

Marianne Stallvik

**Assessing patients for optimal
treatment by utilising and testing
ASAM Criteria for substance use
disorder and co-occurring
psychiatric disorders**

Validity of ASAM Criteria

Thesis for the degree of Philosophiae Doctor

Trondheim, January 2015

Norwegian University of Science and Technology
Faculty of Social Sciences and Technology Management
Department of Psychology



NTNU – Trondheim
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Preface and Acknowledgements

The present dissertation: “Assessing patients for optimal treatment by utilising and testing ASAM Criteria for substance use disorder and co-occurring psychiatric disorders” and project was funded by the Norwegian Directorate of Health and Drug and Alcohol Treatment in Central Norway from 2006 to 2013. In this context, ‘Central Norway’ refers to the three counties of Sør-Trøndelag, Nord-Trøndelag and Møre-Romsdal located in the mid-region of Norway. The treatment services for patients with a substance use disorder in these three counties has from 2004-2014 been organised under their own health authority to enhance both treatment and research for this patient group. The core aim of the present dissertation was to investigate the validity of the newly revised ASAM Criteria software version in the Norwegian population of patients with substance use disorders. An additional aim was to examine the prevalence of treatment needs in the region both in terms of level of care and the need for an integrated programme for co-occurring substance use and psychiatric disorders. A multicentre study was conducted at 10 Norwegian treatment facilities for substance use disorders; this dissertation consists of a pilot study of the translated ASAM Criteria second revised software version and three research papers. These papers have been accepted for publication in international scholarly peer reviewed journals. The project and some of the results have also been presented at several local, regional, national and international research conferences.

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Preface and Acknowledgments

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List of Papers

This dissertation is based on the empirical papers listed below.

- I. Stallvik, M., Gastfriend, D. R. & Nordahl, H. M. (2014). Matching Patients with a substance use disorder to optimal level of care with the ASAM criteria software (Journal of Substance Use, published online July 08, 2014. doi: 10.3109/14659891.2014.934305).
- II. Stallvik, M., & Gastfriend, D. R. (2014). Predictive and convergent validity of the ASAM criteria software in Norway. *Addiction Research and Theory* (Posted online May 2, 2014, doi:10.3109/16066359.2014.910512).
- III. Stallvik, M., & Nordahl H. M. (2014). Convergent validity of the ASAM criteria in co-occurring Disorders. *Journal of Dual Diagnosis*, 10(2), 68-78. doi:10.1080/15504263.2014.906812.

Summary

The main purpose of this dissertation was to investigate ASAM Criteria software revised version for predictive and convergent validity by assessing patients with a substance use disorder to optimal level of care (LOC). The dissertation combines one unpublished pilot study and three main papers. The pilot study is based on a satisfaction survey (n=8) and inter-rater reliability testing of patient videos (n=5) and assessors' agreement. The validation study has a prospective naturalistic double-blind multi-site design and the three papers are based on data from a structured baseline interview (n=261) and follow-up interview (n=153) three months after treatment initiation. They were recruited from 10 different centres in the mid-region of Norway. The private and public treatment facilities included in this dissertation cover the specialised treatment for substance use disorders in the region, with detoxification services, outpatient, inpatient and residential treatment both short and long-term. Opioid Maintenance treatment is also included, and can be given in either outpatient or inpatient setting depending on patients' needs. The public clinic follows a biopsychosocial approach for understanding and treatment of substance use disorders which includes a variety of services. Interventions include, for example, motivational interviewing, individual or group therapy sessions, family therapy, cognitive therapy, milieu therapy, social skills training, vocational training, physical training and many more. The various services provided in this region clearly show the complexity in providing treatment for this disorder, and the need for thorough assessment before placing patients at a specific LOC. The services are closely connected to or in direct cooperation with the municipalities covering housing and occupational needs. The theoretical framework for the dissertation is to apply a biopsychosocial approach to understanding, assessment and treatment of patients with a substance use disorder. While this is the consensus reached in the field, different approaches still exist. There is a necessity to examine the history of the development of the concept of addiction to the substance use

disorder definition we see and use today, to understand how the biopsychosocial approach emerged as the consensus in the field. The shift from a moral model to medical approach is vital to the understanding of the concept of the disorder and treatment of it. In addition, the main diagnostic and classification systems that Norway and the ASAM criteria uses when classifying substance use disorders will be discussed.

This study was initiated by the region itself in light of the need for harmonising the regions' assessment practices and investigating the prevalence of service need in the region. Because ASAM criteria software version is based on the DSM-IV criteria and follows a biopsychosocial approach to substance use disorder, this approach was deemed appropriate. In addition it is the only tool that can give automatic treatment recommendations on LOC placement based on over 6000 calculations. In need of translation and because it was a revised second edition, the criteria underwent validation testing on Norwegian substance use disordered population even though validation testing from USA provides support for the use of the criteria. ASAM criteria is a computer-assisted structured interview and clinical decision support programme that implements validated tools including the Addiction Severity Index and measures biopsychosocial conditions to match patients to an optimal LOC. Paper I assessed patients seeking help for substance use disorders in order to determine the ASAM Criteria's predictive validity in terms of treatment outcomes among matched and mismatched patients. At post-test, patients who had received matched treatment based on the ASAM recommendation reported less use of alcohol and cannabis versus undermatched patients. Overmatched patients had no better outcomes than matched patients; in some cases no change occurred or a more intensive LOC was recommended at post-test. Consistent with prior studies, the ASAM Criteria Software Norwegian version demonstrates elements of predictive validity for determining intensity of LOC placement using all three prospectively planned measures.

Paper II examined the discrepancies between ASAM Criteria LOC recommendations and Treatment-as-Usual, along with the software's ability to clinically distinguish between patients with different LOC to determine convergent validity. The discrepancies found are in line with previous research: the more intensive recommendation by ASAM yielded better outcomes three months after for the matched group. The ability of the ASAM Criteria to clinically distinguish between the different LOC lends support for the software's convergent validity. This ability to distinguish by severity was taken further in the third paper which also examined the programme's Dual Diagnosis taxonomy, incorporated in the second revised version to assess patients' need for more specialised programmes for co-occurring psychiatric disorders. We aimed to study the prevalence of co-occurring disorders programme recommendations and ASAM Criteria convergent validity in terms of locating patients with co-occurring disorders and discriminating between severities among those who received more intense recommendations. The results are in line with previous research with the use of these criteria, and the different recommendations show differences in characteristics, severity and outcomes. The higher the recommendation, the more psychiatric severity seen among the patients recommended for them. Significant differences were seen in both characteristics and severity. The results show a high prevalence of dual diagnosis programme recommendations in this region and characteristically clinical meaningful differences between the different recommendations. The new version of ASAM Criteria Software Dual Diagnosis taxonomy convergent validity is supported by the results. The successful translation and software testing in Norway should encourage larger studies – preferably across nations and treatment system – seeking higher power with larger subsamples across primary drug of choice and match/mismatched conditions.

1. Introduction

1.1. Background and main aims

The present dissertation investigated data to test and validate the second revised ASAM Criteria software version and its usefulness in correct placing of patients with a substance use disorder to optimal level of care (LOC). The complexity of substance use disorders demands a health care system that is up to date both in terms of knowledge of the disorder and optimal treatment for these patients. To achieve this, it is vital to conduct more thorough assessments to match services to fit the needs of the patients. New reforms in Norway and patients' rights regulated by law enhance the need for harmonising the practice in terms of assessing and providing optimal services for these patients.

The Health authorities in Norway have the responsibility to make sure that the patients are given inter-disciplinary specialised treatment (Department of Health, 2004). How patients are assessed before they enter specialised substance abuse treatment today varies greatly where some assessment centres have vast experience with this kind of work while others do not, and the patients' drug use and life situations can make these assessments difficult. As a result, the patients can be given treatment options before a complete assessment of their needs meaning the options can be based on a lack of knowledge about the patient's condition, and in addition some centres have little knowledge about all treatment options available to address the patient's needs.

Given the different approaches for assessing patients with a substance use disorder and questions used when assessing patients' severity on important dimensions, key elements for measuring severity may go unnoticed when aspects of their substance use problems are not dealt with. In order to secure quality work, harmonising the practice with a standardised validated assessment tool for all of the centres in this region is desirable. Introducing a

comprehensive assessment tool can give the centres the opportunity to measure patient's needs on important dimensions at earlier stages before they enter treatment, and give the treatment centres a better foundation for decisions about treatment placement and individual plans for the patient.

Searching for a standardised assessment tool, the ASAM Criteria (American Society of Addiction Medicine Criteria, second revised version) was deemed eligible for studying patients in Norway with a substance use disorder. The instrument was developed from ASAM patient placement criteria to match patients to discrete LOC based on their needs across six dimensions (Mee-Lee, Shulman, Fishman, Gastfriend, & Griffith, 2001), and was translated into Norwegian. The Criteria and its biopsychosocial measurement dimensions have been shown both to predict treatment success and to be cost effective (Annis, 1988; Alterman et al., 1994; Gastfriend & McLellan, 1997, Hayashida et al., 1989; Sharon et al., 2003; Magura et al., 2003).

The validation testing of the ASAM Criteria has undergone substantial research however this second revised software version has not undergone such validation testing on multi-sites with follow-up measures. With the new version translated into Norwegian, a multi-site validation study in the central region of Norway was conducted after a pilot study on the translated version. The results in this present dissertation are taken from baseline and second follow-up interview from a total of four interviews with recruited patients.

1.1.1. Main aims

Conducting a validation study of ASAM second revised edition in Norway is important for many reasons and the main aims of the study were:

1. Possibilities of using the revised software version of the ASAM Criteria for harmonising the assessment centres' procedures through pilot testing satisfaction among assessors and patients and inter-rater reliability measures of the revised version.
2. Investigate predictive and convergent validity with the second revised Norwegian software version for treatment outcomes and baseline severity among the different recommendations.
3. Investigate the prevalence of needs both in terms of LOC needed in the region and the need for integrated services for patients with co-occurring substance use disorder and psychiatric disorders for future health care planning.

The theoretical background, a biopsychosocial understanding of substance use disorders, has shaped the development of the concept of addiction used earlier to the substance use disorder concept we use today. The causes, sustainment and treatment of this disorder throughout history from a moral view to a more medical understanding are vital to understand how this has affected treatment and also assessment of needs. The shift from patients being understood as immoral outlaws to receiving patients' rights by law in Norway equal to other chronic disorders is important for treatment development and outcomes for this group (Department of Health, 2004). The introduction will begin with a description of the development of different approaches to the biopsychosocial model we use today. This also entails a description of the two classification systems and diagnostic manuals for substance use disorders used in Europe and USA, one used by the Norwegian health care system (ICD-10) and the assessments centres included in this study, while the other is incorporated into the ASAM Criteria (American Psychiatric Association, 2000; DSM-IV). The introduction also includes a section about treatment offered in Norway based on the biopsychosocial approach, and how

assessments are executed in this region. The history and development of the ASAM Criteria is briefly described together with the inclusion of co-occurring disorders in the revised version and prevalence among patients suffering from a substance use disorder. The last section discusses why these placement criteria can be useful in Norway and the specific hypotheses the three articles have investigated.

1.2. The history of the addiction concept to substance use disorder we use today

Around 1850, society began to see the effects of high alcohol consumption in their working class, and the addicts were viewed as immoral criminals that needed to be punished and persecuted for their abuse. It was believed that through discipline, they would become more moral human beings thus leading to a reduction in use (Hamran, 2005). Alcohol was also seen as a poison whereby the availability of this poison led to misuse and addiction. The solution was to keep people away from it so the problem would disappear. One of the most important tools society uses today is actually to control access to substances. Control over the availability of alcohol in our society has been effective for prevention purposes (Hamran, 2005).

1.2.1 Disease model

In the beginning of 1900, reports began stating that different drugs could have harmful side effects (Goldstein, DesLauries, Burda, & Johnson-Arbor, 2009) and people were still craving alcohol despite lack of access (Fekjær, 2004). The moral model shifted to a disease model for understanding addiction propagating the idea that people needed treatment and help for their addiction problems rather than being punished. More treatment centres were developed, but some believers of the moral model forced hard labour on alcoholics as treatment. With the

shift in 1930 involving a more medical approach to the concept, more disciplines started to look at correlations between use and harmful effects, and develop broader treatment alternatives. Families were involved more closely in the treatment of their family members as their importance was discovered (Fekjær, 2004). Interdisciplinary treatment became central in the field – which continues to be important today. For medical personnel, the medical perspective has been predominant while for other disciplines the psychosocial has been more important. This can be due to the fact that they have traditionally worked with patients at different times and phases of their treatment. Working across disciplines and integrating all of these perspectives is now viewed as the most effective approach to the treatment of patients with a substance use disorder.

1.2.2. International Classification of Diseases (ICD-10)

ICD-10 (International Classification of Diseases, rev 10) was developed by the World Health Organization in 1992 (WHO, 1993). ICD-10 is used widely in Europe today and is the diagnostic manual used by the Norwegian health care system to determine substance use disorder. Currently, it is classified as a mental and behavioural disorder supporting the view of addiction as a learned behavioural disorder. This is the criteria used to assess if the individual has a problematic use of substances, or clear dependence to a drug or multiple drugs, namely addiction. The diagnostic criteria of addiction as per ICD-10 guidelines are listed below:

”Recognized by an unfit pattern of drug use which leads to clinical deterioration or exhaustion shown in three (or more) of the following factors:”

- 1) **Tolerance:** Increased amount of substances is necessary to obtain the desired effects (i.e. development of tolerance symptoms);
- 2) **Abstinence:** Physiological abstinence symptoms when substance use is stopped or reduced;
- 3) **Use** of substances in larger amount or over longer periods of time than intended
- 4) A persistent **urge** exists or there are few successful attempts to cut down or control the use
- 5) Much of the **time** is spent on activities that are necessary to retrieve, use, and recover from the substance abuse
- 6) **Important social**, occupational, or recreational activities are abandoned or reduced because of the abuse
- 7) The **use continues** regardless of persistent or accommodating physical and psychological problems which most likely are caused by or worsened by their drug use

The diagnostic classification by ICD-10 can be viewed as categorical and does not take into account that different abusers have different degrees of severity. Some are not as severely inflicted as others, and this is dependent on multiple factors. Different drugs have different consequences on the development of physical and psychological dependence, tolerance development, and other biological, social, environmental factors.

1.2.3. DSM-IV

The American classification system, operating with the ASAM Criteria, is called DSM-IV (American Psychiatric Association, 2000). It separates substance addiction into criteria for substance abuse and criteria for dependence. A distinction between abuse and dependence was based on the concept of abuse as a mild or early phase; dependence as a more severe manifestation.

The definition for substance abuse is a pattern leading to significant impairment or distress as manifested by one or more of the following four criteria:

1. Failure to fulfil major role or obligation
2. Frequent use of substances in situations in which it is physically hazardous (e.g., driving an automobile or operating a machine when impaired by substance use)
3. Frequent legal problems for substance use
4. Continued use despite having persistent or recurrent social or interpersonal problems

The dependency criteria are similar to the ones in ICD-10. Now, the revised fifth version classifies substance dependence as substance use disorder (American Psychiatric Association, 2013). The term is used in this dissertation as a standard phrasing of the disorder and has also been the standard phrase in the submitted articles this dissertation is based on. A single diagnosis matches the patients' symptom experience better while considering their problems on a continuum from mild to severe. Each specific substance is addressed as a separate use disorder (e.g., alcohol use disorder, opiate use disorder, etc.), but nearly all substances are diagnosed based on the same overarching criteria. In this overarching disorder, the criteria have not only been combined, but strengthened. Whereas a diagnosis of substance abuse previously required only one symptom, mild substance use disorder in DSM-5 requires two to three symptoms from a list of 11. Drug craving will be added to the list and problems with law enforcement will be removed due to cultural considerations that make the criteria difficult to apply internationally.

As mentioned earlier, the ICD-10 criteria is used in the Norwegian health care system and DSM-IV (now updated to include the fifth version in the fall 2013 version) is incorporated in the ASAM Criteria software. Services vary in this region's health care system but have a goal to individually adjust treatment offered to fit patients' needs whenever possible (Referral

routines; www.rus-midt.no). Treatments have become broader and more scientifically funded than rehabilitation was previously. The shift in approaches to the disorder affecting the development of treatment, and the shift towards a biopsychosocial approach to the assessment and treatment of patients with substance use disorder means that more patients' needs are met, although all the needed LOC and services are still lacking. However the services are becoming increasingly aware of the patients with co-occurring disorders like somatic and psychiatric disorders with programmes being created to target these needs together with their substance use disorder to achieve success in treatment (Evjen, Øiern, & Kielland, 2003).

1.3. Biopsychosocial approach

One of the first advocates for this approach within the medical world was George L. Engel (Engel, 1977). He challenged the biomedical thinking by showing other significant factors affect the disease and its course. He stated that the biomedical approach did not answer the scientific and social challenges that medicine and psychiatry were facing and he was referring to the effect of treating patients with placebo medicine – showing the influence of psychosocial factors on many biological treatments. Study results have shown that medicine alone cannot treat patients with substance use disorders, but a combination of medicine and psychosocial treatment does have a positive effect on patients (Volpicelli, Pettinati, McLellan & O'Brien, 2001). The medication should have been effective by itself if the biology of humans was the predominant factor. Engel's biggest contribution to the field was challenging and broadening clinical views and understanding of the disease by applying a broader medical approach to meet patient needs. The weakness of earlier approaches is that they are insufficient and not broad enough to give comprehensive and satisfying explanations on their own. A combination of ideas from different perspectives can address the limitations of individual theories. Substance use disorder in all its complexity is more fully explained and

understood from a biopsychosocial view which takes into account several factors in understanding of the disorder.

A biopsychosocial approach to explain addiction considers all factors associated with the cause, development and expression of the disorder. In 2004, reforms by the Norwegian government sought to give addicted patients' rights to treatment that are equivalent to other chronic medical diseases (Department of Health, Patient right law, 2004). The goal was that addiction treatment should evolve into inter-disciplinary specialised services that focus on individually-based social, biological and mental health needs. The complexity of addiction demands comprehensive assessment (Gastfriend & McLellan, 1997; Ravndal, Vaglum, Lauritzen, 2005); without it, there is a risk of treating the wrong problems or failing to provide services that meet patients' needs. There is also a consensus in the field regarding the complex interaction between biological, psychological, and social factors that contribute to the development and maintenance of substance use disorder. This is shown by the composition of their personnel group, which is interdisciplinary, i.e. doctors, nurses, psychologist, social workers who together address multiple needs of the patients. Services offered include medical therapy, behavioural therapy, individual and group therapy, performed in an outpatient setting or inpatient setting. Moreover, there is interdisciplinary assessment teams examining the areas of a patient tied to a substance use disorder. And the underlying approach that providers follow is biopsychosocial for understanding, assessing and treating this disorder although not always in such a systematic order like the ASAM Criteria. A widely held belief, the complex interaction of biological, psychological and social factors affects the development and sustains substance use disorders and therefore the assessment and treatment should adopt this approach.

1.3.1 Biological factors

The effect of our genes in substance use disorder is still unclear (Buckland, 2008). Genes linked to vulnerability for developing alcoholism that are connected to neural pathways in the reward system, behaviour control, and resistance to stress have been discovered (Ducci & Goldman, 2008). In their article, the authors state that genes account for more than 50% of the explained variance in vulnerability to develop alcoholism in twin studies thus supporting a high inheritance factor. But it is hard to locate specific genes when one is dealing with complex diseases like substance use disorders, although the biological influence is clear. And to fully understand the disorder, one needs to examine the interaction of genes and the environment. The environment and stimuli associated with the substance or its use can provoke a conditioned response and activate craving and symptoms of abstinence. The disassociation between drug incentives which make you want it, together with the good experience it gives, are linked to a hypersensitive reward system due to intake over time (Leshner & Kobb, 1999). Sensitivity arises from the direct effect of the drug and associated stimuli not directly related to the drug. This leads to more use, and the abusing behaviour is coupled with poor decision making and impaired ability to judge one's behaviour. This lack of control is tied to changes in the brain. Long term use damages the nucleus accumbens which uses dopamine to regulate and induce euphoria. A substance stimulates dopamine release or enhances its activity, and long term use can deplete the nucleus accumbens' ability to regulate euphoria. When the intake of substances stops, withdrawal symptoms emerge recognised by the opposite of euphoria, which is dysphoria. This chronic relapsing disorder has been found to create maladaptive drug associated memories, and thus also a learned disorder (Milton & Everett, 2012).

Withdrawal symptoms vary, but some common markers exist (The Norwegian Medical Association, 2006). These abstinence symptoms refer to the physiological or psychological

craving symptoms like shivering, fever, restlessness, and a strong urge to use substances. Irregular activity in the nucleus accumbens is associated with withdrawal symptoms and can lead to use of substances to avoid the unpleasantness (Lehmann & Jensen, 2004). The chemical effect leads to a desire for more when it leaves the body, and common for all substances is that symptoms are a sign of imbalance in the body indicating psychical dependency. In addition to psychological dependency, this contributes to and sustains intake and behaviour. Psychological dependency is the sensation of a strong desire or urge to take substances and controlling behaviour related to intake (WHO, 1993).

1.3.2. Psychological factors

Personality traits and mental disorders can influence substance use disorders greatly. Traits such as excitement seeking and risk taking can increase attractiveness of substances (Cami & Farre, 2003). Disorders such as schizophrenia, bipolar disorder, depression, and ADHD are associated with greater risk for developing substance use disorder – but causality is difficult to determine. Was it the psychological disorder that caused the substance use disorder or was it the latter that caused the mental disorder? Both can be affected and what we can determine is that prevalence of co-occurring psychological disorders among substance use disorders is high both in Norwegian studies and international ones (Bakken, Landheim & Vaglum, 2005; Cole & Sacks, 2008; Helseth, Samet, Johnsen, Bramness & Waal, 2013; Melberg, Lauritzen & Ravndal, 2003; Ravndal et al., 2005; Schulte, Meier, Stirling & Berry, 2008). This comorbidity makes it harder to treat and can have a negative effect on outcomes like high attrition, low treatment attendance, and worse outcome (Angarita, Reif, Pirard, Lee, Sharon, & Gastfriend, 2007; Hides, Dawe, Young, & Kavanagh, 2007; Magura et al., 2003; Schulte, Meier, Stirling & Berry, 2010).

1.3.3. Social factors

Even if an individual through genetic inheritance and social factors can be at risk for developing substance use disorders, they do not have to develop this disorder; however this vulnerability creates a greater risk if they are brought up in a hostile environment with conflicts, bad parent/child relations, substance use, and physiological or psychological abuse. Among adult alcoholics, a majority reported being victims of child abuse and/or sexual abuse (Stewart, 1996). Likewise children from very good and stable homes can also develop substance use disorders. Clark, Lesnick, and Hegedus (1992) found that youths with alcohol, substance abuse or dependency had 6 to 12 times higher probability of being a victim of physical abuse and 18 to 21 times greater chance of being subjected to sexual abuse than others without this disorder. The use might inhibit anxiety and depression they experience, and over time they identify themselves with other users with similar issues. The new environment sustains the use and gives the involved a sense of identity which often is not in accordance with the rest of society. And their social network is often scarce and little supportive when they decide to enter treatment. This loneliness can make it more difficult to remain drug free after treatment (Persson & Stallvik, 2007). In Persson and Stallvik's study, patients reported that it can be challenging to approach family and old friends; their sense of not belonging and not being worthy is high among these patients. They often also lack work obligations, school, or leisure activities to keep them occupied. When obtaining drugs, taking them, and recreating after intake has been the main activity for such a long time it can be quite challenging to fill this void with health promoting activities. Many report having social anxiety as a consequence of not being part of society for a long time further complicating matters. Patients also reported that when they feel bored or experience loneliness, cravings increase and the further down the spiral they go, the harder it is to re-enter society.

The **biopsychosocial** model incorporates leading theories in the field and gives a framework for understanding why some develop this disorder, and why it sustains despite all the negative consequences. The uniqueness and needs an individual possesses are taken into consideration with such an approach to substance abuse and dependency as a disorder. Biological, psychological and social factors contribute to or inhibit the possibilities to come into contact with substances and develop addiction through genes, physical or psychological disorders, family relations, and other environmental factors.

1.4. Treatment in Norway

A biopsychosocial approach has implications for the LOC provided in our health care system. Previously, the LOC in Norway were categorised by how long it takes for the patients to undergo treatment (i.e. detoxification, normally taking less than two weeks, was defined as level one, whereas outpatient treatment was defined as level two, inpatient less than six months as level three, and inpatient treatment over six months as level four). Now the field in Norway has shifted and we see a division of LOC based on intensity and resources that the clinics can provide. Intensity accounts for personnel resources, therapy offered and medical treatment provided. A greater focus on co-occurring disorders those patients might have demands psychiatric and medical programmes to meet patients' needs (Evjen et al., 2003). The division of levels are now more in line with the division in ASAM Criteria (Mee-Lee et al., 2001), and new levels have also been developed in this region which were unavailable when this study began recruiting centres. Intensive outpatient services also called day treatment providers were not available, but is currently a developing LOC in this region. Individuals with this disorder often enter treatment late therefore the disorder has had time to develop and cause major consequences for the individual's physical status, psychological

health and work obligations, housing and social networks. Phases of treatment are usually based on the patients' initial understanding of their problems with substances based on Prochaska and DiClementes' (1992) phases of change theory. They might feel pressured by their environment to enter treatment, but might not have the desire to be treated themselves. They can also be detected and referred to treatment by social workers helping them with financial and housing issues. Referrals must include a thorough description of the problem, history, other co-occurring disorders, individual plans and suggestions, or treatment preferences of the patients.

1.5 Assessment of substance use disorder in the middle region of Norway

The middle region of Norway had 10 assessment centres where a thorough assessment of patients' needs are taken with some using unstructured interviews and others structured instruments to measure severity like the Addiction Severity Index (ASI; McLellan, Luborsky, Woody & O'Brien, 1980). Testing ASAM Criteria as a possible tool for harmonising practices to improve assessment and placement is one of this dissertation's major aims. The complexity of addiction creates a need for a comprehensive assessment of needs (Gastfriend & McLellan, 1997; Ravndal et al., 2005); without it, there is a risk of treating the wrong problems or failing to provide services that meet patients' needs. Defining substance use disorders as a biopsychosocial disorder both in etiology and expression demands that the assessment and treatment employ this approach (Gastfriend & Mee-Lee, 2003). The assessment process must consider the influence of a substance use disorder on the patient's physical health, psychological health and social conditions, along with the notion that substances have a clear effect on the brain especially long term use, and all of this must be considered during the assessment and intake process. By interviewing the patients thoroughly, it becomes easier to observe how they answer the structured questions, how they respond to

them, and if there are severe cognitive deficiencies that need further assessment to fully understand the patients' needs.

1.6. History of assessment and ASAM Criteria

The Patient Placement Criteria (PPC) published by the ASAM represents the most common protocol for assigning patients to treatment in the USA since its original publication in 1991 (Hoffman, Halikas, Mee-Lee, & Weedman, 1991). By 2001 it had undergone considerable research and added sub-levels of care and a focus on co-occurring disorders in the second revised version, ASAM PPC-2R (Mee-Lee et al., 2001).

The ASAM Criteria Software, endorsed by a national professional society, is a structured and comprehensive assessment designed to recommend the optimal LOC. The ASAM Criteria, used by a majority of US states (Mee-Lee et al., 2001), has undergone several studies supporting its usage and the principle of these criteria multidimensional needs assessment in treatment planning (Annis, 1988; Hayashida et al., 1989; Alterman et al., 1994; Mechanic, Schlesinger & McAlpine, 1995; Gastfriend & McLellan, 1997; Hser, Polinsky, Maglione & Anglin, 1999; McLellan et al., 1997; Gastfriend, Lu & Sharon, 2000). It is a structured interview that implements validated tools like the ASI (McLellan et al., 1992) to assess patients' needs, with clinical decision support software, quantitatively calculating all of the ASAM Criteria adult admission decision rules. Studies in the USA found high inter-rater reliability (Baker & Gastfriend, 2003), good face validity (CSAT, 1995), and predictive validity (Angarita et al., 2007; Magura et al., 2003; Sharon et al., 2003; Staines, Kosanke, Magura, Bali, Foote, & Deluca, 2003; Turner, Turner, Reif, Gutowski, & Gastfriend, 1999). Convergent validity has also been reported, e.g., patients with different LOC recommendations were distinct on ASI Subscale Composite Scores (ASI CS) such as ASI

Medical and Psychological and on alcohol withdrawal measures, with progressively more severe scores as the LOC intensity escalates (Sharon et al., 2003).

The criteria and the dimensions on which patients are measured have been shown both to predict treatment success and to be cost effective (Annis, 1988; Altermann et al., 1994; Gastfriend & McLellan, 1997; Hayashida et al., 1989). Studies of patients mismatched by the ASAM Criteria have shown that they are less likely to show up for treatment and have worse treatment outcomes than matched patients who had better 90-day outcomes (patients were 38 % more likely to enter continued treatment after detox, and less likely to return to detox within 90 days; Angarita et al., 2007; Magura et al., 2003; Staines et al., 2003). Staines et al. (2003) also compared the degree of agreement for the ASAM Criteria Software versus counsellors' assessment under treatment-as-usual (TAU) conditions. In this study, clinical staff had training and computer-guided interview assistance along the ASAM dimensional assessment process, however, the actual ASAM Software algorithm score was kept blind to staff and patients. Surprisingly, staff disagreed with the computer scored LOC recommendations in 58% of the 248 cases, and the ASAM Software recommended a more intense initial LOC than the TAU protocol in 81% of the discrepant cases. The patients who were assigned to treatments that were matched by the computer had better 90-day outcomes, even after TAU clinicians received ASAM Criteria training and used computer-assisted interviewing (but without the algorithm) (ASAM Criteria; Mee-Lee et al., 2001). These results indicate that the software has both convergent ability in terms of discriminating by severity measures (Sharon et al., 2003) and predictive validity with better LOC placement and assessment of patients' needs with the use of the structured interview that ASAM Criteria has over TAU.

1.7. Co-occurring disorders among patients with a substance use disorder

Several studies including patients with both a substance use disorder and a co-occurring psychiatric disorder show high prevalence in both Norwegian and international studies (Bakken et al., 2005; Cole & Sacks, 2008; Helseth et al., 2013; Melberg, Lauritzen, & Ravndal, 2003; Ravndal, Vaglum, & Lauritzen, 2005; Schulte et al., 2008). While numbers vary by study, national studies have found prevalence within 32 to 65% (Bakken et al., 2005), while international studies have found lower but increasing numbers (20% in Grant et al., 2004; 46% in Schulte et al., 2008). Patients categorized in this group have poorer prognosis, legal difficulties and unemployment (Dausey & Desai, 2003), and higher prevalence of suicide attempts (Bakken & Vaglum, 2007; Darke, Ross, Lynskey, & Teesson, 2004). These considerations need to be taken into account when assessing and treating these patients. By not recognising co-occurring problems early, clients' needs might not be met, which in turn can lead to unfavorable outcomes like high drop-out rates, no-show for treatment, and less beneficial outcomes from treatment (Angarita et al., 2007; Hides et al., 2007; Magura et al., 2003; Schulte et al., 2010). Results from studies on integrated treatment seem to indicate that it is more effective than sequential services for this group of patients (Brunette, Mueser, & Drake, 2004).

Patients with a high severity of co-occurring problems matched to high service-intensity programmes have better treatment outcomes than patients with high co-occurring severity treated in low-intensity programmes, showing that matching by intensity has improved outcomes (Chen, Barnett, Sempel, & Timko, 2006). The most recent fall 2013 ASAM Criteria book changed the term Dual Diagnosis to co-occurring mental disorder.

1.8. Revised version assessed needs and LOC including Dual Diagnosis programme recommendations

In the revised version, Mee-Lee and colleagues (2001) introduced taxonomy of addiction treatment programmes based on their Dual Diagnosis capability. The categories are defined as Addiction Only Services, Dual Diagnosis Capable and Dual Diagnosis Enhanced. Based upon the fact that a majority of patients with a substance use disorder also have a co-occurring psychiatric disorder, it has been proposed that all addiction treatment should at least be Dual Diagnosis capable (Minkoff, Zweben, Rosenthal, & Ries, 2003). Thus, the addiction treatment programmes should be able to handle patients with co-occurring disorders which are stable in symptoms and severity. McGovern, Xie, Acquilano, Segal, and Drake (2007) studied the ASAM taxonomy for dual diagnosis categories and found that one-fourth of the programmes classified themselves as Addiction Only Services only, two-thirds (65%) of the programmes reported being in the Dual Diagnosis Capable category, and a few (10%) programmes classified themselves as Dual Diagnosis Enhanced programmes. Results support the taxonomy of ASAM classification system by showing that Dual Diagnosis Enhanced programmes report treating patients with significantly greater psychiatric severity than Dual Diagnosis Capable and Addiction Only Services. However more research is needed regarding the use of ASAM taxonomy to test its validity for making clinical distinctions between the different recommendations.

1.9. Why patient placement criteria in Norway?

The human mind rarely follows formal criteria to form judgments and conduct decision making, and we are slow to adopt new treatments despite research and clinical evidence of safety and superiority (Hogarth, 1987; Volpicelli, Alterman, Havashida, & O'Brien, 1992). If

decision rules for the use of the Norwegian version of the ASAM Criteria software specify optimal placements, and patients are assigned to treatments that yield the best outcomes, at the least intensive LOC for their needs to be met safely, it can have great benefits for the patients' healing and rehabilitation process and the utilisation of available resources. Over-matching, i.e. referral to a more intensive LOC, would then be recognised as more restrictive and/or more costly than needed. Under-matching, i.e. referral to a less-than-recommended LOC, may then lead to poor engagement, poor retention, poor clinical outcome, and low cost-effectiveness. Also the greater need for a standardised tool for assessing patients will be beneficial for both clinical and research purposes and further development of health care services for this patient group.

Using such a standardised software based tool will also simplify the process of collecting patient data, reviewing it, and analysing it by having a software based programme that provides transferable raw data for the recommendation and severity report on each patient. This is useful both clinically and for research purposes.

1.10. Specific hypotheses tested in this dissertation

It is important to replicate previous studies conducted with the first edition of the ASAM Criteria using the Second Edition, Revised version, as well as on a different national sample with different languages and treatment systems, to further investigate abilities to both match and discriminate between patients' symptom severity and needs. This dissertation also includes a pilot study conducted prior to the validation study that was not published due to a small sample of assessors and patients. However it is included in the dissertation to show the translation process and satisfaction and inter-rater reliability among assessors and patients. This is information deemed important for clinicians and health care systems thinking of

adopting these Criteria in their own system. In addition to answering one of the dissertation's main aims, possibilities and usage of the ASAM Criteria for harmonising the assessment centres practice in the region are considered. After the pilot study was complete, the validation study started and data was gathered for the three main articles this dissertation combines.

The first article this dissertation includes tested the ASAM Criteria Software, Second Edition, Revised version in Norwegian for predictive validity among the Norwegian substance use disorder treatment-seeking population. At baseline and follow-up, we examined drop-out from assigned treatment before the three month follow-up interview, frequency of use of alcohol or other medical or illegal substances in the last 30 days, severity measures on the ASI Composite Subscale Scores (ASI CSs), and whether initially matched *vs.* mismatched patients would subsequently require a lower or higher LOC at follow-up, according to the ASAM Criteria recommendation.

The second article further extends the work of the first one by exploring two hypotheses: first, the new ASAM Criteria LOC recommendations should show convergent validity with the most commonly used addiction severity measure, the ASI CSs, and second, the ASAM LOC recommendations should show predictive validity, in terms of discrepancies between patients assigned according to ASAM *vs.* TAU placement. Replicating and extending the findings by Staines et al. (2003), which used the ASAM PPC-1 (Patient Placement Criteria) version, we sought to study the newer ASAM Criteria software version, to investigate whether the more restrictive ASAM placements are justified by better treatment outcomes. Finally, whereas that was a single-site study, the articles in this dissertation use multiple sites which allow for greater inclusion of patients, LOC, treatment variation, and generalisability.

The third article further extends the work of the two previous ones by exploring the convergent validity for Dual Diagnosis programmes. The aim of this study is to investigate

the prevalence of Dual Diagnosis Programme recommendation among treatment seeking patients with a substance use disorder, and investigate what characterises those that get Addiction Only Services, Dual Diagnosis Capable or Dual Diagnosis Enhanced recommendation by the ASAM Criteria software. Also treatment outcomes at three months after treatment initiation among those with and without Dual Diagnosis programme recommendation were assessed on the variables; show for treatment assigned and treatment retention. These outcome measures together with the discrimination of severity in the low vs. high treatment recommendations are used to test ASAM Criteria software version for convergent validity. We also studied changes in the ASI CSs to see how the patients' severity changed in the already existing treatment system without specific Dual Diagnosis programmes to offer.

2. Method

2.1. Pilot study of the Norwegian translated version

Since this study was in preparation for a large multi-site validation study, assessors from several clinics were recruited. Ten clinics from the central region of Norway covering three counties agreed to participate and provide personnel to be trained as ASAM assessors. Patients were recruited from the same clinics. Both outpatient and inpatient clinics with a variety of services were included. The final sample consisted of eight out of 20 assessors; chosen based on practical reasons, they were the first to complete the course and complete their training videos, to check their satisfaction with the ASAM Criteria and its feasibility. No significant differences were found between the assessors or patients' on descriptive variables between those chosen to participate in this pilot-study and those who were left out.

2.1.1. ASAM Assessors

The final sample in this study included eight assessors with satisfaction data, and six assessors with complete ASI composite scores from 5 training video interviews. The assessors consisted of six females and two males with a mean age of 42 (30-55). The assessors had a minimum of 15 years of school (M=16, SD=1.51) and maximum of 19 years, and a minimum (max) of 3.5 (19) years with experience as a clinician in the drug addiction field (M=9.13, SD=6.08).

2.1.2. Pilot Patients

The target videos consisted of 10 patients, and five of these videos were completed by all of the assessors to quality check the software and inter-rater reliability (three men and two females). Ages ranged from 27 to 49 years (M= 36.4, SD = 9.26). The main drug of choice was opiates (two men and one female), sedatives/sleeping pills (one female), stimulants (one man). In addition, they all had co-occurring problems with other drugs like sedatives, alcohol, stimulants and cannabis, and four patients reported co-occurring anxiety and depression diagnoses. One patient also reported PTSD together with ADHD and two patients reported personality disorders. Four out of five patients had previously been in contact with addiction treatment facilities for their substance use disorder. Number of treatment contacts with different addiction treatments facilities ranged from zero to three (M; SD = 1.8; 1.30), but counting only stays for detoxification this number ranges from zero to five (M; SD = 2.2; 1.92). LOC determined by clinicians in this sample was: two inpatient placements, two outpatient opiate maintenance treatment, and one with a combination of inpatient and opiate maintenance treatment. For marital status, three patients reported being single, and two had co-living arrangements with their partners.

2.1.3. Procedure Pilot study

The translation of the software was a major task in this project, and the importance of high quality and cross cultural adaptation of the translation of instruments to ensure that concepts stay in line with the original design of the instrument is crucial (Gjersing, Caplehorn, & Clausen, 2010). We chose to do a full scale translation and correction of the ASAM Criteria before it could be used in a validation study to ensure that we would be using the instrument for the purpose for which it was designed, namely assessing the severity and needs and recommending patients for optimal treatment services. We also designed a comprehensive training programme to ensure that assessors would be sufficiently trained to execute the interviews properly. The original instrument was translated from the original English into Norwegian based on recommendations from previous studies (Hoffmann et al., 1991; Weedman, 1987). Two individuals produced the initial translations independently. The translators were native Norwegian speakers with good fluency in the original language and the translated versions were synthesised into a single version by a third independent translator. Thereafter, the synthesised translation was reviewed by an expert committee, comprising methodologists, health professionals, language professionals and the translators. The expert committee assessed whether a word or phrase reflected the same meaning in both the original and adapted versions, and if they were in line with previously translated instruments in Norway which the ASAM Criteria software edition included, such as the Europ-ASI (Lauritzen & Ravndal, 2004). The ASI questions were identical to the already existing Europ-ASI and with other items, changes were made to reach consensus. These assessments ensured that items were translated correctly and would be relevant in the new setting. The instrument underwent several changes based on these assessments, and also during interview testing, changes were made to the language. Based on these changes, we produced a Norwegian version of the complete ASAM Criteria questions and answers set, and

could move forward with testing the instruments' feasibility and validity for the Norwegian drug addicted population. After the certification courses where all the ASAM elements and software were introduced and tested, they rated 10 training videos to complete the course and qualify for a certification diploma. During this time, they also received individual supervision, group supervision, and a 1-day course to review and discuss the levels described in ASAM Criteria and evaluate their experience with the assessments. After their first and last video, they were asked to fill out a 34-item questionnaire specially designed for this pilot study.

2.1.4. Training video

In order to create target videos for the training and assessment of the assessors across the treatment programmes in the region, the Principal Investigator conducted the ASAM Criteria computerised interview with 10 inpatient and outpatient patients. The 10 target videos consisted of a full side view of the patient and audio of both the interviewer and the patient. Duration of administration was automatically recorded during the interviews by the software programme and was compared to previously reported administration times.

2.1.5. Satisfaction Questionnaire

During the course, all assessors were asked which elements were important for their satisfaction with the instrument, and key issues that were mentioned by all included that the software should be broad enough to cover all aspects of the patient, easy and time efficient to execute, and that the computer should not interfere with the clinical assessment setting and diminish personal contact with the patient. A set of 34 questions was created to measure the ASAM-assessors' satisfaction with different aspects of the ASAM Criteria software edition. The assessors were asked to rate their satisfaction on a five-point Likert scale, with open

questions for comments on the different parts of the assessment tool and its usability. They were told to grade how satisfied/unsatisfied they were or how much they agreed/disagreed with the questions. In addition, we added a question regarding use of this assessment interview on all patients they assess, with a yes/no/unsure response category (question item 2), and question 4 if the use of the computerised ASAM Criteria software was a risk to the personal contact experience with the patient. They were given the questionnaire on two separate occasions, once after their first training assessment interview and again after their last training interview. With regard to their comments, the items in the satisfaction questionnaire also included questions regarding computer use, knowledge enhancement from the assessment, and if they wanted to add, change, or remove any of the questions.

2.1.6. Satisfaction among patients

Patients' experiences with the structured interview were collected using open-ended questions at the end of the interview: How was your experience with this form of interviewing compared to how you were assessed when you entered treatment? And are you confident that I have asked all the questions I need to know about your needs and make a placement decision?

2.1.7. Statistical analysis

Duration of administration was automatically recorded for each section of the assessment and descriptive statistics were calculated. Satisfaction with the ASAM Criteria software was evaluated by examining whether there were any changes in the individual satisfaction questionnaire items after the first and last training video interviews. For inter-rater reliability (IRR) testing, counsellors were asked to rate 10 videos, of which five complete training

videos were used for the IRR calculation with the intra class correction method (ICC). The assessors were evaluated based on how well they agreed on the ASI-composite scores on the five videos. For complete surveys, we had technical issues with the software causing loss of data on the PPC dimensions, and this affected the determination of LOC. These pilot findings were sent back to the programmers and repaired before the execution of the larger validation study on the ASAM Criteria software. As this was fixed after the pilot study, we could not measure Inter-rater reliability for LOC recommendations.

2.2. Validation study

2.2.1 Sampling and procedure

The sample comprises treatment seeking patients with a substance use disorder from the mid-region of Norway. In addition to a baseline interview and follow-up after three months, patients were also asked to do two more interviews six and 12 months after treatment initiation. This study includes data from baseline and three month follow-up interview. There was also a pilot study conducted prior to the full scale validation study which is included as a separate section.

This prospective double-blind, multi-site, naturalistic study was conducted at 10 different assessment and treatment clinics from the region, sampled across three counties. Both outpatient and inpatient clinics with a variety of services were recruited. During February 2010 and July 2012, patients at the treatment clinics were approached by ASAM assessors. These clinics consisted of six inpatient and four outpatient facilities. Specialised treatment for patients with a substance use disorder was differentiated into four LOC in Norway when the study started, with detoxification at the lowest level and inpatient treatment over six months as the highest LOC offered (Norwegian Ministry of Health, 2009). Division was based upon

length descriptions, not intensity. However this changed during the study period and became similar to the division of LOC that we see in the ASAM Criteria with more focus on coordination of services (Mee-Lee et al., 2001; Norwegian Ministry of Health, 2009). The levels in Norway are now divided like this:

1. Outpatient treatment
2. Intensified outpatient/day-treatment
3. Inpatient/residential treatment

The intensity and amount of services are taken into consideration in the division of LOC. Detoxification and opiate maintenance therapy can be offered at any level, together with somatic and psychiatric services that patients might need. Patients from day treatment were not included in the validation study as there were no centres providing this LOC when we started recruiting.

2.2.1. Sample

All the necessary applications were distributed and approved before patients were recruited. The study was approved by the Regional Committees for Medical Health Research Ethics (REK) and the Norwegian Social Science Data Services. The assessors at each centre informed the patients about the study and all recruited patients provided informed consent. Eligible patients had to be ≥ 18 years of age, speak and understand the Norwegian language, and be stable with regard to intoxication with alcohol and/or drugs, and/or psychiatric symptoms. Stable meant that they either had to be cognitively cleared from their last substance use, or had taken prescribed or tolerable doses such that they could function in an interview setting. Eligible patients did not have to be abstinent. They agreed to accept TAU recommended placement, and they were all clinically diagnosed with substance dependence

or abuse according to the International Classification Diagnostic, version 10 (WHO, 1993) Criteria for this diagnosis which is the preferred diagnostic classification system in Norway. There were 310 patients approached in this study and 290 agreed to participate (94% response rate).

The sample in this study is comparable to other similar studies in Norway (Landheim, Bakken, & Vaglum, 2003; Melberg et al., 2003; Nordfjærn, Hole, & Rundmo, 2010). The latest study from the same region is also similar in terms of higher reports on unemployment, mood disorders and anxiety compared to the two first ones, and consequently the representativeness of this current study with Norwegian substance use disorder patients was considered satisfactory. The final clinical sample consisted of 261 patients, 66% male, ages 18–61. A majority was never married (79%), 36 % were living alone, and 46 % with family, partner or friends. Nine percent (9%) of the total sample lived with children. Over 18% reported no stable living arrangement in the last three years. A mean of almost 11 years ($SD = \pm 1.87$) of education was reported and the longest occupied job had a mean of almost 5 years ($SD = \pm 2.13$). Almost half of the sample (49%) were unemployed and only 13% had income from employment in the last 30 days. There was a mean average on nearly four legal convictions in the sample.

On clinical measures, the majority of the sample reported stimulants as main drug of choice (32%), followed by 24% with alcohol, 17% with opiates, and 12% with sedatives. Also 42.5% reported using two or more substances per day so they could be classified as poly-drug users. Treatment history in substance abuse treatment revealed an average of one stay ($SD = \pm 5.27$) in alcohol treatment prior to this and two stays in drug treatment ($SD = \pm 4.63$), however this variable was skewed with some patients having over 70 and 60 stays in alcohol and drug treatment. When removing those outliers, we see that mean prior stays in alcohol treatment dropped from one to 0.57 ($SD = \pm 1.66$), and drug treatment with a mean of 1.80 ($SD = \pm 2.92$).

Psychiatric diagnosis was reported by ASAM assessors and analysed group wise separating those in need for Addiction Only Services or Dual Diagnosis Capable or Dual Diagnosis Enhanced programmes. Common psychiatric diagnosis reported by patients in all three groups were anxiety (49% (n = 47), 67% (28) and 57% (70), depression (51% (49), 45% (19) and 51% (63)), and borderline or other personality disorders (28% (27), 31% (13) and 38% (47). Less common in Addiction Only Services, but more frequently reported by patients with Dual Diagnosis Capable and Dual Diagnosis Enhanced recommendation were bipolar disorder (5 % (5) vs. 14% (6) and 11% (13), psychosis (2% (2) vs. 10% (4) and 17% (21), PTSD (5% (5) vs. 26% (11) and 18% (22) and eating disorders (3% (3) vs. 7% (3) and 10% (12). On PTSD and Psychosis, there were significantly more reports from the Dual Diagnosis groups compared to Addiction Only Services. In the Addiction Only Services group, 49% (47) of the patients reported having an active psychiatric diagnosis vs. 62% (Dual Diagnosis Capable, n= 26; Dual Diagnosis Enhanced, n= 76) in both the Dual Diagnosis groups but the difference was not significant.

Over 65% (62) in the Addiction Only Services group had never been in psychiatric inpatient treatment before, and 35% (34) has never been in psychiatric outpatient care. However in the Dual Diagnosis Capable group, 52% (22) had never been in psychiatric inpatient treatment before and 43% had never been in psychiatric outpatient care. And in the Dual Diagnosis Enhanced group, 47% (58) had never entered psychiatric inpatient care and only 24% (30) had never undergone psychiatric outpatient care.

2.2.2. Procedure

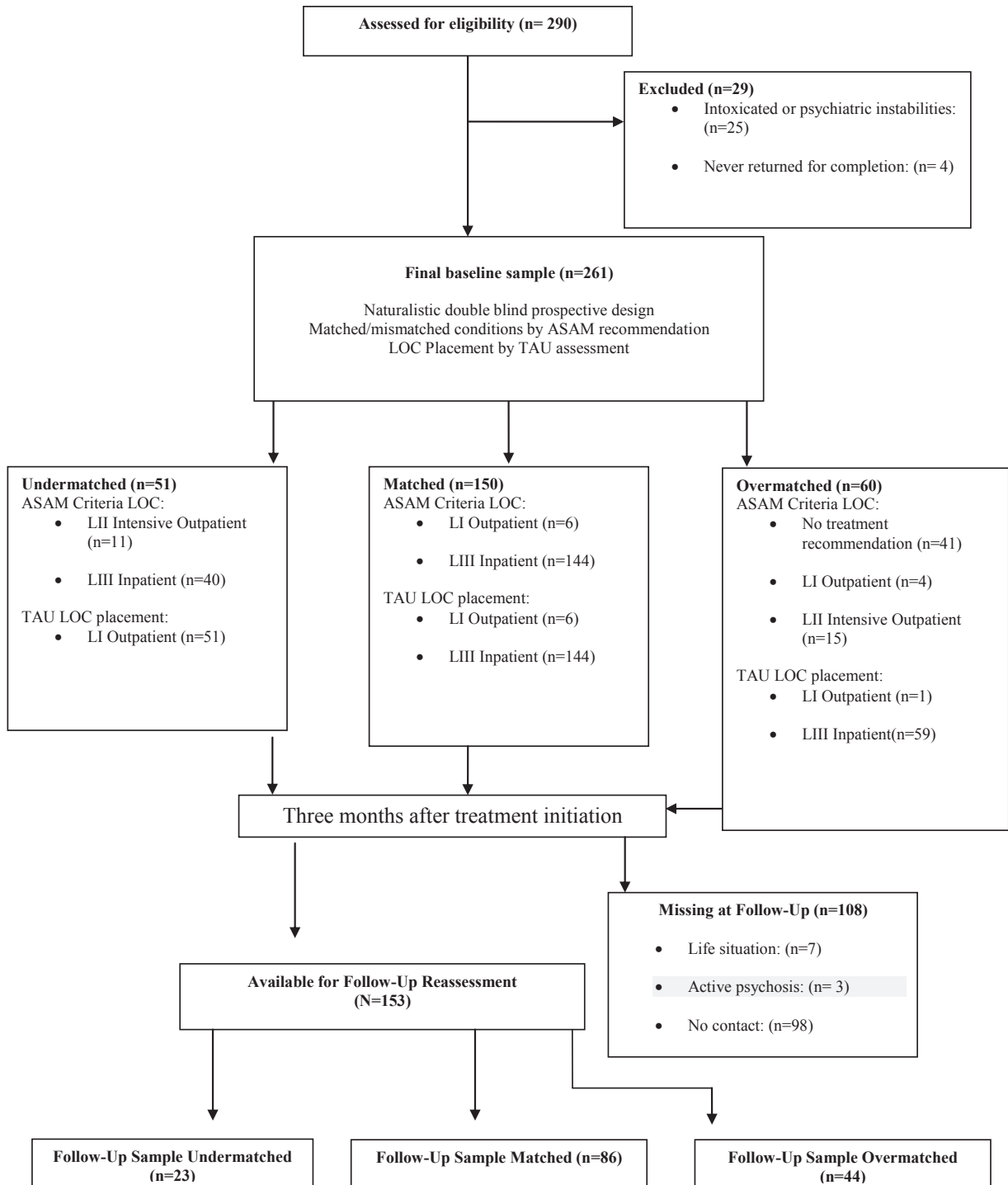
All patients received a TAU assessment, i.e., routine intake interview at assessment centres by personnel who had not been introduced to the ASAM Criteria. Afterwards, patients received the ASAM Criteria Software interview at baseline with trained ASAM assessors who did not participate in the centres'/clinics' TAU assessment or placement during the study period.

During the ASAM interview, patients were interviewed during the same 30-day time period as during their TAU interview, i.e., at intake. Matching was defined by the congruence of the clinically-derived TAU recommendation relative to the ASAM recommendation (the putative gold standard). If they agreed, the patient was categorised as belonging to the matched group. If the TAU assignment was higher, the patients were categorised as overmatched and if lower than the software recommendation, the patient was defined as undermatched.

2.2.3. Double blind design

Because the recommendation by the software is created in a separate report file, we were able to lock this function so that the recommendation would be kept blind to both assessors and patients. If they tried to view the report, a message appeared informing the user that the ASAM recommendation was concealed for research purposes. Patients and ASAM-assessors were kept blind to the ASAM algorithm-based LOC recommendation at both baseline and follow-up, and the patients were naturalistically referred to the TAU-recommended LOC. Interviews took place in routine offices and patients were contacted by the ASAM assessors (not necessarily the same one) again after three months for follow-up interviews. Figure 1 shows a Flow Chart of the recruitment and follow-up process.

Figure 1: Participant recruitment and follow-up rates



2.3. Measurement instruments

2.3.1. Case Report Form

For all patients included in the study, a journal was created in which ASAM assessors registered the patient's LOC recommended by TAU and whether the patient remained in treatment at follow-up interview. Additional information like drug screening/episodes, interview process, or other vital information was also registered in the journal.

2.3.2. ASAM Criteria Software Interview

The ASAM Criteria is used by a majority of US states (Mee-Lee et al., 2001) and has undergone nine studies with 3641 patients. Inter-rater reliability with the first edition software was 0.77 (ICC) (Baker & Gastfriend, 2003). Results from our pilot study are similar in regard to inter-rater reliability on the ASI composite scores. The current Second Edition, Revised tool (PPC-2R) assesses prior treatment, substance use duration, frequency and recency, severity of addiction, substance use disorder diagnosis, withdrawal symptoms, relapse potential, personality characteristics and psychiatric symptoms, cognitive function, motivation for treatment and environmental factors. It includes previously validated tools including (in the Norwegian version) the European version of the ASI (Hodgins & El-Guebaly, 1992; Leonhard, Mulvey, Gastfriend, & Shwartz, 2000; Lauritzen & Ravndal, 2004), the Hamilton Depression Scale (Hamilton, 1960), the Clinical Institute Withdrawal Assessment for Alcohol (CIWA-AR) (Sullivan, Sykora, Schneiderman, Naranjo, & Sellers, 1989), and the The Clinical Institute Narcotic Assessment (CINA) Scale for Withdrawal Symptoms (Peachey & Lei, 1988; Mee-Lee et al., 2001). With approximately 6,000 calculations, the software constructs an algorithm-based recommendation, a 3-5 page report describing the patient's needs within the different dimensions, and a final LOC recommendation. The diagnostic

terminology used in this software version was consistent with the DSM-IV (American Psychiatric Association DSM, Fourth Edition, 2000; the ASAM Criteria Fall 2013 version incorporates DSM-5).

The ASAM Criteria is a highly intricate (350 page) hierarchical decision tree in which the decision rules are organised along six clinical dimensions of assessment:

1. Intoxication and withdrawal
2. Biomedical complications and conditions
3. Emotional/behavioural complications and conditions
4. Treatment readiness
5. Potential for continued use or relapse
6. Environmental conditions.

These are matched to 6 general LOC:

- 0.5 Early Intervention: contains services for individuals who are at risk of developing substance-related problems or for those for whom there is not yet sufficient information to document a substance use disorder.
- I. Outpatient Treatment: organized, non-residential services, which may be delivered in a wide variety of settings. Addiction or mental health treatment personnel provide professional evaluation, treatment and recovery service. Such services are provided in regularly scheduled sessions and follow a defined set of policies and procedures or medical protocols.

- II. Intensive Outpatient Treatment, e.g., partial hospitalization: organized outpatient service that delivers treatment services during the day, before or after work or school, in the evening or on weekends. Such programs provide essential education and treatment components while allowing patients to apply their newly acquired skills within "real world" environments. Programs have the capacity to arrange for medical and psychiatric consultation, psychopharmacological consultation, medication management, and 24-hour crisis services.
- III. Residential/Inpatient Treatment: services staffed by designated addiction treatment and mental health personnel who provide a planned regimen of care in a 24-hour live-in setting. They are housed in, or affiliated with, permanent facilities where patients can reside safely. They are staffed 24 hours a day. Mutual and self-help group meetings generally are available on-site. Level III encompasses four types of programs and defining characteristic of all Level III programs is that they serve individuals who need safe and stable living environments in order to develop their recovery skills.
- IV. Medically Managed Intensive Inpatient Services, e.g., hospital care: provide a planned regimen of 24-hour medically directed evaluation, care and treatment of mental and substance-related disorders in an acute care inpatient setting. They are staffed by designated addiction-credentialed physicians, including psychiatrists, as well as other mental health and addiction credentialed clinicians.
- OMT. Opioid Maintenance Treatment: medical maintenance therapy like methadone or buprenorphine for opiate use disorders, which can be delivered within any level of care if the criteria's for an opiate use disorder is met.

Within these levels of care, there exist detailed sub levels for more specific program criteria, and there is also specific program recommendation given for co-occurring disorders.

A thorough description of all the LOC mentioned above can be found in Mee-Lee and colleagues' book (2001). The descriptions contain guidelines for what a LOC should contain in the form of personnel, therapies, support systems, and documentation. Three types of programs within the recommended LOC reflect their ability to address co-occurring substance related and mental disorders. These are Addiction Only Services, Dual Diagnosis Capable and Dual Diagnosis Enhanced.

Addiction Only Services deals with patients with none or minor psychiatric disabilities that are not perceived to be interfering with treatment for their substance use disorder.

Dual Diagnosis Capable programs mainly focus on treatment of substance related disorders, but also treat patients who have relatively stable diagnostic or sub-diagnostic co-occurring mental health problem related to an emotional, behavioural or cognitive disorder.

Dual Diagnosis Enhanced is designed to treat patients who have more unstable or disabling co-occurring mental disorders in addition to their substance related disorders. All staff must be cross-trained in both disorders. High staff ratio with a main focus on the patients' dual diagnosis instability and integrated dual diagnosis staff, services and content are found in this programme specification.

2.3.3. Psychiatric diagnosis

Analyses in article III uses data where the patients were asked directly if they have an active psychiatric diagnosis and ASAM assessors are asked to report any active psychiatric

diagnosis the patients might have after interviewing them on symptom severity and history of psychological problems. These are used as outcome variables along with ASI CSs to determine severity and characteristic differences within the different LOC recommendations.

2.3.4 The European ASI (Europ-ASI)

The ASI was developed to evaluate the severity of addiction-related problems in terms of lifetime perspectives as well as recent use (past 30 days) on the following dimensions: medical status, employment and support status, drug and alcohol use, legal status, family and social relationships and psychiatric status (McLellan et al., 1980; McLellan et al., 1992). The ASI in the Norwegian ASAM Software is a European version; its reliability and validity is well documented (Hodgins & El-Guebaly, 1992; Leonard et al., 2000; Lauritzen & Ravndal, 2004). ASI CSs is calculated using a subset of items from each of the seven domains. For example, The Psychiatric CSs screens for a range of problems including depression, anxiety, violent behaviour, hallucinations, and suicide-related episodes in the past 30 days. Additionally, clients provide information on prescribed medications for any psychological/emotional problems. For more detailed information of the composite scores, the manual is available online (www.Triweb.tresearch.org/CompositeManual; McGahan, Giffith, Parente & McLellan, 1986).

2.4 Norwegian LOC included in the study

In this study, only Outpatient (ASAM Level I) and Inpatient/Residential Care (Level III) were available and included as TAU options. Personnel on both LOC are interdisciplinary trained, often with additional formal education in substance use disorders and psychiatric co-occurring disorders. The LOC have access to and collaborate with community social workers to secure

housing arrangement, and to assist patients in attending more intense treatment if needed by referral or closely coordinated services such as acute medical or psychiatric care units. The LOC provide help or assistance with vocational training, and there is a focus on family and friend relationships to enhance patients' social support. All clinics apply a biopsychosocial approach to the understanding and treatment of substance use disorders. This means that all these aspects, biological conditions and complications, social and psychological conditions and complications should be taken into consideration when assessing and recommending treatment services to fit the needs of the patient.

In the outpatient setting, patients receive individual therapy at least once a week, but the majority also have more than one session, e.g., with counsellor, psychologist, psychiatric or medical services. Both group therapy and vocational training are provided at this level if needed. Opiate maintenance treatment and other medical services are also provided. Length of treatment is based on patients' progression but often involves a minimum of 10-12 sessions.

In the inpatient setting, treatment is offered for three months to 1.5 years depending on the patient's needs. Some programmes have more experience with severe alcohol dependence, others with drug dependence, but they address all substances as well as other needs. The therapies offered vary, but common services include a set weekly treatment plan that patients follow over time which includes individual sessions, group sessions, exercise, leisure activities, legal assistance, housing assistance and vocational training/school.

2.5 Statistical power and group size

The effects of the PPC assessment are measured as a function of clinical difference in outcome between matched and mismatched treatments. A meaningful difference in outcome in favour of optimal matching should be at least 25%, as indicated by a 25% decrease in

reported drug/alcohol use. Furthermore, we accept a probability of Type I error of 5% with 80% power, requiring 95 patients in each condition. The 95 patient requirement was not met for the matched and mismatched groups at three month follow-up (n=85, n=68, respectively).

2.6 Statistical analysis

Violation testing was performed for outliers, normality and linearity before analyses were conducted. In the first article, descriptive statistics were carried out to investigate sample characteristics on both demographic and clinical variables. Baseline and follow-up outcome measures in this study included: a) dropout, b) frequency of drug use last 30 days reported at intake, c) the seven ASI CS scores, and d) whether patients were assessed and recommended by the ASAM Criteria software to the same, higher or lower LOC at follow-up compared to their baseline LOC recommendation by ASAM. A lower or unchanged follow-up LOC would be considered a positive outcome. A higher LOC at follow-up is seen as a worsening of symptoms and less progression requiring additional services.

To assess the primary outcome event that should be predicted by ASAM LOC under-matching (*vs.* matching), i.e., drop-out from baseline to follow-up, an independent t-test for continuous variables and Chi-square for categorical ones was used to analyse drop-out and potential baseline differences between patients who dropped out from the study *versus* (*vs.*) patients who remained in treatment. In the event of meaningful baseline differences between the baseline and follow-up samples, an intent-to-treat analysis might be in order; therefore paired sample t-tests were used to detect significant changes for the three groups separately on the frequency of use and ASI CSs, from baseline to follow-up. GLM univariate analysis of variance was used to analyse differences for matched *vs.* undermatched, and matched *vs.* overmatched groups, applying the patients' baseline measures as covariates. The baseline covariates included the ASI CSs and frequency of use. Estimates of effect sizes (Cohen's *d* and *Cramer's V*) were also included in paper I. These were calculated to examine the strength

of group differences. A d value around .10-.20 is usually interpreted as a small difference, .40-.50 as a medium difference and a value around .70 or above reflects a strong difference (Cohen, 1992).

In Article II, the analysis of level of agreement/disagreement between LOC assignment from TAU and ASAM algorithm based recommendation, utilised a Crosstab with Pearson Chi-square analysis. Determination of convergent validity used the baseline ASI CSs differences between the three LOC, followed by a planned contrast test to determine the significance of clinical differences between pairs of LOC. Determination of the predictive validity of matching vs. mismatching employed a paired sample t-test on the ASI CSs mean changes from baseline to follow-up. This second report separates the analyses by LOC and explores discrepant cases in terms of both match/mismatch condition and LOC assignment.

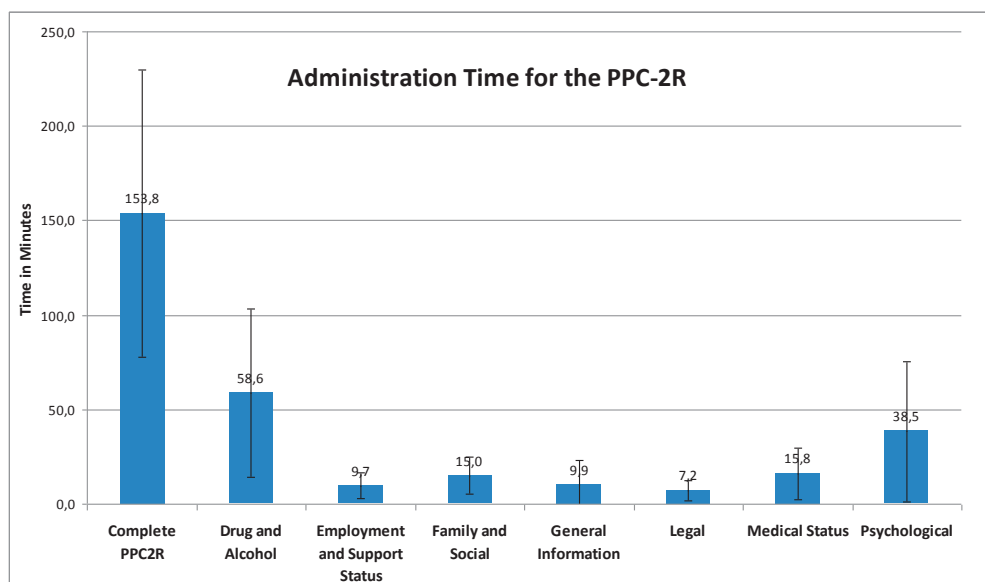
And finally in article III to show the prevalence of the different treatment recommendations by the ASAM software, we used percentage distributions. Univariate ANOVA and Chi-square tests were used to analyse baseline group differences for the different recommendations on demographical and clinical characteristics. We analysed group differences across the three recommendations on the following outcome variables: demographic and clinical status and history (psychiatric diagnosis, treatment history, no-show for assigned treatment and suicide attempts) at baseline. When a significant difference was found, we applied a Scheffe post-hoc analysis to determine which of the groups differed. Retention at follow-up was also analysed to see if they differed on this variable. Paired sample t-test was used to study changes in the ASI CSs from baseline to follow-up. A planned contrast test was conducted using GLM univariate analysis between the low to high intensity ASAM recommendations to determine if patients with more intense recommendations were significantly more severe. Analyses from all the articles were performed with the statistical analysis package PAWS, version 18.

3. Results

3.1. Pilot study

The primary purpose of this pilot study was to conduct a quality check of the Norwegian translation of the ASAM Criteria second revised software version by measuring: duration of administration, satisfaction and inter-rater reliability among the assessors and patients who had completed the training course and training videos.

Pilot study figure 1: Administration Time for the ASAM PPC-2R



3.1.1. Duration of Administration

The durations of administration registered for each section during the interview are shown in Pilot study figure 1. Drug and alcohol section together with the psychological one is the most time consuming parts of the interview with a mean of 59 and 39 minutes. No patients refused to undergo the interview or terminated prematurely. Patients had no problems completing the

interview in one session, and only two patients needed two sessions to complete the interview due to other appointments.

3.1.2. Satisfaction among Assessors on the 34-item Satisfaction Questionnaire (N=8)

Pilot table 1 shows descriptive statistics of means for each question item, and difference in means before and after completion of training with the videos. The first 5 pairs in Table 1 show the assessors' satisfaction with ASAM software edition and the last 8 pairs shows their satisfaction with the instruments' different sections. The satisfaction items mean change from the first to the second session ranged between -0.101 to 0.445, showing a higher satisfaction on the second session for items 3, 5, 6, 7, 8, 15; no changes on items 1,9,10,12, 13, and decrease in satisfaction on items 11 and 14.

Also two other questions were assessed in addition to these pairs (Item 2 and 4). Question 2 asked if they would use the software assessment on all of their patients and they reported the same at both test points. Two people answered yes, 2 reported no, and 4 were unsure if they could use it on all patients. This indicates that they did not see this as an assessment option for all referred patients, which makes sense in a clinically diverse patient group.

Question 4 asked if the experience of personal contact during the interview session changed after the training period. After their first interviews, there was only one assessor who reported that the assessment interview gave room for personal contact, and after the completion of training there were five assessors reporting personal contact. Five assessors answered "both" after the first video and only one reported "both" at follow-up, meaning that the experience of personal contact shifted towards a more positive experience after more training. There was also a change from zero to two "unsure" answers at follow-up.

When asked if the use of ASAM Criteria gave the assessors enhanced knowledge (Question 1), no one reported being dissatisfied, and six of eight assessors reported being satisfied to very satisfied, indicating that they felt enhancement in knowledge when using ASAM Criteria to assess patients.

For the question on how satisfied they were with the interview they just executed (Question 3), six assessors reported being satisfied, and two assessors answered the category “neutral” that is in the middle of the 5-point Likert scale (satisfied with some parts, unsatisfied with others), revealing good satisfaction when conducting an interview with this instrument.

When asked to rate their satisfaction with the ASAM Criteria versus how they assess as usual (**Question 5**), five assessors reported being satisfied with the ASAM Criteria compared to how they would usually assess patients. This indicates greater satisfaction with the use of ASAM Criteria than assessment as usual. The use of a computer was reported to be satisfactory for five of the assessors (**Question 6**), and the rest answered that they were “neutral”. Overall satisfaction with the ASAM Criteria show that seven assessors report being satisfied (**Question 7**), and one reported being neutral.

The ASAM Criteria is structured into eight sections with multiple questions in each. Assessors were asked about their satisfaction regarding each specific section: general information, work/vocational activity, family/social network, drug history, medical health, legal issues, psychological health, and an overall “completion” section rating the patients’ needs, and availability of and access to those services. Results for each of these sections all had a mean above 3.5 indicating a high degree of satisfaction among the assessors on all sections.

Table 1: Mean scores in the pilot study on Satisfaction among assessors with the ASAM PPC-2R before and after training

Questions/items	First session	Second session	Mean change after completion of training
*Item 1: Did the assessment with the use of ASAM Criteria enhance your knowledge about the patient?	3.78	3.78	0.0
**Item 3: How would you rate your overall satisfaction with ASAM Criteria?	3.22	3.67	0.45
Item 5: How satisfied/unsatisfied are you with ASAM compared to assessment as usual?	3.33	3.56	0.22
Item 6: How satisfied/unsatisfied are you with using a computer during the interview?	3.44	3.56	0.12
Item 7: How satisfied/unsatisfied are you with the entire interview session as a whole?	3.56	3.78	0.22
Item 8: How satisfied/unsatisfied are you with the Completion section in ASAM?	3.33	3.56	0.23
Item 9: How satisfied/unsatisfied are you with the Work section?	4.0	4.0	0
Item 10: How satisfied/unsatisfied are you with the Psychological section?	3.67	3.67	0
Item 11: How satisfied/unsatisfied are you with the Family section?	4.0	3.89	-0.11
Item 12: How satisfied/unsatisfied are you with the Drug section?	3.89	3.89	0
Item 13: How satisfied/unsatisfied are you with the Legal section?	4.11	4.11	0
Item 14: How satisfied/unsatisfied are you with the Medical section?	3.78	3.67	-0.11
Item 15: How satisfied/unsatisfied are you with the General section?	3.89	4.0	0.11

3.1.3 Satisfaction among patients

All patients were asked after the interview session how they experienced the interview and they all were positive towards the interview. Only one out of 10 patients reported too many questions. Those nine other patients who did not find it too excessive found the structure to be very good when it came to retrieving information about their needs and expressing them. The broadness gave them a sense of security that the assessors had gone through all the important dimensions with respect to their needs, and security that they had given the information necessary for the assessors to place them in the right LOC. All patients reported being secure that they had been given the necessary questions to place them in optimal treatment and none had additional questions that they believed were important for assessing their needs.

Pilot table 2 shows the ICC for ASI composite scores on all 5 test videos. Using the composite scores of the ASI as means for establishing inter-rater reliability, it was possible to demonstrate perfect or near perfect agreement across all assessors.

Table 2: Inter-rater reliability measures on ASI and ASAM Criteria dimensions across 6 assessors on 5 patient videos in the pilot study.

ASI Composite Subscale scores		CI (95 %)	ICC (*SIGN.)
Medical	Lower bound	.951	.992***
	Upper bound	1.00	
Employment	Lower bound	.831	.954***
	Upper bound	.997	
Alcohol	Lower bound	.955	.992***
	Upper bound	1.0	
Drug	Lower bound	.797	.944***
	Upper bound	.996	
Legal	Lower bound	1.0	1.0***
	Upper bound	1.0	
Family	Lower bound	.883	.987***
	Upper bound	1.0	
Psychiatric	Lower bound	.935	.988***
	Upper bound	1.0	

*p<.05 **p<.01 ***p<.001 CI=Confidence Interval.

3.2. Paper I: Matching Patients with a Substance Use Disorder to Optimal Level of care with the ASAM Criteria Software

The aim of this article was to investigate the ability of the second revised ASAM Criteria Software to predict outcomes among patients with a substance use disorder after three months in treatment. A total of 261 (171 males) patients completed the baseline interview. Of the total sample, 57% (n=150) were matched according to the ASAM Criteria recommendation, almost 20% (n=51) were undermatched and 23% (n=60) were overmatched. Over 40% of the total study sample did not show for the follow-up interview, and dropout was indeed greater in the undermatched patients. A total of 55% (n=28) of the undermatched group left treatment before three month follow-up interview versus 38% (n=57) in the matched group and 30% (n=18) in the overmatched group. At post-test, patients who had received matched treatment reported less use of alcohol and cannabis *vs.* undermatched patients. On the ASI CSs, the matched group had a significant reduction in six out of seven severity composite scores (all but ASI Employment) versus two (ASI Drug and ASI Family) out of seven in the undermatched, and three (ASI Alcohol, ASI Drug and ASI Legal) out of seven within the overmatched group. Percent of patients per group ready to step-down to lower LOC was: 46% under-matched, 61% matched, and 17% over-matched, favoring the matched condition. Controlling for baseline measures on frequency of use and the 7 ASI CSs in a GLM univariate analysis, the matched group had significantly lower follow-up severity than the overmatched group on ASI CSs Family scores.

Overmatched patients did not have better outcomes than matched patients; in some cases no change occurred or a more intensive LOC was recommended at post-test. Consistent with prior studies, the ASAM Criteria Software Norwegian version demonstrates elements of predictive validity in determining intensity of LOC placement using all three prospectively planned measures.

3.3. Paper II: Predictive and Convergent Validity of the ASAM Criteria Software in Norway

This second report further extends the work in article I by exploring two hypotheses: first, that the new ASAM Criteria LOC recommendations should show convergent validity with the most commonly used addiction severity measure, the ASI, and second, that the ASAM recommendations should show predictive validity, in terms of discrepancies between patients assigned according to ASAM vs. TAU. The greatest discrepancy between TAU and ASAM was with LII Intensive Outpatient Care. This was caused by the unavailability of LII at the time in this region. In contrast, with the availability in Norway for LIII, this Inpatient category yielded agreement in 78% of the cases. The ASAM Software recommended a more intensive LOC than TAU in 20% of cases. Of the 261 patients, there were 41 who did not receive a LOC recommendation (i.e., data showed sub-clinical severity or were insufficient). These patients were excluded and the final sample size for the analyses was $n=220$. Results revealed significant differences for the LOC placement by TAU vs. ASAM recommendations. The group that was ASAM-recommended to receive the most intensive LOC, LIII Inpatient/Residential, had a consistent pattern of higher observed mean baseline scores than the outpatient group (LI+LII) on all seven ASI CSs. Comparing the groups, significantly higher severity means were found in the most intensive LOC on ASI Psychological CSs and ASI Drug CSs. The ability of the ASAM Criteria to clinically distinguish between the different LOC lends support for the software's convergent validity.

The differential outcomes for the matched versus mismatched groups demonstrates predictive validity for the ASAM Criteria Software. The undermatched group had worse outcomes than the matched group for all undermatched conditions, which favors' the ASAM Criteria recommendation. The overmatched group did not appear to benefit from more intensive placement by TAU, thus also favouring the ASAM Criteria recommendation.

3.4. Paper III: Convergent validity of the ASAM Criteria in Co-occurring Disorders.

The aim for the third article was to look at the prevalence of Dual Diagnosis programme recommendations, and investigate what characterises those patients with Addiction Only Services, Dual Diagnosis Capable or Dual Diagnosis Enhanced recommendation from the ASAM Criteria software. Finally treatment outcome three months after treatment initiation was investigated among those with and without Dual Diagnosis recommendation on the following variables: show for treatment assigned, treatment retention, and change in severity in the ASI CSs. The sample contained 96 (37%) patients who received Addiction Only Services programme recommendation along with 42 (16%) patients recommended for Dual Diagnosis Capable programme and 123 (47%) patients recommended for Dual Diagnosis Enhanced programme. Studying group differences showed significantly lower age and fewer years of work experience in the Dual Diagnosis Enhanced group compared to Dual Diagnosis Capable and Addiction Only Services groups. We see an overall higher percent with Bipolar disorder, Psychosis, Borderline or other personality disorders, PTSD, and eating disorders in both the Dual Diagnosis groups compared to Addiction Only Services group, but only PTSD and Psychosis is significantly different. A higher percentage of suicide attempts were found in the Dual Diagnosis Capable (45%) and Dual Diagnosis Enhanced (44%) groups compared to Addiction Only Services group (31%), but these differences were not significant. Both the Addiction Only Services (five out of seven ASI CSs) and Dual Diagnosis Enhanced (six out of seven ASI CSs) group had reduced severity at follow-up, but when controlling for baseline measures no group differences were found. The higher the recommendation, the more psychiatric severity we see among the patients recommended for them. This implies that the ASAM Criteria has the ability to discriminate on psychiatric severity and thus support convergent validity for the criteria on co-occurring disorders.

4. Discussion

4.1. Pilot study

This pilot study left us with an instrument and a network of skilled assessors which could be used to test the validity of the PPC on the Norwegian population. It yielded a quality-checked training programme, and tested satisfaction and inter-rater reliability which may be useful in the future to secure skilled assessors across the country of Norway.

4.1.1. Inter-rater reliability

Inter-rater reliability among the assessors showed near perfect agreement on the ASI CSs on this revised edition with Norwegian language. This is very similar to the findings found by Baker and Gastfriend (2003) for the PPC-1 Assessment Software, indicating that the computer-assisted structured interview is an effective system for delivering and recording ASI scores. Also, this finding indicates that even with counsellors whose focus is clinical care; a quality research assessment can be obtained with the help of the instrument.

The process of establishing inter-rater reliability for LOC assignment was not possible in this pilot study, but has previously been conducted with success in Baker and Gastfriend's study. In the future, our team will test inter-rater reliability on the LOC assignment with the new and quality checked version of the ASAM Criteria second revised software version (Norwegian). Given the results from previous studies (Baker & Gastfriend, 2003; Magura et al., 2003) these results further support the use of this structured software interview in a clinical setting by skilled assessors for optimal placement of patients with a substance use disorder.

Administration time for the comprehensive psychosocial assessments averaged 2.5 hours in line with previous studies with trained interviewers (Magura et al., 2003). This finding does not take into account the longer-term learning curve which can be expected to yield further time efficiencies in the future, as was found with the PPC-1 (Turner et al., 1999). In that

software interview, initial duration of administration fell by 15% on average after 20 patient administrations. Patients in our pilot and validation study had few or no problems finishing the interview in one session, and only a few needed two sessions to complete the interview due to other appointments. There are questions in the ASAM Criteria software version that can be removed in the future to reduce the number of questions asked, some questions which are asked more than once. Separating between panic attack and anxiety attack in the USA is important since there are different medications used to treat it, but in Norway we do not and we might be better off with one question instead of the current 16. Another way would be to provide the assessors with definitions of the two states and check the appropriate box.

Possible changes like the one suggested will have an impact on administration time, but it will also depend on the severity of the patient. The more issues and needs a patient has, the more questions need to be answered and thus the interview takes longer to execute.

Both patients and assessors have reported satisfaction with the length and depth of this structured interview. Assessors reported greater knowledge about their patients' needs, and patients reported being more reflective about their own needs. Showing acceptable administration times, high satisfaction among clinicians and high inter-rater reliability for ASI CSs assessment, the Norwegian ASAM Criteria Software second revised version and the Norwegian Software Training Programme appear to provide more than adequate feasibility and reliability to justify its broader implementation in a regional, multi-site, real-world treatment system and possibilities for harmonising practice among assessment centres. This pilot study produced an instrument and a network of skilled assessors which were further used to test the validity of the revised ASAM Criteria software edition for patients in the mid-region of Norway.

These are findings from a very small pilot-study, so the results should be discussed with caution. A larger satisfaction and inter-rater reliability testing on multiple variables, including LOC, with several assessors and patients would be interesting to conduct if a widespread distribution of the assessment tool is planned for the future.

4.2. Validation study

The core aim of the present dissertation was to examine the ASAM Criteria second revised version predictive and convergent validity in terms of matching patients with a substance use disorder to optimal LOC and provide the assessment centers a possible tool for harmonising the region's practice. The specific aims were investigated and discussed in three different empirical papers. The first paper focused on the predictive validity of the ASAM Criteria on matching patients to optimal LOC and investigated differences in outcomes among those matched to the right LOC to the ones mismatched to a lower or higher level than needed. The outcome variables included retention, frequency of use, severity on the ASI CSs, and recommended LOC at follow-up. The findings demonstrate elements of validity for the Norwegian translated software version of the ASAM Criteria and are in line with previous studies (Sharon et al., 2003; Magura et al., 2003). The discrepancies between the ASAM Criteria recommendations and TAU placement were investigated further in the second paper with a greater focus on the outcomes among match and mismatched patients on different LOC along with the Criteria's convergent validity in terms of discriminating between those with low/high severity and less/more intense LOC needs. In the third and last paper, the ASAM Criteria was investigated for convergent validity in terms of discrimination among those in need for Dual Diagnosis Programmes and characteristic differences in severity between the different recommendations. Together these three papers present the specific aims for this

project to answer the main aim: to validate the second revised Norwegian translated ASAM Criteria software edition.

The predictive validity in article one and two was tested by comparing outcomes from the matched patient group with the mismatched groups and results favoured the matched group in all four categories measured at follow-up: retention, reductions in substance use, ASI CSs, and LOC recommendations.

A significantly higher portion of the under-matched patients dropped out of the assigned treatment, and the matched group had a significant reduction in days of stimulant use compared to the overmatched group, supporting the hypothesis that mismatching is not beneficial for the patients. Matched patients had better three months outcome than both the mismatched groups and the software discriminate, thus showing support for convergent validity between those with low vs. high severity in the recommendations. This indicates that the Norwegian translated revised ASAM Criteria software version is a valid tool to assess and recommend optimal LOC for patients with a substance use disorder. The findings from the articles also suggest better recommendation by the ASAM Criteria software than TAU, justified with better results among the matched versus mismatched patients. A better recommendation and placement can contribute to an improved utilisation of the region's treatment offers and also fulfil patients' needs in a more satisfactory way for better treatment outcomes by better placements.

Results from the third paper revealed a high proportion Dual Diagnosis programme recommendations from the ASAM Criteria software in this region. The group differences that were found support the convergent validity of the ASAM taxonomy for co-occurring disorders and the software's ability to identify patients in need for integrated programme services. The successful outcomes in the Dual Diagnosis Enhanced group, nevertheless,

suggest that these patients can have as good outcomes as those with less intense needs, as long as their needs receive appropriate care at the right intensity.

4.3. Assessed to optimal LOC

4.3.1. Frequency of use from Baseline to Follow-up

Alcohol consumption was significantly reduced for the matched and overmatched group, in line with a previous validation study of the ASAM Criteria (Magura et al., 2003). The overmatched group was no better than the matched group at follow-up, and actually had less improvement on the ASI CSs than the matched group. Thus, it appears unwise to overuse available resources when one only gets the same, less improvement, or a worsening of severity scores, than a matched LOC achieves.

Sedative/hypnotic use was the only category that increased among the matched group and significantly decreased among the undermatched group. This might possibly be due to primary care patients becoming newly managed by addiction treatment centers, which in Norway tend to provide medically managed care with sedatives to optimize patients' programme retention, e.g., through enhancing sleep, or reducing severe anxiety/anxiety attacks. To explore this hypothesis, prescription adherence was surveyed: in the matched patient group almost 70% took prescriptions as intended vs. 25% of the under-matched group. The common use of sedative in treatment clinics our study follows international clinical guideline recommendations (not exceeding two weeks) and appropriate doses are used. Were the use of it is problematic and patients do not compliant to the description the treatment plan is revised accordingly. Primary doctors are advised to stop prescribing sedatives when their patients enter treatment for a substance use disorder, and this can be the reason we see a drop in the use among under-matched patients. This discrepancy might also be caused by the fact

that under-matched patients may have lacked optimal services and therefore show a lack of compliance.

Cannabis reduction was also significant for matched patients, and reduction in use of two or more substances per day also shows a trend favouring the matched group. This was not the case for the mismatched patients. It should be noted that analysis of these specific substance use changes offers substantially less statistical power because not all patients used each of the analysed substances.

4.3.2. Changes in ASI CS severity scores

Greater statistical power should be anticipated from the ASI subscale analysis, because all patients provided data and the variables are continuous at fairly high resolution, although it would be preferable to have mismatched samples that are equal in size to the matched sample. The statistical power set to detect differences was 95 in each group and we did not reach that level of inclusion in all three groups. The ASI paired sample t-tests favoured matching *vs.* both under-matching and overmatching, with significant improvements among the matched group on six out of the seven ASI CSs. Under-matched patients showed improvement in two and the overmatched group improved on three subscales, but it is worth noting that the under-matched group significantly reduced ASI Drug severity scores and ASI Family score. This indicates that treatment has had an effect, although it was less intense than recommended, but not to the same extent for the under-matched patients as seen for the matched condition.

The ASI Employment dimension, however, was unchanged for all groups. This might be explained by the fact that the first three months of treatment focus on addressing medical, psychiatric and behavioural improvement before employment issues; follow-up interviewers noted that patients seemed concerned with employment only as they became healthier throughout the treatment process. The results are similar to the study by Turner et al., 2003,

which also found this variable to fail in differencing between the groups. No studies have followed the patients with a second interview with the use of the computerized edition like ours. Therefore it is difficult for direct comparisons.

4.3.3. Changes in LOC recommendations

Patients' LOC recommendations at follow-up were changed in a positive direction for 61% of the matched group and 46% in the under-matched group. It however changed in a negative direction for the overmatched group, in which only 17% were recommended for a lower intensity LOC at follow-up than at baseline. None in the matched group were recommended for a more intense LOC at follow-up, but in the overmatched group, over 35% of patients (out of 46) were recommended for a higher LOC than baseline recommendations. These results are interesting compared to previous research, which also found worse outcomes among overmatched patients in the form of more "no shows" for the next step in treatment (Angarita et al., 2007). If overmatching yields no better treatment outcome than matched patients, and also can result in worsening of outcomes, there is considerable clinical risk in patient assessment – not just in giving less treatment than patients need, but also in giving too much.

4.4. Predictive and convergent validity of ASAM Criteria second revised version

The second paper of this dissertation examined convergent validity for the ASAM Criteria Software and further detailed its predictive validity in terms of three-month follow-up outcomes for patients whose placements were matched according to the ASAM Criteria vs. those whose TAU placements consisted of lower or higher intensity than ASAM

recommended. The sample consisted of 150 patients matched to the recommended LOC based on the ASAM Software algorithm, 51 under-matched and 60 overmatched patients.

The greatest discrepancy between TAU and ASAM was with LII Intensive Outpatient Care (LII). This was caused by the unavailability of LII at the time in this region. In contrast, with the availability in this region of Norway for LIII Inpatient/residential treatment (LIII), this category yielded agreement in 78% of the cases. The ASAM Software recommended a more intensive LOC than TAU in 20% of the cases. These results are also similar to previous research (Staines et al., 2003) and the overall study provided a sufficient sample size of mismatched cases to yield meaningful results.

4.4.1. Convergent validity

Mean severity scores in patients who were ASAM-recommended to the more intensive LIII were higher on all ASI CS scores, and significantly so on ASI Drug and Psychological scores, vs. patients recommended to less intense LOC. This is in line with a previous study on the ASAM Criteria's convergent validity (Sharon et al., 2003). Patients with more severe substance abuse, less social support, or co-occurring psychological disorders benefit more from inpatient vs. outpatient treatment (Bartak et al., 2011; Magura et al., 2003) justifying a LIII recommendation. Opposite findings were found however, in cocaine users matched to LII day-treatment vs. those overmatched to LIII treatment, although that study used only a partial implementation of the ASAM Criteria, First Edition (McKay & McLellan, 1992), which may have limited the effectiveness of its algorithm. With the present study's use of the newer ASAM Criteria, second revised edition and the comprehensive computerised implementation, the more severe means on seven out of seven dimensions, and significant change on ASI Drug and ASI Psychological CS scores demonstrate consistency in the ASAM Criteria Software's ability to make clinical distinctions. Furthermore, it makes clinical sense that the ASI

Psychological and ASI Drug CS scores might both reach significant baseline differences between the LOC, based on their association in prior literature (Lehman, Myers, Thompson, & Corty, 1993). Specifically, the impact of psychological problem loading on related dimensions, including family and social supports (Kashner, Rader, Rodell, Beck, Rodell & Muller, 1991), and their relationships with legal problems (American Psychiatric Association, 2000) are also evidenced by the higher severity ASI Legal CS mean score.

4.4.2. Outcomes at Follow-Up for the different match/mismatch LOC conditions

The under-matched group has worse outcomes than the matched group, which favors the ASAM Criteria recommendation. Under-matching may be based on patients' own preferences for outpatient treatment, due to work or family responsibilities, or practical issues such as geography or convenience. Such reasons, however, warrant more educational and motivational effort on the part of assessment clinicians, since the data indicate that patients would enjoy better outcomes if they can accept the ASAM recommended placements. Alternatively, under-matching may occur due to lack of access to certain LOC, as was the case with many LII recommendations – and in this case, the ASAM Software serves as a needs assessment tool for LOC, precisely revealing the quantitative shortage of treatment slots in a geographic region. Given the adverse outcomes of such mismatching, public entities would be wise to respond by improving access to care, as is now the case with provision of LII in this region of Norway. The overmatched group did not appear to benefit from more intensive placement by TAU, thus also favouring the ASAM Criteria recommendation. Although overmatched patients in LIII (a controlled environment) might be expected to benefit from elimination of access to substances and presumably fewer craving triggers, this is less effective and more costly – both in terms of unnecessary restrictiveness for the patient, and inefficient service provision for the treatment system. Overall, these results shed light on

the crucial need for thorough assessments before matching patients' needs to appropriate services.

4.5. Characteristics and prevalence of Dual Diagnosis programme recommendations

To investigate the need for integrated services among treatment seeking patients with a substance use disorder and ASAM taxonomy for Dual Diagnosis programmes, we analysed prevalence and characteristic differences between patients who received Dual Diagnosis programme recommendations and those who do not in a third paper. We found that a total of 37% of the patients received Addiction Only Services recommendation, 16% Dual Diagnosis Capable, and 47% were recommended for Dual Diagnosis Enhanced programmes. This showed a high prevalence, and compared with prior research showing 32% to 65% patients with co-occurring disorders (Bakken et al., 2005); the number of Dual Diagnosis programmes recommendation by ASAM seems to be justified.

4.5.1. Characteristic differences between the three groups

Baseline characteristics reveal a significantly lower age and work experience among Dual Diagnosis Enhanced recommended patients compared to Addiction Only Services and Dual Diagnosis Capable group. More patients in both Dual Diagnosis groups report having a confirmed psychiatric diagnosis, but the differences between the groups are not significant. The history of significantly more psychiatric treatments in the Dual Diagnosis Capable and Dual Diagnosis Enhanced group compared to Addiction Only Services group indicates a higher psychological severity, maybe even chronicity within these groups, which in turn can be viewed in favour of ASAM Criteria. We expected a greater severity in those groups if the taxonomy of ASAM Criteria is correctly designed and can discriminate between patients. This

notion further strengthens with clinicians reporting higher percentage of patients with moderate to severe psychiatric disorders in the Dual Diagnosis groups, significantly higher reports for PTSD and psychosis.

4.5.2. Show rate and retention

No differences were found on showing up for assigned treatment, like previous research has found when studying patients with a substance use disorder and a co-occurring psychiatric disorder (Angarita et al., 2007). To secure transitions from one LOC to another, there has been a greater coordination between the clinics in this region, and patients are given information about the treatment before they enter to reduce anxiety and stress during transitions. This might explain the greater show rate for treatment we see for all three groups in our region compared to a previous study. For retention, a higher percentage in the Dual Diagnosis Enhanced recommended group dropped-out of treatment within the first three months (45% drop out compared to 33% and 34% in the other groups), but the difference between the groups was not significant.

4.5.3. Suicide attempt and outcome differences at three month Follow-Up

Higher proportion of suicide attempts have been seen among patients with co-occurring disorders in prior research (Bakken & Vaglum, 2007; Darke et al., 2004), and also in our study we see the highest reported attempts in the Dual Diagnosis Capable and Dual Diagnosis Enhanced group. However no significant differences were found and there are even fewer differences between the groups on thoughts about suicide and tangible plans. One possibility is that ASAM Criteria considers responses on additional questions regarding imminent danger for the patients, by themselves or others, to recommend a suitable LOC for the patients.

There are significantly more reductions three months after treatment initiation in severity among the Addiction Only Services and Dual Diagnosis Enhanced group on the ASI CSs than for the Dual Diagnosis Capable group. The results might be explained by the fact that the Dual Diagnosis Capable group included older patients and more females than the other two groups. This group also has a higher percentage reporting alcohol as main drug of choice, which could affect the treatment outcome. Older patients might be more engaged in their treatment planning and decisions, but might also have more chronic disorders, more cognitive deficits from alcohol abuse and thus are more resistant to treatment. Or they are in such a stable state that their severity gets underestimated both by themselves and the assessment personnel placing them. Issues regarding self-report measures on psychiatric symptoms from patients have been brought up, and Cole and Sacks (2008) found that patients are more likely to underestimate their psychiatric suffering thus creating a lower prevalence than in reality. This can lead to less attention and treatment for co-occurring psychiatric disorders among this group and might explain the lack of significant reduction on all dimensions except for Alcohol and Drug ASI CSs.

Both in the Dual Diagnosis Capable and Dual Diagnosis Enhanced, higher portions of patients were sent by TAU to inpatient treatment services, and although not significantly different, there are less inpatient placements among the Addiction Only Services group. This can be attributed to the more intense services needed by patients with co-occurring disorders, and thus support ASAM Criteria ability to place individuals with more severe needs to more intense services. There are similar results among the Addiction Only Services and Dual Diagnosis Enhanced group on the ASI CS severity scores: both significantly reduced severity scores on a majority of the dimensions and had an increase on the ASI Employment score. The improvements in both groups suggest that the services provided in this region have the capability to deal with more acute and severe co-occurring disorders, and given the right

intensity of services both groups have successful treatment outcomes. This is in line with prior research that shows better outcomes with the right intensity and integration of services to treat both disorders (Brunette et al., 2004; Magura et al., 2003; Sharon et al., 2003). The higher mean severity at baseline seen in the Dual Diagnosis Capable and Dual Diagnosis Enhanced compared to Addiction Only Services group shows support for ASAM ability to discriminate between LOC. On ASI composite score Legal, Family and Psychological; Dual Diagnosis Enhanced is significantly more severe than both Dual Diagnosis Capable and Addiction Only Services. This is in line with previous research in the field with similar results (Sharon et al., 2003).

4.6. Study Limitations and Strengths

First, dropout, which is common in studies including patients with a substance use disorder and may be greater in real world clinical samples, is an outcome that validates the ASAM matching hypothesis in this study, but also appears to have impacted our statistical power. Given the trends we see for stimulants and sedatives in the first paper, larger samples at reassessment might have yielded greater statistical power, particularly with the GLM analysis. Prior studies reporting rates with only 60% of the “easiest to locate” subsample of an enrolled population have been found to provide valuable information and only to be minimally different when compared to complete samples, and study attrition may also be unpredictable from patient characteristics (Hanstein, Downey, Rosengren, & Donovan, 2000). It is important to know that our study offered no incentives in the form of money or other benefits to induce patients to complete their follow-up interviews, although compensation might have increased the follow-up rate. However, this can be viewed as strength of our study as patients participated without compensation. Although future research should strive for higher follow-up rate by recruiting significant others and employ other outreach efforts, as Lauritzen,

Ravndal, and Larsson (2012) did. Their study had high rates (over 90% at first interview) at all time-points with a Norwegian drug population.

Second, the lack of randomization might have biased against the results, as the matched group at baseline showed a tendency to be younger and had higher ASI CS Employment, Drug, legal and Psych scores than the mismatched conditions. Also the use of paired t-test does not allow for covariate adjustment, it only allows us to say that correct LOC placement appears to have had an effect in reducing severity on several dimension in the matched group. There can also be other demographic variables causing the effect we see, together with differences in how well the clinics used in this study follow the Criteria described by ASAM. These differences might have reduced the extent to which matching could demonstrate a clinical outcome advantage over mismatching. The naturalistic design might also have caused the lack of significant reduced severity on multiple variables in the Dual Diagnosis Capable group that we saw from the third article, caused by a small group size and different gender distribution compared to the two other groups studied. However, the use of such a design made it possible to investigate the naturalistic prevalence of treatment needs among patients with co-occurring substance use disorder and psychological disorders in the treatment seeking population in this region. Nevertheless, the outcome findings are substantially in line with previous validation studies on the ASAM Criteria, and the naturalistic design can also be viewed as beneficial as it reflects the naturally-occurring treatment-seeking population in this region.

Third, a relevant methodological problem is that differences between the ASAM Software-obtained treatment recommendation and clinically derived LOC can be a result of the numbers of categories available and how experienced the TAU centers was. If the clinicians had the full continuum of four LOC available in the community as the ASAM Criteria recommend, then discrepancies could have been different from those seen here. Also how experienced the clinics are with assessing the patients will affect their recommendation. A

solution to this could have been to categorise them from their experience, but since no golden standard existed and a harmonization of practice was the goal, this was left untouched. Also the lack of control over important clinical issues like; execution of treatment therapy, the effect of clinical relations the patient has on treatment attendance and outcomes, and if the LOC are fully categorized and functioning like described by the ASAM Criteria might have affected the results. In order to be a fully functioning LOC based on the ASAM Criteria means that setting, therapies, personnel groups, and documentation need to be following the description made by the criteria to fully be capable to handle the patient's needs. Otherwise it does not follow the criteria set for a successful treatment outcome for the patients.

Fourth, The ASI is the most widely-used severity assessment in addiction (McLellan et al., 1992), and the reliability and validity of the European ASI and its Composite Subscale score method are well documented (Lauritzen & Ravndal, 2004). In the measurement of convergent validity, the ASI CSs were used, and some of these questions are used in the ASAM computerised algorithm. The ASI questions obtain approximately 50% of the data needed for the ASAM Criteria Software algorithm; however, the two instruments have very different scoring logics: the ASI's is actuarial whereas the ASAM Criteria's is hierarchical. Therefore, these two approaches have similar, reliable data acquisition, but different scoring – making them relevant and valuable for comparison but non-overlapping. The ASI CSs should therefore be different across patients who are recommended by the ASAM Criteria for different levels of care. Thus, while worthy of mention, the danger of overlap is minimal.

Fifth, since we lack categorisation of the LOC included in this study with regards to their Dual Diagnosis capability we do not have the ability to conclude if the results are a direct result of co-occurring needs being met, but we suspect this might be the case since the Dual Diagnosis Enhanced group improved as well as the Addiction Only Services group. The high number of patients in need for intense services in this study can be due to the fact that

symptoms are higher when entering treatment. But patients have also been found to underestimate their psychological problems when entering treatment, influenced by their more optimistic view after treatment has been assigned with treatment expectancies (Rokkan & Brandtsberg-Dahl, 2003). This can lend support for a true picture of the prevalence of needs for integrated services in this region.

4.7. Future research and clinical implications

Given the lack of harmonised assessment services and treatment services available in Norway and many other countries, this software offers a valuable clinical assessment instrument which can enhance knowledge of the patient and coordination of services to suit both patients' clinical and recovery support needs. The ASAM Criteria Software also appears to be worthy of implementation in research trials nationally and internationally. Pilot study among assessors and patients reveal high satisfaction with the use of this tool in the assessment process, and the results from the validation study now conducted in this Norwegian region are in line with previous research and favours the use of ASAM Criteria to enhance the assessment process, placement decision, enhance the utilisation of the region's existing LOC and optimal treatment outcomes for the patients. In addition the software can be used to measure the patients' progression during treatment to adjust services based on changed needs and clinical status. The successful translation and software testing in Norway should encourage larger studies – preferably across nations and treatment systems seeking higher power with larger subsamples across primary drug of choice and match/mismatched conditions. Future studies should investigate this further with larger samples, aim for a full categorisation of included LOC with Dual Diagnosis Capability, and test the capacity of the programmes that do exist and the patients' outcomes from these programmes.

The findings in these papers need to be further investigated including the full continuum of ASAM LOC, because this study lacked LII Intensive outpatient treatment and included only a

small sample in LI Outpatient category. LOC should also be confirmed as actually delivering the services specified by the ASAM Criteria – and a certification procedure has been published to aid this task (McGovern et al., 2007). Finally, future studies should enroll larger samples, use follow-up procedures with multiple contact persons, and compensate research attendance to reduce data loss and aid retention.

4.8. Conclusions

This study had three main aims:

1. To apply the revised software version of the ASAM Criteria for harmonising the assessment centers' procedures through testing satisfaction and feasibility among assessors and patients along with inter-rater reliability measures of the revised version.
2. To investigate predictive and convergent validity with the second revised Norwegian software version for treatment outcomes and baseline severity among the different recommendations.
3. To investigate service and therapist's demand in terms of LOC needed in the region and the need for integrated services for patients with co-occurring substance use disorder and psychiatric disorders for future health care planning.

Conclusions:

1. The studies indicated high satisfaction among assessors and patients and inter-rater reliability was high supporting a valid collection of patient data to execute the validation study.
2. Despite the limitations with high drop-out rate, unequal group sizes and lack of treatment levels of care; the ASAM Criteria's show predictive validity by revealing

results favouring the matched group and characteristic differences. The progressively more severe composite scores both in terms of LOC intensity and programs recommendations for co-occurring disorders support the validity of the ASAM Criteria as a useful tool.

3. There is need of more intensive outpatient treatment services in this region and high prevalence of Dual Diagnosis Programme recommendations indicating a need for more intense psychiatric services for these patients.

While taking the limitations of the study into consideration, the strength of the study and findings offer important insights into the assessment and use of the ASAM Criteria Second Edition, Revised software version which incorporates ASAM Criteria taxonomy. Both in the assessment process and for treatment planning purposes, this appears to be a promising tool worth using in a clinical setting, and for future research purposes.

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Matching Patients with a substance use disorder to
optimal level of care with the ASAM criteria software



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Abstract

Great variation in patient assessment across Norwegian addiction programs necessitated a solution for harmonization. The American Society of Addiction Medicine (ASAM) Criteria Software is a computer-assisted structured interview and clinical decision support program. Using validated tools including the Addiction Severity Index (ASI), it measures biopsychosocial conditions to match patients to an optimal level of care (LOC). METHODS: This prospective, multi-site, assessed eligible patients with substance use disorders seeking treatment in the mid-region of Norway at intake (n=261) and three months after (n=153) with naturalistic LOC placement on: 1) retention, 2) severity on 7 ASI composite subscale scores and 3) readiness for step-down care. RESULTS: Retention differed significantly across groups and was lowest with under-matching vs. matching/over-matching (45% vs. 62% vs. 70%, $p=.024$). Matched patients reported less month-3 use of alcohol ($p<.05$) and cannabis ($p<.05$) vs. no significant reductions with under-matching, and ASI Composite Scores fell with matching on six of seven scales, 2/7 with under-matching and 3/7 with over-matching. Percent of patients per group ready to step-down to lower LOC was: 46% under-matched, 61% matched, 17% over-matched. CONCLUSIONS: Although more research is needed. The ASAM Criteria Software Norwegian version demonstrates predictive validity in determining placement using all three prospectively planned measures.

Introduction

The complexity of addiction demands comprehensive assessment; without it, there is a risk of treating the wrong problems or failing to provide services that meet patients' needs (Gastfriend & McLellan, 1997; Ravndal, Vaglum, Lauritzen, 2005). Studies show that mismatching patients yields worse follow-through to next stage of treatment, more use of substances at follow-up and excessive resources use (Magura et al., 2003; Sharon et al., 2003; Angarita, et al., 2007).

The Patient Placement Criteria (PPC) published by the American Society of Addiction Medicine (ASAM) is a widely endorsed addiction treatment protocol in the USA since 1991 (Hoffman et al., 1991). By 2001 the criteria had undergone considerable research and added sub-levels of care and a focus on co-occurring disorders in the second revised version, ASAM PPC-2R (Mee-Lee et al., 2001). A biopsychosocial approach is applied to understand substance use disorder and factors associated with the cause, development and expression of the disorder. The Criteria and its biopsychosocial measurement dimensions have been shown both to predict treatment success and to be cost effective (Annis, 1988; Alterman et al., 1994; Gastfriend & McLellan, 1997, Hayashida et al., 1989). Government reforms initiated in 2004 gave the Norwegian Health Enterprises responsibility for assuring that patients receive specialized addiction treatment (Department of Health, 2004); however, in the absence of any harmonized practice for assessment the system needed a standardized validated tool across all centres.

The ASAM Criteria Software is a structured and comprehensive assessment designed to recommend the optimal level of care (LOC) (Mee-Lee et al., 2001). It is a structured interview that implements validated tools (ASI, McLellan, 1992) to guide clinicians in

assessing patients' needs, with clinical decision support software, quantitatively calculating all of the ASAM Criteria adult admission decision rules. Studies in the USA have found high inter-rater reliability (Baker & Gastfriend, 2003), good face validity (CSAT, 1995), convergent validity (Staines et al., 2003; Turner, et al., 2003; Stallvik & Nordahl, 2003), and predictive validity (Sharon, et al., 2003; Magura et al., 2003; Angarita, et al., 2007).

Why Placement Criteria?

The human mind rarely follows formal criteria to form judgment and conduct decision making, and we are slow to adopt new treatments despite research and clinical evidence of safety and superiority [Hogarth, 1987; Volpicelli et al., 1992]. The ASAM hypothesis holds that patients can be assigned to treatments that yield the best outcomes in the least restrictive and costly settings, for the shortest durations necessary. Over-matching, i.e. referral to more intense LOC, would be overly restrictive and/or costly. Under-matching, i.e. referral to a less than recommended LOC would yield poor engagement, poor retention, poor clinical outcome and increased healthcare utilization. Valid computer-assisted criteria would establish a common assessment language, help clinicians assess patients objectively and comprehensively, and establish a science-based model for determining needs for admission, continued stay, transfer, and discharge across all SUD treatment settings.

It is important to evolve further from studies previously conducted with the first edition of the ASAM Criteria with the Second Edition, Revised version, and also on a different national sample with different languages and treatment systems, to investigate its abilities to both match and discriminate between patients' needs. Most of the studies have tested the earlier version of the Criteria, and they include few outcome measures (frequency of use, show-rate, and readmissions) and few follow-up studies have been executed. One study has found that mismatched patients with co-occurring disorders had greater no-show rate than matched

(Angarita et al.2007). We tested this hypothesis and also looked at retention the first 3 months of treatment. In addition we found no published studies on the ASI composite subscale scores in terms of predictive validity with the use of ASAM Criteria. Since the ASI it is one of the main feeders to the instrument, it would be interesting to study in term of predictive validity. Previous studies have used them to test the criteria for convergent validity with results supporting the Criteria ability to discriminate among the patients with different LOC recommendations (Staines et al., 2003; Turner et al., 2003).In addition a previous study found less use of alcohol at post-test (2003Magura et al., 2003) and more readmission among those match and mismatched to the criteria and found more readmission among the mismatch (Sharon et al., 2003). In our study we investigated the amount of match vs mismatched patients who received a lower level of LOC at follow-up instead of readmissions since we did a follow-up. A lower LOC would mean a positive progression from treatment and that the patients' needs are met. Based upon the research found and taking it a step further the following questions are tested in this study: a) drop-out from assigned treatment before 3 month follow-up interview; b) clinical improvement, in terms of both frequency of substance use in the last 30 days and the 7 Addiction Severity Index Composite Subscale Scores (ASI CSs), and c) step-down status, i.e., whether initially matched vs. mis-matched patients would subsequently be ready for a lower LOC at follow-up, according to the ASAM Criteria recommendation. If the ASAM Criteria shows predictive validity the matched patients should be a) show less drop-out from treatment; b) show more clinical improvements in terms of less use and lower severity on the ASI CSs at follow-up, and c) show readiness for a lower LOC

Method

Sample

This double-blind, multi-site, naturalistic study was conducted at 10 different outpatient and inpatient assessment and treatment centres from rural and urban areas of central Norway.

Patients were ≥ 18 years of age, spoke Norwegian fluently, and were stable with regard to intoxication with alcohol and/or drugs (cognitively cleared from their last substance use, or had taken prescribed or tolerable doses such that they could function in an interview setting), and/or psychiatric symptoms. Patients agreed to accept Treatment as Usual (TAU) recommended placement, and were diagnosed with substance dependence or abuse according to the International Classification Diagnostic, version 10 (ICD-10). All patients provided informed consent which was approved along with the study protocol by the Regional Committees for Medical Health Research Ethics.

We did not have data on all those referred to treatment in the recruitment period. However the sample characteristics were in line with previous studies in this region (Nordfjærn, Hole & Rundmo, 2010). Of a total of 310 patients asked, there were only 20 who did not want to participate. Since so few respondent declined we did not check for any differences in characteristics between those **who joined** versus those who did not. Patients who joined the study received a TAU assessment, i.e., routine intake interviews at routine assessment centers by personnel who had not been introduced to the ASAM Criteria. Afterwards, patients received the ASAM Criteria Software interview at baseline with trained ASAM software assessors who did not participate in the centres' TAU assessment or placement during the study period. Patients were contacted by an ASAM assessor (not necessarily the same one as at baseline) again after three months for follow-up interviews. During the baseline TAU and ASAM interviews, patients were asked about the identical 30-day pre-intake period. Patients

and ASAM-assessors were kept blind as to the ASAM algorithm-based LOC recommendation at both baseline and follow-up, and the patients were naturalistically referred to the TAU-recommended LOC.

Matching was defined as congruence between the clinically-derived TAU recommendation and the ASAM recommendation (the putative gold standard). The patient was defined as mismatched if the TAU assignment was lower than the ASAM recommendation (i.e., under-matched) or higher (over-matched). Drop-out was defined on patients who dropped out of their assigned treatment within the first three months of treatment and before treatment completion.

Measures

The original instrument was translated from the original English into Norwegian based on recommendations from previous studies (Hoffmann et al., 1991; Weedman, 1987; Gjersing, Caplehorn, & Clausen, 2010), and we did a full scale translation where all items were back-translated and both clinical expertise and language consultants were included in the process.

The ASAM Criteria, used by a majority of US states (Mee-Lee et al., 2001), has undergone several studies supporting its usage and the principle of these criteria multidimensional needs assessment in treatment planning (Annis, 1988; Hayashida et al., 1989; Alterman et al., 1994; Mechanic, Schlesinger & McAlpine, 1995; Gastfriend & McLellan, 1997; Hser, Polinsky, Maglione & Anglin, 1999; McLellan et al., 1997; Gastfriend, Lu & Sharon, 2000). Inter-rater reliability with the first edition software was 0.77 (Intra-class correlation coefficient) (Baker & Gastfriend, 2003). The current Second Edition, Revised tool (PPC-2R) includes previously validated tools including (in the Norwegian version) the European version of the Addiction

Severity Index (Lauritzen & Ravndal, 2004; Hodgins & El-Guebaly, 1992; Leonhard et al., 2000), the Clinical Institute Withdrawal Assessment for Alcohol (CIWA-AR) (Sullivan et al, 1989), and the The Clinical Institute Narcotic Assessment (CINA) Scale for Withdrawal Symptoms (Peachey & Lei, 1988; Mee-Lee et al., 2001). With approximately 6,000 distinct calculations, the software constructs an algorithm-based recommendation, a 3-5 page report describing the patient's needs in the different dimensions, and a final LOC recommendation. The diagnostic terminology used in this software version was consistent with the DSM-IV (American Psychiatric Associations Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, 2000; the fall 2013 version incorporates DSM-5).

The ASAM Criteria is a highly intricate (350 page) hierarchical decision tree in which the decision rules are organized along six clinical dimensions of assessment:

1. Intoxication and withdrawal
2. Biomedical complications and conditions
3. Emotional/behavioural complications and conditions
4. Treatment readiness
5. Potential for continued use or relapse
6. Environmental conditions.

These are matched to 6 general LOC:

- 0.5 Early Intervention: contains services for individuals who are at risk of developing substance-related problems or for those for whom there is not yet sufficient information to document a substance use disorder.
- I. Outpatient Treatment: organized, non-residential services, which may be delivered in a wide variety of settings. Addiction or mental health treatment personnel provide professional evaluation, treatment and recovery service. Such services are provided in regularly scheduled sessions and follow a defined set of policies and procedures or medical protocols.
- II. Intensive Outpatient Treatment, e.g., partial hospitalization: organized outpatient service that delivers treatment services during the day, before or after work or school, in the evening or on weekends. Such programs provide essential education and treatment components while allowing patients to apply their newly acquired skills within "real world" environments. Programs have the capacity to arrange for medical and psychiatric consultation, psychopharmacological consultation, medication management, and 24-hour crisis services.
- III. Residential/Inpatient Treatment: services staffed by designated addiction treatment and mental health personnel who provide a planned regimen of care in a 24-hour live-in setting. They are housed in, or affiliated with, permanent facilities where patients can reside safely. They are staffed 24 hours a day. Mutual and self-help group meetings generally are available on-site. Level III encompasses four types of programs and defining characteristic of all Level III programs is that they serve individuals who need safe and stable living environments in order to develop their recovery skills

- IV. Medically Managed Intensive Inpatient Services, e.g., hospital care: provide a planned regimen of 24-hour medically directed evaluation, care and treatment of mental and substance-related disorders in an acute care inpatient setting. They are staffed by designated addiction-credentialed physicians, including psychiatrists, as well as other mental health- and addiction-credentialed clinicians.
- OMT. Opioid Maintenance Treatment: medical maintenance therapy like methadone or buprenorphine for opiate use disorders, which can be delivered within any level of care if the criteria's for an opiate use disorder is met.

Within these levels of care, there exist detailed sub levels for more specific program criteria, and there is also specific program recommendation given for co-occurring disorders which has shown convergent validity (Stallvik & Nordahl, 2014).

Norwegian LOC included in the study

In this study, only Outpatient (ASAM Level I) and Residential Care (Level III) were available and included as TAU options. Personnel on both LOC are interdisciplinary trained, often with additional formal education in substance use disorders and psychiatric co-occurring disorders. The LOC apply a biopsychosocial approach, referring to more intensive medical or psychiatric treatment if needed, collaborating with community social workers to secure housing, assisting with vocational training and addressing patients' social support needs. Outpatients receive weekly individual therapy, usually more than one weekly group and individual session, with counsellor, psychologist, psychiatric, and medical services and vocational training, if needed. Opiate maintenance treatment and other medical services are also provided. Treatment length, based on patients' progression, often exceeds 10-12 sessions. Inpatient treatment is offered for 3 to 18 months, depending on patient need. Programs vary in experience with alcohol vs. drug dependence, but all address all substances as well as other

needs. Common services include a set weekly treatment plan that includes individual and group sessions, exercise, leisure activities, legal assistance, housing assistance and vocational training/school.

Statistical analysis

Baseline and follow-up outcome measures in this study included: a) dropout; b) clinical improvement, i.e., frequency of drug use last 30 days reported at intake and the 7 ASI CS scores at baseline; and c) step-down status, i.e., whether patients were assessed and recommended by the ASAM Criteria software to a lower (*vs.* same or higher) LOC at follow-up compared to their baseline LOC recommendation by ASAM. Step-down to a lower follow-up LOC would be considered a positive outcome. To assess the primary outcome event that should be predicted by ASAM LOC under-matching (*vs.* matching), i.e., drop-out from baseline to follow-up, an independent t-test for continuous variables and Chi-square for categorical ones was used to analyse drop-out and potential baseline differences between the groups that dropped out *vs.* remained in treatment. In the event of meaningful baseline differences between the baseline and follow-up samples, an intent-to-treat analysis might be compromised; therefore paired sample t-tests were used to detect significant change from baseline to follow-up for the 3 groups separately on frequency of use and the 7 ASI composite subscale scores (Medical, Employment, Alcohol, Drug, Legal, Family and Psychological). . GLM Univariate analysis of variance was next used to analyse differences for matched *vs.* under-matched, and matched *vs.* over-matched groups. The patients' baseline severity measures on the 7 ASI CSs and frequency of use last 30-days were used as covariates (Independent variables) and their follow-up scores on the 7 ASI CSs and frequency of use last 30-days were the dependent variables in the analysis. Analyses were performed with the statistical analysis package PAWS18.

RESULTS

The final clinical sample consisted of 261 patients, 66% male, ages 18–61. Figure 1 shows a Flow Chart of the recruitment and follow-up process. Table 1 shows demographics for the baseline and follow-up samples for all 3 groups.

Figure 1: Participant recruitment and follow-up rates

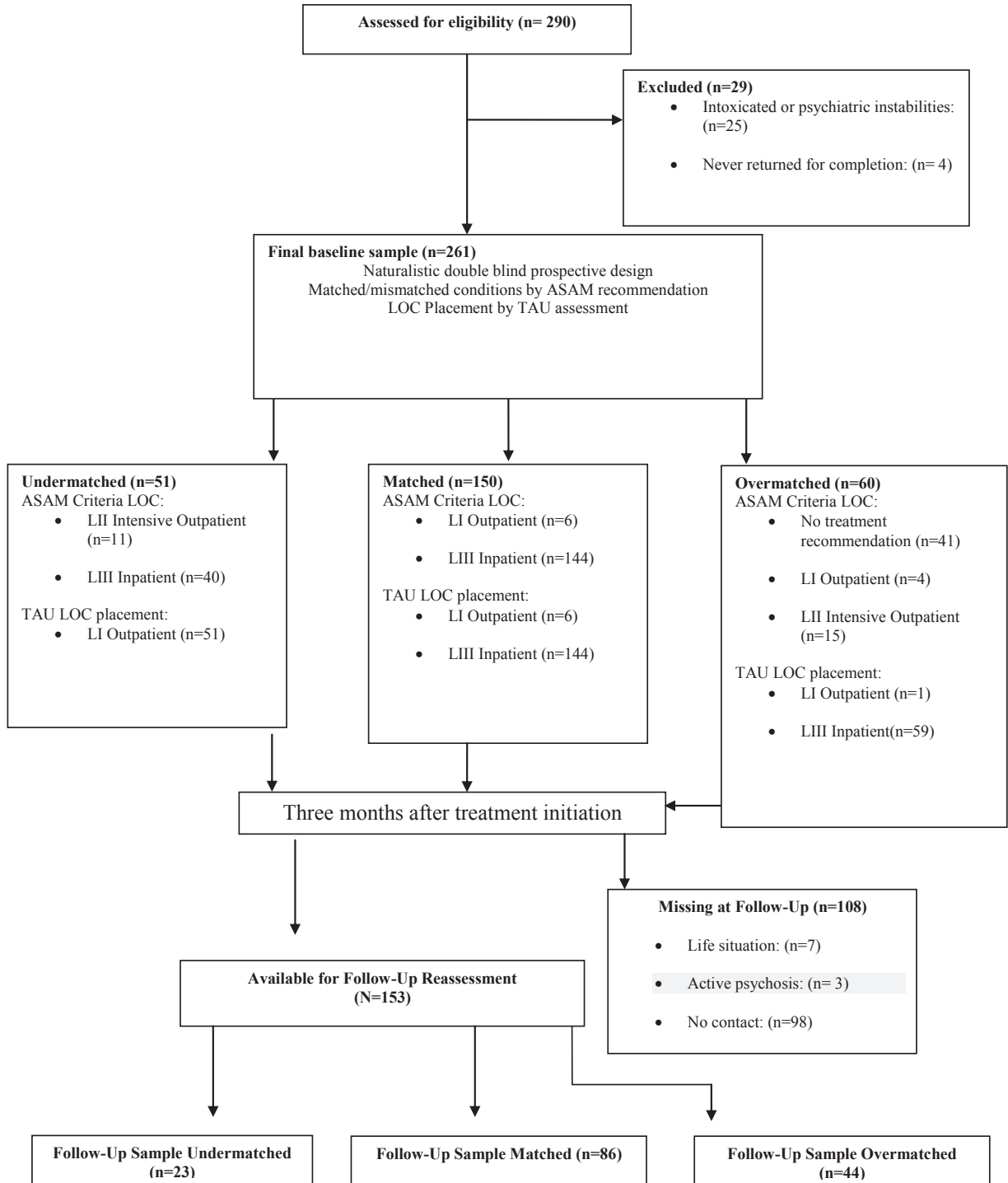


Table 1: Baseline and follow-up demographics for matched, under-matched and over-matched groups

Characteristic	Baseline				Follow-Up			
	Total n=261 M(±SD)	Match n=150 M(±SD)	Under- match n=51 M(±SD)	Over- match n=60 M(±SD)	Total n=153 M(±SD)	Match n=86 M(±SD)	Under- match n=23 M(±SD)	Over- match n=44 M(±SD)
Age (years)	32.08 (±10.63)	30.80 (±10.17)	33.98 (±10.38)	33.76 (±11.69)	32.52 (±10.56)	31.00 (±10.27)	35.35 (±8.92)	34.07 (±11.69)
Gender (%(n)):								
Males	66 (171)	64 (96)	65 (33)	70 (42)	64 (98)	64 (55)	56 (13)	68 (30)
Females	34 (90)	36 (54)	35 (18)	30 (18)	36 (55)	36 (31)	44 (10)	32 (14)
Marital Status (%(n)):								
Never married	79 (206)	82 (123)	70 (36)	79 (47)	78 (120)	84 (72)	52 (13)	80 (35)
Married	8 (20)	6 (9)	12 (6)	8 (5)	8 (12)	6 (5)	13 (4)	7 (3)
Divorced/separated	13 (35)	12 (18)	18 (9)	13 (8)	14 (21)	10 (9)	35 (6)	14 (6)
Years lived at last address	4.76, (±6.19)	4.06, (±5.60)	6.11 (±7.17)	4.06 (±5.60)	5.22, (±5.69)	4.49, (±5.51)	4.82 (±4.14)	6.76 (±6.90)
Living arrangement last 3 years (%(n)):								
With family, partner, or friends	46(120)	47(71)	55 (28)	48 (29)	43 (66)	49 (42)	48 (11)	30 (13)
Alone	36(93)	35 (53)	35 (18)	35 (21)	41 (62)	34 (29)	48 (11)	50 (22)
No stable living arrangement	18(48)	17 (26)	10.00 (5)	17 (10)	16 (25)	17 (15)	4 (1)	20 (9)
Education (years complete)	10.62 (±1.87)	10.60 (±1.68)	10.76 (±2.32)	10.53 (±1.98)	10.60 (±1.87)	10.68 (±1.15)	10.18 (±2.54)	10.65 (±1.96)
Work (years occupation)	4.69 (±2.13)	5.67 (±7.32)	6.95 (±6.46)	7.56 (±9.20)	7.10, (±7.98)	6.04, (±7.04)	8.22 (±7.15)	8.22 (±9.61)
Work-status (last 3 years, %(n)):								
Full time	21 (56)	21 (32)	22 (11)	22 (13)	22 (33)	17 (15)	26 (6)	27 (12)
Part-time	9 (24)	7 (11)	12 (6)	12 (7)	8 (12)	6 (5)	4 (1)	14 (6)
Student	3 (8)	2 (3)	4 (2)	5 (3)	3 (4)	2 (2)	0	5 (2)
Retired/disability	19 (49)	19 (29)	25 (13)	12 (7)	19 (29)	21 (18)	30 (7)	9 (4)
Unemployed	49 (127)	52 (78)	37 (19)	50 (30)	49 (75)	53 (46)	39 (9)	45 (20)
Income source (last 30 days, %(n)):								
Employment	13 (33)	11 (16)	18 (9)	13 (8)	9 (14)	7 (6)	13 (3)	11 (5)
Unemployed/public assistance	51(132)	56 (84)	35 (18)	50 (30)	45 (69)	51 (44)	26 (6)	43 (19)
Retirement/disability	36.01(92)	32.90 (47)	33 (26)	32.25 (19)	36.00 (59)	32.9 (30)	52.17 (11)	50 (18)
Legal convictions	3.74, (±4.05)	3.65 (±4.02)	2.42 (±2.43)	5.14 (±4.86)	2.74 (±2.62)	3.07 (±2.99)	2.20 (±2.68)	2.10 (±1.20)

Baseline differences between matched and mis-matched conditions

Independent t-tests at baseline revealed a trend towards a significant lower age ($t=1.915(199)$, $p=.057$, $d=0.31$). No other demographic differences were found between the match and mismatched conditions. None of the groups differed significantly on baseline frequency of use in the last 30 days. The matched group had a significantly higher baseline severity than the under-matched on the ASI Legal CSs ($t= -2.396(199)$, $p=.018$, $d=0.41$) and ASI Employment CSs (Levene's test indicated unequal variances $F= 13.47$, $p<.001$; $t = -2.054(67.49)$, $p=.044$, $d=0.37$), and the over-matched group was significantly less severe than the matched group on the ASI Drug ($t= -4.962(208)$, $p<.001$, $d=0.79$) and Psychological CSs (Levene's test indicated unequal variances $F= 6.941$, $p=.009$; $t= -4.962(140.126)$, $p<.001$, $d=0.77$).

Study drop-outs

Over 40% of the total study sample did not show for the follow-up interview, and dropout was indeed greater in the under-matched patients. The overall proportions of matched vs. mismatched groups were similar between baseline and follow-up (57%:43% and 56%:44%), however at follow-up, a Chi Square analysis showed significant differences between the conditions ($\chi^2=7.472$ (2), $p= .024$, *Cramer's V*=.169). The effect size for this finding is considered small (Cohen, 1988). A total of 55 % (n=28) of the under-matched group left treatment before the 3 month follow-up interview vs. 38 % (n=57) in the matched group and 30 % (n=18) in the over-matched group. The final follow-up sample was 23 under-matched, 86 matched, and 44 overmatched.

As a result of this differential dropout pattern, it was important to examine differences between the baseline and follow-up samples. No differences were found for the demographic variables in Table 1. No differences were found on frequency of use of different substances or the 7 ASI Composite Subscale scores at baseline within the three conditions.

Clinical status at baseline and follow-up

In Table 2 clinical status on frequency of use is displayed with ASI CSs for all groups at baseline (Table 2a) and follow-up (Table 2b). Table 2a also displays mean years of use.

Table 2a: Baseline Clinical status on duration of use, frequency of use last 30 days and ASI Composite Scores for matched, under-matched and over-matched groups

Characteristic	BASELINE						
	Total n=261 M (±SD)	n	Match n=150 M (±SD)	n	Under-match n=51 M (±SD)	n	Over-match n=60 M (±SD)
Mean years used							
Mean days used (during last month)							
Alcohol	15.18 (±9.62) 12.75 (±10.70)	81	14.69 (±9.38) 13.85 (±11.06)	37	15.78 (±9.75) 11.65 (±10.16)	26	16.05 (±10.18) 10.76 (±10.24)
Opiates	6.07 (±5.40) 19.93 (±11.65)	46	6.05 (±5.34) 19.70 (±11.92)	14	6.15 (±5.78) 21.07 (±11.54)	7	6.09 (±5.49) 22.57 (±11.13)
Sedatives/ Hypnotics	7.84 (±6.53) 18.18 (±11.98)	77	7.91 (±6.34) 18.90 (±11.93)	25	6.18 (±5.70) 17.32 (±12.31)	20	9.12 (±7.55) 17.05 (±12.15)
Stimulants	8.84 (±6.57) 14.58 (±10.12)	50	8.66 (±6.38) 13.60 (±9.92)	15	7.18 (±6.72) 16.73 (±10.77)	15	9.76 (±6.04) 15.67 (±10.40)
Cannabis	10.79 (±7.24) 18.43 (±10.80)	58	11.45 (±7.47) 18.55 (±10.62)	20	9.88 (±6.17) 18.33 (±11.32)	18	9.87 (±7.26) 18.12 (±11.43)
Two or more substances per day	9.11 (±6.15) 16.22 (±9.49)	73	3.73 (±3.72) 16.70 (±9.80)	21	7.57 (±6.24) 16.48 (±9.82)	17	9.66 (±6.38) 13.62 (±7.48)
ASI Subscale Composite Score							
Medical	.24 (±.29)	150	.28 (±.31)	51	.20 (±.26)	60	.21 (±.27)
Employment	.86 (±.22)	150	.88 (±.20)	51	.79 (±.28)	60	.87 (±.21)
Alcohol	.09 (±.14)	150	.09 (±.14)	51	.12 (±.16)	60	.06 (±.12)
Drug	.21 (±.12)	150	.24 (±.12)	51	.21 (±.12)	60	.16 (±.10)
Legal	.10 (±.17)	150	.12 (±.18)	51	.05 (±.14)	60	.08 (±.15)
Family	.20 (±.18)	150	.21 (±.18)	51	.20 (±.20)	60	.16 (±.17)
Psychological	.26 (±.17)	150	.29 (±.17)	51	.28 (±.18)	60	.17 (±.14)

Table 2b: Clinical status at follow-up on the ASI Composite Scores and frequency of use last 30 days for matched, under-matched, and over-matched

Characteristic	FOLLOW-UP						
	Total n=153 M (±SD)	n	Match n=86 M (±SD)	n	Under-match n=23 M (±SD)	n	Over-match n=44 M (±SD)
Mean days used (reported last 30 days at intake)							
Alcohol	7.06 (±8.40)	22	7.73 (±8.72)	15	8.57 (±10.11)	14	4.29 (±5.85)
Opiates	19.04 (±12.75)	17	19.59 (±12.32)	6	20.83(±14.29)	4	14.00(±14.72)
Sedatives/ Hypnotics	16.21 (±12.95)	35	19.03 (±12.80)	8	5.25 (±6.50)	9	15.40(±13.38)
Stimulants	9.65 (±11.89)	14	5.14 (±7.92)	4	14.50(±13.23)	5	18.40(±15.88)
Cannabis	8.19 (±9.38)	14	6.86 (±8.70)	9	14.25(±10.70)	4	2.20 (±.84)
≥2 substances per day	9.19 (±10.80)	17	8.63 (±10.93)	10	12.20(±10.96)	9	7.67(±11.39)
ASI Subscale Composite Score							
Medical	.18 (±.24)	86	.16 (±.21)	23	.20 (±.27)	44	.18 (±.27)
Employment	.89 (±.19)	86	.91 (±.17)	23	.84 (±.24)	44	.89 (±.19)
Alcohol	.04 (±.10)	86	.04 (±.12)	23	.06 (±.10)	44	.02 (±.08)
Drug	.12 (±.08)	86	.12 (±.07)	23	.15 (±.11)	44	.09 (±.06)
Legal	.06 (±.14)	86	.08 (±.15)	23	.01 (±.04)	44	.06 (±.13)
Family	.12 (±.16)	86	.11 (±.14)	23	.11 (±.19)	44	.15 (±.17)
Psychological	.20 (±.15)	86	.22 (±.15)	23	.22 (±.18)	44	.14 (±.13)

For 32% of the total sample, stimulants were the main drug of choice, followed by 24% with alcohol, 17% with opiates, and 12% with sedatives. A total of 82.4 % (n= 215) have at some point been poly-substance users; used 2 or more substances per day in their lifetime, and 111 (42.5%) report poly-substance use the last 30 days.

Changes in Frequency of Substance Use from baseline to follow-up

A paired sample t-test was performed on frequency of use during the last 30 days and on ASI CSs between baseline and follow-up (Table 3).

Table 3: Paired sample t-test on the outcome measures for all three groups, and GLM Univariate analysis of variance between matched and mis-matched groups with baseline measures as covariates

	Match t, p (n=86)	Under-match t, p (n=23)	Over-match t, p (n=44)	Match vs. under-match: F, p, (Cohen's d)	Match vs. over-match: F, p, (Cohen's d)
Mean days used last month					
Alcohol	2.39, .03*	1.56, .13	2.34, .04*	.78, .38 (-0.08) .00, .96 (0.46)	
Opiates	-.08, .94	-.11, .92	1.00, .50	.83, .38 (-0.09) 1.12, .32 (0.41)	
Sedatives/hypnotics	1.23, .23	1.79, .13	1.58, .18	3.04, .09 (1.36) .13, .72 (0.28)	
Stimulants	2.34, .05	1.23, .31	-.74, .51	.96, .35 (-0.86) 6.15, .04* (-1.06)	
Cannabis	2.66, .03*	.49, .64	1.83, .21	1.62, .22 (-0.76) .78, .40 (0.75)	
Two or more substances per day	1.90, .10	.12, .91	1.59, .25	2.53, .14 (-0.33) .23, .65 (0.09)	
ASI Subscale Composite Score					
Medical	4.25, .00‡	1.04, .31	.35, .73	1.08, .30 (-0.08) 1.73, .19 (-0.08)	
Employment	-1.64, .11	-.60, .55	-.40, .69	1.55, .22 (0.29) 1.32, .25 (0.16)	
Alcohol	3.10, .00‡	.99, .34	2.48, .02†	.82, .37 (-0.18) .08, .78 (0.21)	
Drug	8.97, .00‡	4.46, .00‡	4.24, .00‡	2.55, .113 (0.32) 3.58, .06 (0.43)	
Legal	2.99, .00‡	1.4, .17	2.19, .03*	2.231, .14 (0.63) .27, .60 (0.22)	
Family	5.26, .00‡	2.39, .03*	1.83, .07	.01, .93 (-0.06) 4.29, .04* (-1.17)	
Psychological	3.66, .00‡	1.6, .13	1.77, .08	.166, .68 (0) 2.05, .154 (0.57)	

*p<0.05; †p<0.01; ‡p<0.001

On frequency of days used at follow-up, the matched group had significantly reduced their use of alcohol by 6 days/month compared to baseline, reduced cannabis use by 11 days/month, and showed statistical trends towards reduction in stimulant use by 8 days/month and reduction in use of 2 or more substances per day. No such significant reductions were seen for the under-matched group. The over-matched group had significant reduction on alcohol frequency, by 7 days/month.

After controlling for frequency of use last 30 days baseline measures in a GLM Univariate analysis, the matched group had significantly lower use of stimulants at follow-up than the over-matched group and the effect size is considered strong ($F=6.15$, $p=.04$, $d= - 1.06$).

Changes in Mean ASI CS scores from baseline to follow-up

On the ASI CSs, the matched group had a significant reduction in 6 out of 7 scores (all but ASI Employment) vs. 2 (ASI Drug and ASI Family) out of 7 scores for the under-matched, and 3 (ASI Alcohol, ASI Drug and ASI Legal) out of 7 for the over-matched group. The Employment dimension was unchanged for all groups.

After controlling for the 7 baseline ASI CSs in a GLM Univariate analysis, the matched group had significantly lower follow-up severity than the over-matched group on the ASI Family score and the effect size is considered strong ($F=4.29$, $p=.04$, $d= - 1.17$). No other significant differences were found.

Changes in ASAM LOC recommendation from baseline to follow-up

Of the 86 matched patients who showed for the follow-up interview, 61% were now recommended to step down to a lower LOC at follow-up, and 39% were recommended to the same LOC. Of the 23 under-matched patients, 46% were ready to step down to lower LOC at follow-up; 50% were recommended to the same LOC and 1 was recommended for higher LOC. Of the 44 patients over-matched at baseline, 17% were recommended for a lower LOC

at follow-up; 48% were recommended for same and 35% for higher LOC. A Chi Square analysis showed significant differences and a moderate effect size between the conditions (*Fisher`s Exact test=47.027, p<.001, Cramer`s V=.41*).

Discussion

The aim of this study was to validate the ASM Criteria by investigating these three hypotheses: a) matched patients should show less drop-out from treatment than mismatched; b) matched patients should show more clinical improvements in terms of less use and lower severity on the ASI CSs at follow-up and c) matched patients should show readiness for a lower LOC at follow-up. Results on this three favoured the matched group in all outcomes measured: retention, clinical severity on use and ASI Composite Subscale scores, and readiness for step down to lower LOC.

Significantly more under-matched patients dropped out shown by a moderate effect size, 55% vs. 38% in the matched group, supporting the first hypotheses that match patients show less drop-out from treatment. Stimulants, the most common drug of abuse in this region (Nordfjærn et al., 2010), showed a significant reduction in days of use for the matched vs. over-matched group, supporting the hypothesis that over-matching is not beneficial, but matching might be.

There are few studies testing predictive validity on the ASAM Criteria; ours separates from the other studies by testing the revised software edition, on multiple sites instead of only one site, and with several more outcome variables like the ASI CSs which previously has not been tested for predictive validity. This makes it difficult for direct comparison with results from other studies showing results favoring the tools convergent validity. However we used the frequency of use of different substances and found similar results to a prior study which reported less use of alcohol among the matched patients (Magura, et al., 2003).

Alcohol use in our study showed a significant reduction in the matched and over-matched group. The over-matched group had no better results than the matched group at follow-up, and had less improvement on the ASI CSs than the matched group.

Sedative/hypnotic use is the only category that increased in the matched group while significantly decreasing in the under-matched group. This might be due to primary care patients becoming newly managed by addiction treatment centers, which in Norway tend to provide medically managed care with sedatives to optimize patients' program retention, e.g., by enhancing sleep, or reducing severe anxiety/anxiety attacks. In the matched patient group almost 70% took prescriptions as intended *vs.* 25% of the under-matched group. The common use of sedative in treatment clinics our study follows international clinical guideline recommendations (not exceeding two weeks) and appropriate doses are used. Were the use of it is problematic and patients do not compliant to the description the treatment plan is revised accordingly. Primary doctors are advised to stop prescribing sedatives when their patients enter treatment for a substance use disorder, and this can be the reason we see a drop in the use among under-matched patients. This discrepancy might be caused by the fact that under-matched patients may have lacked optimal services or dropped out of the treatment.

Cannabis reduction was also significant for matched patients, and reduction in use of 2 or more substances per day shows a trend favoring matching. This was not the case for the mismatched patients. It should be noted that analysis of these specific substance use changes offers substantially less statistical power because not all patients used each of the analyzed substances.

The ASI paired sample t-tests favored matching *vs.* both under-matching *and* over-matching, with significant improvements among the matched group on 6 out of the 7 ASI Subscales.

Under-matched patients showed improvement in only 2 and the over-matched group improved on 3 subscales, but is worth noting that the under-matched group significantly

reduced ASI Drug severity scores and ASI Family score. Treatment has an effect, but not as successfully with under-matching as with matching.

The ASI Employment dimension, however, was unchanged for all groups, suggesting that the first 3 months of treatment focus on addressing medical, psychiatric and behavioral improvement before employment. The results are similar to the study by Turner et al., 2003, which also found this variable to fail in differencing between the groups. No studies have followed the patients with a second interview with the use of the computerized edition like ours. Therefore it is difficult for direct comparisons.

Patients were recommended for step-down to lower LOC at follow-up in 61% of the matched group vs. 46 % in the under-matched and 17 % in the over-matched group. None in the matched group were recommended for a more intense LOC at follow-up, but in the over-matched group, over 35% of patients (out of 46) were recommended for a higher LOC than at baseline. The difference between groups was significant and effect size considered moderate. These results are also interesting compared to previous research, which found more “no shows” among over-matched patients for the next step in treatment (Angarita et al., 2007). If over-matching yields no better treatment outcome than matching, and is also associated with worsening outcomes, there may be considerable clinical risk in patient assessment – not just from giving less treatment than patients need, but also from giving too much.

Study Limitations

Dropout, which is common in SUD trials and may be greater in real world clinical samples such as this, is an outcome that validates the ASAM matching hypothesis in this study, but also appears to have impacted our statistical power. Given the trends we see for stimulants and sedatives, larger samples at reassessment might have yielded greater statistical power,

particularly with the GLM analysis. Prior studies reporting rates with only 60 % of the “easiest to locate” subsample of an enrolled population have been found to provide valuable information and only to be minimally different when compared to complete samples, and study attrition may also be unpredictable from patient characteristics (Hanstein et al., 2000). The present study offered no financial or other retention incentives. Future research should incorporate significant others and other outreach efforts that have yielded high retention rates (Lauritzen et al., 2012).

The lack of randomization might have biased against the results, as the matched group at baseline showed a tendency to be younger and had higher ASI CS Employment, Drug, legal and Psych scores than the mismatched conditions. Also the use of paired t-test does not allow for covariate adjustment, it only allows us to say that correct LOC placement appears to have had an effect in reducing severity on several dimension in the matched group. There can also be other demographic variables causing the effect we see, together with differences in how well the clinics used in this study follow the ASAM Criteria. These differences might have reduced the extent to which matching could demonstrate a clinical outcome advantage over mis-matching; nevertheless, the outcome findings are substantially in line with previous validation studies on the ASAM Criteria.

To address patients’ individual needs, it is important that programs offer treatments meeting the intensity and service specifications of the ASAM Criteria. A useful taxonomy has been described by McGovern et al. (2007).

Conclusion

Despite these limitations, these findings offer important insights into the assessment and use of the ASAM Criteria PPC-2r software. Both in the assessment process and for treatment planning purposes, this appears to be a useful tool. Given the lack of harmonized assessment

services and treatment services available in Norway and many other countries, it offers a valuable clinical assessment which can enhance knowledge of the patient and coordination of services to suit both patients' clinical and recovery support needs. The results are based on real-world patients in routine treatment, and are in line with previous validation studies. Our results favour the matched group on retention, drug use and addiction severity, and readiness for a lower LOC placement at 3 months. The fact that such research has been successfully replicated across different national samples, languages and treatment systems should encourage further exploration of this tool as a potential international standard for SUD patients.

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DISCLOSURES

Marianne Stallvik reports no financial relationships with commercial interests. Dr. David R. Gastfriend is President and CEO of RecoverySearch Inc. and was contracted for training and scientific participation by Drug and Alcohol Treatment in Central Norway Trust (Rusbehandling Midt-Norge). Hans M. Nordahl reports no financial relationships with

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Predictive and convergent validity of the ASAM
criteria software in Norway

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ABSTRACT

The ASAM Criteria Software from the American Society of Addiction Medicine is a new computer-assisted structured interview and clinical decision support program that implements validated tools such as the Addiction Severity Index (ASI), and measures biopsychosocial conditions to match patients to an optimal level of care (LOC). The study methods involved a prospective, double-blind, multi-site, naturalistic study of substance use disordered treatment seekers. We analyzed: 1) discrepancies in ASAM Criteria LOC recommendations *vs.* Treatment-as-Usual (TAU), 2) the software's ability to clinically distinguish between patients with different LOC (convergent validity) and 3) predictive validity. Results indicated that the discrepancies in TAU LOC recommendations *vs.* the Software were in line with previous research. Baseline comparisons using ASI Composite Subscale scores (CSs) showed better agreement with the ASAM LOC recommendations *vs.* TAU. Finally, the ASAM recommendations were associated with better outcomes three months later for the matched *vs.* mis-matched groups. These results confirmed the Software's convergent validity as well as predictive validity. These outcomes are promising and suggest that programs should avoid both under- and over-matching patients. Future, both national and international studies, should include the full complement of LOC specified in the ASAM Criteria, properly characterized, with larger samples.

INTRODUCTION

Addiction is a biopsychosocial disorder both in etiology and expression, and therefore patient assessment needs to employ this multi-dimensional approach in order to recommend optimal treatment (Gastfriend & Mee-Lee, 2003). To prioritize treatment assignment along a continuum of different levels of care (LOC), each involving different staffing, services, intensity and restrictiveness, requires a thorough assessment of patients' individual needs. In 2007, treatment in Norway shifted toward defining LOC in terms of intensity and more specific time frames, consistent with the Patient Placement Criteria (PPC) of the American Society of Addiction Medicine (ASAM) (Mee-Lee, Shulman, Fishman, Gastfriend & Griffith, 2001). The ASAM Criteria is a set of professionally developed guidelines for matching Substance Use Disordered (SUD) patients to optimal LOC to produce the best treatment outcome (Hoffman, Halikas, Mee-Lee & Weedman, 1991). Validation studies of the ASAM Criteria have created a computerized algorithm that led to a web-based user-friendly, clinical decision support software which performs as many as 6000 calculations based on information on the patients' needs and history to recommend an optimal LOC (Sharon et al., 2003). The ASAM Software implements previously validated tools such as the Addiction Severity Index (ASI, McLellan, 1992) in a computer-guided interview.

The ASAM Criteria

The ASAM Criteria's six dimensions have shown to predict treatment success and to be cost effective at the same time (Alterman et al., 1994; Gastfriend & McLellan, 1997; Hayashida et al., 1989). Studies demonstrate that patients who are mis-matched in TAU assessments compared to what the ASAM Criteria would recommend are less likely to show up for assigned treatment and have worse treatment outcomes than matched patients (Staines, Kosanke, Magura, Bali, Foote & Deluca, 2003; Magura et al., 2003; Angarita, Reif, Pirard,

Lee, Sharon & Gastfriend, 2007). Several studies conducted in the USA found the ASAM Criteria Software to have high inter-rater reliability (Baker & Gastfriend, 2003), face validity (CSAT, 1995), and predictive validity (Sharon et al, 2003; Turner, Turner, Reif, Gutowski & Gastfriend, 1999; Staines et al., 2003; Magura et al., 2003). Convergent validity has also been reported, e.g., patients with different LOC recommendations were found to be distinct on ASI CSs such as the ASI Medical and Psychological subscales and on alcohol withdrawal measures, with progressively more severe scores as the LOC intensity escalated (Sharon et al., 2003).

ASAM vs. TAU recommendation

Staines et al. (2003) compared the degree of agreement for the ASAM Criteria Software vs. counsellors' assessment under TAU conditions. In this study of the first edition ASAM Criteria (PPC-1), clinical staff had training and computer-guided interview assistance along the ASAM dimensional assessment process, however, the actual ASAM Software algorithm LOC recommendation was kept blind to staff and patients. Surprisingly, staff disagreed with the computer scored LOC recommendations in 58% of the 248 cases, and the ASAM Software recommended a more intense initial LOC than the TAU protocol in 81% of those discrepant cases. The patients who were assigned to treatments that were matched by the computer had better 90-day outcomes (patients were 38 % more likely to enter continued treatment after detox, and less likely to return to detox within 90 days), even after TAU clinicians received ASAM Criteria training and used computer-assisted interviewing (but without the algorithm) (ASAM PPC-2R; Mee-Lee et al., 2001).

New software was developed to implement the ASAM PPC Second Edition, Revised (PPC-2R), with new levels, sublevels, and detailed decision rules. This version was implemented in

a new validation study, conducted in Norway. Initial results from this study showed that matched patients had better outcomes than mis-matched patients at three-month follow-up (Stallvik, Gastfriend & Nordahl, 2014). This second report further extends that work by examining ASAM vs. TAU discrepancies and exploring two hypotheses: first, that the new ASAM Criteria LOC recommendations should show convergent validity with the most commonly used addiction severity measure, the ASI, and second, that the ASAM LOC recommendations should show predictive validity in the differential outcomes between patients assigned according to ASAM vs. TAU. Replicating and extending the findings of the Staines et al. (2003) study, which used the PPC-1 version, we sought to study the newer PPC-2R version software, to investigate whether the more restrictive ASAM placements are justified by better treatment outcome. Finally, whereas that was a single-site study, the Norwegian government-sponsored system made feasible a multi-site study.

METHODS

Sample

As previously reported, 261 treatment-seeking SUD adults were recruited between February 2010 and July 2012 [Stallvik, et al., 2014]. Of these 66% were male, and the mean age was 32 years (18-61). Over 79% were unmarried, 46% lived with family, friends or partner, and 53% received unemployment or public assistance. Sample characteristics are in line with previous studies conducted in this region (Nordfjærn, Hole & Rundmo, 2010). Baseline (BL) demographic characteristics were tested across the three cohorts with different naturalistic ASAM LOC recommendations, which showed no significant differences in age, gender, and years of education or income source. All patients had substance dependent or abuse disorders meeting International Classification Diagnostic, version 10 (ICD-10) Criteria. Comparing the

BL *versus* Follow-up (F/U) samples no significant differences was found in the matched or mismatched conditions.

Procedure

All patients provided informed consent which was approved along with the study protocol by the Regional Committees for Medical Health Research Ethics (REK). Interviews took place in routine clinical offices, and patients were interviewed by trained ASAM Software assessors at BL and again after three months with an F/U interview which again used the ASAM Software, although not necessarily with the same assessor as at BL. The patients had to be ≥ 18 years of age, had to speak and understand the Norwegian language, and be stable with regard to intoxication with alcohol and/or drugs, and/or psychiatric symptoms to complete the interview sessions. Patients could have a severe psychiatric diagnosis, but could not be included if they were in an active psychotic stage at the time of inclusion or interview.

The TAU interview is unstructured and non-standardized, and should cover substance use history/status/treatment, family/social relations, living arrangement, school/work obligations, medical needs and psychological needs.

Patients were asked to report on the same 30-day period for both the TAU and ASAM interviews, because the interviews might not be conducted on the same day. All ASAM assessors had at least 3 years of clinical experience and could not participate in TAU intake interviews during the study. They were trained in a 32-hour course over four days in the understanding and use of the ASAM Criteria Software. The course included extensive training in ASI interviewing, since this is one of the major instruments included in the ASAM Software. After the course they watched 10 training videos to enhance their interviewing skills and facilitate familiarity with the use of the software. To maintain double-blinding,

patients, ASAM-assessors, TAU assessors and care providers were kept unaware of the ASAM-recommended LOC, so all actual placements were naturalistic, according to the TAU clinical recommendation.

Measurement

Data included patients' LOC placements from TAU assessments, scores from the ASAM Software on the seven ASI composite subscales, duration of ASAM administration time, and final ASAM LOC recommendation.

ASAM Criteria Software Interview

The tool assesses patients along six dimensions of need: 1) Intoxication and Withdrawal, 2) Biomedical Complications and Conditions, 3) Emotional/Behavioural Complications and Conditions, 4) Treatment Readiness, 5) Potential for Continued Use or Relapse, and 6) Environmental Conditions. Within these dimensions, questions address the history of prior treatment, substance use duration, frequency and recency, severity of addiction, substance use disorder diagnosis, withdrawal symptoms, relapse potential, psychiatric symptoms, motivation for treatment and family/social/environmental factors. The Software incorporates previously validated tools such as the European version of the ASI [Lauritzen & Ravndal, 2004]. A more detailed explanation of the assessment requirements, dimensions and LOC is described by Mee-Lee and colleagues [2001]. The software constructs an algorithm-based recommendation and a report describing the patient's needs on the different dimensions, and a final level of care recommendation. There are four main LOC in ASAM, which can be summarized as: Level I: Outpatient treatment (LI), Level II: Intensive Outpatient (LII), Level III: Inpatient/residential (LIII), and Level IV: Hospitalization (LIV). A patient might receive no LOC recommendation either because his/her needs are not severe enough to justify a LOC

or because the patient's constellations of problems might not mathematically resolve to any clear LOC in the ASAM decision logic. In such cases, the ASAM Criteria Software calls for the intake counselor to select the least intensive and restrictive LOC that will minimally meet the patient's needs in all dimensions. While this is the instruction given for clinical use of the ASAM Criteria, because of the blinded nature of these placement recommendations, non-resolving cases could not be used in some of the study's data analyses.

The diagnostic terminology is consistent with the DSM-IV (American Psychiatric Associations Diagnostic and Statistical Manual of Mental Disorders, 2000) (updated to DSM-5 as of October 2013 in the web-enabled application).

The European Addiction Severity Index (EuropASI)

The ASI CS calculations were developed to evaluate the severity of addiction-related problems in terms of lifetime as well as recent use (past 30 days) on the following dimensions: medical status, employment and support status, drug and alcohol use, legal status, family/social relationships and psychiatric status (McLellan, Luborsky, Woody & O'Brien, 1980; McLellan et al., 1992; McGahan, Giffith, Parente & McLellan, 1986). The ASI in the Norwegian ASAM Software is the European version; its reliability and validity is well documented (Hodgins & El-Guebaly, 1992; Leonard, Mulvey, Gastfriend & Shwartz, 2000; Lauritzen & Ravndal, 2004).

Recommendation by the ASAM Criteria

Two LOC were available in this region for study: LI Outpatient treatment and LIII Inpatient treatment. LII Intensive outpatient services were not available in this region at the beginning of the study. In the outpatient setting, patients receive individual therapy at least once a week, for at least 10-12 sessions, but the majority have more than one session each week, e.g., with counsellor, psychologist, psychiatric or medical service provider. In the inpatient/residential setting, treatment is offered from three months to 1.5 years, depending on the patient's needs, and a variety of therapies are offered. Because all patients who required detoxification received this prior to the study in LIV Hospital Care, the final recommendations by the ASAM Software for patients recruited to this study included: LI Outpatient Care, LII Intensive Outpatient Treatment (i.e., day treatment or partial hospital), and LIII Inpatient/Residential Rehabilitation.

Statistical analysis

The analysis of discrepancy between LOC assignment from TAU and ASAM algorithm based recommendation utilized a Crosstab with Pearson Chi-square analysis. Determination of convergent validity used the BL ASI CSs differences between the three LOC, followed by a planned contrast test to determine the significance of clinical differences between pairs of LOC. Determination of the predictive validity of matching *vs.* mis-matching employed a paired sample t-test on the ASI CSs mean changes from BL to F/U. Results from the match/mis-match conditions have previously been analysed on this sample (Stallvik et al., 2014); this report separates the analyses by LOC and explores discrepant cases in terms of both match/mis-match condition and LOC assignment. Analyses were performed with the statistical analyze package PAWS18.

RESULTS

ASAM vs. TAU recommendation

The sample consisted of 57.5 % (150 of 261) matched to the ASAM-recommended LOC by TAU. The mis-matched group included 19.5 % (51 of 261) undermatched and 23 % (60 of 261) overmatched patients.

Table 1 shows the Crosstabulation distribution of ASAM-recommended LOC vs. the actual LOC the patients received.

Table 1: Crosstabulation table of LOC placement by TAU and ASAM Software

ASAM Criteria LOC Recommendation	LOC Placement by TAU (N; %)		
	Outpatient Level I	Inpatient Level III	Total
Recommended for: No Treatment	9 22%	32 78%	41
Recommended for: LI Outpatient	6 60%	4 40%	10
Recommended for: LII Intensive Outpatient	11 40%	15 60%	26
Recommended for: LIII Inpatient/Residential	40 21.7%	144 78.3%	184
Total	66	195	261

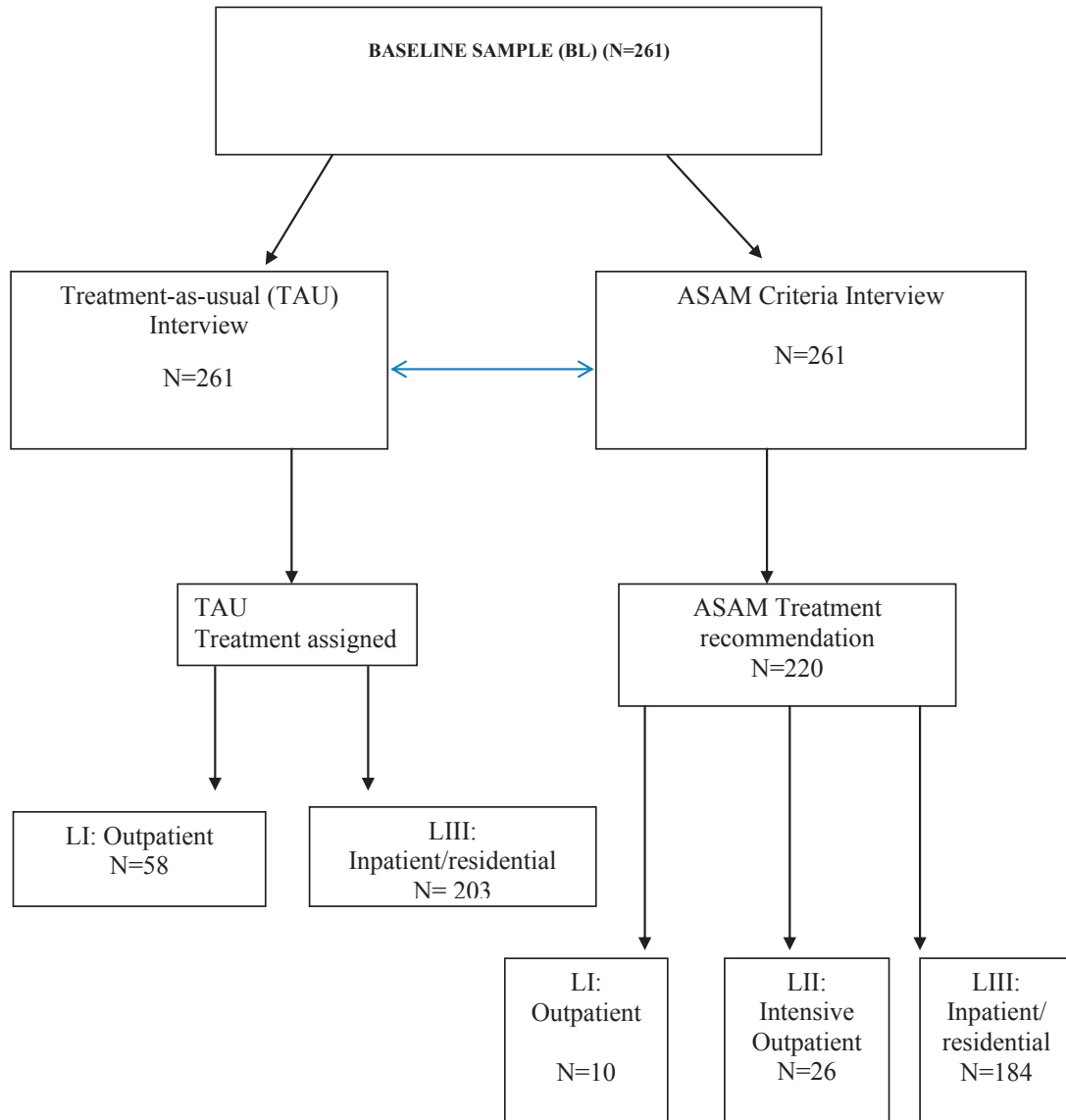
Shaded cells = Matched patients; unshaded cells = mis-matched patients.

No Treatment: This recommendation could arise if the patient's data showed sub-clinical severity or were insufficient for the algorithm to resolve a recommendation.

Of the 261 patients there were 41 who did not receive a LOC recommendation by ASAM (i.e., data showed sub-clinical severity or were insufficient). These patients were excluded from the Chi-square and ANOVA analyses. The final sample size for the analyses was 220. Chi-square analysis revealed overall significant differences for the LOC placement by TAU vs. ASAM recommendations ($\chi^2=11.363$, $p=.003$). When the ASAM algorithm recommended LI, 40% (4 of 10) patients were overmatched to LIII treatment by TAU. For the ASAM

residential LIII recommendations, clinicians undermatched 21.7% (40 of 184) to LI. Given the unavailability of LII in this region, all of the 26 patients recommended by ASAM to this LOC were necessarily mis-matched, with 58% (15 of 26) more being sent overmatched to LIII than undermatched to LI. The total number of patients who were mis-matched was 111 (42.5% of 261). Figure 1 display the TAU treatment assignment for the whole sample and the ASAM recommendations.

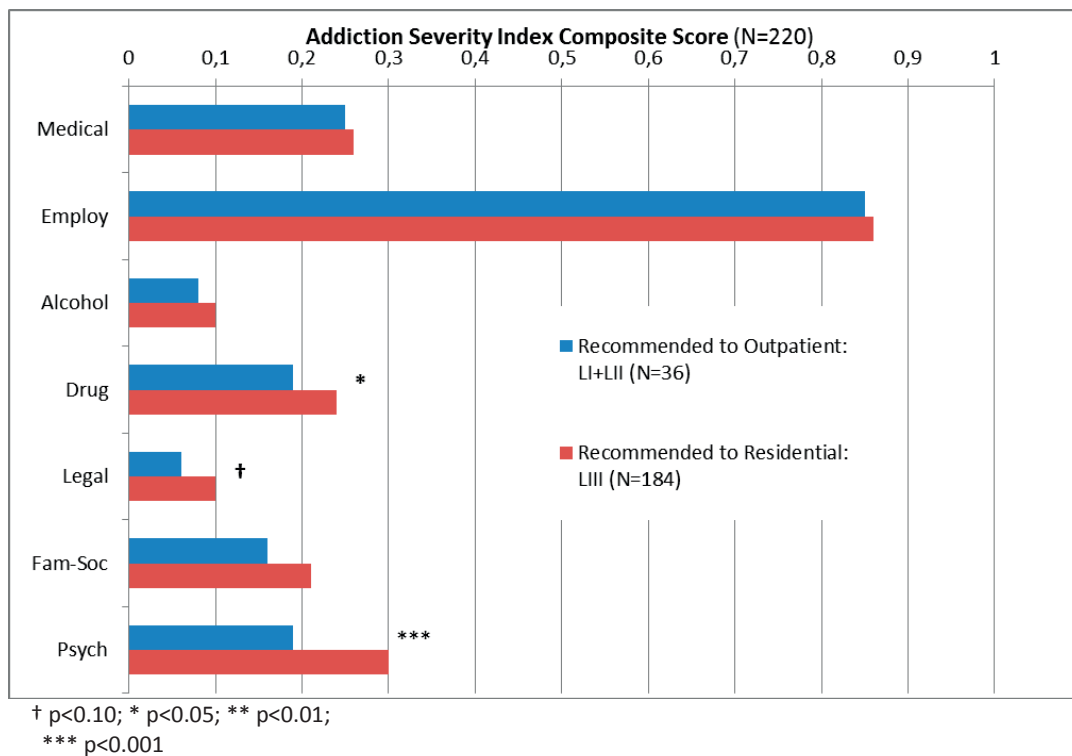
Figure 1 Procedure study design



Convergent validity

The analysis of convergent validity, using mean ASI CSs at BL, is displayed in Figure 2. The group that was ASAM recommended to receive the most intensive LOC, LIII Inpatient/Residential, had a consistent pattern of higher observed mean BL scores than the outpatient group (LI+LII) on all seven ASI CSs.

Figure 2: Mean baseline clinical differences, ANOVA on mean severity differences between Outpatient and Residential LOC



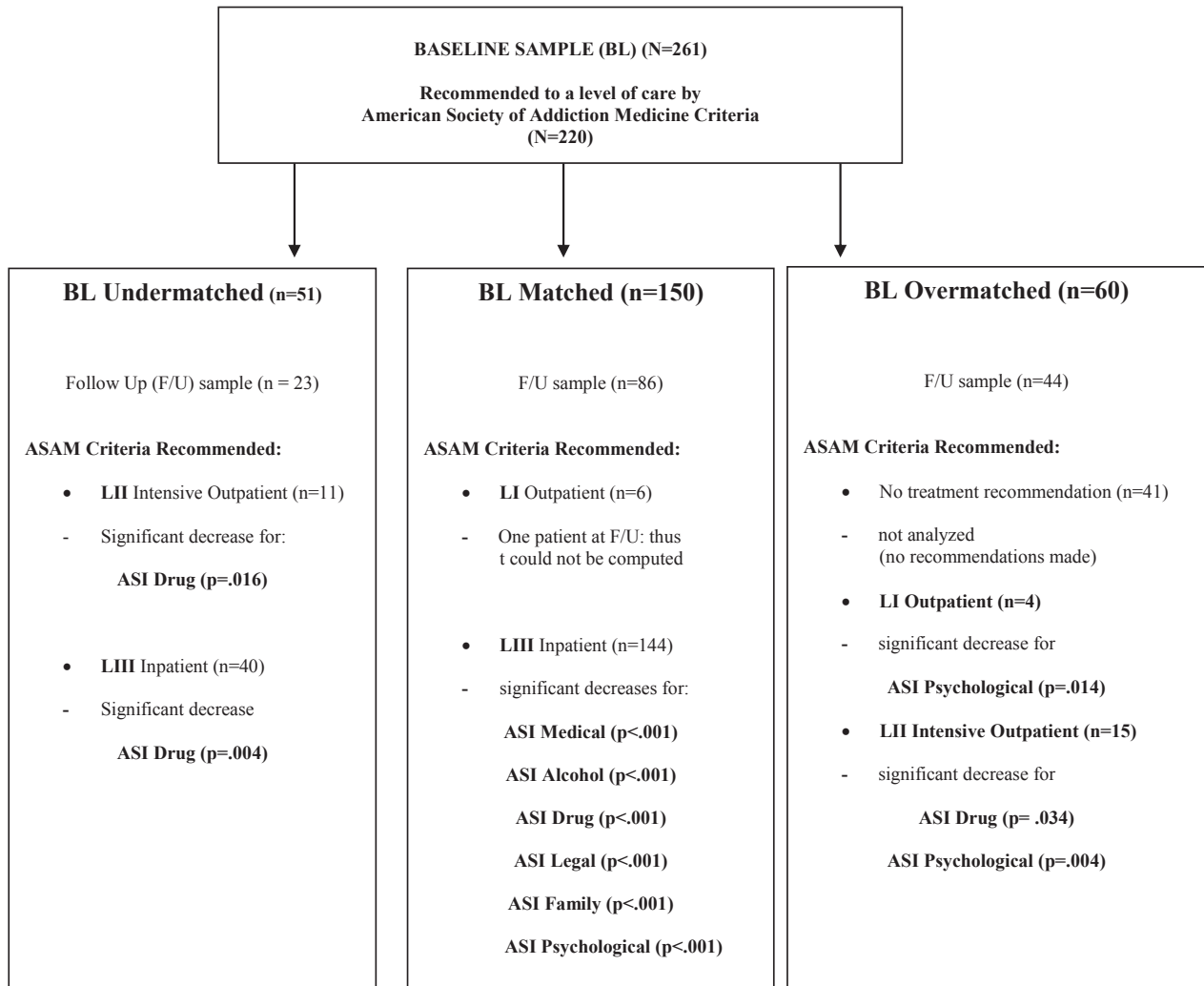
In a GLM univariate analysis with contrast analyses applied there were significantly higher severity means at the most intensive LOC on ASI Psychological CSs (p<.001) and ASI Drug

CSs ($p < .05$). We also saw a trend for higher severity on ASI Legal among the LIII compared to the group recommended for outpatient care.

Predictive validity with three-month F/U outcomes

Figure 3 displays the different match/mismatch conditions and their mean severity change on ASI CSs at F/U.

Figure 3: Interaction of match/mismatch conditions and intensity of LOC with paired sample t-test on ASI CS mean score changes from baseline to follow-up



Undermatched: Recommended for LII/Received LI

Of the 51 patients who were classified as undermatched, i.e., receiving a lower LOC than recommended by ASAM, 11 were recommended for Level II. Most ASI CSs for this subgroup decreased (improved) from BL to F/U, but none of the changes were significant except for the ASI Drug CSs ($t= 4.009$, $p= .016$); meanwhile, the ASI Employment CSs actually increased (worsened).

Undermatched: Recommended for LIII/Received LI

Clinicians placed 40 patients in LI Outpatient care whom ASAM had recommended for LIII. These patients showed mean decreases on most ASI CSs, although none were significantly improved except for the ASI Drug CSs ($t=3.377$, $p=.004$); meanwhile, the ASI Employment CSs worsened in this group as well.

Overmatched: LI Outpatient Recommended/Received LIII

ASAM recommended LI Outpatient treatment for four patients who were overmatched, receiving LIII. These patients had non-significant decreases in mean ASI Medical, Alcohol, Drug, Family, and Psychological CSs. Only the ASI Psychological CS was significantly changed ($t=8.273$, $p=.014$).

Overmatched: LII Intensive Outpatient Recommended/Received LIII

ASAM recommended 15 patients for LII intensive outpatient care, who were placed by TAU in LIII inpatient. At F/U, 12 overmatched patients remained in the study; these had non-significant decreases in all mean ASI CSs values. A significant change was found for ASI Drug ($t=2.417$, $p=.034$) and ASI Psychological CSs ($t=3.664$, $p=.004$).

Matched: Recommended LI/Received LI

As only one patient remained at F/U, this category was not analyzed.

Matched: Recommended LIII/Received LIII

The matched group had significantly better outcomes after three months than both the undermatched and the overmatched groups (Stallvik et al., 2014). The matched group had significant reductions in severity in 6 out of 7 ASI CS areas; and a slight increase on ASI Employment CSs which was not significant.

DISCUSSION

These analyses examined convergent validity for the ASAM Criteria Software and further detailed its predictive validity in terms of three-month F/U outcomes for patients whose placements were matched according to the ASAM Criteria *vs.* those whose TAU placements consisted of lower or higher intensity than ASAM recommended. The sample consisted of 150 patients matched to the recommended LOC based on the ASAM Software algorithm, 51 undermatched and 60 overmatched patients.

The greatest discrepancy between TAU and ASAM was with LII Intensive Outpatient Care. This was caused by the unavailability of LII at the time in this region. In contrast, with the availability and guaranteed coverage in Norway for LIII, this Inpatient category yielded agreement in 78% of the cases. The ASAM Software recommended a more intensive LOC than TAU in 20% of cases. These results are similar to previous research (Staines et al., 2003) and the overall study provided a sufficient sample size of mismatched cases to yield meaningful results. An important finding of this study, however, is that discrepancies between TAU and the ASAM Criteria recommendation occur about half the time, and similarly in three different studies: 43% in the present Norwegian cohort, 58% in a New York City study (Staines et al., 2003) and 53% in a U.S. Veterans Administration Medical Center (Sharon et al., 2003). Such high rates of mis-matching implies substantial cost and patient restrictiveness penalties to societies – despite the common use of conventional managed care techniques in the latter two environments.

Convergent validity

Mean severity scores for patients who were ASAM-recommended to the more intensive LIII were higher on all ASI CSs and significantly so on ASI Drug and Psychological CSs *vs.*

patients recommended to less intensive LOC. This is in line with a previous study on the ASAM Criteria's convergent validity (Sharon et al., 2003). Patients with more severe substance abuse, less social support, or co-occurring psychological disorders benefit more from inpatient vs. outpatient treatment (Magura et al., 2003; Bartak et al., 2011), justifying a LIII recommendation. Opposite findings were found however, in cocaine users matched to LII day treatment vs. those overmatched to LIII inpatient/residential treatment, although that study used only a partial implementation of the ASAM Criteria, First Edition (McKay & McLellan, 1992), which may have limited the effectiveness of its algorithm. With the present study's use of the newer ASAM Criteria, 2nd Edition-Revised version and the comprehensive computerized implementation, the more severe means on seven out of seven dimensions, and significant change on ASI Drug and Psychological CSs demonstrate consistency in the ASAM Criteria Software's ability to make clinical distinctions. Furthermore, it makes clinical sense that the ASI Psychological and Drug CSs might both show significant baseline differences between different LOC, based on their association in prior literature (Lehman, Myers, Thompson & Corty, 1993), the impact of psychological problem loading on related dimensions, including family and social supports (Kashner, Rader, Rodell, Beck, Rodell & Muller, 1991), and their relationships with legal problems (DSM-IV, 2000), which are also in evidence in the higher severity ASI Legal CSs.

Outcomes at F/U for the different match/mis-match LOC conditions

The undermatched group had worse 90-day outcome than the matched group, which supports predictive validity for the ASAM Criteria. Naturalistic undermatching may be due to patients' own preferences for outpatient treatment due to work or family responsibilities, or practical issues such as geography or convenience. Such reasons, however, warrant more educational and motivational effort by clinicians in the course of assessment, since the data indicate that

patients would achieve better outcomes if they accept the ASAM-recommended placements. Alternatively, undermatching may occur due to lack of access to certain LOC, as was the case with many LII placements – and in this case, the ASAM Software serves as a needs assessment tool, precisely revealing the quantitative shortage of treatment slots in a geographic region. Given the adverse outcomes of such mis-matching, public entities would be wise to respond by improving access to care, as is now the case with provision of LII in this region of Norway.

The overmatched group did not appear to benefit from more intensive placement by TAU, thus also supporting the validity of the ASAM Criteria. Although overmatched patients in LIII (a controlled environment) might be expected to benefit from elimination of access to substances and presumably fewer craving triggers, this is less effective and overly costly – both in terms of unnecessary restrictiveness for the patient, and inefficient service provision for the treatment system. Overall, these results shed a light on the crucial need for thorough assessments before matching patients' needs to appropriate services.

Limitations

A relevant methodological consideration is that differences between the ASAM Software-obtained treatment recommendation and clinically derived LOC can be a result of the numbers of categories available. If the clinicians had the full continuum of four LOC available in the community as the ASAM Criteria recommend, then discrepancies could have been fewer than those seen here. The naturalistic approach to the design may have biased against validity findings, as the prior report on this study found that the matched group at BL differed from the mis-matched groups with younger age, and higher ASI Drug, Legal, Employment and Psychological scores (Stallvik et al., 2014). These differences might have

reduced the extent to which matching could demonstrate a clinical outcome advantage over mis-matching; nevertheless, predictive validity was supported.

In the measurement of convergent validity the ASI CSs were used, and ASI questions supply approximately 50% of the ASAM assessment's data needs. However the ASI CSs calculations are actuarial and these scores are not used in the ASAM LOC determination, which employs considerably different hierarchical decision logic. Given these differences in calculation, the danger of overlapping is minimal. Therefore, the progressively more severe means on seven out of seven ASI CSs and meaningful clinical distinctions between the LOC lend support to the convergent validity of the ASAM Criteria. These findings need to be further investigated with larger samples and with the full continuum of ASAM LOC, because this study lacked LII Intensive outpatient treatment and also included only a small sample in LI Outpatient. LOC should also be confirmed as actually delivering the services specified by the ASAM Criteria – and a certification procedure has been published to aid this task (McGovern, Xie, Acquilano, Segal & Drake, 2007).

Conclusion

The ability of the ASAM Criteria to clinically distinguish between the different LOC as shown by these data lends support for the software's convergent validity. The differential outcomes for the matched *vs.* mis-matched groups demonstrate predictive validity for the ASAM Criteria Software. These outcomes suggest that programs should avoid both under- and over-matching patients. Future studies, both national and international, should include all LOC specified in the ASAM Criteria, properly characterized, with larger samples. The convergent and predictive validity demonstrated by these results are promising for the widespread release of the ASAM Criteria Software that is currently underway.

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Declaration of interest: None

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Convergent validity of the ASAM criteria in co-occurring Disorders

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ABSTRACT

Objective: The complexity of substance use and psychiatric disorders demands thorough assessment of patients for integrated services. We tested the convergent validity of the software version of the American Society of Addiction Medicine (ASAM) second edition-revised criteria for patient placement by examining the software's ability to discriminate based on a variety of demographic and clinical factors. **Methods:** This prospective naturalistic multi-site study examined the software's assignment of patients to three types of treatment (Addiction Only Services, Dual Diagnosis Capable, and Dual Diagnosis Enhanced), and whether these assignments indicated an ability to discriminate between patients with and without dual diagnosis based on clinical characteristics and severity. Ten addiction treatment clinics spanning three counties participated, and both patients and ASAM assessors were kept blind to the ASAM recommendation. Patients were assigned to their respective treatment options based on routine assessment by clinicians at intake, which they had in addition to the ASAM interview. Three months after treatment initiation a follow-up interview with ASAM was conducted. **Results:** There were 261 patients in the study, 96 (36.7%) were assigned to Addiction Only Services, 42 (16.1%) to Dual Diagnosis Capable, and 123 (47.1%) to Dual Diagnosis Enhanced. Patients assigned to the two Dual Diagnosis groups were significantly more likely to be younger and have fewer years of work than other patients. There were significant differences in history of inpatient and outpatient psychiatric treatment across groups. For example, a larger percentage of those in Addiction Only Services had never been in inpatient treatment, while more of those in the two Dual Diagnosis groups had three or more inpatient stays. Despite similar alcohol and drug severity scores, patients recommended by the Software for Dual Diagnosis Enhanced programs showed a gradient of significantly higher psychiatric ($p<.001$), legal ($p<.04$) and family ($p<.001$)

Addiction Severity Index composite scores at baseline than patients in Dual Diagnosis Capable and Addiction Only Services. **Conclusions:** Results show a high prevalence of co-occurring program recommendations with statistically significant and clinically meaningful differences between patient groups. The convergent validity of the revised version of ASAM Criteria Software is supported by these results.

Keywords: *ASAM Criteria, dual diagnosis program, prevalence, Addiction Severity Index, characteristics, convergent validity, co-occurring disorders, severity composite scores*

INTRODUCTION

There is a high prevalence of co-occurring substance use and psychiatric disorders (i.e., dual diagnosis) in both Norwegian and international studies (Melberg Lauritzen & Ravndal, 2003; Ravndal, Vaglum & Lauritzen, 2005; Bakken, Landheim & Vaglum, 2005; Cole & Sacks, 2008; Schulte, Meier, Stirling & Berry, 2008; Helseth, et al., 2013). The numbers vary, but national studies have found prevalence rates of 32 - 65% (Bakken et al., 2005), while international studies have found lower but increasing numbers; 20% in 2004 (Grant et al., 2004) and 46% in 2008 (Schulte et al., 2008). Patients with dual diagnosis have poorer prognosis, legal difficulties and unemployment (Dausey & Desai, 2003), and higher prevalence of suicide attempts (Darke, Ross, Lynskey & Teesson, 2004; Bakken & Vaglum, 2007).

Because of the problems associated with dual diagnosis, it is critical to identify the presence of co-occurring disorders at intake and develop an appropriate treatment plan. Lack of early identification and proper treatment can lead to less benefit and worse treatment results, like high attrition, low treatment attendance, and worse outcomes (Magura et al., 2003; Hides, Dawe, Young & Kavanagh, 2007; Schulte, Meier, Stirling & Berry, 2010; Angarita, Reif, Pirard, Lee, Sharon & Gastfriend, 2007). In addition to early detection and appropriate planning, services delivered via integrated treatment programs seem to be more effective than those delivered sequentially (Brunette, Mueser & Drake, 2004).

The Patient Placement Criteria of the American Society of Addiction Medicine (ASAM; Mee-Lee, Shulman, Fishman, Gastfriend & Griffith, 2001) is one of the most elaborate sets of professionally-developed guidelines for matching patients with substance use disorders to

optimal levels of care (Hoffman, Halikas, Mee-Lee & Weedman, 1991). The validity of the ASAM Criteria first edition has been supported by several studies (CSAT, 1995; Baker & Gastfriend, 2003; Sharon et al., 2003; Staines, Kosanke, Magura, Bali, Foote & Deluca, 2003; Magura et al., 2003). The revised version of the ASAM Criteria introduced taxonomy of addiction treatment programs based on their capacity to provide services to people with dual diagnosis (Mee-Lee et al., (2001). The categories were defined as *Addiction Only Services*, *Dual Diagnosis Capable*, and *Dual Diagnosis Enhanced*. Studies have shown that patients with a high severity of co-occurring substance use and psychiatric problems who were placed in high service-intensity programs had better treatment outcomes than patients with high co-occurring severity treated in low-intensity programs, showing that matching in terms of intensity has improved outcomes (Chen, Barnett, Sempel & Timko, 2006).

Based upon the fact that many patients with substance use disorders also have a co-occurring psychiatric disorder, researchers have proposed that all addiction treatment programs should at least be Dual Diagnosis Capable (Minkoff, Zweben, Rosenthal & Ries, 2003). That is, all addiction treatment programs should be able to support patients with dual diagnosis who have stable and less severe psychiatric symptoms. McGovern and colleagues (2007) studied the ASAM taxonomy for dual diagnosis categories and found that one-fourth of the programs classified themselves as Addiction Only Services, two-thirds (65%) of the programs reported being in the Dual Diagnosis Capable category, and a few (10%) programs classified themselves as Dual Diagnosis Enhanced programs. Results support the taxonomy of the ASAM classification system by showing that Dual Diagnosis Enhanced programs reported treating patients with significantly greater psychiatric severity than Dual Diagnosis Capable and

Addiction Only Services respectively. However, more research with the revised ASAM taxonomy is needed to test whether these different level of care recommendations make significant and meaningful clinical distinctions.

A computerized software program has been developed to implement the ASAM Criteria Second Edition-revised version with new levels, sublevels, and upgraded decisions rules. This software version was tested in a validation study in Norway and showed support for the ASAM Criteria's ability to predict outcomes. Optimally matched patients had better outcomes after three months than mismatched patients (Stallvik & Gastfriend 2014). In addition to the predictive validity testing, the Criteria have also shown convergent validity in a previous study on the main levels of care, where the patients with the highest severity levels also received higher level of care recommendations by ASAM Criteria (Sharon et al., 2003). With this present article we further extend the work by Sharon and colleagues by exploring whether the ASAM Criteria taxonomy for co-occurring disorders is able to identify those in need of dual diagnosis program recommendations and whether there are significant and meaningful clinical differences between the different groups that support such recommendations. In other words, if two patients have identical alcohol and drug severity, but one of them has more severe psychiatric needs, the ASAM Criteria Software must be able to discriminate these needs and recommend dual diagnosis service enhancements.

Specifically, this study investigated: 1) the prevalence of dual diagnosis program recommendations (Dual Diagnosis Capable or Dual Diagnosis Enhanced) for patients seeking substance use disorder treatment; 2) the baseline clinical characteristics of patients who were

assigned to Addiction Only Services, Dual Diagnosis Capable or Dual Diagnosis Enhanced care; and 3) treatment outcomes at three-month follow-up among patients in all three groups.

Outcomes included the following variables: treatment initiation, treatment retention, and severity scores on the Addiction Severity Index (ASI). Finally, the ASAM Criteria recommendations for co-occurring disorders were compared with ASI severity scores, the most commonly used addiction severity measure, to test convergent validity. Specifically, the ASAM Criteria should be able to discriminate correctly between patients with similar alcohol and drug severity but who have different severity in psychiatric and related areas and therefore different needs for treatment.

METHODS

Study Design and Participants

This naturalistic multi-site study was conducted at 10 different assessment/treatment clinics in the middle region of Norway covering three counties, with both rural and suburban areas included. These clinics offer a variety of services in both outpatient and inpatient settings. No formal categorization of dual diagnosis capability is reported by the clinics, but most appear to provide an intermediate set of services similar to those of a Dual Diagnosis Capable program. All services have interdisciplinary treatment services, staff, and close referral to more intense psychiatric care when needed.

Patients were recruited during February 2010 – July 2012. Following a complete discussion of the study by assessors at the clinic, patients provided written informed consent. The study was

approved by the Norwegian Regional Ethics Committee (NREK) and conducted in accordance with the Declaration of Helsinki. The patients had to be at least 18 years of age, speak and understand the Norwegian language, and be stable enough in regard to addiction and/or psychiatric symptoms to complete the interview sessions. Patients were excluded based on psychiatric symptoms only if their symptoms were so severe that they were unable to participate in the interview session. All participants had substance dependence or abuse disorders meeting International Classification Diagnostic, version 10 (ICD-10) Criteria (WHO, 1993).

All patients received the agency's routine assessment at intake and an ASAM baseline interview. Interviews took place in routine offices and patients were contacted by the ASAM assessors again after three months for a follow-up interview. The ASAM assessors participated in a four-day training on use of the revised ASAM Criteria Software that included extensive training in the Addiction Severity Index interviewing, since this is one of the major instruments included in ASAM Software. After the course they executed 10 training videos to enhance their interviewing skills and facilitate familiarity with the use of the software. Patients and assessors were blinded to the ASAM recommendation, and patients were assigned to the level of care recommended by the routine intake assessment. ASAM assessors registered whether patients entered their assigned treatment, and if they were still in treatment at the time of the follow-up interview.

The ASAM Criteria Software Interview

The ASAM Criteria have undergone several studies and are used by a majority of US states (Mee Lee et al., 2001). Inter-rater reliability (intra-class correlation coefficient) with the first edition of the software was 0.77 (Baker & Gastfriend, 2003). The revised version (ASAM Patient

Placement Criteria –Second Edition- Revised) assesses prior treatment, substance use duration, frequency and recency, severity of addiction, substance use disorder diagnosis, withdrawal symptoms, relapse potential, psychiatric symptoms, motivation for treatment and environmental factors. The scores on these dimensions are matched to appropriate levels of care. Six main levels of care can be recommended, and the three levels discussed here are included among them. The diagnostic terminology used in this software version was consistent with the DSM-IV (American Psychiatric Associations Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, 2000). Three types of programs within the recommended levels of care reflect their ability to address co-occurring substance and mental disorders. These are Addiction Only Services, Dual Diagnosis Capable and Dual Diagnosis Enhanced.

Addiction Only Services are appropriate for patients without a psychiatric disorder, and those with a psychiatric disorder that is not perceived to be interfering with substance use treatment. This recommendation does not mean that there is no psychiatric diagnosis, but that this dimension is perhaps taken care of by other resources, stable, and/or not interfering with treatment for substance use disorders.

Dual Diagnosis Capable programs are appropriate for patients with psychiatric disorders that may be more severe but are currently stable and not interfering with substance use treatment to a substantial degree.

Dual Diagnosis Enhanced services are designed to treat patients who have more unstable or severe co-occurring mental disorders that will interfere significantly with substance use

treatment if left unaddressed. All staff must be cross-trained in both disorders. These programs have a high staff-to-patient ratio with a focus on patients' dual diagnosis instability and integrated dual diagnosis staff, services and program content.

The program recommendations are designed to match the functional needs of patients. The main difference between Dual Diagnosis Capable and Dual Diagnosis Enhanced is that the latter has more resources and staff mix, but the program content itself is fairly similar across both levels of care (Minkoff, 2008). Dual Diagnosis Enhanced programs can serve patients with a substance use disorder and active moderate to severe psychiatric symptomology or baseline psychiatric disability, whereas Dual Diagnosis Capable programs are only appropriate for those whose psychiatric symptoms are less active. For example, Dual Diagnosis Enhanced services would be appropriate for individuals with active PTSD symptoms with significant flashbacks, or baseline schizophrenia with moderate impairment, who need greater access to personnel trained in mental health issues and symptom reduction, smaller groups, and so on.

In this study, outpatient (ASAM Level I) and inpatient/residential (Level III) care were available for participants. Personnel were interdisciplinary, often with additional formal education in substance use disorders and co-occurring psychiatric disorders. Both levels of care have access to and collaborate with community social workers to secure housing and to assist patients to attend more intensive treatment if needed by referral or via closely coordinated services such as acute medical or psychiatric care units. The services provide help or assistance with vocational training, and there is a focus on family and friend relationships to enhance patients' social supports. In the outpatient setting, patients receive individual therapy at least once a week, but

the majority also have other sessions, such as with a counsellor, psychologist, psychiatrist or medical personnel. In the inpatient/residential setting, treatment is offered from three months to 1.5 years depending on the patient's needs. The therapies offered are varied, but common services include a set weekly treatment plan that patients follow over time, which includes individual sessions, group sessions, exercise, leisure activities, housing assistance and vocational training/school.

Two stages of assessment are used to identify patient's psychiatric needs when entering treatment. First, patients are asked directly if they have any psychiatric diagnoses. Second the ASAM assessors conduct a broad review of psychological symptoms and, if any are present, investigate symptom severity, recency and the relationship between symptoms and substance use or withdrawal.

The European Addiction Severity Index

The ASAM Criteria Norwegian translation incorporates previously validated tools such as the European version of the ASI (Ravndal, 2004; Hodgins & El-Guebaly, 1992, Leonhard, Mulvey, Gastfriend & Shwartz, 2000). The European ASI uses subscale composite scores to quantitatively evaluate the severity of addiction-related problems on seven dimensions: medical, employment and support, drug use, alcohol use, legal issues, family history, family and social relationships and psychiatric status over the past 30 days (McLellan et al., 1992; McGahan et al., 1986). The reliability and validity of the European ASI is well documented (Ravndal, 2004).

Statistical Analysis

To show the prevalence of the different treatment recommendations by the ASAM software we used percentage distributions. Univariate ANOVA and Chi-square tests were used to analyse baseline group differences across the three levels of care recommendations on demographics, psychiatric symptoms, treatment history, treatment initiation, treatment retention, and suicide attempts. Any significant differences were explored using a Scheffé analysis to determine which of the groups differed. Paired sample t-tests were used to study changes in the ASI composite scores from baseline to follow-up. A planned contrast test was conducted using GLM Univariate analysis to determine whether patients with more severe psychiatric symptoms were in fact assigned to the higher level of care. Analyses were performed with the statistical analysis package PASW 18.

RESULTS

A total of 261 patients were recruited into the study. These participants were primarily male ($n = 171$, 65.5%), were never married ($n = 206$, 72.9%), and had a mean age of 32.08 years ($SD = 10.63$). Approximately half had a psychiatric diagnosis ($n = 149$, 57.1%), 66 (25.3%) were treated in an outpatient setting, and 195 (74.7%) were treated in an inpatient setting. The most common drugs of choice were stimulants ($n = 84$, 32.2%) and alcohol ($n = 64$, 24.5%), and about a third of participants had a lifetime history of a suicide attempt ($n = 103$, 39.5%). Of the 261 patients who began the study, 158 (60.5%) remained in treatment at the 3-month follow-up.

Program Recommendations for Co-occurring Disorders

Based on the routine intake assessment, 96 patients in the study (36.7%) received a recommendation to Addiction Only Services, 42 (16.1%) were matched to Dual Diagnosis Capable programs, and 123 (47.1%) were referred to Dual Diagnosis Enhanced programs. Of the 96 patients assigned to Addiction Only Services 83 actually initiated treatment (86.5%), while 37 (88.1%) of those assigned to the Dual Diagnosis Capable group and 106 (86.2%) of those assigned to the Dual Diagnosis Enhanced group actually initiated treatment. Treatment retention was also similar across groups, with 63 (65.6%), 27 (64.3%), and 68 (55.3%) patients still in treatment at the 3-month follow-up.

Demographic Baseline Data and Characteristics

The three groups' characteristics at baseline are displayed in Table 1.

Table 1
Demographic Characteristics and Group Differences at Baseline (N = 261)

Characteristic	AOS n=96	DDC n=42	DDE n=123	ANOVA/Chi- square, <i>p</i> -value
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	
Age (years)	33.46 (11.18)	36.26 (11.61)	29.63 (9.23)	$F = 7.67, p < .001$
Education (years)	10.63 (1.87)	10.55 (1.61)	10.63 (1.98)	$F = .034, p = .966$
Work (years)	7.09 (8.35)	9.94 (9.61)	4.49 (5.58)	$F = 6.77, p < .001$
	<i>n (%)</i>	<i>n (%)</i>	<i>n (%)</i>	
Gender				$\chi^2 = 5.96, p = .051$
Males	63(66)	21 (50)	87 (71)	
Females	33 (34)	21 (50)	36 (29)	
Marital Status				$R^1 = 10.10, p=.092$
Never married	72 (75)	28(67)	106 (86)	
Married	10 (10)	9(21)	5 (4)	
Divorced/separated	14 (15)	5(12)	12 (10)	
Living arrangement past 3 yrs				$\chi^2 = 20.52, p = .115$
Family, partner, friends	49 (51)	19(45)	60 (49)	
Alone	28 (29)	20(48)	44 (36)	
No stable arrangement	19 (20)	3(7)	18 (15)	

Note. AOS = Addiction Only Services; DDC = Dual Diagnosis Capable; DDE = Dual Diagnosis Enhanced.

¹Fisher Exact Test

The three groups were significantly different in age and work history. A Scheffe analysis in the Univariate ANOVA revealed a significantly lower age in the Dual Diagnosis Enhanced group compared to Dual Diagnosis Capable ($p=.002$) and Addiction Only Services group ($p=.027$). With regard to work, the Scheffe revealed that the Dual Diagnosis Enhanced recommended patients had significantly fewer years of work in their lifetime than Dual Diagnosis Capable ($p=.002$), but not the Addiction Only Services ($p=.194$) patients. No other significant demographic differences were found, although there was a trend toward gender differences across groups ($p=.051$). The percentage of males was 66% in the Addiction Only Services group, 50% in the Dual Diagnosis Capable group, and 70% in the Dual Diagnosis Enhanced group.

Clinical History and Characteristics

Table 2 shows clinical characteristics across the three groups. Surprisingly, while the percentage of patients reporting a psychiatric diagnosis was greater in the Dual Diagnosis Capable and Dual Diagnosis Enhanced groups compared to the Addiction Only Services group (62%, 62%, and 49%, respectively), these differences were not statistically significant.

Table 2: Clinical History and Group Differences at Baseline (N = 261)

Characteristic	AOS n=96	DDC n=42	DDE n=123	Chi-square, p-value
	n (%)	n (%)	n (%)	
Has a psychiatric diagnosis	47 (49)	26 (62)	76 (62)	$\chi^2=4.097, p=.129$
Symptoms experienced ¹				
Anxiety	47 (49)	28 (67)	70 (57)	$\chi^2= 3.884, p=.143$
Depression	49 (51)	19 (45)	63 (51)	$\chi^2= .492, p=.782$
Bipolar	5 (5)	6 (14)	13 (11)	$\chi^2= 2.558, p=.278$
Personality disorder	27 (28)	13 (31)	47 (38)	$\chi^2= 2.596, p=.273$
Psychosis	2 (2)	4 (10)	21 (17)	$\chi^2= 13.099, p=.001$
PTSD	5 (5)	11 (26)	22 (18)	$\chi^2= 12.410, p=.002$
ADHD	20 (21)	5 (12)	25 (20)	$\chi^2= 1.709, p=.426$
Eating disorder	3 (3)	3 (7)	12 (10)	$\chi^2= 3.625, p=.163$
History of inpatient treatment				$\chi^2= 13.942, p=.007$
0	62 (65)	22 (52)	58 (47)	
1-2	19 (26)	7 (17)	38 (31)	
3 or more	9 (9)	13 (31)	27 (22)	
History of outpatient treatment				$\chi^2 13.754, p=.008$
0	34 (35)	18 (43)	30 (24)	
1-2	57 (59)	19 (47)	71 (58)	
3 or more	5 (5)	4 (10)	23 (19)	
Drug of choice				
Stimulants	27 (28)	13 (31)	44 (36)	$\chi^2 1.480, p=.477$
Alcohol	24 (25)	14 (33)	26 (21)	$\chi^2 1.751, p=.417$
Opiates	18 (19)	8 (19)	26 (21)	$\chi^2 .083, p=.959$
Initiated assigned treatment	83 (87)	37 (88)	106 (86)	$\chi^2 = .101, p = .971$
Retention after 3 months	63 (66)	27 (64)	68 (55)	$\chi^2 = 2.71, p = .258$
Psychiatric disability pension	13 (14)	5 (12)	17 (14)	$\chi^2 = .119, p = .942$
Suicidal thoughts (lifetime)	64(67)	23 (55)	80 (65)	$\chi^2 = 1.91, p = .385,$
Suicidal thoughts (30 days)	15 (16)	5 (12)	23 (19)	$\chi^2 = 1.04, p = .596$
Suicidal plan (lifetime)	39(41)	14 (33)	59 (48)	$\chi^2 = 3.06, p = .216,$
Suicidal plan (30 days)	7 (7)	5 (12)	19 (15)	$\chi^2 = 2.87, p = .239$
Suicide attempt (lifetime)	30 (31)	19 (45)	54 (44)	$\chi^2 = 4.31, p = .116$
Treatment setting				$\chi^2 = 5.276, p = .072$
Outpatient	32 (33)	8 (19)	26 (21)	
Inpatient	64 (67)	34 (81)	97 (79)	

Note. AOS = Addiction Only Services; DDC = Dual Diagnosis Capable; DDE = Dual Diagnosis Enhanced; PTSD = posttraumatic stress disorder; ADHD = attention deficit hyperactivity disorder.

¹Symptoms are reported instead of diagnoses because the software does not generate clinical diagnoses.

There were, however, significant differences across groups on history of inpatient and outpatient treatment. A significantly higher percentage of patients in the Addiction Only Services group (65%) never had inpatient treatment, as compared to those in the Dual Diagnosis Capable (52%) and Dual Diagnosis Enhanced groups (47%), while a larger percentage of those in the Dual Diagnosis Capable (31%) and Dual Diagnosis Enhanced (22%) groups had three or more psychiatric inpatient stays in contrast to only 9% of the Addiction Only Services group. Similar results were found for prior treatment in psychiatric outpatient settings. More patients in the Dual Diagnosis Enhanced group had three or more outpatient treatment episodes (19%), compared to either of the other two groups (10% in the Dual Diagnosis Capable group and 5% in the Addiction Only Services group). There were no other significant differences across groups on clinical history

Psychiatric Symptomatology Reported by Clinicians

Table 2 lists the proportion of patients in each group who reported a history of experiencing particular psychiatric symptoms during the ASAM assessment. Symptoms are reported instead of diagnoses because patients may experience symptoms in multiple categories and the Software does not attempt to generate clinical diagnoses per se. Only two types of psychiatric symptoms differed across groups. Chi square analysis shows a larger percentage of patients in both Dual Diagnosis recommended groups that experienced symptoms in the psychosis ($p < .001$) and PTSD categories ($p < .02$), than reported in the Addiction Services Only group. There were no other significant differences on symptom measures or suicide measures.

Convergent Validity Using Baseline ASI Composite Scores

To analyze the convergent validity of the ASAM Criteria, we examined the three groups using their baseline Addiction Severity Index subscale composite scores compared with their assigned treatment type. GLM univariate analysis on baseline scores revealed significant differences in three-way comparisons on ASI subscale composite scores for Legal, $F(2,258) = 3.16, p = .044$; Family, $F(2,258) = 8.49, p < .001$; and Psychological, $F(2,258) = 13.10, p < .001$.

A planned post hoc Scheffe test was applied on differences between the groups and no significant differences were found between the Addiction Only Services group and the Dual Diagnosis Capable group. Addiction Only Services group compared to Dual Diagnosis Enhanced group did show significantly lower severity on Psychological ($p < .001$) and Family ($p < .05$), and the Dual Diagnosis group compared to the Dual Diagnosis Enhanced was significantly lower in severity on Family ($p < .001$) and Psychological ($p < .05$).

Differences in Severity Scores at Three-month Follow-up

Paired sample t-tests shown in Table 3 comparing each groups' follow-up ASI CSs data with their own baseline scores showed that all three groups improved significantly on the Alcohol and Drug subscales.

Table 3
Paired Sample t-test on Change in Addiction Severity Index Subscale Composite Scores from Baseline to Follow-up

ASI Subscale	AOS <i>n</i> =96		Paired t-test <i>t</i> (df), <i>p</i> -value	DDC <i>n</i> =42		Paired t-test <i>t</i> (df), <i>p</i> -value	DDE <i>n</i> =123		Paired t-test <i>t</i> (df), <i>p</i> -value
	Baseline	Follow-up		Baseline	Follow-up		Baseline	Follow-up	
Medical	.20 (±.26)	.18 (±.26)	1.103 (58),.275	.26 (±.30)	.15 (±.19)	1.935(26),.064	.27 (±.31)	.19 (±.24)	3.145(66), .002
Employment	.85 (±.22)	.88 (±.22)	-.554 (58), .582	.84 (±.25)	.89 (±.18)	-1.314(26), .200	.87 (±.21)	.90 (±.20)	-1.082(66), .283
Alcohol	.09 (±.15)	.04 (±.10)	2.633 (58),.011	.11 (±.15)	.05 (±.15)	2.098(26),.046	.08 (±.14)	.03 (±.08)	2.233(66),.029
Drug	.20 (±.12)	.10 (±.07)	5.837 (58),.000	.24 (±.13)	.12 (±.07)	4.776(26),.000	.22 (±.11)	.13 (±.08)	7.847(66),.000
Legal	.08 (±.16)	.05 (±.12)	2.294 (58),.025	.05 (±.14)	.05 (±.14)	.617(26),.543	.12 (±.18)	.08 (±.15)	3.325(66),.001
Family	.17 (±.17)	.11 (±.15)	3.595 (58),.001	.13 (±.14)	.12 (±.15)	1.103(26),.280	.24 (±.19)	.13 (±.16)	5.061(66),.000
Psychological	.20 (±.15)	.16 (±.13)	2.403 (58),.020	.23 (±.15)	.22 (±.16)	1.205(26),.239	.32 (±.18)	.22 (±.16)	3.526(66),.001

Note. AOS = Addiction Only Services; DDC = Dual Diagnosis Capable; DDE = Dual Diagnosis Enhanced.

There was also a general pattern of improvement across most subscales in the Addiction Only Services and Dual Diagnosis Enhanced groups. Significant improvements were made by patients in these two groups on the Alcohol, Drug, Legal, Family, and Psychological subscales, and those in the Dual Diagnosis Enhanced group also improved on the Medical subscale.

DISCUSSION

This study investigated the Second Edition revised version of the ASAM Criteria taxonomy for patients with substance use disorders and co-occurring psychiatric disorders. A total of 37% of patients received ASAM recommendations for Addiction Only Services, 16% for Dual Diagnosis Capable, and 47% for Dual Diagnosis Enhanced programs. This provides support for the

recommendations by the ASAM Software in this Norwegian sample. A total of 63% of patients were identified as needing dual diagnosis care, which is in line with prior research showing prevalence rates of co-occurring substance use and psychiatric disorder in the range of 32% to 65% (Bakken et al., 2005).

Baseline characteristics revealed significantly lower age and less work experience among Dual Diagnosis Enhanced patients compared to the Addiction Only Services and Dual Diagnosis Capable groups, as well as a trend toward a gender difference in the Dual Diagnosis Enhanced group, with more males compared to the two other groups. This finding is similar to another, which found that patients with co-occurring disorders were more likely to be males with younger age and less education (Kavanagh, Waghorn, Jenner et al., 2004).

Although the percentage of patients who reported having a psychiatric diagnosis was higher in the two groups receiving Dual Diagnosis service recommendations than in the Addiction Only Services group, the differences were not statistically significant. However, there were significant differences on history of inpatient and outpatient psychiatric treatment, indicating that the Dual Diagnosis Capable and Dual Diagnosis Enhanced groups, compared to the Addiction Only Services group, had higher levels of symptom severity and functional impairment. Similar differences were seen in patterns of psychiatric symptoms. While the ASAM Criteria are not designed to determine psychiatric diagnoses, they do assess patterns of symptoms that occur in several common psychiatric disorders. Patients in both Dual Diagnosis groups showed significantly higher symptoms of psychosis and PTSD than those in the Addiction Only Services group. All of these findings regarding various psychiatric measures are consistent with the

ASAM recommendations, and with our expectation that differences like this would be seen if the taxonomy of the ASAM Criteria had the ability to appropriately discriminate between patients.

Unlike previous research among patients with dual diagnosis (Angarita et al., 2007), we found no significant differences between groups on initiation of assigned treatment. This may be explained by a general increase in coordination between the clinics in this region as part of an overall effort to improve rates of treatment initiation. With regard to suicidality, prior research has found a higher proportion of suicide attempts among patients with co-occurring disorders (Darke et al., 2004; Bakken & Vaglum, 2007). While our data did not show statistically significant differences in suicidality, the patterns were in the expected direction. Patients in Dual Diagnosis Capable and Dual Diagnosis Enhanced groups showed higher rates of suicide attempts than those in Addiction Only Services, and there was a gradient from Addiction Only Services, to Dual Diagnosis Capable, to Dual Diagnosis Enhanced of increasing frequency of patients reporting suicide plans in the past 30 days.

Both groups of patients who were ASAM-recommended for co-occurring services (Dual Diagnosis Capable and Dual Diagnosis Enhanced) had roughly 4:1 ratios of patients who were assigned to inpatient versus outpatient treatment services, while the ratio among the Addiction Only Services group was 2:1. Although these differences were not statistically significant, the trend is consistent with the ASAM Criteria's intent to place individuals with more severe needs in more intensive treatment services. Prior research has shown better outcomes with this type of intensity and service integration matching to treat both disorders (Sharon et al., 2003; Magura et al., 2003; Brunette et al., 2004). Patients with more severe substance abuse, less social support,

or comorbid psychological disorders benefited more from initiating care with inpatient as opposed to outpatient treatment (Magura et al., 2003; Bartak et al., 2011).

There were no significant group differences on show for assigned treatment at follow-up. In previous research involving patients with dual diagnosis, only analyses designed to examine specific levels of match versus mis-match proved valid for demonstrating predictive validity (Angarita et al., 2007). The current study was not designed to test for follow-up differences and had three structural artifacts that would foster regression to the mean and undermine a predictive finding regarding co-occurring disorders: first, groups were not assigned to differing levels of co-occurring services; second, the Norwegian system provides a strong level of co-occurring services coordination for all programs in this region; and third, the higher ratio of routinely-assigned placements of co-occurring patients into Level III residential care meant that patients tended to get matched to what they needed – which would tend to promote good outcomes for all.

Convergent validity was supported by statistically significant differences across the three groups on several ASI subscale composite scores at baseline. The Dual Diagnosis Enhanced group had significantly higher severity scores than Dual Diagnosis Capable and Addiction Only Services on the Legal, Family, and Psychological subscales. This is in line with previous research with the earlier edition of the ASAM Criteria Software (Sharon et al., 2003) and with the present study's use of the newer ASAM Criteria, 2nd Edition-Revised and the comprehensive computerized implementation, the significant more severe means on three of the dimensions demonstrate some consistency in the ASAM Criteria Software's ability to make clinical distinctions among patients

with need for Dual Diagnosis programs. Furthermore, it makes clinical sense that there were significant baseline differences on the Psychological subscale scores between the three level of care groups, based on their association in prior literature (Lehman, Myers, Thompson & Corty, 1993), their relationships with legal problems (APA, 2000), the impact of family and social supports (Kashner, Rader, Rodell, Beck, Rodell & Muller, 1991).

Addiction Severity Index Composite Subscale scores at follow-up show that there are significantly more clinical improvements among the Addiction Only Services and Dual Diagnosis Enhanced group than for the Dual Diagnosis Capable group. One explanation might be that the Dual Diagnosis Capable group included older patients and more females than the both the other groups. This group also has a higher percentage reporting alcohol as main drug of choice, which could affect treatment outcome. Older patients might be more engaged in their treatment planning and decisions, but might also have more chronic disorders, more cognitive deficits from alcohol abuse that are more resistant to treatment. The Dual Diagnosis Capable group had significant more stays in psychiatric inpatient setting when counting three or more stays, suggesting higher instabilities and psychiatric severity prior to this treatment and that supports the chronicity notion and might be contributing to less improvements in this group at follow-up. Females, which are equally represented as the men in the Dual Diagnosis Capable have been found to have worse treatment outcome if they has additional disorders (Cohen et al., 2010.) Findings in their study suggest that a sub-group of women with co-occurring PTSD and substance use disorder who endorsed eating disorder symptoms responded differently to group treatment. There might be a chance that their cluster of disorder makes it more difficult to adjust treatment to fit their needs, and that there are a need for more specialized individualized program for patients experiencing a cluster of disorder that's affecting each other. It might also be caused

by patients being in such a stable state that their severity gets underestimated both by themselves and the assessment personnel. Issues regarding self-report measures on psychiatric symptoms from patients have been brought up, and Cole and colleagues (2008) found that patients are more likely to underestimate their psychiatric suffering thus creating a lower prevalence number than what the reality is. That can lead to less attention and treatment for co-occurring psychiatric disorders among this group and might explain the lack of significant reduction on dimensions in the Dual Diagnosis Capable group except for Alcohol and Drug scores which are reduced.

There are similar results among the Addiction Only Services and Dual Diagnosis Enhanced group on the Addiction Severity composite scores, both groups significantly reduced in severity scores on a majority of the dimensions, and had an increase in Employment score. The clinical improvements in both groups suggest that the services provided in this region have capability to deal with more acute and severe co-occurring disorders, and given the right intensity of treatment both groups can have successful outcomes. This is in line with prior research that shows better outcome with the right intensity and integration of services to treat both disorders (Sharon et al., 2003; Magura et al., 2003; Brunette et al., 2004). Patients with more severe substance abuse, less social support, or co-occurring psychological disorders benefit more from inpatient vs. outpatient treatment (Magura et al., 2003; Bartak et al., 2011). The rise in Employment severity scores, although not significant, suggests that employment needs might be a distal need and treatment focus compared to more proximal addiction and health priorities during the first three months.

Limitations and Strengths

The use of a naturalistic design has its drawbacks in determining group differences, especially when group sizes differ however, naturalistic designs do reflect the naturally-occurring treatment-seeking population, which can also be viewed as strength. In addition, the naturalistic design is vulnerable to uncontrolled extraneous influential variables across study cohorts. Subgroup analyses and between-group analyses might have been affected by small group sizes and differential age and gender distributions. Since this study lacked categorization of the levels of care and their co-occurring service capabilities, we could not determine if the results are a result of co-occurring needs being met. Patient self-report has been found to suffer from underestimation of psychological problems upon entering treatment, due to optimism in anticipation of treatment assignment and treatment expectancies (Rokkan & Brandtsberg-Dahl, 2003). Another limitation is that ASAM Criteria is not a psychiatric diagnostic tool – it only seeks to determine the least intensive and restrictive setting of care to manage the patient’s clinical needs. Therefore, an Addiction Only Service recommendation does not mean that there is no psychiatric diagnosis, but it cannot be used as a DSM diagnostic instrument for other psychiatric disorders than substance and alcohol use disorder. We can only look at symptom severity from patients’ response on anxiety, depression, appetite, sleep, and so on, so in a future study we need to include a Diagnostic instrument to compare it to ASAM and validate its placement to a greater extent for psychiatric assessment. However this is an assessment tool for placing individuals to levels of care and there are more questions in the ASAM that gather data to finalize the level of care recommendations. Patients might have less severe depression and

anxiety symptoms than a single category of "anxiety" and "depression" gives information on, and their scores on the other dimension might justify the recommendation made by ASAM.

It should also be noted that the Addiction Severity Index questions are embedded in the ASAM Criteria interview, and we use the ASI composite scores in the convergent validity analysis. The actuarial ASI composite scores are not used in the ASAM determination of level of care, however, as this employs a hierarchical decision rule logic. Thus, while worthy of mention, the danger of overlap is negligible.

Conclusion

If the ASAM Criteria Software is valid, it should be able to discriminate successfully between patients with similar alcohol, drug and medical severity but who have differing severity in psychiatric and related areas – and it should therefore recommend different programs for these types of patients. The group differences that were found in this study support the convergent validity of the ASAM taxonomy for co-occurring disorders and the Software's ability to identify patients in need of integrated program services. The prevalence of Dual Diagnosis recommendations by the revised edition of ASAM Criteria Software was fairly high in this region of Scandinavia; hence, effective treatment matching is essential for individual recovery and for regional public health. The improvement in ASI severity scores at follow-up in the Dual Diagnosis Enhanced group suggests that these patients can benefit from treatment, in similar ways as those without dual disorders, as long as their needs receive appropriate care. Future studies should investigate this further with larger and more diverse samples like individuals with mandated or court-ordered treatment for substance use disorder, recruit from mental health

clinics, prison programs, and aim for a full spectre of included levels of care from level I to level IV to control for other factors associated with less beneficial treatment results. It is also vital to include valid diagnostic assessment tools and clinical judgment on psychiatric diagnoses in future studies of the ASAM taxonomy for co-occurring disorder and validate patients' treatment outcomes using research designs including DD program categorised treatment services that are structured to test ASAM co-morbidity matching among these programs.

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