I and II, as the respondents might have had a greater interest in SCTS than OH professionals in general. This self-selection of participants may have restricted the generalization of the findings.

Another weakness is the gap between the collection of data on OH physicians and OH nurses in 2013 and the collection of data on occupational physiotherapists in 2017, as the perspectives of the various OH professionals may have evolved over time. Unfortunately, it is difficult to predict the direction or magnitude of any potential changes in their opinions. Although the interprofessional SC practices and policies were the same in both years, the different timeframes might have impacted the participants' responses. Electronic surveys have limitations such as generally lower response rates., but in my study, the response rate was higher than the average typically obtained from surveys today. Internal validity of the questionnaire was tested using Cronbach's alpha (internal consistency coefficient) as a measure of subscale reliability. The mean value of the motivation statements was based on six statements and Cronbach's alpha was 0.85. Correspondingly, the mean value of attitudes toward SCTS was based on four statements, and Cronbach's alpha was 0.756. The collaboration subscale consisted of six statements, and its Cronbach's alpha was 0.90.

In Sub-study III, respondents were selected from the educational institution because they had to be interested in participating in the application development workshop and had to have a personal interest in mHealth. They also had to be interested in SCTS. The group was selected on the basis of their specialization, and the co-design workshop was elective and voluntary. The workshop was conducted interdisciplinarily, following a co-design approach in which the users in the design process play an active role in knowledge development, idea generation and concept development. (Noorbergen,T. et al., 2021) In terms of the representativeness of participants, the expressions needs for autonomy, competence and relatedness did not vary according to whether the participants were current, former or non-users of nicotine products. They also received no prior information on SDT. Instead, by specifically selecting participants who were nicotine dependent and analysing their perceptions of different SCTS, a homogeneous representation could yield different results. In my study, the respondents were quite heterogeneous, with varying demographic backgrounds, yet their responses to SC support aligned with current recommendations. Qualitative analysis aims to understand the phenomenon under study, and the result confirmed my preliminary understanding that SDT should be integral to future SC and SCTS. In Sub-study III, selection, elitist and holistic bias may have been possible. In terms of selection bias, the task of disseminating information at the school may have attracted a specific profile. A researcher might exhibit elitist bias by choosing to focus solely on the most intriguing remarks, whereas holistic bias occurs when a single comment is disproportionately emphasized.

Previous studies have shown SDT and IPC to be effective frameworks in health promotion and health behaviour change (Choi et al., 2014; Mouazzen et al., 2024; Reeves et al., 2017; Richard M. Ryan and Edward L. Deci, n.d.; Teixeira et al., 2020).

In addition, employing co-design methodology and fostering IPC, particularly by engaging diverse stakeholders, ensured the implementation of best practices (Noorbergen,T. et al., 2021). Ultimately, the strength of my research lies in its interdisciplinary approach, examining SC support through the lens of these various theories for the first time in the OH context in Finland.

6.4 Significance of the study

OH professionals considered SC important and were motivated to develop their expertise. The occupational physiotherapists' knowledge differed significantly from that of the OH physicians and OH nurses (Sub-study I). Examination of IPC revealed that SC occurred randomly and variably, clear process guidelines for IPC in SC were missing (Sub-study II). Occupational physiotherapists resources were not utilized in the SC measures. The user perspectives of mCessation application were categorized using STD as theoretical framework. Of the basic psychological needs (autonomy, competence and relatedness), autonomy was highlighted the most. (Sub-study III). Figure 19 shows the study flowchart and summarizes the findings of this doctoral research.

During my research, the industry changed significantly, and the importance of this study may be even greater now than when I began it. Health professionals are struggling to keep up with the rapidly increasing array of nicotine products, making continuous and up-to-date training essential. Cessation guidance should not depend on the interest of individual professionals; OHS should have clear, interdisciplinary processes based on researched information. The organization and management of OHS should enable continuous interprofessional and interdisciplinary training for employees and prioritize the implementation of processes for addressing nicotine addiction. I believe that the OH environment should consciously utilize IPC and SDT frameworks. These models can also be applied to other lifestyle guidance. Lifestyles are significantly linked to employees' work capacity, and one of the key tasks of OHS is the prevention and promotion of illness in collaboration with workplaces. (Oellingrath et al., 2019; Pihlajamäki et al., 2019; Tarro et al., 2020) In the ongoing tobacco crisis, aggressive marketing of new nicotine products has led to young people, including small children, being exposed to nicotine. This situation demands that all health professionals remain vigilant to nicotine dependence and stay informed of the various nicotine products available.

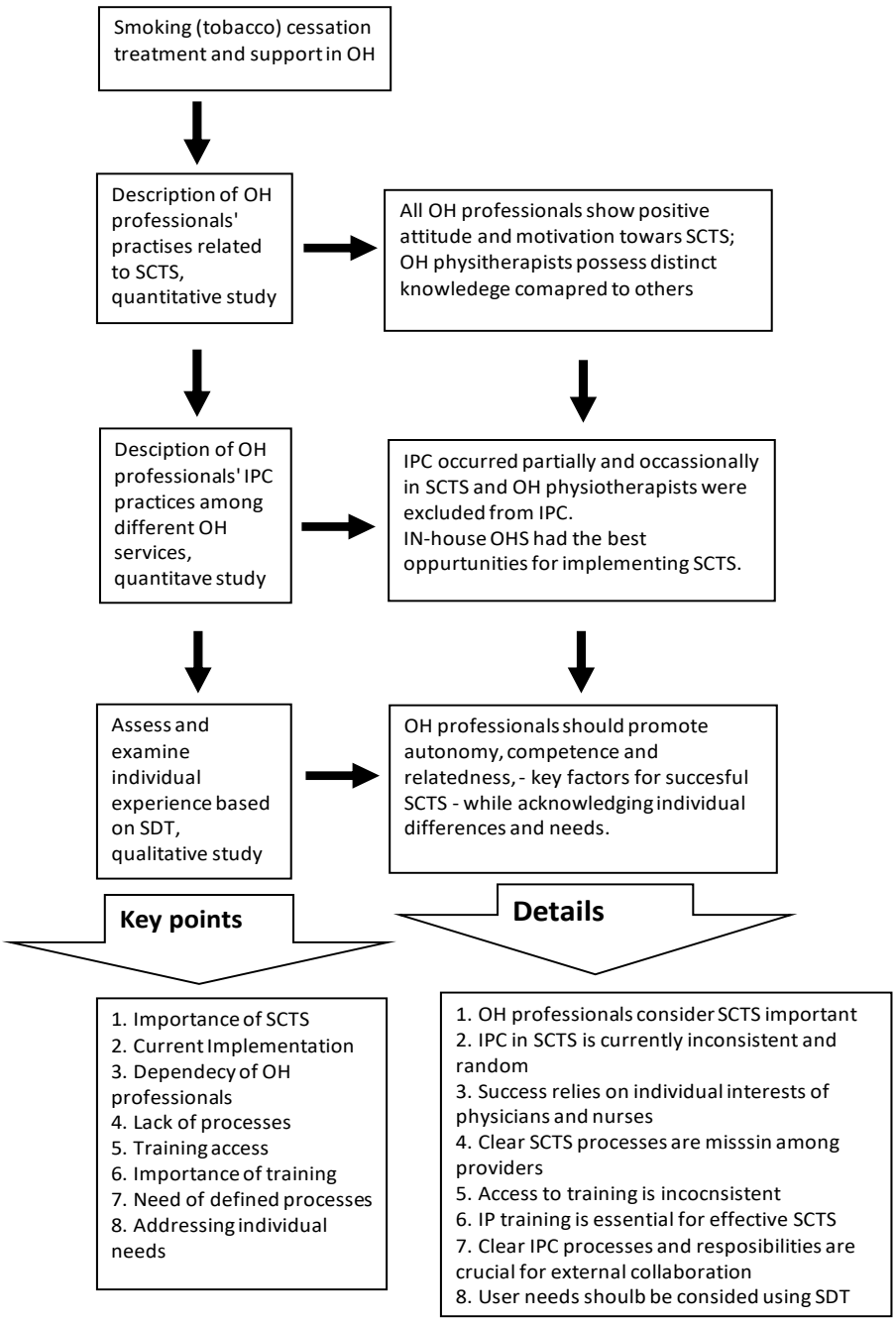

Figure 19 Study flowchart and findings of this dissertation

6.5 Implications and recommendations for further research

In the future, interprofessional collaborative practices should be strengthened, and all OH professional should receive continuous training in smoking (tobacco) cessation. SDT- and IPC-based action model for SCTS should be developed in OHS (Figure 20.) Practical tools are needed to identify individuals' and patients' perceptions that enhance autonomy, competence and relatedness. These findings have implications for both smoking (tobacco) cessation and other lifestyle promotion at the induvial and workplace levels. Although this study focused on nicotine addiction related to smoking, the same cessation requirements apply to other forms of nicotine addiction.

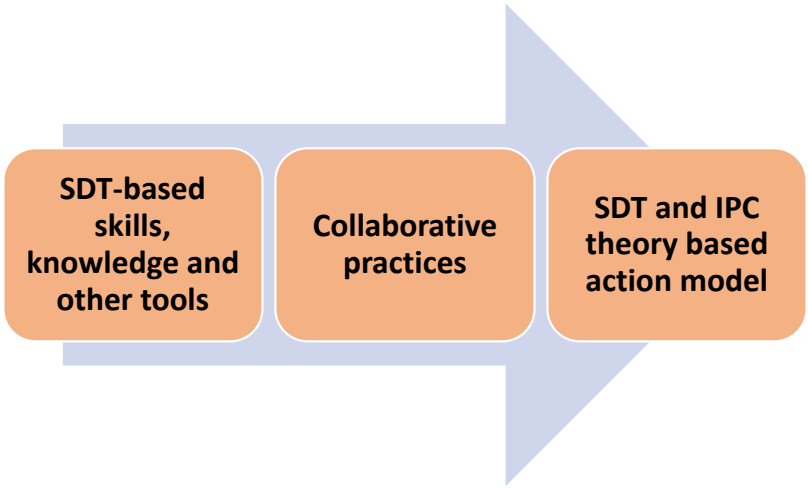

Figure 20 Professionals' expertise and other tools form the foundation for collaborative practices. An operational model based on the frameworks of SDT and IPC is also needed.

Further research is still needed in several areas. First, further studies are required to develop an SDT- and IPC-based action model for OHS. Second, this action model should be implemented and tested implemented and tested by intervention research in different operational OH environments, to find the effective practices of IPC in SCTS. In addition, it is increasingly important to identify the advantages of different operational environments and how effectively IPC, as observed in in-house settings, can be implemented in the private sector.

Third, employees' perceptions should be assessed to determine whether the SCTS meets their expectations. The co-design approach could be applied for OHS clients and users of nicotine products. Fourth, as a complementary element, SDT-based and tested mCessation could provide support for both OHS and their clients, including both individuals and employers. A potential solution could be a gamified application based on SDT and grounded in empirical research.

6.6 Conclusion and policy implications

Smoking and nicotine cessation strategies have been underutilized in OHS and for supporting the working-age population. Development efforts should be initiated on the basis of research examples that focus on prevention and health promotion. The insights from my dissertation should be applied to resource management, skills development, and when enhancing interdisciplinary training and collaboration. Training on nicotine addiction should be included in the basic education of all health care professionals, and opportunities for continuous skills development and knowledge updating should be ensured. According to my research, lifestyle guidance is perceived as challenging, which aligns with previous findings. The SDT, which contains six sub-theories, has proven to be a global mega-theory, and its understanding should be integrated more effectively into all stages of education, from basic training to specialization and workplace training. Potential additional instruments, such as mCessation, should be developed and integrated into this toolkit.

During the final stages of writing my dissertation, concerning trends emerged in political decision-making on snus and nicotine pouches. Information in the health care sector evolves rapidly, and knowledge must continually be updated if high-quality health care services are to be provided. Employees may face inequality if access to training varies depending on employers. This can also lead to significant variation in the quality of care received by health care users. Trade unions also play a crucial role in updating the skills of health care professionals.

Last, but not least, the tobacco industry is rapidly introducing a variety of tobacco products onto the market with the aim of addicting children and young people to nicotine, to ensure sales of nicotine products both now and in the future. Researchers should also be aware that the tobacco industry has recruited scientists to scientifically prove the harmlessness of nicotine products. Therefore, impartial research on nicotine products is crucial. Legislation should respond more swiftly by imposing restrictions to nicotine products and should more effectively protect children, young people, and all age groups from products that are harmful to health.

Integrating IPC and SDT frameworks would enable OHS to not only respond effectively to market developments but also enhance individuals' autonomy,

competence and relatedness – thereby improving SC outcomes across the working-age population. The role of OHS in smoking and nicotine product cessation could be further strengthened if physiotherapists received more SC education and individuals' needs were paid more attention in SCTS. IPC and clear processes, along with well-defined responsibilities, would be crucial requirements for conducting multiprofessional collaboration and multidisciplinary work outside organizations, such as OH collaborations.

References

Airaksinen, J., Ervasti, J., Pentti, J., Oksanen, T., Suominen, S., Vahtera, J., Virtanen, M., Kivimäki, M., 2019. The effect of smoking cessation on work disability risk: a longitudinal study analysing observational data as non-randomized nested pseudo-trials. Int. J. Epidemiol. 48, 415–422. https://doi.org/10.1093/ije/dyz020

Airaksinen, J., Jokela, M., Virtanen, M., Oksanen, T., Pentti, J., Vahtera, J., Koskenvuo, M., Kawachi, I., Batty, G.D., Kivimäki, M., 2017. Development and validation of a risk prediction model for work disability: multicohort study. Sci. Rep. 7, 13578. https://doi.org/10.1038/s41598-017-13892-1

Albarrak, D.A., Alotaibi, A.B., Alotaibi, R.F., Alramadhan, S.H., Bin Muhanna, A.I., Aldehan, A.M., Bin Abdulrahman, K.A., 2023. The Association Between Nicotine Dependence and Mental Health in the General Population of Saudi Arabia: A Cross-Sectional Analytical Study. Int. J. Gen. Med. 16, 5801–5815. https://doi.org/10.2147/IJGM.S429609

Altendorf, M.B., Smit, E.S., Azrout, R., Hoving, C., Weert, J.C.M. van, 2021. A smoker's choice? Identifying the most autonomy-supportive message frame in an online computer-tailored smoking cessation intervention. Psychol. Health 36, 549–574. https://doi.org/10.1080/08870446.2020.1802457

An, L.C., Foldes, S.S., Alesci, N.L., Bluhm, J.H., Bland, P.C., Davern, M.E., Schillo, B.A., Ahluwalia, J.S., Manley, M.W., 2008. The impact of smoking-cessation intervention by multiple health professionals. Am. J. Prev. Med. 34, 54–60. https://doi.org/10.1016/j.amepre.2007.09.019

Andersson, M., Blanc, P.D., Torén, K., Järvholm, B., 2021. Smoking, occupational exposures, and idiopathic pulmonary fibrosis among Swedish construction workers. Am. J. Ind. Med. 64, 251–257. https://doi.org/10.1002/ajim.23231

Andrés, A., Castellano, Y., Fu, M., Feliu, A., Ballbè, M., Antón, L., Baena, A., Fernández, E., Martínez, C., 2019. Exploring individual and contextual factors contributing to tobacco cessation intervention implementation. Addict. Behav. 88, 163–168. https://doi.org/10.1016/j.addbeh.2018.08.003

Baenziger, O.N., Ford, L., Yazidjoglou, A., Joshy, G., Banks, E., 2021. E-cigarette use and combustible tobacco cigarette smoking uptake among non-smokers, including relapse in former smokers: umbrella review, systematic review and meta-analysis. BMJ Open 11, e045603. https://doi.org/10.1136/bmjopen-2020-045603

Ball, E., Rivas, C., 2021. Health Apps Require Co-development to Be Acceptable and Effective. Front. Psychol. 12, 714453. https://doi.org/10.3389/fpsyg.2021.714453

Bandura A., 1986. Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice Hall.

Banks, E., Yazidjoglou, A., Brown, S., Nguyen, M., Martin, M., Beckwith, K., Daluwatta, A., Campbell, S., Joshy, G., 2023. Electronic cigarettes and health outcomes: umbrella and systematic review of the global evidence. Med. J. Aust. 218, 267–275. https://doi.org/10.5694/mja2.51890

Battista, A., Torre, D., 2023. Mixed methods research designs. Med. Teach. 45, 585–587. https://doi.org/10.1080/0142159X.2023.2200118

Behrens, T., Ge, C., Vermeulen, R., Kendzia, B., Olsson, A., Schüz, J., Kromhout, H., Pesch, B., Peters, S., Portengen, L., Gustavsson, P., Mirabelli, D., Guénel, P., Luce, D., Consonni, D., Caporaso, N.E., Landi, M.T., Field, J.K., Karrasch, S., Wichmann, H.-E., Siemiatycki, J., Parent, M.-E., Richiardi, L., Simonato, L., Jöckel, K.-H., Ahrens, W., Pohlabeln, H., Fernández-Tardón, G., Zaridze, D., McLaughlin, J.R., Demers, P.A., Świątkowska, B., Lissowska, J., Pándics, T., Fabianova, E., Mates, D., Bencko, V., Foretova, L., Janout, V., Boffetta, P., Bueno-de-Mesquita, B., Forastiere, F., Straif, K., Brüning, T., 2023. Occupational exposure to nickel and hexavalent chromium and the risk of lung cancer in a pooled analysis of case-control studies (SYNERGY). Int. J. Cancer 152, 645–660. https://doi.org/10.1002/ijc.34272

Bendotti, H., Lawler, S., Ireland, D., Gartner, C., Hides, L., Marshall, H.M., 2022. What Do People Want in a Smoking Cessation App? An Analysis of User Reviews and App Quality. Nicotine Tob. Res. Off. J. Soc. Res. Nicotine Tob. 24, 169–177. https://doi.org/10.1093/ntr/ntab174

Black, N., Johnston, M., Michie, S., Hartmann-Boyce, J., West, R., Viechtbauer, W., Eisma, M.C., Scott, C., de Bruin, M., 2020. Behaviour change techniques associated with smoking cessation in intervention and comparator groups of randomized controlled trials: a systematic review and meta-regression. Addict. Abingdon Engl. 115, 2008–2020. https://doi.org/10.1111/add.15056

Bobak, A., Raupach, T., 2018. Effect of a Short Smoking Cessation Training Session on Smoking Cessation Behavior and Its Determinants Among General Practitioner Trainees in England. Nicotine Tob. Res. Off. J. Soc. Res. Nicotine Tob. 20, 1525–1528. https://doi.org/10.1093/ntr/ntx241

Bodner, M.E., Rhodes, R.E., Miller, W.C., Dean, E., 2020. Predictors of physical therapists' intentions to counsel for smoking cessation: Implications for practice and professional education. Physiother. Theory Pract. 36, 628–637. https://doi.org/10.1080/09593985.2018.1490365

Bold, K.W., Garrison, K.A., DeLucia, A., Horvath, M., Nguyen, M., Camacho, E., Torous, J., 2023. Smartphone Apps for Smoking Cessation: Systematic Framework for App Review and Analysis. J. Med. Internet Res. 25, e45183. https://doi.org/10.2196/45183

Bosdriesz, J.R., Willemsen, M.C., Stronks, K., Kunst, A.E., 2015. Socioeconomic inequalities in smoking cessation in 11 European countries from 1987 to 2012. J. Epidemiol. Community Health 69, 886–892. https://doi.org/10.1136/jech-2014-205171

Bricker, J.B., Watson, N.L., Mull, K.E., Sullivan, B.M., Heffner, J.L., 2020. Efficacy of Smartphone Applications for Smoking Cessation: A Randomized Clinical Trial. JAMA Intern. Med. 180, 1472–1480. https://doi.org/10.1001/jamainternmed.2020.4055

Burkhardt, T., Scherer, M., Scherer, G., Pluym, N., Weber, T., Kolossa-Gehring, M., 2023. Time trend of exposure to secondhand tobacco smoke and polycyclic aromatic hydrocarbons between 1995 and 2019 in Germany - Showcases for successful European legislation. Environ. Res. 216, 114638. https://doi.org/10.1016/j.envres.2022.114638

Cahill, K., Lancaster, T., 2014. Workplace interventions for smoking cessation. Cochrane Database Syst. Rev. (2):CD003440. doi, CD003440. https://doi.org/10.1002/14651858.CD003440.pub4

Carradore, M., Michelini, E., Caretta, I., Carpi, S., Corradini, L., Ganapini, S., Lumetta, F., Paterlini, G., Pedroni, E., Russo, A., Sarli, L., Artioli, G., 2021. Interprofessional collaboration between different health care professions in Emilia Romagna. Acta Bio-Medica Atenei Parm. 92, e2021033. https://doi.org/10.23750/abm.v92iS2.11954

Carson, K.V., Verbiest, M.E.A., Crone, M.R., Brinn, M.P., Esterman, A.J., Assendelft, W.J.J., Smith, B.J., 2012. Training health professionals in smoking cessation. Cochrane Database Syst. Rev. 2012, CD000214. https://doi.org/10.1002/14651858.CD000214.pub2

Charlesworth, L., Hutton, D., Hussain, H., 2019. Therapeutic Radiographers' perceptions of the barriers and enablers to effective smoking cessation support. Radiogr. Lond. Engl. 1995 25, 121–128. https://doi.org/10.1016/j.radi.2018.12.002

Chatdokmaiprai, K., Kalampakorn, S., McCullagh, M., Lagampan, S., Keeratiwiriyaporn, S., 2017. Factors Predicting the Provision of Smoking Cessation Services Among Occupational Health Nurses in Thailand. Workplace Health Saf. 65, 253–261. https://doi.org/10.1177/2165079916670661

Chellian, R., Behnood-Rod, A., Bruijnzeel, A.W., 2023. Development of Dependence in Smokers and Rodents With Voluntary Nicotine Intake: Similarities and Differences. Nicotine Tob. Res. Off. J. Soc. Res. Nicotine Tob. 25, 1229–1240. https://doi.org/10.1093/ntr/ntac280

Chen, A., Machiorlatti, M., Krebs, N.M., Muscat, J.E., 2019. Socioeconomic differences in nicotine exposure and dependence in adult daily smokers. BMC Public Health 19, 375. https://doi.org/10.1186/s12889-019-6694-4

Cheung, K.L., Eggers, S.M., de Vries, H., 2020. Combining the Integrated-Change Model with Self-Determination Theory: Application in Physical Activity. Int. J. Environ. Res. Public. Health 18, 28. https://doi.org/10.3390/ijerph18010028

Choi, J., Noh, G.-Y., Park, D.-J., 2014. Smoking cessation apps for smartphones: content analysis with the self-determination theory. J. Med. Internet Res. 16, e44. https://doi.org/10.2196/jmir.3061

Chong, S.O.K., Pedron, S., Abdelmalak, N., Laxy, M., Stephan, A.-J., 2023. An umbrella review of effectiveness and efficacy trials for app-based health interventions. NPJ Digit. Med. 6, 233. https://doi.org/10.1038/s41746-023-00981-x

Cobos-Campos, R., de Lafuente, A.S., Apiñaniz, A., Parraza, N., Llanos, I.P., Orive, G., 2020. Effectiveness of mobile applications to quit smoking: Systematic review and meta-analysis. Tob. Prev. Cessat. 6, 62. https://doi.org/10.18332/tpc/127770

Conti, A.A., Tolomeo, S., Steele, J.D., Baldacchino, A.M., 2020. Severity of negative mood and anxiety symptoms occurring during acute abstinence from tobacco: A systematic review and meta-analysis. Neurosci. Biobehav. Rev. 115, 48–63. https://doi.org/10.1016/j.neubiorev.2020.04.018

Crosby, L.M., 2025. Unravelling the Risk of Poisoning From Nicotine-Containing Tobacco Products in Children Less Than Five Years of Age. Nicotine Tob. Res. Off. J. Soc. Res. Nicotine Tob. 27, 378–386. https://doi.org/10.1093/ntr/ntae044

Danielsson, M., Tanner, T., Patinen, P., Birkhed, D., Anttonen, V., Lammi, A., Siitonen, S., Ollgren, J., Pylkkänen, L., Vasankari, T., 2021. Prevalence, duration of exposure and predicting factors for snus use among young Finnish men: a cross-sectional study. BMJ Open 11, e050502. https://doi.org/10.1136/bmjopen-2021-050502

Darabseh, M.Z., Aburub, A., Fayed, E.E., 2023. The Role of Physiotherapists in Smoking Cessation Management: A Scoping Review. Healthc. Basel Switz. 11, 336. https://doi.org/10.3390/healthcare11030336

Darabseh M.Z., Selfe J., Morse C.I., Degens H., n.d. Impact of vaping and smoking on maximum respiratory pressures and respiratory function.

Deci, E.L., Ryan, R.M., 2012. Self-determination theory in health care and its relations to motivational interviewing: a few comments. Int. J. Behav. Nutr. Phys. Act. 9, 24. https://doi.org/10.1186/1479-5868-9-24

DeShazo, S.J., Crossnoe, R.C., Bailey, L.C., Rogers, J.M., Naeger, P.A., 2024. Non-Tobacco Nicotine Dependence and Rates of Postoperative Complications in Total Knee Arthroplasty: A

Propensity-Matched Comparison. J. Am. Acad. Orthop. Surg. 32, 1032–1037. https://doi.org/10.5435/JAAOS-D-23-01053
Dinardo, P., Rome, E.S., 2019. Vaping: The new wave of nicotine addiction. Cleve. Clin. J. Med. 86, 789–798. https://doi.org/10.3949/ccjm.86a.19118
Domić, A., Pilipović-Broćeta, N., Grabež, M., Divac, N., Igić, R., Škrbić, R., 2024. Intensive Intervention on Smoking Cessation in Patients Undergoing Elective Surgery: The Role of Family Physicians. Med. Kaunas Lith. 60, 965. https://doi.org/10.3390/medicina60060965
Duaso, M.J., Bakhshi, S., Mujika, A., Purssell, E., While, A.E., 2017. Nurses' smoking habits and their professional smoking cessation practices. A systematic review and meta-analysis. Int. J. Nurs. Stud. 67, 3–11. https://doi.org/10.1016/j.ijnurstu.2016.10.011
Duaso, M.J., McDermott, M.S., Mujika, A., Purssell, E., While, A., 2014. Do doctors' smoking habits influence their smoking cessation practices? A systematic review and meta-analysis. Addict. Abingdon Engl. 109, 1811–1823. https://doi.org/10.1111/add.12680
Duodecim, 2024. Current Care Guidelines on Tobacco dependence and cessation.
Duodecim Current Care Guidelines, n.d. Current Care Guidelines on Tobacco dependence and cessation.
Edwards, E.A., Lumsden, J., Rivas, C., Steed, L., Edwards, L.A., Thiyagarajan, A., Sohanpal, R., Caton, H., Griffiths, C.J., Munafò, M.R., Taylor, S., Walton, R.T., 2016. Gamification for health promotion: systematic review of behaviour change techniques in smartphone apps. BMJ Open 6, e012447. https://doi.org/10.1136/bmjopen-2016-012447
Ekblad, M.O., 2022. Treatment of nicotine dependence needs be strengthened in primary health care. Scand. J. Prim. Health Care 40, 329–330. https://doi.org/10.1080/02813432.2022.2159638
European Agency for Safet and Health at Work (EU-OSHA), n.d. Työterveyttä ja -turvallisuutta koskeva EU:n strategiakehys 2021–2027.
Eurostat, n.d. Smoking of tobacco products by sex, age and degree of urbanisation. https://doi.org/10.2908/hlth_ehis_sk1u
Evenhuis, A., Occhipinti, S., Jones, L., Wishart, D., 2023. Factors associated with cessation of smoking in health professionals: a scoping review. Glob. Health Action 16, 2216068. https://doi.org/10.1080/16549716.2023.2216068
Finnish Institute for Health and Welfare, 2023. Tobacco Statistic 2023.
Finnish Institute for Health and Welfare, 2022. Tupakoinnin yhteiskunnalliset kustannukset vuonna 2020 ja vertailu vuoteen 2012.
Finnish Institute for Health and Welfare, F.I. for H. and W., 2025. Jo joka neljäs alle 40-vuotias mies käyttää nikotiinipusseja.
Finnish Instutute for Health and Welfare, n.d. Tobacco.
Ganz, O., Fortuna, G., Weinsier, S., Campbell, K., Cantrell, J., Furmanski, W.L., 2015. Exploring Smoking Cessation Attitudes, Beliefs, and Practices in Occupational Health Nursing. Workplace Health Saf. 63, 288–296. https://doi.org/10.1177/2165079915578582
GBD 2019 Tobacco Collaborators., 2021. Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and attributable disease burden in 204 countries and territories, 1990-2019: a systematic analysis from the Global Burden of Disease Study 2019. Lancet Lond. Engl. 397, 2337–2360. https://doi.org/10.1016/S0140-6736(21)01169-7
GBD 2021 Tobacco Forecasting Collaborators, 2024. Forecasting the effects of smoking prevalence scenarios on years of life lost and life expectancy from 2022 to 2050: a systematic analysis for the Global Burden of Disease Study 2021. Lancet Public Health 9, e729–e744. https://doi.org/10.1016/S2468-2667(24)00166-X
Gillison, F.B., Rouse, P., Standage, M., Sebire, S.J., Ryan, R.M., 2019. A meta-analysis of techniques to promote motivation for health behaviour change from a self-

determination theory perspective. Health Psychol. Rev. 13, 110–130. https://doi.org/10.1080/17437199.2018.1534071
Global Center for Good Governance in Tobacco Control, 2024. Novel and Emerging Tobacco and Non-Tobacco Products (NENTPs).
Goodchild, M., Nargis, N., Tursan d'Espaignet, E., 2018. Global economic cost of smoking-attributable diseases. Tob. Control 27, 58–64. https://doi.org/10.1136/tobaccocontrol-2016-053305
Gould R., Ilmarinen J., Järvisalo J., Koskinen S., 2008. Dimensions of work ability. Results of the Health 2000 Survey.
Halonen, J.I., Atkins, S., Hakulinen, H., Pesonen, S., Uitti, J., 2017. Collaboration between employers and occupational health service providers: a systematic review of key characteristics. BMC Public Health 17, 22. https://doi.org/10.1186/s12889-016-3924-x
Haskins, B.L., Lesperance, D., Gibbons, P., Boudreaux, E.D., 2017. A systematic review of smartphone applications for smoking cessation. Transl. Behav. Med. 7, 292–299. https://doi.org/10.1007/s13142-017-0492-2
Havermans, A., Pennings, J.L.A., Hegger, I., Elling, J.M., de Vries, H., Pauwels, C.G.G.M., Talhout, R., 2021. Awareness, use and perceptions of cigarillos, heated tobacco products and nicotine pouches: A survey among Dutch adolescents and adults. Drug Alcohol Depend. 229, 109136. https://doi.org/10.1016/j.drugalcdep.2021.109136
Heidel, A., Hagist, C., 2020. Potential Benefits and Risks Resulting From the Introduction of Health Apps and Wearables Into the German Statutory Health Care System: Scoping Review. JMIR MHealth UHealth 8, e16444. https://doi.org/10.2196/16444
Heloma, A., Korhonen,T., Patja,K., Salminen,O., Winell, K. (toim.), 2022. Tupakka- ja nikotiiniriippuvuus. Duodecim.
Heloma,A., 2003. Impact and implementation of the Finnish Tobacco Act in Workplaces. Academic dissertation. University of Tampere.
Hernández-Pérez, A., García-Gómez, L., Robles-Hernández, R., Thirión-Romero, I., Osio-Echánove, J., Rodríguez-Llamazares, S., Baler, R., Pérez-Padilla, R., 2023. Addiction to Tobacco Smoking and Vaping. Rev. Investig. Clin. Organo Hosp. Enfermedades Nutr. 75, 158–168. https://doi.org/10.24875/RIC.23000117
Hoskins, K., Ulrich, C.M., Shinnick, J., Buttenheim, A.M., 2019. Acceptability of financial incentives for health-related behavior change: An updated systematic review. Prev. Med. 126, 105762. https://doi.org/10.1016/j.ypmed.2019.105762
Hu, T., Gall, S.L., Widome, R., Bazzano, L.A., Burns, T.L., Daniels, S.R., Dwyer, T., Ikonen, J., Juonala, M., Kähönen, M., Prineas, R.J., Raitakari, O., Sinaiko, A.R., Steinberger, J., Urbina, E.M., Venn, A., Viikari, J., Woo, J.G., Jacobs, D.R.J., 2020. Childhood/Adolescent Smoking and Adult Smoking and Cessation: The International Childhood Cardiovascular Cohort (i3C) Consortium. J. Am. Heart Assoc. 9, e014381. https://doi.org/10.1161/JAHA.119.014381
Hudson, C.C., Gauvin, S., Tabanfar, R., Poffenroth, A.M., Lee, J.S., O'Riordan, A.L., 2017. Promotion of role clarification in the Health Care Team Challenge. J. Interprof. Care 31, 401–403. https://doi.org/10.1080/13561820.2016.1258393
Hughes, J.R., Keely, J., Naud, S., 2004. Shape of the relapse curve and long-term abstinence among untreated smokers. Addict. Abingdon Engl. 99, 29–38. https://doi.org/10.1111/j.1360-0443.2004.00540.x
Iivanainen, S., Kurtti, A., Wichmann, V., Andersen, H., Jekunen, A., Kaarteenaho, R., Vasankari, T., Koivunen, J.P., 2024. Smartphone application versus written material for smoking reduction and cessation in individuals undergoing low-dose computed tomography (LDCT) screening for lung cancer: a phase II open-label randomised controlled trial. Lancet Reg. Health Eur. 42, 100946. https://doi.org/10.1016/j.lanepe.2024.100946

Ilesanmi, O.S., Faseru, B., Afolabi, A.A., Odukoya, O., Ayo-Yusuf, O., Akinsolu, F., Adebiyi, A.O., Evans, W.K., 2024. Physician-brief advice for promoting smoking cessation among cancer patients on treatment in low and middle-income countries: a scoping review. BMC Cancer 24, 149. https://doi.org/10.1186/s12885-024-11872-z

Isoherranen, K., n.d. Uhka vai mahdollisuus : moniammatillista yhteistyötä kehittämässä, Academic dissertation. University of Helsinki.

Jallinoja, P., Absetz, P., Kuronen, R., Nissinen, A., Talja, M., Uutela, A., Patja, K., 2007. The dilemma of patient responsibility for lifestyle change: perceptions among primary care physicians and nurses. Scand. J. Prim. Health Care 25, 244–249. https://doi.org/10.1080/02813430701691778

Johnson, J.L., Adkins, D., Chauvin, S., 2020. A Review of the Quality Indicators of Rigor in Qualitative Research. Am. J. Pharm. Educ. 84, 7120. https://doi.org/10.5688/ajpe7120

Jubber, I., Ong, S., Bukavina, L., Black, P.C., Compérat, E., Kamat, A.M., Kiemeney, L., Lawrentschuk, N., Lerner, S.P., Meeks, J.J., Moch, H., Necchi, A., Panebianco, V., Sridhar, S.S., Znaor, A., Catto, J.W.F., Cumberbatch, M.G., 2023. Epidemiology of Bladder Cancer in 2023: A Systematic Review of Risk Factors. Eur. Urol. 84, 176–190. https://doi.org/10.1016/j.eururo.2023.03.029

Juranić, B., Rakošec, Ž., Jakab, J., Mikšić, Š., Vuletić, S., Ivandić, M., Blažević, I., 2017. Prevalence, habits and personal attitudes towards smoking among health care professionals. J. Occup. Med. Toxicol. Lond. Engl. 12, 20. https://doi.org/10.1186/s12995-017-0166-5

Kesmodel, U.S., 2018. Cross-sectional studies - what are they good for? Acta Obstet. Gynecol. Scand. 97, 388–393. https://doi.org/10.1111/aogs.13331

Keto, J., Jokelainen, J., Timonen, M., Linden, K., Ylisaukko-oja, T., 2015. Physicians discuss the risks of smoking with their patients, but seldom offer practical cessation support. Subst. Abuse Treat. Prev. Policy 10, 43. https://doi.org/10.1186/s13011-015-0039-9

Keyes Daniel, Turfe Hussein, das Joe M., 2025. StatPearls, Prevention Strategies. StatPearls Publishing.

Kim, K., Picciotto, M.R., 2023. Nicotine addiction: More than just dopamine. Curr. Opin. Neurobiol. 83, 102797. https://doi.org/10.1016/j.conb.2023.102797

Klebe, S., Leigh, J., Henderson, D.W., Nurminen, M., 2019. Asbestos, Smoking and Lung Cancer: An Update. Int. J. Environ. Res. Public. Health 17, 258. https://doi.org/10.3390/ijerph17010258

Kumar, R., Sahu, M., Rodney, T., 2022. Efficacy of Motivational Interviewing and Brief Interventions on tobacco use among healthy adults: A systematic review of randomized controlled trials. Investig. Educ. En Enfermeria 40, e03. https://doi.org/10.17533/udea.iee.v40n3e03

Kuoppala, J., Lamminpää, A., Husman, P., 2008. Work health promotion, job well-being, and sickness absences--a systematic review and meta-analysis. J. Occup. Environ. Med. 50, 1216–1227. https://doi.org/10.1097/JOM.0b013e31818dbf92

Kwon, O.B., Jung, C., Kim, A., Park, S.W., Byeon, G., Lee, S.-J., Kim, W.J., 2024. Associations between Nicotine Dependence, Smartphone Usage Patterns, and Expected Compliance with a Smoking Cessation Application among Smokers. Healthc. Inform. Res. 30, 224–233. https://doi.org/10.4258/hir.2024.30.3.224

Lang, T., Nicaud, V., Slama, K., Hirsch, A., Imbernon, E., Goldberg, M., Calvel, L., Desobry, P., Favre-Trosson, J., Lhopital, C., Mathevon, P., Miara, D., Miliani, A., Panthier, F., Pons, G., Roitg, C., Thoores, M., 2000. Smoking cessation at the workplace. Results of a randomised controlled intervention study. Worksite physicians from the AIREL group. J. Epidemiol. Community Health 54, 349–354. https://doi.org/10.1136/jech.54.5.349

Latre-Navarro, L., Quintas-Hijós, A., Sáez-Bondía, M.-J., 2024. The combined effects of an anatomy program integrating drawing and gamification on basic psychological needs

satisfaction among sport sciences students: Results of a natural experiment. Anat. Sci. Educ. 17, 366–378. https://doi.org/10.1002/ase.2358
Latulippe, K., Hamel, C., Giroux, D., 2020. Co-Design to Support the Development of Inclusive eHealth Tools for Caregivers of Functionally Dependent Older Persons: Social Justice Design. J. Med. Internet Res. 22, e18399. https://doi.org/10.2196/18399
Lauria, V.T., Sperandio, E.F., de Sousa, T.L.W., de Oliveira Vieira, W., Romiti, M., de Toledo Gagliardi, A.R., Arantes, R.L., Dourado, V.Z., 2017. Evaluation of dose-response relationship between smoking load and cardiopulmonary fitness in adult smokers: A cross-sectional study. Rev. Port. Pneumol. 23, 79–84. https://doi.org/10.1016/j.rppnen.2016.11.007
Le Foll, B., Piper, M.E., Fowler, C.D., Tonstad, S., Bierut, L., Lu, L., Jha, P., Hall, W.D., 2022. Tobacco and nicotine use. Nat. Rev. Dis. Primer 8, 19. https://doi.org/10.1038/s41572-022-00346-w
Lee, J., Lee, S., Lee, M., Kang, Y.J., 2021. Occupational health nurses' personal attitudes toward smoking: A cross-sectional study. J. Occup. Health 63, e12221. https://doi.org/10.1002/1348-9585.12221
Lee, J., Lee, S., Lee, W., Lee, S.H., Kwack, W.G., Kang, Y.J., 2023. Underestimation of smoking hazards and smoking cessation intervention efficiency among healthcare professionals: A cross-sectional study among Korean occupational health nurses. Tob. Induc. Dis. 21, 55. https://doi.org/10.18332/tid/162320
Levesque, C.S., Williams, G.C., Elliot, D., Pickering, M.A., Bodenhamer, B., Finley, P.J., 2007. Validating the theoretical structure of the Treatment Self-Regulation Questionnaire (TSRQ) across three different health behaviors. Health Educ. Res. 22, 691–702. https://doi.org/10.1093/her/cyl148
Li, W.H.C., Ho, K.Y., Wang, M.P., Cheung, D.Y.T., Lam, K.K.W., Xia, W., Cheung, K.Y., Wong, C.K.H., Chan, S.S.C., Lam, T.H., 2020. Effectiveness of a Brief Self-determination Theory-Based Smoking Cessation Intervention for Smokers at Emergency Departments in Hong Kong: A Randomized Clinical Trial. JAMA Intern. Med. 180, 206–214. https://doi.org/10.1001/jamainternmed.2019.5176
Lindson, N., Pritchard, G., Hong, B., Fanshawe, T.R., Pipe, A., Papadakis, S., 2021. Strategies to improve smoking cessation rates in primary care. Cochrane Database Syst. Rev. 9, CD011556. https://doi.org/10.1002/14651858.CD011556.pub2
Loisel P. and Anema J.R. (eds.), 2013. Handbook of Work Disability: Prevention and Management. Springer Science+Business Media, New York.
Luxton, N., Redfern, J., 2020. The role of physiotherapists in smoking cessation. J. Physiother. 66, 207–210. https://doi.org/10.1016/j.jphys.2020.09.007
Malin,M., Reijula,K., 2022. Tupakkariippuvuuden hoito työterveyshuollossa kirjassa Tupakka-ja nikotiiniriippuvuus. Duodecim.
Manjarres-Posada, N., Onofre-Rodríguez, D., Benavides-Torres, R., 2020. Social Cognitive Theory and Health Care: Analysis and Evaluation. Int. J. Soc. Sci. Stud. 8. https://doi.org/10.11114/ijsss.v8i4.4870
Mariano B., n.d. Towards a global strategy on digital health. Bull World Health Organ 2020 Apr, 231-231A. https://doi.org/10.2471/BLT.20.253955.
Martela, F., Ryan, R.M., 2024. Assessing Autonomy, Competence, and Relatedness Briefly Validating Single-Item Scales for Basic Psychological Need Satisfaction. Eur. J. Psychol. Assess. https://doi.org/10.1027/1015-5759/a000846
Mersha, A.G., Eftekhari, P., Kennedy, M., Gould, G.S., 2023. Attitudes and practices of health care providers towards improving adherence to smoking cessation medications in Australia: A descriptive study. Health Promot. J. Aust. Off. J. Aust. Assoc. Health Promot. Prof. 34, 848–855. https://doi.org/10.1002/hpja.674

Mersha, A.G., Gould, G.S., Bovill, M., Eftekhari, P., 2020. Barriers and facilitators of adherence to nicotine replacement therapy: a systematic review and analysis using the capability, opportunity, motivation, and behaviour (com-b) model. Int. J. Environ. Res. Public. Health 17, 8895. https://doi.org/10.3390/ijerph17238895

Michie, S., van Stralen, M.M., West, R., 2011. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. Implement. Sci. IS 6, 42. https://doi.org/10.1186/1748-5908-6-42

Miikka Vähänen, 2015. Tupakoinnin yhteiskunnalliset kustannukset ja niiden arviointimenetelmät. THL.

Ministry of Social Affairs and Health., n.d. Occupational Safety and Health Administration in Finland 2016–2022 M.

Ministry of Social Affairs and Health., n.d. Occupational Health Care.

Ministry of Social Affairs and Health, STM., 2021. Työterveyshuollon ammattihenkilön määritelmää ehdotetaan muutettavaksi.

Ministry of Social Affairs and Health.STM., 2025. Statistic on occupational health care.

Mouazzen, A.-K., Blomberg, K., Jaensson, M., 2024. Perceptions of interprofessional team collaboration among professionals working in the occupational health service in Sweden. J. Occup. Health 66. https://doi.org/10.1093/joccuh/uiad009

Murriky, A., Allam, E., Alotaibi, H., Alnamasy, R., Alnufiee, A., AlAmro, A., Al-Hammadi, A., 2025. The relationship between nicotine dependence and willingness to quit smoking: A cross-sectional study. Prev. Med. Rep. 53, 103066. https://doi.org/10.1016/j.pmedr.2025.103066

Muza, L.C., Egenasi, C.K., Steinberg, W.J., Benedict, M.O., Habib, T., Mampuya, F., van Rooyen, C., 2024. Healthcare providers' knowledge, attitudes and practices on smoking cessation intervention in the Northern Cape. Health SA SA Gesondheid 29, 2489. https://doi.org/10.4102/hsag.v29i0.2489

Nahhas, G.J., Cummings, K.M., Halenar, M.J., Sharma, E., Alberg, A.J., Hatuskami, D., Bansal-Travers, M., Hyland, A., Gaalema, D.E., Morris, P.B., Duffy, K., Chang, J.T., Lagaud, G., Vivar, J.C., Marshall, D., Blanco, C., Taylor, K.A., 2022. Smokeless Tobacco Use and Prevalence of Cardiovascular Disease Among Males in the Population Assessment of Tobacco and Health (PATH) Study, Waves 1-4. Prev. Med. Rep. 25, 101650. https://doi.org/10.1016/j.pmedr.2021.101650

Nataliya V. Ivankova, Laura Q. Rogers, Michelle Y. Martin, Maria Pisu, Dorothy Pekmez, Lieu Thompson, Kevin R. Fontaine, Yu-Mei Schoenberger-Godwin, Allyson Hall, Ivan I. Herbey, ami L. Anderson, Robert A. Oster, Kelly Kenzik, Wendy Demark-Wahnefried, 2024. Using Mixed Methods Research to Optimize Healthy Lifestyle Intervention Adaptation for Web-Based Delivery: A Pragmatic Approach. J. Mix. Methods Res. 18, 247–258. https://doi.org/10.1177/15586898241255714

Niemiec, C.P., Ivarsson, A., Weman, K., Smit, E., Williams, G.C., 2023. Self-determination theory and the smoking cessation process: Daily electronic self-reports can identify the initiation of quit attempts. Patient Educ. Couns. 115, 107886. https://doi.org/10.1016/j.pec.2023.107886

Nissinen, Sari; Kauranen, Tiina; Lappalainen, Kirsi; Oikarinen, Tom; Virtanen, Elina, 2023. Työterveyshuollon toiminta ja laatu Suomessa 2023.

Noorbergen,T., Adam,M., Teybner, T., Collins,C., 2021. Using Co-design in Mobile Health System Development: A Qualitative Study With Experts in Co-design and Mobile Health System Development. JMIR MHealth UHealth 9. https://doi.org/10.2196/27896

Nordic Welfare Centre, 2025. Development in nicotine product use among youth.

Ntoumanis, N., Ng, J.Y.Y., Prestwich, A., Quested, E., Hancox, J.E., Thøgersen-Ntoumani, C., Deci, E.L., Ryan, R.M., Lonsdale, C., Williams, G.C., 2021. A meta-analysis of self-determination

theory-informed intervention studies in the health domain: effects on motivation, health behavior, physical, and psychological health. Health Psychol. Rev. 15, 214–244. https://doi.org/10.1080/17437199.2020.1718529
O'Brien, D., Long, J., Quigley, J., Lee, C., McCarthy, A., Kavanagh, P., 2021. Association between electronic cigarette use and tobacco cigarette smoking initiation in adolescents: a systematic review and meta-analysis. BMC Public Health 21, 954. https://doi.org/10.1186/s12889-021-10935-1
Occupational Health Care Act, n.d.
Oellingrath, I.M., De Bortoli, M.M., Svendsen, M.V., Fell, A.K.M., 2019. Lifestyle and work ability in a general working population in Norway: a cross-sectional study. BMJ Open 9, e026215. https://doi.org/10.1136/bmjopen-2018-026215
Ofori, S., Rayner, D., Mikhail, D., Borges, F.K., Marcucci, M.M., Conen, D., Mbuagbaw, L., Devereaux, P.J., 2024. Barriers and facilitators to perioperative smoking cessation: A scoping review. PloS One 19, e0298233. https://doi.org/10.1371/journal.pone.0298233
Ortis, A., Caponnetto, P., Polosa, R., Urso, S., Battiato, S., 2020. A Report on Smoking Detection and Quitting Technologies. Int. J. Environ. Res. Public. Health 17. https://doi.org/10.3390/ijerph17072614
Pardavila-Belio, M.I., Canga-Armayor, A., Duaso, M.J., Pueyo-Garrigues, S., Pueyo-Garrigues, M., Canga-Armayor, N., 2019. Understanding how a smoking cessation intervention changes beliefs, self-efficacy, and intention to quit: a secondary analysis of a pragmatic randomized controlled trial. Transl. Behav. Med. 9, 58–66. https://doi.org/10.1093/tbm/ibx070
Parmar, M.P., Kaur, M., Bhavanam, S., Mulaka, G.S.R., Ishfaq, L., Vempati, R., C, M.F., Kandepi, H.V., Er, R., Sahu, S., Davalgi, S., 2023. A Systematic Review of the Effects of Smoking on the Cardiovascular System and General Health. Cureus 15, e38073. https://doi.org/10.7759/cureus.38073
Patja, K., 2025. Uusien nikotiinituotteiden haitallisuuden arviointi. Duodecim 141, 819–826.
Peacock, A., Leung, J., Larney, S., Colledge, S., Hickman, M., Rehm, J., Giovino, G.A., West, R., Hall, W., Griffiths, P., Ali, R., Gowing, L., Marsden, J., Ferrari, A.J., Grebely, J., Farrell, M., Degenhardt, L., 2018. Global statistics on alcohol, tobacco and illicit drug use: 2017 status report. Addict. Abingdon Engl. 113, 1905–1926. https://doi.org/10.1111/add.14234
Pennanen, M., Broms, U., Korhonen, T., Haukkala, A., Partonen, T., Tuulio-Henriksson, A., Laatikainen, T., Patja, K., Kaprio, J., 2014. Smoking, nicotine dependence and nicotine intake by socio-economic status and marital status. Addict. Behav. 39, 1145–1151. https://doi.org/10.1016/j.addbeh.2014.03.005
Pesis-Katz, I., Williams, G.C., Niemiec, C.P., Fiscella, K., 2011. Cost-effectiveness of intensive tobacco dependence intervention based on self-determination theory. Am. J. Manag. Care 17, e393-398.
Peters, G.-J.Y., Ruiter, R.A.C., Kok, G., 2013. Threatening communication: a critical re-analysis and a revised meta-analytic test of fear appeal theory. Health Psychol. Rev. 7, S8–S31. https://doi.org/10.1080/17437199.2012.703527
Picciotto, M.R., Kenny, P.J., 2021. Mechanisms of Nicotine Addiction. Cold Spring Harb. Perspect. Med. 11, a039610. https://doi.org/10.1101/cshperspect.a039610
Pignataro, R.M., 2017. Tobacco cessation counseling within physical therapist practice: Results of a statewide survey of Florida physical therapists. Physiother. Theory Pract. 33, 131–137. https://doi.org/10.1080/09593985.2016.1266719
Pignataro, R.M., Gurka, M., Jones, D.L., Kershner, R.E., Ohtake, P.J., Stauber, W., Swisher, A.K., 2015. Educating Physical Therapist Students in Tobacco Cessation Counseling: Feasibility and Preliminary Outcomes. J. Phys. Ther. Educ. 29, 68–79. https://doi.org/10.1097/00001416-201529030-00009

Pihlajamäki, M., Uitti, J., Arola, H., Ollikainen, J., Korhonen, M., Nummi, T., Taimela, S., 2019. Self-reported health problems and obesity predict sickness absence during a 12-month follow-up: a prospective cohort study in 21 608 employees from different industries. BMJ Open 9, e025967. https://doi.org/10.1136/bmjopen-2018-025967

Prijić, Ž., Igić, R., 2021. Cigarette smoking and medical students. J. BUON Off. J. Balk. Union Oncol. 26, 1709–1718.

Proper, K.I., van Oostrom, S.H., 2019. The effectiveness of workplace health promotion interventions on physical and mental health outcomes - a systematic review of reviews. Scand. J. Work. Environ. Health 45, 546–559. https://doi.org/10.5271/sjweh.3833

Rahman, A., Alqaisi, S., Alzakhari, R., Saith, S., 2023. Characterization and Summarization of the Impact of Electronic Cigarettes on the Cardiovascular System: A Systematic Review and Meta-Analysis. Cureus 15, e39528. https://doi.org/10.7759/cureus.39528

Rajani, N.B., Mastellos, N., Filippidis, F.T., 2021. Impact of Gamification on the Self-Efficacy and Motivation to Quit of Smokers: Observational Study of Two Gamified Smoking Cessation Mobile Apps. JMIR Serious Games 9, e27290. https://doi.org/10.2196/27290

Rantanen J, Lehtinen S., R., n.d. Basic Occupational Health Services. Julkari 2007 Httpswww Julkarifihand 10024135069.

Ravi, K., Indrapriyadharshini, K., Madankumar, P.D., 2021. Application of Health Behavioral Models in Smoking Cessation - A Systematic Review. Indian J. Public Health 65, 103–109. https://doi.org/10.4103/ijph.IJPH_1351_20

Reeves, S., Pelone, F., Harrison, R., Goldman, J., Zwarenstein, M., 2017. Interprofessional collaboration to improve professional practice and healthcare outcomes. Cochrane Database Syst. Rev. 6, CD000072. https://doi.org/10.1002/14651858.CD000072.pub3

Reeves, S., Xyrichis, A., Zwarenstein, M., 2018. Teamwork, collaboration, coordination, and networking: Why we need to distinguish between different types of interprofessional practice. J. Interprof. Care 32, 1–3. https://doi.org/10.1080/13561820.2017.1400150

Reijula, J.P., Reijula, K.E., 2010. The impact of Finnish tobacco legislation on restaurant workers' exposure to tobacco smoke at work. Scand. J. Public Health 38, 724–730. https://doi.org/10.1177/1403494810379168

Rice, V.H., Heath, L., Livingstone-Banks, J., Hartmann-Boyce, J., 2017. Nursing interventions for smoking cessation. Cochrane Database Syst. Rev. 12, CD001188. https://doi.org/10.1002/14651858.CD001188.pub5

Richard M. Ryan and Edward L. Deci (Ed.), n.d. Self-Determination Theory. Basic Psychological Needs in Motivation, Development and Wellness. 2018. The Guilford Press. New York, London.

Rissanen, I., Nerg, I., Oura, P., Huikari, S., Korhonen, M., 2024. Productivity costs of lifelong smoking-the Northern Finland Birth Cohort 1966 study. Eur. J. Public Health ckae057. https://doi.org/10.1093/eurpub/ckae057

Rogers, B., Kono, K., Marziale, M.H.P., Peurala, M., Radford, J., Staun, J., 2014. International survey of occupational health nurses' roles in multidisciplinary teamwork in occupational health services. Workplace Health Saf. 62, 274–281. https://doi.org/10.1177/216507991406200702

Ross, B.M., Barnes, D.M., 2018. Self-Determination Theory With Application to Employee Health Settings. Workplace Health Saf. 66, 367–372. https://doi.org/10.1177/2165079917749863

Rossi, K., Heinonen, K., Heikkinen, M.R., 2000. Factors affecting the work of an occupational health nurse. Occup. Med. Oxf. Engl. 50, 369–372. https://doi.org/10.1093/occmed/50.5.369

Ryan, R.M., Deci, E.L., 2000. Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. Contemp. Educ. Psychol. 25, 54–67. https://doi.org/10.1006/ceps.1999.1020

Sahan, C., Gunay, T., Simsek, H., Soysal, A., Ergor, G., 2018. Socioeconomic factors associated with tobacco smoking in Turkey: a cross-sectional, population-based study. East. Mediterr. Health J. Rev. Sante Mediterr. Orient. Al-Majallah Al-Sihhiyah Li-Sharq Al-Mutawassit 24, 705–713. https://doi.org/10.26719/2018.24.8.705

Sakowski, P., Marcinkiewicz, A., 2019. Health promotion and prevention in occupational health systems in Europe. Int. J. Occup. Med. Environ. Health 32, 353–361.

Salehi, N., Janjani, P., Tadbiri, H., Rozbahani, M., Jalilian, M., 2021. Effect of cigarette smoking on coronary arteries and pattern and severity of coronary artery disease: a review. J. Int. Med. Res. 49, 3000605211059893. https://doi.org/10.1177/03000605211059893

Samad, S., Baloch, B., Abdul Qadeer, M., 2024. Vaping epidemic among the youth in Pakistan: urgent measures required to combat the rising trend. Future Sci. OA 10, FSO965. https://doi.org/10.2144/fsoa-2024-0011

Sangaleti, C., Schveitzer, M.C., Peduzzi, M., Zoboli, E.L.C.P., Soares, C.B., 2017. Experiences and shared meaning of teamwork and interprofessional collaboration among health care professionals in primary health care settings: a systematic review. JBI Database Syst. Rev. Implement. Rep. 15, 2723–2788. https://doi.org/10.11124/JBISRIR-2016-003016

Sansone, L., Milani, F., Fabrizi, R., Belli, M., Cristina, M., Zagà, V., de Iure, A., Cicconi, L., Bonassi, S., Russo, P., 2023. Nicotine: From Discovery to Biological Effects. Int. J. Mol. Sci. 24, 14570. https://doi.org/10.3390/ijms241914570

Santiago-Torres, M., Mull, K.E., Sullivan, B.M., Kendzor, D.E., Bricker, J.B., 2022. Efficacy and utilization of smartphone applications for smoking cessation among low-income adults: Secondary analysis of the iCanQuit randomized trial. Drug Alcohol Depend. 231, 109258. https://doi.org/10.1016/j.drugalcdep.2021.109258

Sauni, R, S., R. et al, 2012. Työterveyshuolto Suomessa vuonna 2010 ja kehitystrendi 2000–2010.

Savuton Suomi 2030, n.d. Tobacco Act.

Scala, M., Dallera, G., Gorini, G., Achille, J., Havermans, A., Neto, C., Odone, A., Smits, L., Zambon, A., Lugo, A., Gallus, S., 2025. Patterns of use of heated tobacco products: a comprehensive systematic review. J. Epidemiol. https://doi.org/10.2188/jea.JE20240189

Schmidt, L., Sjöström, J., Antonsson, A.-B., 2015. Successful collaboration between occupational health service providers and client companies: Key factors. Work Read. Mass 51, 229–237. https://doi.org/10.3233/WOR-141855

Schot, E., Tummers, L., Noordegraaf, M., 2020. Working on working together. A systematic review on how healthcare professionals contribute to interprofessional collaboration. J. Interprof. Care 34, 332–342. https://doi.org/10.1080/13561820.2019.1636007

Seo, S., Cho, S.-I., Yoon, W., Lee, C.M., 2022. Classification of Smoking Cessation Apps: Quality Review and Content Analysis. JMIR MHealth UHealth 10, e17268. https://doi.org/10.2196/17268

Shaikh, S.B., Newton, C., Tung, W.C., Sun, Y., Li, D., Ossip, D., Rahman, I., 2023. Classification, Perception, and Toxicity of Emerging Flavored Oral Nicotine Pouches. Int. J. Environ. Res. Public. Health 20, 4526. https://doi.org/10.3390/ijerph20054526

Sheeran, P., Wright, C.E., Avishai, A., Villegas, M.E., Lindemans, J.W., Klein, W.M.P., Rothman, A.J., Miles, E., Ntoumanis, N., 2020. Self-determination theory interventions for health behavior change: Meta-analysis and meta-analytic structural equation modeling of randomized controlled trials. J. Consult. Clin. Psychol. 88, 726–737. https://doi.org/10.1037/ccp0000501

Shehata, S.A., Toraih, E.A., Ismail, E.A., Hagras, A.M., Elmorsy, E., Fawzy, M.S., 2023. Vaping, Environmental Toxicants Exposure, and Lung Cancer Risk. Cancers 15, 4525. https://doi.org/10.3390/cancers15184525

Smith, D.R., 2008. Tobacco smoking by occupation in Australia and the United States: a review of national surveys conducted between 1970 and 2005. Ind. Health 46, 77–89. https://doi.org/10.2486/indhealth.46.77

Sormunen M., Saaranen T., Tossavainen, K., Turunen, H., 2013. Monimenetelmätutkimus terveystieteissä. Sos. Aikakauslehti 50 312-321.

Spaulding, E.M., Marvel, F.A., Jacob, E., Rahman, A., Hansen, B.R., Hanyok, L.A., Martin, S.S., Han, H.-R., 2021. Interprofessional education and collaboration among healthcare students and professionals: a systematic review and call for action. J. Interprof. Care 35, 612–621. https://doi.org/10.1080/13561820.2019.1697214

Stadnick, N.A., Poth, C.N., Guetterman, T.C., Gallo, J.J., 2021. Advancing discussion of ethics in mixed methods health services research. BMC Health Serv. Res. 21, 577. https://doi.org/10.1186/s12913-021-06583-1

Stead, L.F., Koilpillai, P., Fanshawe, T.R., Lancaster, T., 2016. Combined pharmacotherapy and behavioural interventions for smoking cessation. Cochrane Database Syst. Rev. 3, CD008286. https://doi.org/10.1002/14651858.CD008286.pub3

Sun, L., Wang, X., Gu, T., Hu, B., Luo, J., Qin, Y., Wan, C., 2020. Nicotine triggers islet β cell senescence to facilitate the progression of type 2 diabetes. Toxicology 441, 152502. https://doi.org/10.1016/j.tox.2020.152502

Tarro, L., Llauradó, E., Ulldemolins, G., Hermoso, P., Solà, R., 2020. Effectiveness of Workplace Interventions for Improving Absenteeism, Productivity, and Work Ability of Employees: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. Int. J. Environ. Res. Public. Health 17. https://doi.org/10.3390/ijerph17061901

Teixeira, P.J., Marques, M.M., Silva, M.N., Brunet, J., Duda, J.L., Haerens, L., La Guardia, J., Lindwall, M., Lonsdale, C., Markland, D., Michie, S., Moller, A.C., Ntoumanis, N., Patrick, H., Reeve, J., Ryan, R.M., Sebire, S.J., Standage, M., Vansteenkiste, M., Weinstein, N., Weman-Josefsson, K., Williams, G.C., Hagger, M.S., 2020. A classification of motivation and behavior change techniques used in self-determination theory-based interventions in health contexts. Motiv. Sci. 6, 438–455. https://doi.org/10.1037/mot0000172

the Social Insurance Institution of Finland (Kela), 2022. Vuoden 2022 muutokset työnantajan Kela-asioinnissa.

Thornberry, A., Garcia, T.J., Peck, J., Sefcik, E., 2020. Occupational Health Nurses' Self-Efficacy in Smoking Cessation Interventions: An Integrative Review of the Literature. Workplace Health Saf. 68, 533–543. https://doi.org/10.1177/2165079920925106

Tjoncke, J.-A., Goncalves, R., Castaing, N., Molimard, M., Tovagliaro, F., Titier, K., 2020. Death related to nicotine replacement therapy: A case report. Forensic Sci. Int. 309, 110223. https://doi.org/10.1016/j.forsciint.2020.110223

Tomioka, K., Kurumatani, N., Saeki, K., 2020. The Association Between Education and Smoking Prevalence, Independent of Occupation: A Nationally Representative Survey in Japan. J. Epidemiol. 30, 136–142. https://doi.org/10.2188/jea.JE20180195

Travis, N., Warner, K.E., Goniewicz, M.L., Oh, H., Ranganathan, R., Meza, R., Hartmann-Boyce, J., Levy, D.T., 2025. The Potential Impact of Oral Nicotine Pouches on Public Health: A Scoping Review. Nicotine Tob. Res. Off. J. Soc. Res. Nicotine Tob. 27, 598–610. https://doi.org/10.1093/ntr/ntae131

Tremblay, M., Cournoyer, D., O'Loughlin, J., 2009. Do the correlates of smoking cessation counseling differ across health professional groups? Nicotine Tob. Res. Off. J. Soc. Res. Nicotine Tob. 11, 1330–1338. https://doi.org/10.1093/ntr/ntp142

Tremblay, M., Hamel, C., Viau-Guay, A., Giroux, D., 2022. User Experience of the Co-design Research Approach in eHealth: Activity Analysis With the Course-of-Action Framework. JMIR Hum. Factors 9, e35577. https://doi.org/10.2196/35577

Troelstra, S.A., Coenen, P., Boot, C.R., Harting, J., Kunst, A.E., van der Beek, A.J., 2020. Smoking and sickness absence: a systematic review and meta-analysis. Scand. J. Work. Environ. Health 46, 5–18. https://doi.org/10.5271/sjweh.3848

Turunen, Jarno (2020)., n.d. Työterveyshuollon kustannukset ja kattavuus.

Työeläke.fi, 2025. When your working ability has been reduced.

UW-CTRI, 2015. International Classification of Diseases (ICD)-10 Codes Tobacco/Nicotine Dependence, and Secondhand Smoke Exposure Effective.

Valen, H., Becher, R., Vist, G.E., Holme, J.A., Mdala, I., Elvsaas, I.-K.Ø., Alexander, J., Underland, V., Brinchmann, B.C., Grimsrud, T.K., 2023. A systematic review of cancer risk among users of smokeless tobacco (Swedish snus) exclusively, compared with no use of tobacco. Int. J. Cancer 153, 1942–1953. https://doi.org/10.1002/ijc.34643

Vallata, A., O'Loughlin, J., Cengelli, S., Alla, F., 2021. Predictors of Cigarette Smoking Cessation in Adolescents: A Systematic Review. J. Adolesc. Health Off. Publ. Soc. Adolesc. Med. 68, 649–657. https://doi.org/10.1016/j.jadohealth.2020.09.025

van den Brand, F.A., Nagelhout, G.E., Winkens, B., Chavannes, N.H., van Schayck, O.C.P., Evers, S.M.A.A., 2020. Cost-effectiveness and cost-utility analysis of a work-place smoking cessation intervention with and without financial incentives. Addict. Abingdon Engl. 115, 534–545. https://doi.org/10.1111/add.14861

Virtanen, M., Ervasti, J., Head, J., Oksanen, T., Salo, P., Pentti, J., Kouvonen, A., Väänänen, A., Suominen, S., Koskenvuo, M., Vahtera, J., Elovainio, M., Zins, M., Goldberg, M., Kivimäki, M., 2018. Lifestyle factors and risk of sickness absence from work: a multicohort study. Lancet Public Health 3, e545–e554. https://doi.org/10.1016/S2468-2667(18)30201-9

Vulovic V. Tobacconomics, Health Policy Center, Institute for Health Research and Policy, n.d. Economic Costs of Tobacco Use. A Tobacconomics Policy Brief.

Wachs, J.E., 2005. Building the occupational health team: keys to successful interdisciplinary collaboration. AAOHN J. Off. J. Am. Assoc. Occup. Health Nurses 53, 166–171.

Wang, T., Fan, L., Zheng, X., Wang, W., Liang, J., An, K., Ju, M., Lei, J., 2021. The Impact of Gamification-Induced Users' Feelings on the Continued Use of mHealth Apps: A Structural Equation Model With the Self-Determination Theory Approach. J. Med. Internet Res. 23, e24546. https://doi.org/10.2196/24546

Wang, X., Cheng, Z., 2020. Cross-Sectional Studies: Strengths, Weaknesses, and Recommendations. Chest 158, S65–S71. https://doi.org/10.1016/j.chest.2020.03.012

Wang, Y., Sung, H.-Y., Max, W.B., 2024. Changes in e-cigarette use and subsequent cigarette smoking cessation in the USA: evidence from a prospective PATH study, 2013-2018. Tob. Control 33, 365–372. https://doi.org/10.1136/tc-2021-057225

Ward, C.E., Hall, S.V., Barnett, P.G., Jordan, N., Duffy, S.A., 2020. Cost-effectiveness of a nurse-delivered, inpatient smoking cessation intervention. Transl. Behav. Med. 10, 1481–1490. https://doi.org/10.1093/tbm/ibz101

Wee, S.-C., Choong, W.-W., 2019. Gamification: Predicting the effectiveness of variety game design elements to intrinsically motivate users' energy conservation behaviour. J. Environ. Manage. 233, 97–106. https://doi.org/10.1016/j.jenvman.2018.11.127

Wei, H., Horns, P., Sears, S.F., Huang, K., Smith, C.M., Wei, T.L., 2022. A systematic meta-review of systematic reviews about interprofessional collaboration: facilitators, barriers, and outcomes. J. Interprof. Care 36, 735–749. https://doi.org/10.1080/13561820.2021.1973975

White, J.S., Toussaert, S., Raiff, B.R., Salem, M.K., Chiang, A.Y., Crane, D., Warrender, E., Lyles, C.R., Abroms, L.C., Westmaas, J.L., Thrul, J., 2024. Evaluating the Impact of a Game (Inner Dragon) on User Engagement Within a Leading Smartphone App for Smoking Cessation: Randomized Controlled Trial. J. Med. Internet Res. 26, e57839. https://doi.org/10.2196/57839

Whittaker, R., McRobbie, H., Bullen, C., Rodgers, A., Gu, Y., 2016. Mobile phone-based interventions for smoking cessation. Cochrane Database Syst. Rev. 4, CD006611. https://doi.org/10.1002/14651858.CD006611.pub4

Willeke, K., Janson, P., Kirchner, A., Tischer, C., D'Souza, A., Heuschmann, P.U., Zapf, A., Wildner, M., Stupp, C., Keil, T., 2024. Effects of occupational health promotion interventions on health-related outcomes among employees of small businesses and self-employed individuals: A systematic review. Work Read. Mass. https://doi.org/10.3233/WOR-230441

Williams, G.C., McGregor, H., Sharp, D., Kouldes, R.W., Lévesque, C.S., Ryan, R.M., Deci, E.L., 2006a. A self-determination multiple risk intervention trial to improve smokers' health. J. Gen. Intern. Med. 21, 1288–1294. https://doi.org/10.1111/j.1525-1497.2006.00621.x

Williams, G.C., McGregor, H.A., Sharp, D., Levesque, C., Kouides, R.W., Ryan, R.M., Deci, E.L., 2006b. Testing a self-determination theory intervention for motivating tobacco cessation: supporting autonomy and competence in a clinical trial. Health Psychol. Off. J. Div. Health Psychol. Am. Psychol. Assoc. 25, 91–101. https://doi.org/10.1037/0278-6133.25.1.91

Williams, G.C., Patrick, H., Niemiec, C.P., Ryan, R.M., Deci, E.L., Lavigne, H.M., 2011. The smoker's health project: a self-determination theory intervention to facilitate maintenance of tobacco abstinence. Contemp. Clin. Trials 32, 535–543. https://doi.org/10.1016/j.cct.2011.03.002

Woloshin, S., Schwartz, L.M., Welch, H.G., 2008. The risk of death by age, sex, and smoking status in the United States: putting health risks in context. J. Natl. Cancer Inst. 100, 845–853. https://doi.org/10.1093/jnci/djn124

World Health Organization, 2024. WHO clinical treatment guideline for tobacco cessation in adults.

World Health Organization, 2023. Report on the global tobacco epidemic, 2023: protect people from tobacco smoke.

World Health Organization, 2021. The WHO Framework Convention on Tobacco Control: an overview .

World Health Organization, 2019. WHO guideline Recommendations on Digital Interventions for Health System Strengthening.

World Health Organization, 2013. WHO Global Plan of Action on Workers' Health (2008-2017).

World Health Organization, 2010. Framework for action on interprofessional education and collaborative practice. https://www.who.int/publications/i/item/framework-for-action-on-interprofessional-education-collaborative-practice Geneva, Switzerland: WHO.

World Health Organization, 2002. Towards a Common Language for Functioning, Disability and Health ICF.

World Health Organization, n.d. Tobacco.

World Health Organization. Tobacco 2023., n.d.

Yaman Güncan, N., Kurcer, M.A., Erdogan, Z., 2021. The evaluation of the smoking cessation behaviors of coal miners according to the health belief model: A cross-sectional study. Arch. Environ. Occup. Health 76, 539–546. https://doi.org/10.1080/19338244.2021.1950598

Yardley, L., Bishop, F.L., 2015. Using mixed methods in health research: benefits and challenges. Br. J. Health Psychol. 20, 1–4. https://doi.org/10.1111/bjhp.12126

Ye, D., Rahman, I., 2023. Emerging Oral Nicotine Products and Periodontal Diseases. Int. J. Dent. 2023, 9437475. https://doi.org/10.1155/2023/9437475

Zhou, X., Wei, X., Cheng, A., Liu, Z., Su, Z., Li, J., Qin, R., Zhao, L., Xie, Y., Huang, Z., Xia, X., Liu, Y., Song, Q., Xiao, D., Wang, C., 2023. Mobile Phone-Based Interventions for Smoking

Cessation Among Young People: Systematic Review and Meta-Analysis. JMIR MHealth UHealth 11, e48253. https://doi.org/10.2196/48253