Clinical Decision Support System for Opioid Substitution Therapy

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Abstract

Opioid addiction is a chronic relapsing disorder affecting millions of people worldwide and having significant social and health impacts. Opioid substitution therapy has turned out to be one of the most effective treatments for opioid addiction. This paper introduces a Clinical Decision Support System (CDSS) for opioid substitution therapy. Opioid-dependent patients are one of the most resource-demanding patient groups in addiction care in Finland. The CDSS is needed in order to achieve an effective and efficient treatment process for opioid substitution therapy. The developed CDSS has proven to be an effective tool in the case organization. The improvements have increased productivity and ensured the quality of the diagnostics processes. A major factor in productivity improvement is that the developed CDSS keeps track on the tasks that the persons involved in the process have to perform. Furthermore, the CDSS enables effective management of patient flow, as the status of each patient in the process is fully visible.

1. Introduction

The objective of this paper is to introduce a Clinical Decision Support System (CDSS) for the opioid substitution therapy (OST) process. The CDSS has been developed in the South Karelia District of Social and Health Services (Eksote) in Finland. Eksote arranges secondary health care, primary health care, and care for the elderly, as well as social welfare services for its eight member municipalities. Eksote delivers patient-oriented care to approximately 130 000 citizens in South Karelia. It employs approximately 4100 people and has a budget of 500 million US dollars.

Opioids are considered the most harmful of all illicit drugs. Illicit opioids result in a lot of mortality and morbidity. Opioids are intertwined with enormous social and economic costs. In developed countries, this has been repeatedly estimated at close to 0.4 % of the GDP [1]. Opioid substitution therapy as a flexible-dose methadone maintenance treatment (MMT) is more clinically effective and cost-effective than any other drug therapy for dependent opiate users [2]. Opioid-dependent patients are the most resource-demanding patient group per patient in integrated mental health and addiction care at Eksote. The Clinical Decision Support System is needed in order to achieve an effective and efficient treatment process of opioid substitution therapy.

The developed CDSS is a part of the overall CDSS architecture in the Eksote mental health care services unit. The CDSS for the opioid substitution therapy process complements the process layer which already includes specific CDSS solutions for the ADHD (attention deficit hyperactivity disorder) process, the work ability evaluation process, the rehabilitation planning process, and the patient placement process. The main objectives Eksote has set for the CDSS solutions are effective workflow management and standardization of tools, as well as the approaches used within and across the various diagnostic processes. Furthermore, the overall management of the patient flow is one of the focus areas.

2. Opioid substitution therapy process

2.1 Background

The term ‘opioids’ refers to a class of psychoactive substances derived from the poppy plant (including opium, morphine and codeine), as well as semi-synthetic forms (including heroin) and synthetic compounds (including methadone and buprenorphine) with similar properties. [3]

Opioid addiction is a drug addiction which has two prominent features: recurrent failure to control the use of one or more opioids, and continuation of opioid(s) use despite significant harmful consequences. Opioid use disorder is diagnosed mild, if a person has two or
three of eleven symptoms (forming opioid use disorder syndrome) in 12 months. Moderate if four to five symptoms exist and severe if six or more symptoms are prevailing in 12 months. [4]

Opioid addiction is a chronic relapsing disorder that has significant social and health consequences, including high level of unemployment, criminal activity, reliance on health and social services, blood-borne infections, and high prevalence of concurrent other addictions and psychiatric disorders. Opioid substitution treatment is a treatment of chronic opioid-dependent individuals. There is much evidence for the effectiveness of opioid substitution therapy to various problems in opioid addiction [5][6][7][8][9]. Substitution maintenance therapy is one of the most effective treatment options for opioid dependence. It can decrease the high cost of opioid dependence for individuals, their families and the society at large by reducing heroin use, associated deaths, HIV risk behaviors, and criminal activity [9].

Opioid substitution therapy can be maintained with methadone, buprenorphine, levacetylmethadol (LAAM) and slow-release oral morphine (SROM). LAAM was withdrawn from the EU market in 2001 as life-threatening ventricular rhythm disorders had been reported by the European Monitoring Centre for Drugs and Drugs Addiction [10]. SROM is only available in a few European countries (Austria, Bulgaria, and Slovenia). SROM has shown similar intravenous abuse as buprenorphine, and in December 2012, Sweden withheld buprenorphine (Subutex) from the market because of its problematic intravenous abuse. In Finland buprenorphine naloxone (Suboxone) is the most common form of opioid substitution medicine with the share of 58 %, followed by methadone, 38 % [9].

EMCDDA [10] estimates that the current prevalence of adult problem opioid use in Europe is at 0.41 %, which means 1.4 million problematic opioid users. About 50 % of them, i.e. 730 000 patients, receive opioid maintenance treatment. The lowest number of opioid users in opioid maintenance therapy has Latvia (3 %), and the highest Norway (70 %). The highest rate of problem opioid use is in Ireland at seven cases per 1 000 of the adult population.

There were 1.2 persons per 1 000 inhabitants aged 15–64 (range: 1.06 to 1.04), and about 4 204 problem opioid users (range: 3 700 to 4 900) in Finland in 2005, according to the latest estimates of high-risk drug use populations the capture-recapture method [10][11]. On the basis of the estimates from 2005, about 1 300 problematic opioid users lived in the Eksote area in South Karelia in south-east Finland.

Addiction experts (e.g. Thomas D. Crothers, William L. White) have tried over a hundred years to convince professionals and lay people that opiate addiction is primarily a physical disease, which should be treated by medication. Opioid addiction has been defined as a chronic, relapsing disorder [5][12][13]. Neurobiological studies in reward pathways (from the ventral tegmental area (VTA) of the brainstem via nucleus accumbens of the limbic area to the frontal cortex) have shown that dysfunction of the normal reward pathways is a neurobiological explanation of addiction [14][15][16]. Dopaminergic reward pathways in the mesocorticolimbic system play a major role in drug-reward, which is associated with the development of substance dependence, and the dopamine 3-receptor (DRD3) may account for more susceptibility to heroin and opioid addiction [17]. Critics of the (neuro) biological theory of addiction argue that people take drugs because they want to and because it makes sense for them to do so given the choices available, rather than because they are compelled to by the pharmacology of the drugs they take [18][19].

The vivid history of the medical therapy of opioid-dependent patients is full of fierce struggles for and against the legitimate use of opioid medication in treatment [20][21]. Discussion for and against medical treatment of opioid dependency has been going on since the American Civil War (1861-1865) because the hypodermic syringe was invented at that time. Syringes facilitated a faster and more direct route by veins to brain, which accelerated and worsened opioid addiction. 100 years ago, 1914 The Harrison Anti-Narcotic Act (federal system for the regulation of drug manufacturers, pharmacies, and physicians prescribing) shifted the attitudes from treatment of a suffering patient to punishment of a manipulating villain. This national decision closed the existing 44 morphine clinics in the US. The responsibility for the addiction problem was shifted to the criminal justice system. The controversies of treating opioid dependency with opioid medication still confuse the working atmosphere of health and addiction professionals [22].

Today, the most common view of addiction is that opioid addiction is a treatable chronic condition comparable to other chronic conditions, such as hypertension and asthma. "Drug addiction is seen as a chronically relapsing disorder that is characterized by (1) compulsion to seek and take the drug, (2) loss of control in limiting intake, and (3) emergence of a negative emotional state (e.g., dysphoria, anxiety, irritability) reflecting a motivational withdrawal syndrome when access to the drug is prevented" [23]. Recent general theory of addiction states that drug addiction is a real psychiatric disease caused by a three-step interaction between vulnerable individuals and amount/duration of drug exposure [24].
The too mechanistic theory of the biological origin of addiction was broadened by the biopsychosocial model in psychology [25] in order to account better for the realities of opioid-dependent patients. The biopsychosocial model is “suggested with great promise as a viable and much needed alternative to the prevailing “medical model” in which problems and disorders were considered akin to medical diseases and ailments” [26]. The definition of addiction is still elusive [22], which confusing the operationalization of the treatment of opioid use disorder patients [4].

The biopsychosocial model of opioid dependency, and the legislation based on that model declare that the opioid substitution treatment should consist, in addition to the opioid medicine, of psychosocial consultations and interventions. Psychosocial consultations and interventions have been shown to improve the effectiveness of opioid patient treatment [7][27]. The legislation-based demand of psychosocial consultation has become a barrier to the availability of opioid substitution treatment. A Canadian study [28] suggests a different model, Low-Threshold/High-Tolerance Methadone Maintenance Treatment (LTHT MMT), which challenges the traditional comprehensive methadone maintenance program. The study states that “the majority of financial resources are invested in those ancillary psychosocial services that support the biopsychosocial model, whereas the LTHT approach utilizes a medical model and directs resources at medical management.”

The effectiveness of opioid substitution treatment refers to a reduction of mortality and morbidity, and reduction or cessation of opioid and other drugs use. The effectiveness refers also to reduced HIV and viral hepatitis risk behaviors, especially needle use, reduced HIV and viral hepatitis transmission rates, as well as decrease in criminal involvement and redundancy [29].

Contrary to other chronic conditions, e.g. hypertension and asthma, opioid-dependent patients have in addition somatic problems [30], and problems in almost every area of life, which makes the treatment of opioid-dependent patients a challenging enterprise. Opioid treatment experts must deal daily with many-sided problems of the chaotic life of the opioid-dependent patient. The standardized process of opioid substitution treatment can relieve the unnecessary stress and pressures of the employees of integrated mental health and addiction care in their daily work duties.

Opioid substitution therapy consists of different phases: 1) evaluation of the chronic opioid-dependence phase and suitability for opioid substitution therapy (1-3 months, outpatient phase), 2) induction and stabilization phase of opioid substitution therapy (3-6 months, inpatient and outpatient phase), 3) adherence and motivational phase of opioid substitution therapy (3-6 months, outpatient phase, sometimes inpatient phase), 4) early psychosocial rehabilitation phase (6-9 months, outpatient phase), 5) psychosocial rehabilitation phase (9-18 months, outpatient phase), 6) referral to other treatment phase (18-24 months, outpatient phase), and 7) cessation or maintenance phase of the opioid substitution phase (6-24 months, outpatient phase). [31]

In opioid substitution therapy the first two or three years are typically defined as the rehabilitation phase and after three years OST is defined as the maintenance phase. The rehabilitation and maintenance phases have different emphasis and goals, the rehabilitation phase is more active and the goals are focused more on returning the normal functioning of every-day life. The maintenance phase directs to living with a chronic disorder and prevailing the functioning level of this day.

2.2 The process at Eksote

The redesigning of mental health and addiction care services at Eksote [32], and the treatment of opioid-dependent and other drug addiction patients were shifted from an addiction clinic to a newly established non-referral, 24/7/365 open walk-in clinics (MTPA, integrated mental health and addiction care clinic). At the same time, substitution medication was changed from buprenorphine-naloxone to methadone because of process efficiency.

The main goals of the process of opioid substitution treatment in Finland are to examine whether the opioid-dependent patient is qualified to the opioid substitution treatment according to the Finnish law considering delivering opioid substitution therapy (http://www.finlex.fi/en/).

The evaluation process of an opioid-dependent patient at Eksote is to guarantee that the patient has tried other treatment options, for example withdrawal treatments. All information of patient health recordings is gathered by permission from the patient. The evaluated patient is interviewed by an addiction nurse, a social worker and a physician. The relatives of the patient are met when it is possible regarding the circumstances. During the evaluation period, the patients are screened and advised to reduce and abolish consumption of other addictive substances. The rules of opioid substitution therapy are introduced to the patient.

The first aim in the induction of the opioid substitution treatment, which is started in the inpatient ward, is to stabilize the opioid-dependent patients’ physical condition. The other drugs, usually benzodiazepines, are reduced and abolished. Dual-
diagnosis patients, who have other psychiatric diseases, are prescribed medications they really need. The rules of OST are rehearsed. At Eksote the opioid substitution medicine is methadone, because it is the cheapest and fastest available form of an opioid substitution drug (seven times cheaper than buprenorphine-naloxone, and methadone is delivered and patient health recordings filled out in 15 minutes; buprenorphine-naloxone takes easily 30 minutes to give). Methadone is the easiest one to perform as an efficient process (diversion problems with liquid methadone are limited to take-home dosages that are obtained after six months' treatment).

Psychosocial consultation of an individual employee (a care manager) are included as a necessary part of a holistic view of treating patients’ overall health issues and treating drug-related diseases. The personal care manager deals with everyday worries and issues which are not handled at the same time when delivering the daily methadone dose. The recovering opioid-dependent patient has many issues to be solved: health, housing, financing and other urgent issues.

Opioid-dependent patients have usually many psychiatric disorders, for example major depression and several personality disorders, which set strict requirements to qualifications of the employees of OST. The employee must have a working knowledge of psychiatric and addiction conditions.

The purpose of the consultation of occupational therapists and psychologists is to integrate the patient in social and work life. The stabilized and recovering patient is evaluated by his qualifications to start studying, working or rehabilitating his professional career in the working life. Very few of chronic opioid patients have higher education, they have usually dropped out of school in their teens.

The ultimate goal is to free the patient from opioid dependence, which is hardly ever achieved with a chronic opioid-dependent patient. The opioid substitution therapy process has to be planned in a many years perspective, often a lifetime perspective. These goals are negotiated in the treatment meetings, which are held weekly, and when needed at once at the beginning of the OST. Meetings about when the OST patient is stabilized and recovered are held once a month or once in three months. The meetings are held with the patient, the personal care manager, a physician and an addiction nurse. When needed, an occupational therapist and psychologist are invited to the treatment meetings as well.

Opioid substitute patients have so far not been transferred to the pharmacy delivering mode or to the rehabilitation department of integrated mental and addiction care of Eksote.

2.3 Challenges at Eksote

The newly established facility personnel (in November 2010) in the integrated mental health and addiction care clinic (MTPA) faced almost new opioid-dependent patients with buprenorphine-naloxone opioid substitution therapy. The evaluation and induction of opioid substitution treatment of the opioid-dependent patients were done in Kouvola (a city 62 miles from Lappeenranta) or in the social hospital of Järvenpää (124 miles from Lappeenranta). Over a half (over 130 000 US dollars per year) of the annual outsourcing budget for the habilitation of alcohol and substance abuse patients went to these activities. These resources were not for developing the local expertise in the treatment of chronic opioid dependent patients. The joint treatment meetings (mainly issues of the beginning of OST) were held in those distant places, which meant that the whole working day could be spent in treating one patient.

The delivering nurses solved daily opioid medication delivery problems and solutions (intoxication, which meant losing the daily dose, or other issues denying daily doses), which was personalized to the delivering nurses. The physician responsible for the treatment visited the addiction clinic twice a week (three hours per day). The treatment team met twice a week to settle issues of OST, among others insulting or aggressive behavior or other issues regarding the treatment. The patients did not get direct sanctions for their improper behavior and had even forgotten the incident altogether.

The experienced but not qualified competent physician could not improve the opioid substitution process. It was almost impossible to get the consultation of psychologists, occupational therapists or psychiatrists and other specialized personnel in the fragmented and polarized care between mental health and addiction care. Most chronic opioid dependent patients are dual or triple diagnosis patients, who fall between the functional citadels of fragmented care.

The attitude towards treating criminally stigmatized and behaviorally delicate opioid-dependent patients was punitive and abandoning. The patients did not seek for treatment, and when they did, it was mainly at the somatic emergency department, where they were met by somatically focused workers. “Alcohol and other drug dependence can be chronic diseases, but they are usually treated episodically. Few seek treatment, and most who do, do not complete it” [33]. To overcome the barriers to opioid substitution treatment and to achieve a value chain of an opioid-dependent treatment process, it was decided at Eksote to launch a CDSS-facilitated process.
3. Previous research on CDSS for OST

Decision support systems (DSS) are computer technology solutions that can be used to support complex decision-making and problem-solving. One subcategory of DSS is Expert Systems. An expert system is a computer system that emulates the decision-making ability of a human expert [34]. Among the many fields in which Expert System is involved, medicine holds a large domain [35]. There are specialized expert systems used as decision support for different areas in medicine, and these systems are also known by the general term Clinical Decision Support Systems (CDSS). Clinical Decision Support Systems are “active knowledge systems which use two or more items of patient data to generate case-specific advice” [36]. According to Sim et al. [37] CDSS is software that is designed to be a direct aid to clinical decision-making, in which the characteristics of an individual patient are matched to a computerized clinical knowledge base, and patient-specific assessments or recommendations are then presented to the clinician and/or the patient for a decision. The advantages of CDSS include automation of the diagnosis process and objective measurements and observations of selected parameters. CDSSs provide support to the decision-making process, but they do not make any actual decisions; the role of the clinical expert is fundamental in the decision making [38].

Information and communication technology can provide the right health information, to the right person, at the right place, on time and in a secure electronic format. However, developing effective CDSSs for the highly complex and dynamic domain of clinical medicine is a serious challenge for designers, and e.g. poor usability is one of the main barriers to the adoption of these systems [39]. According to Horsky et al. [39], developers need to adopt design practices that include user-centered, iterative design and common standards based on human–computer interaction research methods rooted in ethnography and cognitive science.

A recent study by Nicholas et al. [40] explores how pharmaceutical opioid misuse could be reduced by the implementation of a technological tool. Their paper explores how enhancement to existing clinical decision support systems through real-time, on-line information to prescribers, pharmacists and regulators could address drug-seeking and improve the quality use of medicines. According to Nicholas et al. [40] there is a lack of access to comprehensive information about patients’ medication use, which can contribute to medicines being prescribed inappropriately or in excess of therapeutic need. The poor-quality use of medicines can involve inappropriate prescribing, prescribing errors, adverse drug events, and intentional misuse.

Electronic health record systems play an increasingly important role in opioid dependency treatment, e.g. [41][42]. According to Ghitza and Tai [41], meaningful use of electronic health record system-based tools could help health care professionals in developing appropriate holistic treatment plans based on patients’ complete medical histories, taking into account medications and other treatments furnished by other providers. According to Serpelloni et al. [42], there are electronic health record systems to capture data describing the patient population and treatment outcomes. These systems have been used to obtain information on the types and prevalence of the drugs used, to identify emerging problems, determine the effectiveness of treatment services, plan for treatment services to meet the needs of the patients, and to support evidence-based decision making [42].

Xiao et al. [43] outline the rationale for designing an electronic healthcare record with extensibility, interoperability and decision support functionality. According to Xiao et al. [44], the their aim was to establish a system which facilitates easy data entry and decision support for general practices, as well as easy data collection and auditing for clinical authorities. They implemented a web-based data entry system and a decision support function for the system. The continuous treatment on methadone was incrementally recorded in the episodes of care. Being supplied with the knowledge of the past treatment history, as well as the current condition of the patient, a decision support system can be designed and integrated into the electronic healthcare record, which makes sense of the record and guides the current consultation [44][45].

4. CDSS for the opioid substitution therapy process

4.1 Overall CDSS architecture at Eksote

Eksote has utilized an agile business process management (BPM) process approach to the development of CDSS in the area of mental health care since 2011. The development platform is called Serena Business Manager (www.serena.com/products/sbm), which was chosen after it had been tested in other parts of the organization. The targets Eksote wanted to achieve through the new approach were the following: 1) effective workflow management in order to ensure that all necessary steps in the processes are taken in a timely manner, and 2) process standardization in order to unify the diagnostics processes by enforcing the use of jointly agreed diagnostic tools, question templates
and logic. The first CDSS implemented in mental health care at Eksote was a process solution to support the ADHD diagnostics process [46]. The overall CDSS architecture was first presented by Kemppinen et al. [32], and afterwards the description of the architecture has been expanded further [47].

Based on the positive experiences gained from the ADHD diagnostics process solution, Eksote decided to create a comprehensive CDSS architecture (Figure 1) that includes all the diagnostics tools (e.g. SOFA - Social and Occupational Functioning Assessment Scale) in use, combines individual process solutions for all major mental disorders, and enables planning and management of the rehabilitation phase for each patient. Mental health care patients have often more than one disorder, and thus the decision makers at Eksote decided that it is of utmost importance to maintain an overall view on each patient, i.e. in which diagnostic processes a person is included and which diagnostic tools have been applied to the person.

![Figure 1. Architecture of the mental health care CDSS](image)

The overall CDSS architecture consists of three layers:

1) The tool layer includes all individual diagnostics tools that are currently in use at Eksote. The reason for creating a separate layer for the diagnostic tools is that the tools are not necessarily specifically used for only one mental disorder. As the diagnostic tools are included in the CDSS as individual modules, they can be used across the various diagnostic processes in an effective way.

2) The process layer consists of the process solutions for diagnostics, rehabilitation planning and patient placement. The diagnostics process solutions are used for managing the process workflows and for combining the right set of diagnostic tools for each mental disorder. The process workflows guide the users through the needed process steps in a strict manner. However, the users must always decide specifically which diagnostic tools are to be used for each patient. Currently there are three diagnostics processes in use: ADHD, work ability evaluation and opioid substitution therapy. New diagnostics processes can be added easily to the architecture.

The process solution for rehabilitation planning provides a structured way for deciding on the needed further actions on the basis of the findings in the diagnostics processes. A comprehensive plan is defined for each patient, and this plan is used as the basis for the patient placement process solution. The objective of the patient placement solution is to ensure that each patient will get further treatment in a facility that matches the requirements defined in the rehabilitation plan. The patient placement solution supports the decision makers in managing and balancing the demand (patients) and the supply (available rehabilitation places in various facilities).

3) The customer management layer provides the users with a tool for patient management and enables overall coordination across different processes and domains. By entering a patient’s name and/or social security number the users can see what diagnostic tools have been applied to the patient, which diagnostics processes the person has been involved in, what rehabilitation plans have been defined for the patient, how the plans are being executed, and where the patient has been placed for further treatment. The overall view on the patient removes the earlier problem that a person was included in multiple diagnostic processes and the same diagnostic tools were applied within a short timeframe. The overall view gives a patient-centric view on the processes and tools, showing all relevant information across all diagnostic processes. Laws and regulations permitting, the information can be shared easily with different organizational domains in order to avoid overlapping diagnostics processes.

Due to the layer-based structure, the developed CDSS can be expanded to cover all the diagnostic processes used at Eksote. When a new diagnostic process workflow is added to the process layer, all existing diagnostic tools are available, and new specific tools can be added to the tool layer if needed. The new diagnostic processes and tools are then connected to the customer management layer to enable a holistic view on the patient.

### 4.2 CDSS workflow for the OST process

The first step in the development of the CDSS for the opioid substitution therapy process was to define the process workflow. The mental health care unit had already experience in defining the processes for the CDSS for the ADHD process [46] and the work ability evaluation process [48]. An agile business process development approach was used in order to ensure that the process and the CDSS matched the users'
requirements as closely as possible. The phases of an agile business process development approach have been presented in detail in Kemppinen et al. [47].

The process workflow for opioid substitution therapy consists of six steps (Figure 2):

1) Enter a new patient: The addiction nurse responsible for the OST patients enters a new patient into the CDSS. The nurse enters the patient’s information by using a standardized template included in the CDSS. The nurse also conducts the first evaluation concerning the patient’s qualification for opioid substitution therapy.

2) Organize a preparatory diagnostic meeting: If the addiction nurse has evaluated a patient to be potentially qualified for opioid substitution therapy, the nurse organizes a preparatory diagnostic meeting. The participants of this meeting always include the addiction nurse, the doctor in charge of OST and a social worker. When needed, an occupational therapist and a psychologist participate in the meeting. The objective of the preparatory meeting is to create mutual understanding on the patient’s initial situation and to decide who should carry out more detailed diagnostics on the patient. The outcome of the meeting is a task list recorded in the CDSS.

3) Carry out the diagnostics: Diagnosis by a doctor and a social worker are always required, while a psychologist and an occupational therapist will provide their input based on the decisions in the preliminary meeting. The CDSS includes templates to be used for various diagnostics, like for example AUDIT, MADRS, MDQ, SD5, SCID I and SCID II. Furthermore, standardized templates have been created for the input of the social worker and the occupational therapist. Basically, all diagnostics tools included in the tools layer in the overall mental health care CDSS structure can be utilized in the OST process as well.

4) Organize the final diagnostic meeting: The CDSS keeps track of the progress of the various diagnostics tasks assigned in the preparatory meeting. Once all the persons involved in the process have carried out their tasks, the addiction nurse summons a final diagnostic meeting. The objective of this meeting is to utilize the outcome of the various diagnostics tasks to decide if the patient is qualified for entering opioid substitution therapy. The participants of the final diagnostic meeting always include the addiction nurse, the doctor and the social worker. If needed, the occupational therapist and the psychologist also participate in the meeting.

5) Start OST and evaluate the patient’s progress: If accepted for opioid substitution therapy, the patient is placed in a ward for methadone treatment for a period of six weeks on average. During the treatment, the condition and the progress of the patient is monitored constantly. Both the doctor and the nurses in charge follow up the situation on a daily basis and record their findings into the CDSS. The CDSS supports the follow-up process by providing the doctor and the nurses with diagnostics tools, like CIWA-A and benzodiazepine withdrawal symptoms) and SOWS (screening test for opioid withdrawal symptoms). The opioid substitution therapy is carried out as long as needed to get the patient into a physical and mental condition where treatment in a ward is no longer necessary.

6) Follow-up: After release from opioid substitution therapy in a ward, the patient is still subject to systematic follow-up in order to ensure that the achieved improvement in the patient’s condition is sustained. The CDSS supports this phase by providing the tools for follow-up diagnostics and for recording the outcome of the follow-up procedure. Furthermore, the patient can be entered into new processes, like the ADHD process or work ability evaluation process if the follow-up diagnostics give any indication for such needs.

Overall, the process steps in the opioid substitution therapy process are close to the ones in the ADHD and work ability evaluation processes. Having a similar basic logic across the processes is beneficial for the organization as same users are involved in multiple processes. However, there are some features that differentiate the OST process from the ADHD and work ability evaluation process. Firstly, the number of actors in the OST process is defined more patient-specifically than in the other processes, and there is more variation in the type and number of the diagnostics tools used. Secondly, a specific feature of the OST process is that it includes an observation period in the ward, during which diagnostics tools are used on the patient very extensively. Compared to the other processes, the OST process necessitates a daily follow-up of the patient’s condition and progress and thus provides a lot of data to support decision-making. The observation period and the daily utilization of the diagnostics tools is continued as long as needed.

4.3 Features and benefits of the CDSS for the opioid substitution therapy process

The opioid substitution therapy process is the third diagnostics process in the Eksote mental health care
services unit for which a CDSS has been developed. The main justification for the continuous extension of CDSS utilization is that the developed support systems have enabled Eksote to achieve two main improvements in their mental health care operations [47]: 1) effective workflow management and 2) standardization of the process steps and diagnostics tools used within and across the diagnostics processes.

These improvements have enabled Eksote to increase productivity in mental health care services and to ensure the quality of the diagnostics processes. A major factor in productivity improvement is that the developed CDSS keeps track on the tasks that the persons involved in the process have to perform. Furthermore, the CDSS enables effective management of patient flow, as the status of each patient in the process is fully visible. In the past, there was no transparency to how the responsible persons actually carried out the diagnostics, as everybody could decide themselves which diagnostics tools and approaches to use. The results were not recorded comprehensively, and thus e.g. extensive analyses across all patients were not possible. With the new CDSS, all persons involved in the process have to use the ready-made diagnostics tools that can be found in the system. The results are recorded in the common database, allowing full utilization of the diagnostics data.

One major benefit of the developed CDSS is that it provides an overall view on a patient. As stated above, the patients included in the opioid substitution therapy process often suffer from other mental health care problems. As the CDSS system for the opioid substitution therapy is part of the overall CDSS architecture in Eksote mental health care services, the customer management layer can be utilized to track the status of the patient in the other processes, like for example the ADHD process and work ability evaluation process. Furthermore, the CDSS shows if a certain diagnostics tool has been recently applied to a patient in any process within the overall CDSS architecture, and thus overlapping work can be avoided.

The agile development approach and the IT platform utilized in the development of the CDSS for the opioid substitution therapy process and in the development of the overall CDSS architecture for Eksote mental health care services allow flexible and quick modification and further development of the solutions. The time needed for the development of the first version of the opioid substitution therapy process CDSS was about three weeks. The objective was to have the CDSS in the actual use of practitioners as quickly as possible in order to fine-tune the CDSS based on actual user experiences. The proposals for development are being systematically collected, and corresponding changes and modifications are made on the CDSS. Typically, the requested changes are small and require a few hours of work to have them incorporated in the CDSS.

As with the CDSS solutions for the ADHD process and the work ability evaluation process, there are two main challenges with the CDSS for the opioid substitution therapy process. Firstly, some of the practitioners are dissatisfied with the need to use the diagnostics tools included in the CDSS. This is due to the fact that they can no longer choose whether to use a certain tool or not, as they are required to apply the chosen tools in order to take the process forward. However, the practitioners seem to understand the need for standardizing the diagnostics processes, and thus the dissatisfaction has not become a major hurdle for the use of the CDSS. Secondly, there is a need to create a two-way integration with the patient health record system. Planning for the import of the basic information of the patients to the CDSS and the export of the outcome of the opioid substitution therapy CDSS has been started and the actual implementation of the integration is expected to take place within a year. This is an important step to be taken, as currently the practitioners have to enter the outcome of the CDSS into the patient health record system manually.

5. Experiences and further development

The clinical decision support system of opioid substitution therapy visualized the whole process of OST. A shared vision of OST helped to maintain “the big picture” in rehabilitating chronic opioid-dependent patients. The big picture of treatment is easy to lose because of the daily claims from these patients. Resolving the everyday issues of these patients is prone to the phenomenon of “not seeing the forest from the trees”. The phase of OST in which the patient is, helps both the patient and the employee to concentrate on the issues decided in the treatment meetings. The goals of the different phases of OST are easy to reiterate or develop further in the process of OST in the agile CDSS.

The CDSS of OST facilitates following the phase of the opioid substitution therapy and focusing on the goals of that phase, instead of going back and forth with the ample wishes of patients. Personality disorders are over-presented in these clients. Typically, the behavior of patients with personality disorders confuses and disturbs the treating team. The manipulating style of these patients results easily in conflicts between the members of the treating team.

Opioid substitution therapy is the most resource-consuming process in mental health and addiction care. Every visit or other resources saved by the CDSS is a
The patient health record system is an expensive and time-consuming exercise. However, steps towards a better integration between these two systems are being taken. The overall architecture of the CDSS of Eksote is evolving, and the graphic quality of the layout of the CDSS needs to be elaborated by a graphic designer in order to make it more user-friendly and aesthetic.

6. Conclusions

Opioid addiction is a chronic relapsing disorder affecting millions of people worldwide and having significant social and health impacts on the society. Opioid substitution therapy has turned out to be one of the most effective treatments for opioid addiction. However, the OST is a complex and long-lasting process with multiple actors involved.

Eksote, one of the forerunners in Finnish public health care, faced many challenges when trying to implement the OST process. Based on the experiences in other diagnostic processes [47], Eksote decided to apply an agile business process development process to the opioid substitution therapy process and to develop a CDSS to support the process. The developed CDSS helps Eksote to manage the process workflow and to standardize the diagnostics tools used in the various phases of the process. The developed CDSS is linked to the other CDSS solutions in the Eksote mental health care unit and thus an overall view on a patient can be maintained.

The developed CDSS for the OST process has proven to be an effective tool. However, there are further development needs mainly with regard to the integration of the CDSS with the patient health record system.

7. References


