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Alcohol use disorder and fitness to drive: Discrepancies between health professionals' evaluations and objective measures of alcohol use and cognitive functioning

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Abstract

Aims: In this study, we investigated if health professionals' evaluations of driving ability corresponded with measures of severity of alcohol use and measures of cognitive functions necessary for safely driving a car. **Methods:** A total of 90 participants from a multicentre study were included. Participants were categorised into three groups: (1) the group judged fit to drive (FIT); (2) the group judged not fit to drive (UNFIT); and (3) the group who had lost their driver's licence due to legal sanctions (LEGAL). The participants' AUDIT scores, earlier treatment episodes and results from neuropsychological tests of reaction time, attention and visuospatial ability were included in the analyses. **Results:** We found a significant difference in the severity of alcohol use disorder (AUD) and visuospatial abilities between the FIT and UNFIT groups. Half of the UNFIT group had at least mild visuospatial difficulties, compared to only a quarter in the FIT group. There were no group differences in reaction time or attentional measures. The LEGAL

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group had more severe AUD than the other groups. **Conclusion:** The FIT group did not perform differently from the UNFIT group on attention and reaction time measures. The UNFIT group had more visuospatial impairments, but even half of this group had normal scores. It is uncertain whether the differences between the two groups are of practical significance. The quality of health professionals' evaluations may be questioned, and the results highlight the need for more reliable and valid criteria for doing fitness to drive evaluations.

Keywords
alcohol use disorder, clinical judgement, cognitive function, driving ability, fitness to drive, licence suspension

Health professionals in Norway are obliged to react when meeting patients with alcohol use disorder (AUD) who are not considered fit to drive by either temporarily suspending their driving privileges or reporting them to state authorities that can permanently revoke their right to drive for health reasons. The Norwegian health requirements for holding a driver's licence state that if a patient has an ICD-10 diagnosis (World Health Organization, 1994) of F10.1 Harmful use of alcohol or F10.2 Alcohol dependence, the criteria for fitness to drive might not be met (Helsedirektoratet, 2022). These regulations are similar in other Nordic countries (Kalsi et al., 2019; Styrelsen for patientsikkerhed, 2017; Tervo et al., 2016; Transportstyrelsen, 2010).

A survey among Norwegian physicians in general practice and the specialist health services concluded that they experienced evaluating fitness to drive in individuals with AUD as complicated (Brækhus et al., 2010). Physicians reported lacking knowledge and proper guidelines for doing these evaluations. Likewise, the American Psychiatric Association has noted that psychiatrists are not necessarily qualified to assess driving ability and, therefore, should not be held liable for the patient's driving accidents (Holoyda et al., 2018). Clinicians might find managing the tension between health- and treatment-related decisions and legal implications challenging. On the one hand, detecting who may pose a risk to themselves or fellow road users because of health problems is important. On the other hand, when learning that one's alcohol consumption may cause one to lose one's driver's licence, the patient may decide to discontinue treatment with the consequence of not receiving proper interventions. This may worsen the patient's condition and increase the risk of driving under the influence of alcohol (DUI) and road accidents.

Fitness to drive evaluations present health professionals with several dilemmas. For most people, driving is essential to daily life and gives access to the community, family and friends. Many patients feel insulted or threatened when their ability to drive is questioned, and driving cessation, or licence cancellation, may contribute to a variety of health problems, such as depression, social dysfunction, isolation and mortality (Chihuri et al., 2016; Kokkinakis et al., 2021). In addition, not being able to drive may be a major hindrance to rehabilitative efforts. Losing one's driver's licence may make travelling to and from work more difficult and affect the person's employment situation. This is of considerable importance for patients with AUD since unemployment is a risk factor for substance use (Henkel, 2011). This highlights the importance of thorough, valid and evidence-based evaluations of fitness to drive.

It is estimated that 50%–80% of patients with AUD have some degree of cognitive impairment, which may persist even after detoxification (Bernardin et al., 2014; Nixon & Lewis, 2019; Stavro et al., 2013). Executive

functions, attention, visuospatial ability and memory are the neuropsychological functions most commonly affected in patients with AUD (Bernardin et al., 2014; Domínguez-Salas et al., 2016; Stavro et al., 2013), but a clear relationship between dose of alcohol and impairment has not been firmly established (Ros-Cucurull et al., 2018; Westermeyer et al., 2021; Woods et al., 2016). Hence, we are not in a position to predict which patients are at risk for developing severe chronic cognitive impairments, as many patients will recover when abstaining from drinking (Le Berre et al., 2017). There is growing evidence for neuroplasticity and recovery of cognitive impairment with abstinence (Manning et al., 2017), but some persons will be impaired for a year or more after they quit drinking (Crowe et al., 2020; Stavro et al., 2013).

The purpose of evaluating whether patients with AUD are fit to drive is to prevent individuals who experience severe health conditions or conduct disorders due to alcohol from driving and to limit driving under the influence (DUI) and dangerous driving. It is firmly established that driving while intoxicated affects cognitive functions and increases the risk of accidents (Babor et al., 2022; Garrisson et al., 2021). DUI is an offence that leads to fines, prison sentences and the withdrawal of the driving licence when caught by the police. However, the role of health professionals is not to impose legal sanctions on patients or predict future offences but to evaluate their present medical and psychological state and use this information to decide if the patient can safely drive a car. Thus, health professionals should base their evaluations on reliable and valid prognostic factors, as it is well-documented that clinical judgements often are inferior to statistical predictions (Ægisdóttir et al., 2006). Making accurate predictions of future behaviour has proven difficult, as examples from suicide prevention and violence and recidivism risk assessments have shown (Belsher et al., 2019; Franklin et al., 2017; Helmus et al., 2012; Yang et al., 2010). Past behaviour may be the best predictor of future behaviour (Ouellette & Wood, 1998), and a Finnish study found that the only predictor for new episodes of DUI was former convictions (Mettovaara et al., 2006). However, most patients with AUD have never been convicted of DUI; consequently, clinicians can rarely employ this criterion in fitness to drive evaluations.

The Norwegian health regulations are less explicit about why an individual diagnosed with AUD may not be fit to drive when not under the direct influence of alcohol (Helsedirektoratet, 2022). Besides severe somatic conditions and the use of certain prescription drugs, which clearly impair driving ability, clinicians lack good criteria for fitness to drive evaluations. A literature search reveals no studies directly examining the relationship between the cognitive function and driving ability of patients with AUD when not intoxicated. Complicating the matter further, in clinical practice, it is not uncommon to meet drivers with AUD who claim that they never drive while intoxicated and that they take great care to ensure that they are sober before using their car (for an example from the media, see Sirum-Eikre, 2021). Nonetheless, the quantity of alcohol consumed, the severity of AUD and prolonged cognitive deficits due to alcohol use are, in our experience, often cited by health professionals as the main reasons why individuals with AUD should not drive (see also Mjølstad, 2022). Some may also evaluate the patient as not fit to drive as a preventive measure, as the patient may develop a severe condition in the future (Wahl, 2018). For some time, the national health regulations concerning fitness to drive have been criticised for being ambiguous, despite revisions (Brækhus et al., 2010; Schanke et al., 2010; Wahl, 2018). The guidelines may be interpreted to suggest that patients with AUD experience cognitive deficits, even when they are not under the influence of alcohol, and the contention of a cognitive deficit seems to underlie the notion that they are unsafe drivers. If the rationale behind driving restrictions or licence cancellation for patients with AUD is that they do not master the cognitive abilities required to drive, clinicians should be doing

fitness to drive evaluations based on accurate criteria.

In this study, we compare measures of the relevant cognitive functions among patients with AUD evaluated as fit to drive, patients with AUD evaluated as not fit to drive and patients with AUD who had lost their driver's licence due to legal sanctions to examine if health professionals' unstructured evaluations of driving ability accomplish to differentiate between these groups. To our knowledge, this is the first study of its kind in Norway.

Materials and methods

Study characteristics and participants

Participants included 90 individuals from a Norwegian multicentre study on patient factors predictive of outcomes in AUD treatment. Participants were aged 18 years or older (age range 23–69 years). All patients were diagnosed in the clinic with alcohol dependence or harmful use according to the ICD-10 (WHO, 1994) and were in treatment for AUD. In Norway, a diagnosis of F10.x is required to access specialist AUD treatment services. Diagnoses were confirmed in the study with the Mini International Neuropsychiatric Interview (MINI). A participants' number of earlier treatment episodes is considered a measure of AUD severity and was extracted from the medical journals. One participant was excluded from the study because of a driver's licence cancellation for medical reasons unrelated to AUD.

All participants provided written informed consent. No medical or other risks for the patients were identified. All patients signed a written consent before data were collected in the original study. The study was approved by the Regional Ethics Committee (REK-number 125666) and the local data protection officers at the different study sites.

Driver's licence status

Information about driver's licence status was extracted from medical journals. All patients in the study had been evaluated for fitness to drive by their general practitioner or at substance use disorder outpatient or inpatient clinic. These evaluations are usually unstructured, and no specific test material is used. In addition, a portion of the patients had had their licences cancelled for legal reasons. Based on these evaluations, patients were grouped into three categories: (1) patients judged fit to drive by health professionals (termed FIT); (2) patients judged not fit to drive by health professionals (termed UNFIT); and (3) patients who had their driver's licence revoked by legal authorities, mainly DUI (termed LEGAL).

Measures

Alcohol use disorder identification test (AUDIT). All participants completed the AUDIT at intake. The AUDIT is a validated screening test (Babor et al., 2001; Saunders et al., 1993; WHO, 2001) and is currently the most widely used instrument to identify hazardous or harmful drinking internationally (Babor & Robaina, 2016). It is commonly used to screen for AUD (Lange et al., 2019) and is recommended by the Norwegian Health Directorate as a screening instrument in assessing patients with substance use disorder (SUD) (Helsedirektoratet, 2017). As a result, the AUDIT is routinely employed in clinical practice in specialist health services in Norway. There is evidence that the AUDIT is a sensitive instrument in assessing the severity of alcohol dependence in clinical settings, extending its utility beyond its original use as a brief screening tool (Donovan et al., 2006). The AUDIT is also frequently used as an outcome measure in alcohol intervention trials (e.g., Sundström et al., 2016). Thus, the AUDIT should provide a reasonably accurate index of a person's AUD severity.

The AUDIT consists of 10 questions, yielding a score in the range of 0–40, addressing different areas: consumption, dependence and alcohol-related problems. A score of 0–7 indicates low-risk drinking or abstinence, 8–15 indicates medium-risk alcohol problems, 16–19

indicates high risk and a score of 20–40 points indicates a very high risk of alcohol problems. The Norwegian version is used in the current study. AUDIT scores were missing for four participants.

Neuropsychological tests. The participants underwent a 1-h session of neuropsychological assessment as part of the original study with tests from The Wechsler Adult Intelligence Scale-IV (WAIS-IV) (Wechsler, 2008) and the Delis-Kaplan Executive Function System (D-KEFS) (Delis et al., 2001).

The WAIS-IV is designed to assess a range of cognitive abilities (both verbal and non-verbal) in persons aged 16–90 years and is a widely used test battery among European psychologists (Evers et al., 2012). It consists of 10 core subtests and five supplemental tests with Scandinavian norms. Raw scores are converted into standardised, age-corrected scores. Sub-test scaled scores have a mean of 10; one standard deviation (SD) is a three-point increment or decrease in scaled scores.

The D-KEFS battery evaluates executive functions (higher-level thinking and cognitive flexibility) in children and adults (Delis et al., 2001). It is a comprehensive battery consisting of nine individual tests. Each test is designed to be a separate measure of executive functioning and can be administered individually. The test has been adapted for use in Norway, with American norms. As in the WAIS-IV, raw scores are converted into age-corrected scaled scores, with a mean of 10 and a SD of 3. D-KEFS is the most frequently used test battery among Nordic neuropsychologists (Egeland et al., 2016).

The main cognitive functions required to drive a car safely are as follows: (1) set-shifting; 2) processing speed; and (3) visuospatial abilities (Apolinario et al., 2009; Egeto et al., 2019; Roy & Molnar, 2013). This study used the following subtests to examine the relevant cognitive domains. The Trail making test (TMT) from D-KEFS conditions 2 and 3 are tests of mental processing speed. The TMT condition 4 examines cognitive flexibility and divided attention. The Color word interference test (CWT) from D-KEFS conditions 1 and 2 (colour naming and word reading) are tests of mental processing speed. Block design from WAIS-IV is a visuo-constructive test measuring visuospatial abilities.

Set-shifting was measured using TMT condition 4. TMT 4 scores were missing for one participant. A composite measure was constructed for processing speed from TMT condition 1 and 2 scores and CWT conditions 1 and 2. Data were missing for two participants on the processing speed measure. Visuospatial abilities were measured with Block design. Data were missing for two participants on this measure.

Regarding test procedures, patients in the study were not assessed if they were intoxicated or displaying obvious symptoms of abstinence. If under the influence of alcohol or other substances, they were scheduled for a later appointment. The tests relevant to the present study will be described below.

Statistical analysis

All statistical analyses were performed using SPSS software (v. 29 for Windows; IBM Corp., Armonk, NY, USA). We gathered descriptive statistics for demographic data, and used the Student's t-test to assess differences in continuous variables and the chi-square for categorical variables. To examine the effects of each of the measures between the three groups, we performed a univariate analysis of variance (ANOVA). As we were primarily interested in the potential differences between the FIT and UNFIT groups but included the LEGAL group for comprehensiveness, we had to avoid committing type 2 errors (concluding no difference) simply because of the statistical method. Thus, we chose to use the least significance difference (LSD*)* post-hoc test to assess group differences. Missing data for the different measures are reported in the methods section. Analyses were performed for each measure separately.

Results

Sample characteristics

The sample consisted of 34% women and 66% men (age range = 23–69 years; mean age = 51 years (SD 10.9). Participants did not differ significantly regarding marital status, level of education and source of income (Table 1).

Table 1. Demographics.

	FIT group (n = 33)	UNFIT group (n = 44)	LEGAL group (n = 13)
Age (years)	47.6 (SD 10.7)	54.2 (SD 11.0)	48.7 (SD 8.5)
Men	21 (64)	28 (64)	10 (77)
Women	12 (36)	16 (36)	3 (23)

Note. Values are given as n (%) or mean (SD).
SD = standard deviation.

Severity of alcohol use

Mean scores, SD and group comparisons on AUDIT, treatment episodes and cognitive functions are summarised in Table 2.

The ANOVA revealed a significant between-group difference in the severity of alcohol use $F(2, 86)$ 4,883, $p = .010$. Post hoc comparisons using the LSD test indicated that the FIT group differed significantly from the UNFIT and LEGAL groups. The UNFIT group had a higher mean AUDIT score (M = 22.4) than the FIT group (M = 18.1).

The ANOVA did not reveal a significant difference between the number of treatment episodes. However, the post hoc comparison detected a significant difference between the FIT and the UNFIT groups: the UNFIT group had a greater number of earlier treatment episodes (M = 5.9) compared to the FIT group (M = 2.6).

Neuropsychological tests

All neuropsychological test results in Table 2 are presented as scaled scores. The mean score for visuospatial ability in the UNFIT group was 7.6. Approximately 20% of healthy individuals would score below that level. The remaining results are in the range of 8.3–9.9, characterised as low average to average scores (Lezak, 2012).

Table 2 shows that the groups differed significantly regarding visuospatial ability. Post hoc tests revealed that this difference was between the FIT and UNFIT groups. Neither set-shifting nor processing speed differed between any groups. Of the people in the UNFIT group, 52% had a scaled score of 7 or below, indicating a mild impairment. The equivalent numbers for the FIT and LEGAL groups were 22.6% and 7.7%, respectively. Pairwise Pearson chi-square analyses showed that the difference between the UNFIT group and the two other groups was significant ($p = .010$ and 0.004, respectively). The equivalent numbers for the UNFIT, FIT and LEGAL groups were 41%, 25% and 39% for set-shifting, and 37.5%, 19.2% and 30.8% for processing speed. The latter two comparisons showed no significant differences.

Discussion

The present work examines a much-debated topic: fitness to drive evaluations of patients with AUD to expand on the knowledge of how to make reliable and valid driving evaluations of patients with AUD. The main result is that two out of three cognitive measures did not differ between those judged fit to drive and those not. The third measure differing between the groups did indicate a mild impairment in only half of those judged unfit to drive.

The FIT and UNFIT groups differed on alcohol consumption levels and alcohol-related problems, but the FIT group also had a high risk of alcohol-related problems. The clinical implications of the statistically significant difference may be trivial, as it is not plausible that the difference between high and very high alcohol consumption makes a clear distinction regarding driving ability. The number of earlier

Table 2. Group comparisons and mean scores for AUD severity and cognitive functions.

	FIT group (n = 33)	UNFIT group (n = 44)	LEGAL group (n = 13)	F	p	η^2	Post hoc[a]
AUDIT	18.1 (SD 10.5)	22.4 (SD 8.7)	27.1 (SD 6.1)	4.883	.010[b]	.105	1 < 2 < 3
Treatment episode	2.6 (SD 3.2)	5.9 (SD 7.4)	4.5 (SD 3.2)	2.970	.057	.069	1&3 < 2
Set shifting	8.6 (3.6)	7.5 (3.7)	8.2 (3.7)	.772	.465	.018	
Speed	9.0 (2.1)	8.3 (2.6)	9.1 (2.4)	.929	.399	.021	
Visuospatial	9.9 (5.6)	7.6 (1.7)	8.9 (1.4)	3.988	.022[b]	.086	1&3 > 2

Note. AUD = alcohol use disorder; SD = standard deviation.
[a]LSD post hoc test. [b]Significant at the .05 level.

treatment episodes also discriminated between the FIT and UNFIT groups. Treatment episodes can be interpreted as an indirect measure of AUD severity. With an increased number of treatment episodes, clinicians may be prone to judge the patient as a "chronic" case and, therefore, evaluate driving abilities in a negative way. However, severity and chronicity may not be valid criteria in the decision-making process on their own because no clear dose-response relationship between the quantity of alcohol and cognitive dysfunction is established (Ros-Cucurull et al., 2018; Woods et al., 2016). Patients also differ in premorbid cognitive functioning and cognitive reserve. Some individuals will handle a large amount of alcohol without experiencing many consequences, while others may only tolerate a small amount and experience dysfunctions early on (Høiland & Egeland, 2022; Requena-Ocaña et al., 2021).

The LEGAL group had an even higher AUDIT score than the other groups. In line with earlier research, this indicates that more severe alcohol-related problems are a risk factor for DUI (Dawson et al., 2008; McCutcheon et al., 2009; Robertson et al., 2019). Health professionals may argue that chronic, heavy drinking impairs the patient's health and, thus, driving ability. On the other hand, claiming that heavy drinking is a risk factor for committing offences is a more problematic line of reasoning.

Clinical judgements should ideally correspond with findings on the TMT 4 measuring set-shifting/divided attention, but they did not. Similarly, our composite measure examining speed and reaction time did not produce a significant difference between the groups. In both groups, several individuals had low scores (1–2 SD under the mean), equivalent to moderate to severe difficulties in that area.

The UNFIT group had more difficulties on the visuospatial task, and taken at face value, this may indicate more visual difficulties when driving a car. Nevertheless, half of the UNFIT group had normal scores on visuospatial functioning, which implies no reason to prohibit them from driving. Moreover, when applying this criterion, almost one-quarter of the FIT group also had at least a small visuospatial impairment. Clinical judgements without the aid of objective test measures run the risk of overlooking impaired patients while considering normally functioning patients as impaired.

Excessive alcohol use is a risk factor for various somatic conditions and diseases, but these are probabilistic risk factors (Rehm et al., 2017). Health professionals cannot readily predict that their patients will develop a specific disease in the future. Moreover, if a condition is presumed to impair driving ability, the clinician should outline the underlying mechanisms and the practical consequences for driving ability are clearly specified in the evaluation. Furthermore, if a disease condition makes the patient unfit for driving, the disease will usually affect the cognitive functions discussed in this article. If health professionals in the present study evaluated patients based on disease criteria, we would have expected this to show on test results.

There is also a worry that individuals with AUD do not seek or discontinue treatment prematurely because they fear losing their driver's licence. One of the main concerns in the debate on fitness to drive evaluations is that health professionals take on the role of police officers, while their focus should be on the patient's health condition. This is a legitimate concern, as only a tiny proportion of those struggling with AUD seek treatment, and fear of stigmatisation is one of the main reasons (Keyes et al., 2010; Ray et al., 2019). Delayed treatment seeking may worsen the patient's condition and lead to long-term adverse health outcomes (Chapman et al., 2015). However, the number of patients who discontinue treatment because of conflicts concerning licence suspension is an empirical question and should be investigated further.

To our knowledge, there is no evidence on the real-world effect of clinicians doing fitness to drive evaluations in primary or specialist health services: we do not know whether or how these evaluations affect road safety, accidents and DUIs. A lot of research has investigated the ability to drive in patients with stroke, emerging dementia or traumatic brain injury (Rike et al., 2018) but not in those with AUD or SUD. Literature reviews show that neuropsychological tests can be helpful in assessing fitness to drive and generally recommend tests similar to the ones applied in the present study (Wolfe & Lehockey, 2016) but emphasise the risk of false positives (Smedslund et al., 2015). It has long been established that human factors are the main contributor to accidents (Elander et al., 1993). However, earlier studies have shown that resources invested in DUI evaluations were not worth the effort because predicting new episodes of DUI was difficult, with prognostic accuracy at chance level (Mettovaara et al., 2006). With limited healthcare resources available, it is time to question whether health professionals should invest time and resources in doing evaluations that obviously lack empirical backing and have uncertain prognostic utility.

Nonetheless, as long as the health regulations state that these evaluations should be performed, we recommend that clinicians consider the following advice. Unstructured evaluations should be avoided in most cases. Tests examining mental processing speed, set-shifting, divided attention and visuospatial abilities should be used more than today. Scores on self-report measures like AUDIT or consumption thresholds should not alone form the basis of whether a patient is fit to drive. Consumption-based thresholds lack sensitivity and specificity for predicting negative consequences related to drinking (Pearson et al., 2016; Tucker et al., 2020). Similarly, clinicians are advised never to use biomarkers like PEth-tests (phosphatidylethanol) as the sole measure when making decisions about driving ability (Dyrkorn et al., 2019). It is essential that health professionals also consider that a large range of functioning is accepted when it comes to driving ability. While cognitive status is typically assessed relative to the patient's age group, driving fitness must be assessed based on raw scores with cut-offs indicating impaired driving competence. As speed and set-shifting capacity decline with age (Deary et al., 2009), results deviating from norms among 20-year-olds may still be within accepted limits for driving. With more objective and transparent criteria, patients with AUD may experience fitness to drive evaluations as safer and more meaningful.

Limitations

When drivers' licences are suspended for non-cognitive reasons, such as epilepsy, we cannot expect that tests of cognitive function differ between drivers and non-drivers. The exact details for suspending the drivers' licences are not known for all participants in this study. However, to our knowledge, the patients in the UNFIT group had driving restrictions because of AUD. Only one patient was excluded because the driver's licence was revoked for other medical reasons.

Ideally, we should have compared the dichotomous fit to drive or not-classification

of individuals to an equivalent cognitive classification. However, the tests we use have the relevant design and tasks for evaluating fitness to drive but are not included in test batteries with established cut-offs for driving ability.

There is also a lack of consensus on when patients with AUD should be assessed with neuropsychological tests after abstinence (Oscar-Berman & Marinkovic, 2007; Svanberg et al., 2014). However, the timing of testing depends on what one wishes to examine regarding the patient's cognitive functioning. The test results in this study reflect the actual functioning of the patients, which are important regarding fitness to drive and enhance the ecological validity of the results.

Conclusion

In the present study, we found few significant differences when comparing a group of patients with AUD judged fit to drive and a group judged not fit to drive on objective measures of processing speed, attention, cognitive flexibility, visuospatial ability and severity of AUD. No differences were detected in set-shifting ability and processing speed or reaction time. Our findings suggest clinicians do not use valid criteria when evaluating patients with AUD. Role clarification is important – health professionals should not act as police or other judiciary authorities but base their decisions on current medical conditions. There is a need for operationalised criteria for fitness to drive evaluations in specialist health services and the use of tests to determine the patient's functional level.

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