Abstract: Cognitive impairment is one factor known to affect people's ability to participate in substance misuse treatment because of the range of cognitive, behavioural and emotional problems such impairment can cause. Some of the behaviours described as common features of cognitive impairment, such as impaired self-monitoring and self-regulation and lack of initiative are seen in some treatment modalities to be causes and consequences of addiction thereby prescribing a moral rationale to behaviour that may have a physical cause. The aim of this study was to identify the prevalence of cognitive impairment in a rural Australian substance treatment in-patient population. The Addenbrook’s Cognitive Examination - Revised (ACE-R) was used to screen consenting patients (n = 50). Six (12%) scores were less than or equal to 82 (moderate to severe cognitive impairment), and 20 (40%) were less than or equal to 88 (mild to moderate cognitive impairment). Statistical techniques were used to determine if cognitive impairment was related to different demographic variables. The tests showed that cognitive impairment was not related to age or gender, weakly related to level of education and strongly related to Indigenous status. For example, 82% of Indigenous clients had a score indicating possible impairment, compared to 28% for non-Indigenous. A significant number of people attending in-patient drug and alcohol treatment have some form of cognitive impairment that may affect their ability to participate in the treatment. Indigenous people in rural substance treatment services appear highly likely to have some cognitive impairment. However, further work is required to ensure the screening tool is appropriate for use with Indigenous Australians. Substance misuse treatment providers need to ensure treatment programmes are suitable for people with cognition problems.

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The prevalence of cognitive impairment in a rural in-patient substance treatment program: Identifying complex needs

Abstract

Cognitive impairment is one factor known to affect people’s ability to participate in substance treatment because of the range of cognitive, behavioural and emotional problems such impairment can cause. Some of the behaviours described as common features of cognitive impairment such as poor self-monitoring and self-regulation and dependence/lack of initiative are seen in some treatment modalities to be causes and consequences of addiction thereby prescribing a moral rationale to behaviour that may have a physical cause.

The aim of this study was to identify the prevalence of cognitive impairment in a rural Australian substance treatment in-patient population. The Addenbrook’s Cognitive Examination – Revised (ACE-R) was used to screen consenting patients (n=50). Six (12%) scores were less than or equal to 82 (moderate to severe cognitive impairment), and 20 (40%) were less than or equal to 88 (mild cognitive impairment).

Several statistical techniques were used to determine if cognitive impairment was related to the demographic variables. The tests showed that cognitive impairment was not related to age or gender, weakly related to level of education and strongly related to indigenous status. For example, 82% of Indigenous clients had a score indicating possible impairment, compared to 28% for non-Indigenous.

A significant number of people attending in-patient drug and alcohol treatment have some form of cognitive impairment that will affect their ability to participate in treatment. Substance treatment providers need to ensure treatment programs are suitable for people with cognition problems.
The prevalence of cognitive impairment in a rural in-patient substance treatment program: Identifying complex needs

Substance treatment combines medical and psycho-social elements to support people to reduce or cease their substance use. Individuals tend to come to treatment settings when substance use has some type of negative consequences to their health and well being (Klag, Creed & O’Callaghan 2006). However, that does not mean they come willingly but may be directed by courts, employers or family members who recognise the problematic nature of the individual’s substance use (Wild, Roberts & Cooper 2002). Typically, people in substance treatment have multiple problems that can be both the cause of, and caused by, their substance use; and are more likely to have been in jail or other institutional settings than those without substance problems (Baldry, Dowse, Clarence and Snoyman 2010). Growing recognition of the range of problems many substance users face has led treatment providers to look at the context of treatment to ascertain if it is accessible and appropriate for everyone (e.g. Wild 2006; Meyers & Smith 1997). Cognitive impairment is one factor known to affect people’s ability to participate in treatment because of the range of cognitive, behavioural and emotional problems such impairment can cause (Hensold et al, 2006).

Cognitive impairment (CI) is an umbrella term used here to refer to the impacts of acquired or traumatic brain injury (ABI), intellectual disability or Fetal Alcohol Spectrum Disorder (FASD). While each of these conditions can vary in severity and impact, they have similar broad effects on cognition (Tucker, Vuchinich & Pukish, 1995). Cognitive impairment is a hidden disability which, for example, affects encounters with people in their surroundings, and can lead to difficulties in relations and contacts with society (Strandberg, 2009). The effects of CI are not always visibly obvious (AIHW, 2007); it affects intangible processes like thinking and behaviour (Langan-Fox, Grant & Anglim, 2007). Often the person may have no physical impairment, but lack insight into their own needs and behaviour. Consequently, they do not look like they need help and do not think that they need any help, so often they may not get any help (Mantell, 2010).

A high prevalence of substance use problems has been identified in cognitively impaired people. For example among people with intellectual disability, medical issues such as a compromised tolerance to drugs, a tendency for self-medication and over-medication has been identified (McGillivray & Moore, 2001). A study of adults with Fetal Alcohol
Syndrome (FAS) or FASD found a life span prevalence 50% for confinement (in detention, jail, prison or psychiatric or alcohol/drug inpatient treatment) and 35% for alcohol and drug problems (Caley, Kramer & Robinson, 2005). Cognitive impairment can be acquired via a traumatic brain injury. Alcohol use is a frequent contributing factor in head trauma and a disproportionate number of individuals with alcohol use disorders report a history of head trauma (Bates, Bowden & Barry, 2002). Heavy and prolonged alcohol use can result in alcohol related cognitive impairment that has a slow rather than a sudden onset but with similar results to ABI (Bates, Bowden & Barry, 2002).

Individuals with some form of cognitive impairment will typically experience one or more of the following: attentional dysfunction, dependence/lack of initiative, difficulty executing novel activities, memory impairment or loss, poor organisational and planning skill, poor self-monitoring and self-regulation and an inability to benefit from experience (Langan-Fox, Grant & Anglim, 2007). Further, those with some form of cognitive impairment have been found to experience poor concentration, depression, emotional instability, irritability, impulsive or inappropriate behaviour and reduced ability to problem solve and inflexible thinking (Australian Institute of Health and welfare [AIHW], 2007). These factors indicate that people with CI are likely to experience difficulty engaging with and participating in substance treatment that is predominantly based around cognitive and behavioural activities. Further, some of the behaviours described as common features of CI such as poor self-monitoring and self-regulation and dependence/lack of initiative are seen in some treatment modalities to be causes and consequences of addiction thereby prescribing a moral rationale to behaviour that may have a physical cause (Hensold et al 2006; Goddard 2003).

A study examining appropriate substance treatment for people with cognitive impairment found that ideally a significant part of any intervention would take place in an inpatient facility to maximise the client's ability to learn and retain new information (Degenhardt & Hall, 2000). A further study suggests people with comorbid cognitive impairment and substance use disorders will require extended length of substance treatment as well as specific interventions to address the emotional and behavioural deficits the impairment causes (Sacks et al 2009). However, a staff survey conducted in July 2011 in a rural NSW substance treatment agency found that employees had little or no knowledge about the characteristics of CI, could not easily identify CI in patients and did not perceive CI to be common in those they were working with. A substantial component of the treatment program in both facilities was psycho-educational groups providing information and discussion about,
for example, drug impacts and relapse prevention. These groups used written material and educational techniques likely to be inappropriate for people with CI. As part of a quality improvement program it was decided to identify the prevalence of CI among patients accessing the agency’s inpatient programs to find out if there was a need to adapt usual treatment to better meet cognitively impaired patients needs.

**Method**

The Addenbrook’s Cognitive Examination – Revised (ACE-R) was chosen as a screening instrument after consultation with neuropsychologists because of the screen’s ability to identify mild cognitive impairment affecting memory, attention/orientation, verbal fluency, language and visuo-spatial ability (Mioshi et al 2006). The ACE-R surveys key aspects of cognition without requiring specialised test equipment or specialist professionals to administer it. The ACE-R tests the five areas of cognitive function using simple tasks rather than relying on self-report of memory and brain functioning (Mioshi et al 2006). The screen takes about 20 minutes to administer and score and a version adapted for use in Australia was used (ACE-R-AUS, 2004).

**Ethics**

The study was approved by Charles Sturt University Human Research Ethics Committee (no.2011/129)

**Settings**

Two in-patient substance treatment units in rural NSW

**Participants and sampling**

All patients in the two participating units were invited to participate in the study by the project worker. Participation was voluntary. The project worker made an appointment with patients interested in participating in the project. At the screening appointment potential participants were given a copy of the information sheet, read the information contained within it and given the opportunity to ask questions. Potential risks and distress from the screening tool were described and discussed. These risks related primarily to the possibility of distress from identifying cognitive impairment. The project worker was experienced in supporting distressed people and counselling staff in each facility were available to discuss follow-up and referrals with study participants. Potential participants were asked if they
consented to the screening tool being administered and if so were asked to sign the consent form.

Data collection

The screening tool was administered to consenting participants, the tool scored and the results reported to participants. The results of the screening tool were recorded in an excel spreadsheet. Each participant was identified by their medical record number. Fifty patients were screened with the ACE-R between 21 September 2011 and 25 January 2012. The screen consists of 5 components (maximum score for each component in brackets): Attention and Orientation (18), Memory (26), Fluency (14), Language (26) and Visuospatial (16). Summing these 5 components gives a total of 100. Scores at or below the cut-off of 88 are assessed as having a mild cognitive impairment. Scores at or below 82 are assessed as having a moderate to severe cognitive impairment (Mioshi et al 2006).

In addition to the ACE-R scores, some demographic information was recorded: gender, age, Indigenous status and level of education. The level of education was written down as the highest education level achieved by the client. For the purposes of analysis, this was converted into effective number of full time years in education. In the tables below, level of education is written to reflect school year in order to make it easier to read. For example, a value of 10 corresponds to year 10. A value of 11 corresponds to either year 11 or year 10 + 1 year study in TAFE or other post school study. Level of education was recorded for only 45 clients, thus the other 5 records were excluded when analysing level of education.

Data analysis

Only 6 of the 50 clients had an ACE-R score at or below 82 which indicates a very high likelihood of cognitive impairment (for example, in the study reported in Mioshi et al 2006 there was 100% likelihood of cognitive impairment). This sample size of only 6 gives little power to find significant results. Therefore, analysis was performed both directly on the ACE-R scores as well as the proportion of clients with an ACE-R score at or below 88.

The total ACE-R scores for the 50 clients were skewed to lower values and thus not normal. Similarly, the levels of education were not normal. Thus non-parametric tests (as opposed to tests based on normality) were preferred to do the analysis.
Firstly, a multivariate technique was used to analyse all variables simultaneously. Namely, backwards stepwise logistic regression (Manly 2005, section 8.10) was used to determine if the proportion of clients could be predicted from the demographic variables: gender, age, Indigenous status and level of education. This was performed using PASW Statistics 17 (formerly called SPSS).

Multivariate techniques can be difficult to understand; therefore tests on the individual variables were also performed to better communicate the results. These tests were done using TIBCO Spotfire S+ 8.2.

Analysis of the ACE-R total scores was performed by using Wilcoxon rank-sum tests (Kanji 1999, test 52) to compare the median score for the qualitative variables (Indigenous status and gender) and a Kendall rank correlation test (Kanji 1999, test 59) for the quantitative variables (age and effective years of education).

Analysis of the proportions at or below the 88 threshold was performed by using Fisher’s exact tests (Kanji 1999, test 39) for the qualitative variables (Indigenous status and gender) and Wilcoxon rank-sum tests (Kanji 1999, test 52) for the quantitative variables (age and effective years of education).

Results

A histogram of the total scores appears below. The median total score was 90. For the total score for the 50 clients, 6 (12%, 95% CI [5.0%, 25.0%]) were less than or equal to 82 (moderate to severe cognitive impairment), and 20 (40%, 95% CI [26.7%, 54.8%]) were less than or equal to 88 (mild cognitive impairment). [In the histogram, scores on the boundary of a bar are placed in the bar on the left automatically by the S+ software package.]
Backwards stepwise logistic regression (starting with variables gender, age, Indigenous status and level of education) showed that the proportion of clients with a total score less than or equal to 88 was related to Indigenous status (change in log likelihood if removing the variable: $X^2 = 8.684$, df = 1, $p = 0.03$). Gender and age were not significant. At this cut-off, level of education was also not significant. However, using lower cut-offs, the level of education was significant (for example, level of education is significant using a cut-off of 87; $X^2 = 4.821$, df = 1, $p = 0.028$). This indicates that both Indigenous status and level of education require further investigation.

It would have been preferable to analyse the total ACE-R scores directly. So another multivariate technique was attempted (multiple linear regression). However, the assumption of homogeneity was not tenable and so the analysis could not be used.

*Age and Gender*
All tests showed that the total ACE-R score and level of cognitive impairment were not related to age or gender.

Table 1: Summary of results for indigenous status and level of education.

<table>
<thead>
<tr>
<th></th>
<th>Total ACE-R</th>
<th>Mild Impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>median</td>
<td>count (% of row)</td>
</tr>
<tr>
<td>All</td>
<td>90</td>
<td>20 (40%)</td>
</tr>
<tr>
<td>Indigenous Status</td>
<td>p=0.0067</td>
<td>30 (60%)</td>
</tr>
<tr>
<td>Indigenous</td>
<td>84</td>
<td>9 (82%)</td>
</tr>
<tr>
<td>Non-Indigenous</td>
<td>91</td>
<td>11 (28%)</td>
</tr>
<tr>
<td>Level of Education</td>
<td>0.465</td>
<td>10 (10%)</td>
</tr>
</tbody>
</table>

**Indigenous Status**

The median test score for Indigenous clients was lower than non-Indigenous clients \((Z = -2.7113, p = 0.0067)\) (see Table 1) and there is a higher proportion of Indigenous clients with a score at or below 88 (82% of Indigenous clients had a score indicating possible impairment, compared to 28% for non-Indigenous) \((p = 0.0036)\). Figure 2 demonstrates these differences graphically.
Level of Education

There is a significant correlation between test score and effective years of education (Pearson’s correlation coefficient: $r = 0.465$, Kendall’s rank correlation: $\tau = 0.344$, $p = 0.002$). This shows that education level is related to the test score. The correlation is not strong though, so the median education level of those tests equal or less than the 88 cut-off and the median education level for those above the 88 cut-off were both equivalent to year 10. If a lower cut-off is used, there is a significant difference in medians (for example, with a cut-off of 87 there is a difference of one year: $Z = 2.0809$, $p = 0.0374$). Figure 3 reveals what is happening. Above the cut-off of 88, there is large variability in levels of education and there appears to be no relationship. However, as scores drop below the cut-off (that is, less than or equal to 87), the variability and median level of education drop.

\[ \text{Figure 2: Box plots of total ACE-R score separated by indigenous status. The dashed line corresponds to the cut-off of 88.} \]
To show that the relationship between cognitive impairment and Indigenous status is not simply because of some underlying connection between Indigenous status and education level, a Wilcoxon rank-sum test was used to test for an underlying connection. The test found no significant differences in the median education level between Indigenous and non-Indigenous clients (both medians were equivalent to year 10) ($Z = -0.5165$, p-value = 0.6055).

**Indigenous status vs Level of Education**

To show that the relationship between cognitive impairment and Indigenous status is not simply because of some underlying connection between Indigenous status and education level, a Wilcoxon rank-sum test was used to test for an underlying connection. The test found no significant differences in the median education level between Indigenous and non-Indigenous clients (both medians were equivalent to year 10) ($Z = -0.5165$, p-value = 0.6055).

**Figure 3: Total ACE-R vs Education Level.** The dashed line corresponds to the cut-off of 88.
Discussion

The results of the ACE-R screening found that 40% of those screened were likely to have some form of cognitive impairment and 12% of study participants were very likely to have a serious cognitive impairment. This is a significant finding for the delivery of psycho-social drug and alcohol treatment as around half of the treatment population will experience difficulty understanding, remembering and applying information about drug and alcohol misuse to their own situation (Sacks et al 2009). Further, it is likely that this same group of people will experience barriers to participating in the daily routines of residential treatment and complying with directions from staff (Hensold et al 2006; Mantell 2010).

It is not surprising that level of education and cognitive impairment are related. Individuals with some cognitive impairment while younger are naturally less likely to complete school and other forms of education. One warning though, individuals who did not complete much education might score lower on the ACE-R test due to their level of education rather than cognitive impairment. The test involves reading, writing and simple arithmetic for example.

Figure 4: Education levels for non-indigenous and indigenous clients.
However, all clients in this survey did have at least year 7 level of education so this is unlikely for this group.

In Figure 3 above, higher scores on the ACE-R test appeared independent of level of education. However for lower scores there was a noticeable connection to level of education. Visually, the points in Figure 3 are all in the top left triangle. This observation is consistent with greater cognitive impairment acting as a barrier to completing education (with the sloped side of the triangle roughly indicating the barrier).

Indigenous study participants were much more likely to record a score indicative of cognitive impairment than non-Indigenous study participants. The ACE-R has not been validated for use in Australian Indigenous populations and it may be necessary to make cultural adaptations to the test components. Further research is required to follow-up these results both in terms of cultural appropriateness of the ACE-R and the high proportion of scores below the 88 cut-off.

Age and gender were not found to be significant in identifying cognitive impairment via the ACE-R. This is an important finding for drug and alcohol treatment providers because they cannot assume who is most likely to experience impairment. Women and younger people are just as likely to have problems with cognition as older men. Similarly level of education cannot be used to infer cognitive ability.

**Limitations**

There were only a small number of clients with severe cognitive impairment. Thus generalisations about more severe cognitive impairment cannot be done using this sample, rather only cognitive impairment in general.

**Conclusion**

A significant number of people attending in-patient drug and alcohol treatment have some form of cognitive impairment that will affect their ability to participate in treatment. Substance treatment providers need to ensure treatment programs are suitable for people with cognition problems.
Reference list


