1.0 INTRODUCTION

Alcohol misuse is a major public health concern in South Africa today. It is a major contributory factor to high homicide rates, and high injury rates from assault and vehicular accidents, with resultant personal suffering and economic loss (1,2,3). Globally, cannabis is the most widely used illicit drug, with an estimated 144 million users (4). In Africa, where early reports of its use date back to the 11th century in Egypt (5), cannabis constitutes the main drug of abuse (6).

In the workplace, substance misuse is associated with illness, decreased concentration, occupational accidents, increased health service utilisation, decreased productivity, and increased costs (7,8,9). In the mining industry, a potentially dangerous environment where concentration and coordination are of paramount importance, this risk is likely to be significant. However, despite the fact that South Africa is one of the major mining countries in the world, there is hardly any data on alcohol and cannabis use among its mineworkers.

1.1 Prevalence of Substance Use in the Workforce

1.1.1 Prevalence of alcohol use in the workforce

In the 2003 South African Demographic and Health survey (SADHS), the prevalence of alcohol dependence according to the CAGE criteria (section 1.4.1.1) among those who had ever used alcohol (current and ex-users) was found to be 21% among adult males and 7% among adult females (10). In the workforce, substance use has been

found to vary across occupational categories. In a 1991 national household survey on drug abuse carried out by the United States National Institute on Drug Abuse, higher rates of substance use were reported among employees in lower category occupations such as construction workers compared to professionals (11).

According to a 1997 review by Van der Linde which evaluated the cost of alcohol abuse at a Free State mine in South Africa, alcohol is thought to be the most common substance in the mining industry (7). In a study done by Kew in a South African gold mine in 1992, 32% of the study population, the majority of which were in unskilled or semiskilled occupations, were found to be highly likely to be dependent on alcohol using the CAGE questionnaire (section 1.4.1.1) (12). In a study of 107 high altitude miners carried out by Schinder & Ruder in Argentina between 1976 & 1977, 34% were found to be weekly alcohol drinkers (13). In a 2003 national survey on drug use and health done by the United States (U.S.) Substance Abuse and Mental Health Services Administration, the prevalence of heavy alcohol use among full-time employees in various occupations was found to be 8.6% (14).

1.1.2 Prevalence of cannabis use in the workforce

In 1990, Osterloh and Becker (15) reviewed workplace drug testing in the United States, including that of Lund and Preusser in which 3% of 500 randomly selected practising physicians in New England State surveyed between 1984 to 1985 reported a history of drug dependence (16), and the 1988 study of tractor-trailer drivers in a truck weighing station in the U.S., in which 15% of the 317 randomly selected participants tested positive for cannabinoids in either blood or urine (17). In this

review, Osterloh & Becker reported cannabis as the most common drug detected. In 2001, Verstraete & Pierce reviewed workplace testing in Europe including the United Kingdom (U.K) and reported that urine testing was often performed on-site by occupational physicians with cannabis also being the most common drug detected (18). In a review carried out by George of the results of 1617 urine samples from 82 sources in the U.K submitted to the laboratory for workplace drug testing using immunoassay and confirmatory Gas Chromatography/Mass Spectrometry tests (GC/MS), the latter of which is the gold standard for cannabis testing, 11.6% of urine samples were found to be positive for cannabis (19). In a national survey carried out by the Substance Abuse and Mental Services Administration in the U.S. in 2005, the prevalence of self-reported current illicit drug use (including cannabis) was 8.2% among full-time workers and 10.4% among of part-time workers (20).

1.1.3 Prevalence of workplace accident-related substance use

In a study of trauma patients by Tibbs et al between 1995 & 1996 in a large mine hospital in Welkom, South Africa, (where the national legal blood alcohol limit for professional drivers is 0.02g/100ml or 0.10mg/1000ml of breath and that of non-professional drivers is 0.05g/100ml or 0.24mg/1000ml of breath), blood alcohol concentration (BAC) was found to be over 0.08g/100ml in 5% of cases of occupational injuries (21). In a study carried out by Buchanan in a Zambian copper mine between 1980 & 1985, alcohol tests were positive in 30% of accident cases, with 6% having blood alcohol levels exceeding 17.7mmol/l (i.e. 0.08g/100ml) (22).

In a review of workplace fatalities including that of the mining industry carried out by Alleyne, Stuart & Copes from 1979 to 1986 in Alberta, Canada, 4.3% had blood alcohol levels greater than 0.08g/100ml, the legal limit for driving a car in Alberta, and urine was positive for cannabinoids, the natural metabolite of cannabis, in 8.5% of cases (8).

1.2 Factors Associated With Substance Use

Historically, practices in the mining and agriculture industries such as the *"dop"* system, migrant labour system, availability of cheap or free alcohol, and availability of alcohol on credit, may have contributed to increased alcohol use in the South African workforce. The *"dop"* system, officially prohibited in 1961, entails payment of workers with alcohol *in lieu* of wages (23,24). Cannabis is inexpensive, easy to procure, criminal prosecution for possession is infrequently enforced, and its use is perceived by many as not being problematic (4). These factors may facilitate its use.

Stressful conditions may encourage substance use as a coping mechanism (24). In the mining industry, miners often live in virtual isolation in on-site single-sex hostels where they are away from their families for prolonged periods. In the study by Kew et al among mineworkers in a gold mine in South Africa, loneliness, boredom, and stress were reported as the main reasons for unhealthy alcohol consumption (12). In the Argentinean study mentioned before where 34% of high altitude miners were found to be weekly alcohol drinkers, 65% of respondents were found to chew coca leaves daily, and higher rates of alcohol use and daily use of coca were reported among miners with a heavy workload and those who have only ever worked underground

compared to those who work aboveground (13). In a study carried out by San Jose et al in 2002 among the general population in the Netherlands, drinkers who reported high levels of hazardous working conditions and high levels of demands at work were more likely to be heavy drinkers than light to moderate drinkers (25).

Increased substance use has been reported in those employed in low job categories and those with low levels of education. In a study carried out by Yach & Joubert in 1988, in Mamre, Western Cape, South Africa, alcohol was reported to be a problem in 32% of households in which the head was an unskilled manual worker, compared to 9.1% of households in which the head was a professional or a white-collar worker (26). In the study among workers in a gold mine in South Africa, alcohol misuse was also found to be more common among employees in unskilled or semiskilled occupations (12). In the study among miners in Argentina, alcohol use was found to be more common among drillers and cart-pushers (13). In the studies among employees in various occupations in the US, heavy alcohol use and illicit drug use have been found to be more common among those with less than a high school education (14,20), and those in lower job categories, such as construction workers (12.4%) and labourers (14.7%), compared to professionals (4.4%) (11).

1.3 Effects of Substance Use

1.3.1 Effects of alcohol use

Alcohol has a depressant effect on the central nervous system (27). Delayed effects of acute alcohol intoxication include interference with hand-eye coordination, precision

in manipulation, and object-positioning tasks; and decrease in concentration, reaction time and decision-making ability (27,28,29). These factors can account for the increased risk of human error, work-related accidents (30,31,32), and road traffic accidents (33,34,35,36), that have been reported in those who misuse alcohol.

Increased absenteeism, tardiness, and sick leave, which can lead to decreased productivity, have been found to be higher among workers who use alcohol excessively (27,28,37). Alcohol misuse can lead to increased cost (due to sickness, absence, re-training and loss of expertise) (27), and labour relations problems from arguments (38). It can also lead to increased stress and workload for co-workers (27,39), and an unhealthy work climate where colleagues enable alcohol users when they cover up for them to avoid confrontation or conflict (40,41,42). Alcohol misuse is also associated with social problems like violence (43), and can predispose to conditions such as hypertension, gastritis, liver cirrhosis, gout, tuberculosis, physical dependence, and depression (44).

1.3.2 Effects of cannabis use

Cannabis is usually smoked but less frequently may be ingested. When smoked, it is rapidly absorbed from the lungs into the blood with quick onset of effects (45,46). When ingested however, onset is slower but effects more prolonged (45).

Cannabis has anxiolytic properties with acute effects resulting in feelings of euphoria and relaxation (47). It also has sedative properties and leads to impairment of cognitive and psychomotor performance due to short-term memory loss, impairment

of attention, difficulty in concentrating on complex tasks, loss of coordination, and slow reaction time (47,48,49). Cannabis can impair driving performance and has been linked with road traffic accidents (47,50,51). Regular cannabis use is also associated with impaired occupational functioning (48), which can influence safety in the workplace.

Chronic effects of cannabis use include psychological dependence characterised by deterioration in psychosocial functioning; subtle cognitive deficits, particularly attention, learning, and executive functioning (organising and integrating of information); and possible triggering of the onset of schizophrenia (48,52). Long term use also carries increased risk of respiratory (53) and cardiovascular diseases (47).

1.4 Screening Tools for Substance Use

1.4.1 Screening tools for alcohol misuse

Screening for alcohol misuse can be carried out using questionnaires, breath analysis, and laboratory blood tests.

1.4.1.1 Questionnaires for alcohol misuse screening

Validated screening tools, such as the Alcohol Use Disorder Identification Test (AUDIT), the brief Michigan Alcohol Screening Test (MAST), and the CAGE (see

acronym below) questionnaire (54,55,56,57), can assist in screening individuals who require further assessment for alcohol dependence.

The brief MAST is an abbreviated version of the original 25-item MAST published by Selzer in 1971, and like the AUDIT, it is also a 10-item questionnaire (57). The CAGE questionnaire developed by Ewing and Rouse in 1970 comprises of four questions and is easier to administer (2). The acronym 'CAGE' was derived from key words in the questionnaire:

- Have you ever felt you ought to **C**ut down on your drinking?
- Have people **A**nnoyed you by criticising your drinking?
- Have you ever felt bad or **G**uilty about your drinking?
- Have you ever had a drink first thing in the morning to steady your nerves and get rid of a hangover? (**E**ye-opener)

Two or three positive responses in this questionnaire are highly suggestive of alcohol abuse and possible dependence, while four positive responses are virtually diagnostic (2).

1.4.1.2 Tests of acute alcohol intoxication

Acute intoxication with alcohol can be evaluated by testing the level of alcohol in blood, or in the breath using a breathalyser (58). On ingestion, alcohol is rapidly absorbed from the upper gastrointestinal tract (59). Peak concentrations of ethanol are attained approximately one hour after ingestion and factors influencing levels attained

include the rate at which the drink was taken, whether it was consumed with food, rate of gastric emptying, and body habitus (59). Between 2% to 10% is eliminated in urine and breath (59).

There is no industry-legislated limit for breath or blood alcohol in the South African mining industry although some mines have adopted their own limits, including the South African legal driving limit for non-professional drivers of 0.24mg/1000ml of breath or 0.05g/100ml of blood, and that of professional drivers which is more stringent at 0.10mg/1000ml of breath or 0.02g/100ml of blood (60).

1.4.1.3 Laboratory tests for chronic alcohol misuse

Although laboratory abnormalities of mean corpuscular volume (MCV), aspartate aminotransferase (AST), alanine aminotransferase (ALT), gamma glutamyl transferase (GGT), and uric acid may suggest chronic alcohol use, they are non-specific indicators of liver impairment and can also be raised in other conditions. For example, a raised GGT can occur in chronic hepatitis (27,61). Of these tests, the GGT is the more sensitive indicator. However, findings of blood tests cannot be taken in isolation and thorough assessment and accurate clinical judgment is required (27). Newer and more specific tests for biomarkers of sustained and harmful alcohol consumption, such as Percentage Carbohydrate-Deficient Transferrin Turbidimetric Immunoassay (% CDT TIA) and Early Detection of Alcohol Consumption (EDAC) Test, are emerging (27,57).

1.4.2 Screening tools for cannabis use

The natural metabolites of cannabis (cannabinoids), of which the most potent is delta-9-Tetra-Hydro-Ccannabinol (THC), are found in blood, bile, faeces, and urine (47,48). It may be detected in urine within hours of exposure (62). These metabolites being fat soluble, are stored in the body's fatty tissues including the brain, for prolonged periods after use (45,62). It may be detected in urine up to 6 days after single use and up to a month in chronic users depending on the frequency and intensity of use (15,63). Its presence in urine therefore, does not always signify recent exposure.

Qualitative screening for cannabinoids in urine can be carried out using commercially available rapid tests and laboratory tests, with varying levels of reported sensitivity and specificity (64). However, confirmatory laboratory tests, which can also quantify the amount of cannabinoids in the urine exist, the preferred method being the Gas Chromatography/Mass Spectrometry (GC/MS) method (63). Rapid on-site screening tests are generally cheaper than laboratory tests and can be done as soon as samples are collected with immediate results. Laboratories on the other hand may be located far away from the point of sample collection, especially in mine settings, and adherence to careful storage techniques is required in order to preserve the integrity of results.

1.5 Measures for Control of Substance Use in the Workplace

In South Africa, aspects of legislation refer to safety of mine employees in general, with some making specific reference to substance use. According to the Mine Health and Safety Act of 1996, an employer must provide conditions for safe operation, and every employee must take reasonable care to protect their own health and safety, and that of other workers who may be affected by an act of omission on their part (65). It also states that no persons in a state of intoxication, or in a state likely to render him incapable of caring for himself or others in his charge, will be allowed to enter a mine. This is also stipulated in Regulation 4.7.1 of the Minerals Act of 1991 (66).

However, there are no clear guidelines for implementation of these regulations and the level of interpretation of this responsibility varies from mine to mine, from those without clear guidelines to address substance use, and those with draft policies, to those with existing policies. Where policies exist, they describe the mine regulations in terms of substance use, under what circumstances testing will be carried out (including post-accident), how it will be carried out, and how results will be dealt with.

The Occupational Alcohol Programme (OAP) of the 1970s was one of the earliest attempts at addressing alcohol misuse in the workplace (9). This has been replaced in recent times by Employee Assistance Programmes (EAP) which are broader based and aim at addressing all personal problems that are affecting, or that have a potential to affect, an employee (9).

Some guidelines exist on how to develop a workplace substance policy. One such guide in Australia addresses issues such as health promotion programmes, disciplinary procedures, EAP, and employee testing (67). In 1995, the International Labour Organisation (ILO) adopted a code of practice on the management of alcohol and drug related issues in the workplace (68). This code emphasises a preventive approach and embraces the following principles:

- Joint assessment by employers, workers and their representatives, of the effects of drug use on the workplace and their cooperation in developing a written policy for the workplace.
- Consideration of alcohol and drug related problems as health problems, and a need to deal with them without discrimination, like any other problem in the workplace.
- Recommendation that drug and alcohol policies should cover all aspects of prevention, reduction, and management of alcohol and drug related problems; and integration of relevant information, education and training programmes where feasible, into broad-based human resources development, working conditions, or occupational safety and health programmes.
- Establishment of ethical principles which are vital to concerted and effective action, such as confidentiality of personal information, and the authority of the employer to discipline workers for employment-related misconduct, even where it is associated with the use of alcohol and drugs.

- Consideration of fundamental legal, ethical, and moral issues involved in testing body fluids for alcohol and drugs and determination of when it is fair and appropriate to carry out such testing.

Buy-in of stakeholders is however of utmost importance if any control programme is to succeed.

1.6 Motivation for This Study

Studies conducted to evaluate substance use in the workplace are restricted by concerns for individual rights and fears of jeopardising labour relations (8), making it challenging to design studies which statistically link substances and accidents in the workplace. However, evaluating the prevalence of alcohol and cannabis use among mineworkers in South Africa and factors which influence its use will help in the development of recommendations to improve health and safety. This is of importance to the mining industry because of both the public health implications and the impact on productivity and finances. Using Australian models by Hocking et al where costs of substance use among the Australian workforce estimated at two billion dollars per year between 1991 to 1992 were calculated using tables of aetiological fractions, which statistically attribute a proportion of an illness to alcohol or smoking (69), Van Der Linde in 1997 estimated treatment costs for alcohol-related illnesses in the South Africa mining industry at over R 28 billion per year per 100,000 employees (7).

This study aims to test the following hypothesis:

- Social factors, some related to the South African system of migrant labour, contribute significantly to the use of alcohol and cannabis in South African mines.

In testing this hypothesis, this study will help to provide evidence on which health intervention strategies can be based. Given the dearth of information on alcohol and cannabis use among mineworkers, this study will also help to identify key issues that would need further enquiry in the future.

1.7 Study Aim & Objectives

1.7.1 Overall aim

To determine the prevalence of alcohol and cannabis use, and factors which influence its use among mineworkers in South Africa.

1.7.2 Specific objectives

- To determine the prevalence of alcohol and cannabis use at selected mines.
- To determine the prevalence of accident-related positive alcohol and cannabis tests in these mines.

- To evaluate the relationship between accidents, and alcohol and cannabis use in these mines.
- To determine the knowledge, attitudes, and practice regarding alcohol and cannabis use among miners, and its relationship to health and safety.
- To determine factors which influence alcohol and cannabis use.
- To make recommendations based on the findings of the study.

2.0 METHODOLOGY

This section describes the methodology of this study. Section 2.1 describes the study design, while section 2.2 gives background information on study mines. Sections 2.3, 2.4, and 2.5 describe the methodology of the different aspects of this study (structured interviews, focus group discussions, and record review of accidents respectively), while section 2.6 describes the limitations of the study.

2.1 Study Design

This is a cross sectional analytic study with qualitative and quantitative methodologies. It was carried out in two phases. Structured interviews were carried out during the first phase while focus group discussions and a record review of substance tests related to accident and medical surveillance were carried out in a second phase.

2.2 Study Population

Eleven mines from the major commodity groups mined in South Africa (platinum, diamond, gold, coal, and ‘other‘) were randomly selected to participate in this study. These included three platinum mines, three gold mines, two diamond mines, two collieries, and one granite mine. Of these eleven mines, four declined participation, while seven mines (i.e. two platinum mines, two gold mines, one diamond mine, one colliery, and one granite mine) agreed to participate in the study. There were no

apparent differences between these mines and those which declined participation. Although these mines did not officially state their reasons for declining participation, their reasons may have been related to concerns about anonymity and job security of participants as this study involved alcohol and cannabis tests. These concerns were addressed during meetings with stakeholders (section 2.3.5.1).

2.2.1 Background information on study mines

The Mine Health and Safety Act of 1996 (65) and the Minerals Act of 1991 (66) (section 1.5) guide substance use control in mines. Table 2.1 summarises background information on participating mines at the onset of this study (2002). In order to ensure confidentiality of information obtained from this study, individual names of mines have been coded, and their geographical locations are not described.

While mines G2, D1 & C1 had official substance use policy documents which also addressed issues such as post-accident & medical surveillance-related substance tests (sections 6.1 & 6.2), mine P1 had a draft policy, while mines P2, G1 & O1 had broad informal codes of conduct where the mine reserved the right to carry out tests on employees suspected to be under the influence of substances. In mines P1 & C1, voluntary pre-shift tests are available for employees who suspect they are intoxicated.

As there is no industry legislated limit for alcohol levels, several mines have adopted limits varying from the legal limit for non-professional drivers of 0.24mg/1000ml of breath or 0.05g/100ml of blood, and the legal limit for professional drivers of 0.10mg/1000ml of breath or 0.02g/100ml of blood (60), to zero tolerance of any

levels of alcohol. Employee assistance programmes (EAP) are available for rehabilitation of those with substance use problems in mines P1, G2 & D1. In mine P2, employees with chronic substance misuse problems may be considered for rehabilitation. Substance use at study mines may also lead to disciplinary action.

Table 2.1: Summary of background information on study mines

Background information		**Mine**						
		P1	**P2**	**G1**	**G2**	**D1**	**C1**	**O1**
When commissioned		1992	1989	1996	1952	1992	1980	1996
Underground (UG) or opencast (OC)		OC	UG	OC	UG	OC	UG	OC
Employee size		1500	7543	500	5568	886	860	656
Type of employee lodging		No hostels All live in private lodgings in nearby towns	Hostels & Private lodgings in nearby towns	No hostels All live in private lodgings in nearby towns	Hostels & private lodgings in nearby towns	No hostels All live in private lodgings in nearby towns	Hostels & private lodgings in nearby towns	No hostels All live in private lodgings in nearby towns
[a]Policy	**[b]A**	Draft policy	Code of conduct	Code of conduct	Policy document	Policy document	Policy document	Code of conduct
	[c]B	0.02 (blood)	0.24 (breath)	0.24 (breath)	0.24 (breath)	0.05 (blood)	0.00 (breath or blood)	0.02 (blood)

[a]*Substance use policy*
[b]*Type of substance use document*
[c]*Breath alcohol (mg/1000ml) or blood alcohol (g/100ml) limit. 0.24mg/1000ml of breath=0.05g/100ml of blood, 0.02g/100ml of blood=0.10mg/1000ml of breath*

2.3 Structured Interviews

2.3.1 Sampling

2.3.1.1 Sample size calculation

The sample size for each of the five commodity categories (i.e. platinum, gold, diamond, coal, and other) was calculated as 385 by assuming 50% prevalence of substance use, 95% precision, and 5% margin of error (Appendix A). An additional 20% of 385 (i.e. 77) was added in case of refusals from the study, bringing the sample size per commodity to 462 (i.e. 385+77). Half of this sample size (i.e. 231) was allotted to the one mine in the 'other' category bringing the total sample size of all the mines in the five commodities to 2079 [i.e. (462 X 4) + 231].

The sample size of 2079 was proportionately distributed between the eleven mines in the five commodity groups that had previously been selected to participate in the study, according to their employee population at the time of the study (2002). Although all eleven mines had been included in the initial sample size calculation, four mines eventually declined participation after data collection had begun at some sites in the same commodity category, bringing the sample size to 1698 (table 2.2).

Table 2.2: Summary of sample size of study mines

Mine	Total
P1	110
P2	229
G1	114
G2	424
D1	320
C1	270
O1	231
Total	1698

2.3.1.2 Selection of subjects

A systematic sampling method was utilised. A register of all contract and full-time employees was obtained from each mine. Where possible, employees were grouped together according to job category and workstation/work-shift, which facilitated simultaneous access to employees in the same work area. Every n^{th} employee was selected using a factor that was determined by dividing the total employee size of each mine (table 2.1) by the estimated sample size (table 2.2). This n^{th} factor was 14 for mine P1, 33 for mine P2, 4 for mine G1, 13 for mine G2, and 3 for mines D1, C1, and O1.

2.3.1.3 Inclusion/exclusion criteria & replacement technique

Employees selected by systematic sampling were included in the study. Where an employee was unwilling to participate, the next name immediately below this on the employee register was selected. All categories of employees, including contract workers and management staff, were eligible to participate in the study.

2.3.2 Instruments of measurement

These included a questionnaire, breathalyser for alcohol tests and urine tests for cannabis.

2.3.2.1 Questionnaire

Face-to-face structured interviews were carried out using a questionnaire (Appendix E) which helped to determine the prevalence of alcohol and cannabis use among miners as well as their knowledge and practices regarding substance use, and their perception of its health and safety risks. It was structured to eliminate biases as far as possible. Quality and consistency were achieved through keeping the questions mainly closed and simple.

Questionnaires were administered by a team of interviewers all of whom had at least a matric qualification, with some having a post-matric qualification and previous research experience. These interviewers participated in a three-day training programme carried out by the principal researcher and other members of the research team. The objective of this programme was to train interviewers on how to obtain consent from participants, how to conduct interviews professionally and ethically, how to instruct participants to collect urine and breath samples, and how to label and store urine samples. Mock interviews were carried out to facilitate familiarity with the data collection tools (Appendices C to G) and assess participants' performance.

Questionnaires were translated from English to the local languages in the field by these interviewers who were well versed in various languages and were able to understand the nuances in the different languages. Where necessary, colloquial terms were used to replace technical terms, for example, *"dagga"*, *"pache"* and *"labake"* were used to replace cannabis.

2.3.2.2 Breathalyser tests for alcohol

Breath alcohol was assessed with the Alcatest 7410 plus RS breathalyser, the calibration of which had been verified against another breathalyser (Alcatest 7110) certified by the Council for Scientific and Industrial Research (CSIR), and the South African Bureau of Standards (SABS). This device uses disposable mouthpieces with one-way valves such that air breathed into the instrument can only flow into the breathalyser and cannot be inhaled by participants, thus preventing transmission of infection.

To avoid legal or ethical implications, where interviewers might be faced with the dilemma of allowing miners with excess breath alcohol levels to commence their work-shifts, the reading on the breathalyser screen was permanently set on a "pass" mode (i.e. normal breath alcohol level). Actual breath alcohol levels were not reflected on the monitor, therefore participants and interviewers were unaware of results at the time of the test. Actual results were automatically stored in the instrument and downloaded onto a computer after the interviews.

2.3.2.3 Urine cannabis tests

In order to determine the qualitative method for testing study samples for Tetra-Hydro-Cannabinol (THC), the most potent metabolite of cannabis, comparison was made between a rapid test kit which provided immediate results on-site, and a laboratory test which was more expensive and required careful storage techniques (section 2.3.4.3). Eighty urine samples were tested using both an on-site rapid test-kit, and the Roche Cobas Integra laboratory test (table 2.3).

Table 2.3: Rapid cannabis test results by Cobas Integra test results

	Cobas-Positive	**Cobas-Negative**	**Total**
Rapid test-positive	17 (true positives: a)	2 (false positives: b)	19
Rapid test-negative	4 (false negatives: c)	57 (true negatives: d)	61
Total	21	59	80

Sensitivity of rapid test (a/a + c)=81% , specificity (d/b + d)= 97%, positive predictive value (a/a + b)=89.5%, negative predictive value (d/c + d)=93%..

Results of gas chromatography, the gold standard test for THC, carried out on false positive and false negative samples were in agreement with the Cobas test. The Cobas test was therefore chosen for this study, while the rapid test method was discontinued.

2.3.3 Pilot study

A pilot study was carried out in mine P1 among eleven employees not included in the main study, to pre-test the data collection tools and methods (section 2.3.2). This helped to assess understanding of the questionnaire. It also helped to evaluate some of the logistic difficulties in accessing employees, and highlighted the importance of obtaining detailed information about factors such as the shift system, before accessing participants (section 2.3.4.1).

2.3.4 Data collection

Planning for data collection was carried out over several weeks before data collection commenced at each mine. The major processes involved in the planning and implementation of data collection at study mines have been developed into a model that can assist future researchers planning similar studies (Appendix B).

Although all aspects of data collection (structured interviews, urine & breath sampling) were to be done pre-shift but without disruption of mine activities, this was not always possible due to time constraints. As considerable amount of time was needed to reassure participants about anonymity, and alcohol can be metabolised in the body within hours while cannabis may still be detectable up to a month after use, consent and breath samples were sometimes obtained pre-shift, while structured interviews and urine sampling were done during the shift, and in some instances, post-shift.

Data collection for this phase of the study was carried out between March and October 2002. Data collection was carried out sequentially in all mines. The average data collection period per mine was 5 days.

2.3.4.1 Accessing of participants

The research team arrived early before each shift to meet officials in charge of the shift and set up data collection posts at pre-arranged locations. In order to prevent modification of substance use patterns, selected employees were not informed

beforehand or requested to arrive early before the shift on the day of data collection. Information about the following was important in facilitating access to employees in different shifts.

Shift pattern: This involves shift timings (in some mines, the morning shift commenced around 3.45am and the night shift commenced around 10pm), number of shifts per 24-hour cycle, availability of rest cycle shift, shift overlaps, types of shift system (i.e. permanent shifts or rotating shifts) and rotation schedule.

Type of employee transportation & arrival time: In mines where employees arrived at the mine in buses at scheduled times before the shift, considerable numbers of selected employees were accessible at the same time for the study, provided their transportation arrived early.

Presence or absence of electronic access gates: At surface and underground mines where electronic access gates were available, workers were accessed by 'parade' technique. This implies that prior to the commencement of the shift, selected employees' names were flagged on the mine computer system such that they were unable to automatically gain access into the mine when they clocked in for duty. These employees then contacted mine officials controlling access into the mine who referred them to the research team where they were invited to participate in the study. However, at surface mines where no electronic access gates were available, employees were accessed shortly before their shifts at their workstations.

Location of workstation (underground or surface): As underground workers had a strict schedule for being transported underground, good time management was important in facilitating adequate pre-shift access following the 'parade'. Unlike underground workers, surface workers (including surface workers in underground mines such as administrative staff, and those in surface mines) whose breath samples had been taken pre-shift were still accessible during the shift for structured interviews and urine sampling.

Timing of blasts in shafts: An incidental finding at some mines during the data collection period was that commencement of the shift was delayed following blasting operations and this facilitated extended pre-shift access to participants.

2.3.4.2 Administration of questionnaire

Questionnaires were administered by trained research assistants well versed in local languages. To facilitate the data collection process, research assistants were each given a pamphlet highlighting salient points in the process (Appendix C). The purpose of the study was carefully explained to participants and written informed consent (Appendix D) was obtained before interviews commenced. Anonymity was preserved by excluding participants' names on questionnaires, and keeping information obtained confidential. Participants were reassured that specimens obtained would only be tested for alcohol and cannabis.

2.3.4.3 Collection of urine samples

On completion of the structured interviews, participants were instructed to collect the first portion of their urine stream (in which THC is most likely to be detected if present) into sample bottles. On-site, urine samples were stored in cooler boxes in which the temperature was maintained below 4°C for no longer than 48 hours, after which they were stored in a frozen state in a freezer while they awaited analysis. This was to ensure that should THC be present in any urine sample, it remained biochemically stable till analysis at the laboratory.

2.3.4.4 Breathalyser tests

A mini questionnaire (Appendix F) to determine if participants had recently used other substances containing alcohol (such as cough syrups and mouth sprays) which could give false positive breathalyser tests was completed. Where the history of use of these substances was positive, an appropriate waiting time was observed. Breathalyser tests were then done using disposable mouthpieces. Results were stored in the breathalyser and downloaded after each session of data collection.

On completion of data collection, all participants irrespective of their reported substance use status were given an information sheet of facilities near each mine which provide information about substance use and assistance regarding quitting (Appendix G).

2.3.5 Challenges encountered

2.3.5.1 Lengthy consultation process

A lengthy consultation process of several months led to delayed commencement of data collection due to concerns of employees about issues such as how participants would be randomly selected to prevent targeting of certain employee groups; if all employee groups including management would be eligible to participate; how anonymity would be ensured; concerns about job security should employees test positive for substances; and fears that samples obtained may be tested for Human Immunodeficiency Virus (HIV). These issues were addressed during several meetings with stakeholders including union groups (at national and mine levels) who were reassured that all employees groups would be eligible to participate and that participants would be randomly selected. They were also reassured that anonymity would be preserved with no consequences for participants, and that samples would not be tested for HIV.

2.3.5.2 Logistics of accessing employees

The process of determining the essential information necessary to facilitate access to participants (section 2.3.4.1) and effectively coordinating this information to access them pre-shift for data collection was a major challenge. 'Parading' of employees at underground mines which was a practical way of accessing underground workers pre-shift was not a foolproof method as some employees did not respond despite several

attempts, and there was no other means of contacting them at the time, unlike surface workers who could be accessed at their workstations.

2.3.5.3 Unavailability of urine sample at time of interview

Though some employees had initially consented to participate in the study and provide urine and breath samples, on completion of structured interviews, twenty-nine of the 1571 study participants (i.e. 1.8%) said they did not feel like passing urine at the time of the interview and still claimed they were unable to do so even after further visits by the research team to their workstations during the data collection period.

2.3.6 Facilitating factors

2.3.6.1 Cooperation of stakeholders

This was key to winning the trust of employees. Several meetings including presentations were scheduled with stakeholders at different mines (i.e. union groups and management) to discuss the project and address concerns (section 2.3.5.1). The natural hierarchy of employee representatives was respected and early buy-in of Union officials was obtained at the national, regional, and mine levels respectively. Some of the Union officials at mine level joined the research team during the data collection period, while others made their union offices available for use for conducting interviews, giving the team credibility with participants.

Assistance of management through introduction to relevant personnel and, in some cases, allocation of an employee known and trusted by workers to chaperone the team during the data collection period, also facilitated the process.

2.3.6.2 Masking of results on breathalyser screen

The breathalyser screen did not reflect actual results (section 2.3.2.2) at the time of the test and allayed some of participants' fears about confidentiality.

2.3.6.3 Non-invasive nature of requested tests

Participants were relieved that tests were painless and that samples did not include blood (or saliva) which they felt could be tested for HIV without their knowledge.

2.3.6.4 Experience gained by research team from mine to mine

The data collection process became more efficient from mine to mine with experience gained from each mine, in areas such as the most relevant background information required about work shifts to facilitate accessing of participants (section 2.3.4.1).

2.3.7 Quality assurance

2.3.7.1 Breathalyser tests

The following factors helped in quality assurance of breathalyser tests:

High repeatability of tests: The Alkatest 7410 plus RS breathalyser (section 2.3.2.2) analyses only 1cc of breath per test (irrespective of the amount of air that is blown into the mouthpiece) and has high repeatability of tests.

Timely breathalyser calibration: Due to the heavy use of the breathalyser at each mine, it was calibrated more frequently than required by the manufacturer to ensure accuracy of results obtained.

Pre-test screening for substances that could inappropriately influence breathalyser results: A mini questionnaire (Appendix F) was designed to rule out sources of alcohol other than alcoholic beverages, before breathalyser tests were carried out (section 2.3.4.4).

2.3.7.2 Urine tests

The following factors helped in quality assurance of urine tests:

Evaluation of different urine test methods: Comparison was made between the accuracy of dipstick testing and laboratory Cobas testing for cannabis, and the latter test with a higher accuracy was selected (section 2.3.2.3).

Utilisation of urine specimen most suitable for cannabis tests: Participants were instructed to collect the first portion of their urine stream, in which THC, if present, is most likely to be detected (Appendix C).

Appropriate storage of urine samples: Appropriate temperature was maintained for urine samples obtained (section 2.3.4.3), from collection to analysis, to ensure biochemical stability of metabolite of cannabis (THC) till analysis at the laboratory.

2.3.8 Data analysis

Data was analysed using Excel, SPSS and STATA. Responses were coded and participants were classified according to their substance use status (i.e. cannabis or alcohol). Descriptive statistics were done and comparisons were made between mines. Logistic regression analysis using univariate and multivariate models were also carried out. Univariate analysis was used to evaluate the relationship between substance use and socio-demographic and other variables. Cross tabulations yielding p-values were performed with chi-squares. P-values ≤ 0.05 were regarded as statistically significant, while those ≤ 0.001 were regarded as highly statistically significant. Where these variables were found to be significant for substance use, multivariate analysis was carried out adjusting for socio-demographic variables.

In order to determine if the differences in substance use obtained between mines were due to a cluster effect, logistic regression analysis using univariate models was carried out. The value of the pseudo-coefficient (R^2) determined as part of this analysis was used to estimate the level of variability in study findings due to the type of mine.

2.4 Focus Group Discussions

2.4.1 Study sample

Two discussion groups were scheduled in each of the seven participating mines. One group comprised of mine management representatives and supervisors, while the other consisted of union representatives and health & safety (H&S) representatives in order to facilitate free discussion. Participants were notified beforehand through management and union representatives at respective mines and their daily routine was taken into consideration before the discussion date and time were scheduled.

Ten focus group discussions involving eighty-four mine employees were carried out at six of the seven mines (mines P2, G1, G2, C1, O1, D1) as some groups were unavailable at some mines at the time of the study. In mine D1, two separate groups were carried out for management representatives and supervisors, as both groups work at different sites and could not be accessed at the same time for a discussion (table 2.4). Each group comprised of five to fifteen participants (table 2.5).

Table 2.4: Number of discussion groups carried out at study mines

Mine	No of groups with Union/Health & Safety Representatives	No of with Management Representatives/ Supervisors
P1	Nil	Nil
P2	1	Nil
G1	1	1
G2	1	Nil
D1	Nil	2
C1	1	1
O1	1	1
Total	**5**	**5**

Table 2.5: Number of focus group discussion participants per mine

Mine	No of Union/Health & Safety Representatives	No of Management Representatives/ supervisors	Total
P2	7	Nil	7
G1	5	7	12
G2	8	Nil	8
D1	Nil	11	11
C1	10	15	25
O1	11	10	21
Total	**41**	**43**	**84**

2.4.2 Focus group discussion guidelines

A questionnaire was designed to record socio-demographic information about each participant (Appendix I). Focus group discussion guidelines (Appendix J) consisted of open-ended questions, which helped to delve further into the findings of the structured interviews including the practice of substances use among mine workers and their recommendations for its control.

2.4.3 Pilot study

Discussion guidelines were piloted for understanding among a group of people not included in this study. No modifications were required.

2.4.4 Data collection

Before commencement of discussions, participants were assured of confidentiality, written consent was obtained (Appendix H) and questionnaires on socio-demographic

information were completed (Appendix I). There was an agreement by participants in each group beforehand on the language medium for the discussions, taking into consideration languages spoken by participants. Discussions among employee representatives/supervisors were carried out in English while that of Union/Health & Safety representatives were carried out in English in some mines, and in local languages in others.

Discussions were moderated by an experienced facilitator well versed in local languages and were completed within an hour and a half depending on the work schedule of participants. All discussions were tape-recorded. A note-taker was also present to capture the mood of the discussions and record salient responses on paper. This phase of the study was carried out between May and June, 2003.

2.4.5 Data analysis

Translation and transcription of focus group discussion tapes was done by an experienced researcher, and data was analysed by eliciting common themes from responses. Comparisons were made between these findings and that of the structured interviews.

2.5 Record Review of Accidents

2.5.1 Study sample

Six of the seven mines included in the structured interviews (mines P1, P2, G2, D1, C1, and O1) participated in the record review, which evaluated a five-year period from 1999-2003. Mine G1, which participated in the structured interviews was excluded from this aspect of the study as required information could not be accessed.

2.5.2 Instrument of measurement

A questionnaire about alcohol and cannabis tests related to accidents (excluding natural disasters) and medical surveillance-related was developed (Appendix K). This helped to assess the prevalence of mine accidents in which alcohol or cannabis tests were positive. It also helped to find out more about the protocols used by different mines in carrying out these tests. Information on lost-time injury frequency rate (LTIFR), the number of injuries that result in a minimum of one full shift lost per one million man hours worked (70,71) was also obtained from participating mines for the period covered by this record review (1999 to 2003).

2.5.3 Pilot study

The questionnaire was piloted for understanding among a group of people not included in the study. No modifications in the questionnaire were required.

2.5.4 Data collection

Questionnaires were completed by a management representative in each study mine. Data collection was carried out between March and September, 2004.

2.5.5 Data analysis

Descriptive statistics of prevalence of accident/medical surveillance-related positive alcohol and cannabis tests was carried out. ANOVA (Analysis of Variance) techniques were used to evaluate differences in LTIFR between study mines. The link between LTIFR for 2002 and other indicators of substance use obtained in 2002 during the structured interviews phase of this study (i.e. prevalence of alcohol dependence, prevalence of cannabis use, and prevalence of positive breath alcohol at work), was evaluated using Pearson's correlation analysis and regression analysis.

2.6 Limitations of the Study

Ensuring truthful responses from the study population was the greatest challenge. This was addressed by early buy-in of all stakeholders including employee representatives, and re-assurance about efforts made to ensure confidentiality.

The questionnaire for structured interviews and focus group discussion guidelines were developed in English and translated to the local languages in the field, which could have led to small differences in meaning. However, the use of well trained local

researchers capable of translating the questions into the language of the participant and able to understand the answers (with the nuances of the different languages) helped to accurately represent participants' responses.

Of the eleven mines that were initially selected to participate in this study, four declined participation after a lengthy consultation process. It is possible that these mines were systematically different from the mines that consented to participate in this research. It is also possible that in the mines which participated in the study, employees that declined participation were also systematically different from those that agreed to participate. These factors may have potentially introduced a selection bias. As these respondents may have been users of alcohol and cannabis, it may also have potentially underestimated research findings.

Due to unavailability of relevant records on post-accident and medical surveillance-related substance tests at some mines, the record review did not yield adequate information on the prevalence of positive substance tests related to accidents and medical-surveillance. While relevant inferences were drawn where possible, it was difficult to identify trends or make meaningful comparisons between mines.

Urine and breathalyser testing are established ways of screening for cannabis and alcohol misuse respectively. However, while breathalyser testing can help to determine acute intoxication from which inferences regarding health and safety can be drawn, it is difficult to estimate present level of impairment through qualitative screening for cannabis such as after an accident, as metabolites of cannabis may be detectable in the urine of regular heavy users up to one month after use. Where

quantitative tests are done, significantly high levels of metabolite may give an indication of level of impairment. However, even if substances are found to have been present in significant quantities, the cause of an accident may have been multi-factorial.

The lost time injury frequency rates (LTIFR) compared to substance use rates in this study were general mine values and were not linked to specific individuals. Therefore participants who tested positive for substances may not have been the ones involved in the accidents which contributed to the LTIFR, although a trend of high LTIFR and high substance use rates in study mines may suggest a trend in the findings. Case control or cohort studies would have been more suitable to evaluate the link between substance use and accidents. However, studies to evaluate substance use in the workplace are restricted by concerns for individual rights and fears of jeopardising labour relations.

This study is the first comprehensive study of alcohol and cannabis use in different mines in South Africa and was carried out as a pilot for future studies. While results of this study may not be generalisable to all the mines in South Africa, it provides valuable information that can help to improve health and safety among mineworkers. It has also helped to build trust between stakeholders (including union groups), upon which future studies among this population can be based.

3.0 RESULTS OF BREATHALYSER & URINE TESTS

This section describes results of tests carried out during this study. Section 3.1 describes the response rate while sections 3.2 and 3.3 describe results of breathalyser and urine tests respectively.

3.1 Response Proportion

The response proportion varied from mine to mine between 84% and 99%. Within mines, there was a variation in the proportion of questionnaires administered and breath and urine samples obtained, with the latter (urine samples) being the lowest because some participants were unable to provide urine samples at the time of the interview (section 2.3.5.3). Table 3.1 describes the response proportion by mine.

Table 3.1: Response proportion by mine

Mine	Estimated sample size (n)	No of questionnaires administered (%)	No of breath samples collected (%)	No of urine samples collected (%)
P1	110	108 (98.2%)	108 (98.2%)	108 (98.2%)
P2	229	200 (87.3%)	200 (87.3%)	199 (86.9%)
G1	114	111 (97.4%)	111 (97.4%)	110 (96.5%)
G2	424	359 (84.7%)	359 (84.7%)	358 (84.4%)
D1	320	318 (99.4%)	318 (99.4%)	305 (95.3%)
C1	270	267 (98.9%)	266 (98.5%)	262 (97%)
O1	231	208 (90%)	204 (88.3%)	200 (86.6%)
Total	1698	1571 (92.5%)	1566 (92.2%)	1542 (90.8%)

3.2 Breathalyser Results

Section 3.2.1 describes an overview of all the breathalyser results obtained. Section 3.2.2 makes comparisons between breathalyser results and the legal driving alcohol limit for professional drivers, while section 3.2.3 makes comparisons between breathalyser results and individual mine alcohol limits.

3.2.1 Overview of breathalyser results

Of 1566 samples obtained at study mines, 47 contained alcohol (3%). Mine O1 had the highest percentage of positive tests (7.8%), while mine P1 had the lowest (0.9%) (table 3.2).

Table 3.2: Overview of results of breathalyser tests by mine

Mine	Total samples obtained % (n)	% of samples containing alcohol irrespective of the level (n)	% of samples containing no alcohol (n)
P1	100 (108)	0.9 (1)	99.1 (107)
D1	100 (318)	1.5 (5)	98.4 (313)
P2	100 (200)	2.0 (4)	98.0 (196)
C1	100 (266)	2.2 (6)	97.7 (260)
G1	100 (111)	2.7 (3)	97.3 (108)
G2	100 (359)	3.3 (12)	96.7 (347)
O1	100 (204)	7.8 (16)	92.2 (188)
Mean	**100 (1566)**	**3.0 (47)**	**97.0 (1519)**

3.2.2 Comparison of breathalyser results to specific alcohol limits

As there is no legislated alcohol limit in the mining industry and varying standards have been adopted by study mines (section 2.2.1), the findings of this study were compared to the current South African legal driving limit of 0.10mg/1000ml of breath for professional drivers (59). This served as a benchmark for estimating levels at or above which impairment of judgement is likely to occur, because heavy and complex machinery is often used in mines. However comparison is also made to specific mine limits to evaluate how the results would have been rated in each mine.

3.2.2.1 Comparison of breathalyser results to legal breath alcohol limit for professional drivers

The majority of samples obtained from all study mines did not contain any alcohol (97%) (table 3.3). Of the 3% of samples that contained alcohol, 1.2% contained alcohol below 0.10mg/1000ml of breath, the legal driving limit for professional drivers, and 1.8% (n=28) contained alcohol equal to or above this limit. The prevalence of samples that contained alcohol at or above this limit ranged from 0.9% in mines D1 & G1 to 5.4% in mine O1.

More than half (n=17) of the 28 samples (i.e. 60.7%) which contained alcohol at or above the 0.10mg/1000ml limit, were at levels which were double or more than double the limit, with the sample containing the highest level of alcohol (0.88mg/1000ml of breath) being almost nine times this limit. Samples have been

described according to the day and time of sample collection to reflect level of intoxication in relation to time of day, and day of week (table 3.3). Mine O1 where all the samples positive for alcohol were collected on Monday (table 3.3) also had the highest number of total samples collected on Monday (57.4%) (table 3.4) compared to other mines.

Table 3.3: Comparison of breathalyser results to legal breath alcohol limit for professional drivers of 0.10mg/1000ml

Mine	Actual alcohol readings (mg/1000ml)	Day collected	Time collected	% of samples at or above limit	% of samples below limit (n)	% of samples with no alcohol (n)	Total samples % (n)
P1	0.04	Wednesday	8.50am	Nil	0.9 (1)	99.1 (107)	100 (108)
D1	0.04	Wednesday	6.53am	0.9 (3)	0.6 (2)	98.4 (313)	100 (318)
	0.24*	Wednesday	7.07am				
	0.04	Thursday	6.46am				
	0.22*	Thursday	6.52am				
	0.16	Thursday	8.00am				
G1	0.08	Tuesday	10.28pm	0.9 (1)	1.8 (2)	97.3 (108)	100 (111)
	0.13	Thursday	6.30am				
	0.07	Thursday	10.30am				
C1	0.06	Tuesday	12.14pm	1.1 (3)	1.1 (3)	97.7 (260)	97.7 (260)
	0.07	Wednesday	6.26am				
	0.07	Wednesday	10.13am				
	0.22*	Wednesday	10.55am				
	0.10	Friday	9.45am				
	0.11	Friday	9.56am				
P2	0.27*	Saturday	1.53am	1.5 (3)	0.5 (1)	98.0 (196)	100 (200)
	0.07	Monday	9.17pm				
	0.10	Tuesday	2.15pm				
	0.50*	Tuesday	2.48pm				
G2	0.09	Monday	7:46pm	1.9 (7)	1.4 (5)	96.7 (347)	100 (359)
	0.15	Monday	8:27pm				
	0.05	Monday	8:41pm				
	0.05	Tuesday	7:20pm				
	0.27*	Wednesday	4:29am				
	0.08	Wednesday	4:58am				
	0.13	Wednesday	12:16pm				
	0.12	Wednesday	12.20pm				
	0.24*	Wednesday	7.32pm				
	0.25*	Wednesday	8.11pm				
	0.05	Friday	4.16am				
	0.14	Friday	6.52am				
O1	0.48*	Monday	7.45am	5.4 (11)	2.4 (5)	92.2 (188)	100 (204)
	0.37*	Monday	7.51am				
	0.11	Monday	7.54am				
	0.43*	Monday	7.58am				
	0.21*	Monday	8.27am				
	0.20*	Monday	9.07am				
	0.10	Monday	9.10am				
	0.09	Monday	9.18am				
	0.06	Monday	9.49am				
	0.44*	Monday	9.51am				
	0.03	Monday	9.53am				
	0.55*	Monday	10.51am				
	0.04	Monday	1.24pm				
	0.24*	Monday	1.25pm				
	0.88*	Monday	1.55pm				
	0.03	Monday	3.50pm				
Mean				**1.8 (28)**	**1.2 (19)**	**97.0 (1519)**	**100 (1566)**

**Samples with alcohol levels at double or more than double the limit of 0.10mg/1000ml of breath (n=17).*

Table 3.4: Breathalyser result by day of sample collection by mine

Mine	Breathalyser Result	Day of Collection of breath sample % (n)						
		Mon	**Tue**	**Wed**	**Thurs**	**Fri**	**Sat**	**Total**
O1	Total	57.4 (117)	6.4 (13)	36.2 (74)	-	-	-	100.0 (204)
	Positive	100.0 (16)	-	-	-	-	-	100.0 (16)
	Negative	53.7 (101)	6.9 (13)	39.4 (74)	-	-	-	100.0 (188)
D1	Total	19.5 (62)	20.4 (65)	8.5 (27)	38.4 (122)	13.2 (42)	-	100.0 (318)
	Positive	-	-	40 (2)	60 (3)	-	-	100.0 (5)
	Negative	19.8 (62)	20.8 (65)	8 (25)	38 (119)	13.4 (42)	-	100.0 (313)
P1	Total	-	23.1 (25)	26.9 (29)	33.3 (36)	16.7 (18)	-	100.0 (108)
	Positive	-	-	100 (1)	-	-	-	100.0 (1)
	Negative	-	23.4 (25)	26.2 (28)	33.6 (36)	16.8 (18)	-	100.0 (107)
P2	Total	15.0 (30)	30.5 (61)	9.0 (18)	11.0 (22)	19.0 (38)	15.5 (31)	100.0 (200)
	Positive	25.0 (1)	50.0 (2)	-	-	-	25.0 (1)	100.0 (4)
	Negative	14.8 (29)	30.1 (59)	9.2 (18)	11.2 (22)	19.4 (38)	15.3 (30)	100.0 (196)
C1	Total	10.5 (28)	13.2 (35)	36.5 (97)	24.8 (66)	15.0 (40)	-	100.0 (266)
	Positive	-	16.7 (1)	50 (3)	-	33.3 (2)	-	100.0 (6)
	Negative	10.8 (28)	13.0 (34)	36.2 (94)	25.4 (66)	14.6 (38)	-	100.0 (260)
G2	Total	10.0 (36)	32.3 (116)	37.1 (133)	13.1 (47)	7.5 (27)	-	100.0 (359)
	Positive	25 (3)	8.3 (1)	50 (6)	-	16.7 (2)	-	100 (12)
	Negative	9.5 (33)	33.1 (115)	36.6 (127)	13.6 (47)	7.2 (25)	-	99.9 (347)
G1	Total	-	24.3 (27)	31.5 (35)	44.2 (49)	-	-	100 (111)
	Positive	-	33.3 (1)	-	66.7 (2)	-	-	100 (3)
	Negative	-	24.1 (26)	32.4 (35)	43.5 (47)	-	-	100 (108)
All mines	Total	17.4 (273)	21.8 (342)	26.4 (413)	21.8 (342)	10.5 (165)	2.0 (31)	99.9 (1566)

3.2.2.2 Evaluation of relationship between day of breathalyser test and breathalyser test result

The highest percentage of samples positive for alcohol above the limit of 0.10mg/1000ml (7.3%) was collected on Monday (table 3.4) compared to other days of the week. The association between day of sample collection and breathalyser result was found to be highly significant (p=0.0001) (table 3.5).

The Score test for trend of odds (table 3.6) showed Monday to be the only day with a statistically significant risk of having a positive breathalyser test [OR=1.19 95%,

CI(1.05;1.35), p-value=0.005]. Day of testing was an effect modifier, with Monday, where the outcome of breathalyser tests was different from other days, specifically confounding the results.

Table 3.5: Breathalyser result by day of sample collection in all mines

Day of Sample Collection	Breathalyser positive %(n) row	Breathalyser negative %(n) row	Total %(n) row
Mon	7.3 (20)	92.7 (253)	100 (273)
Tues	1.5 (5)	98.5 (337)	100 (342)
Wed	2.9 (12)	97.1 (401)	100 (413)
Thurs	1.5 (5)	98.5 (337)	100 (342)
Fri	2.4 (4)	97.6 (161)	100 (165)
Sat	3.2 (1)	96.8 (30)	100 (31)
Total	3.0 (47)	97.0 (1519)	100 (1566)
p-value	p=0.0001		

*****

Table 3.6: Evaluation of possible confounding effect of day of breathalyser test on breathalyser result

Day of breathalyser test	Odds Ratio(CI)p-value
Monday	1.19(1.05-1.35)0.005
Tuesday	1.07(0.83-1.37)0.606
Wednesday	0.87(0.73-1.03)0.102
Thursday	0.97(0.75-1.25)0.818
Friday	0.86(0.68-1.09)0.220

**Saturday excluded due to small number of positive samples (table 3.5)*

3.2.2.3 Comparison of breathalyser results to individual mine breath alcohol limit

Individual mine breath alcohol limits vary from 0.00mg/1000ml to 0.10mg/1000ml to 0.24mg/1000ml breath (section 2.2.1). While 1.5% of samples obtained from all study

mines contained alcohol below their individual mine limit, a similar percentage (1.5%) contained alcohol at or above these limits with a range of 0% in mines P1 & G1 to 5.9% in mine O1 (table 3.7).

Table 3.7: Comparison of breathalyser results to individual mine breath alcohol limit

Mine	Mine breath alcohol limit mg/1000ml	% of samples containing no alcohol (n)	% of samples positive for alcohol (n)		Total samples obtained % (n)
			% of samples at or above mine limit	% of samples below mine limit	
P1	0.10	99.1 (107)	0.0 (Nil)	0.9 (1)	100 (108)
G1	0.24	97.3 (108)	0.0 (Nil)	2.7 (3)	100 (111)
D1	0.24	98.4 (313)	0.3 (1)	1.3 (4)	100 (318)
G2	0.24	96.7 (347)	0.8 (3)	2.5 (9)	100 (359)
P2	0.24	98.0 (196)	1.0 (2)	1.0 (2)	100 (200)
C1	0.00	97.7 (260)	2.3 (6)	0.0 (Nil)	100 (266)
O1	0.10	92.2 (188)	5.9 (12)	2.0 (4)	100 (204)
Mean		**97.0 (1519)**	**1.5 (24)**	**1.5 (23)**	**100 (1566)**

3.3 Urine Tests Results for Cannabis

Section 3.3.1 describes urine test results by mine, while results of similar commodity mines are grouped in section 3.3.2

3.3.1 Urine test results by mine

Almost one-tenth (9.1%) of urine samples collected from all study mines tested positive for Tetra-Hydro-Cannabinol (THC), the most potent metabolite of cannabis with a range of 4.6% in mine P1 to 21.5% in mine O1 (table 3.8).

Table 3.8: Overview of urine test results by mine

Mine	% of samples positive for cannabis (n)	% of samples negative for cannabis (n)	Total urine samples collected (n)
P1	4.6 (5)	95.4 (103)	100 (108)
G2	5.6 (20)	94.4 (338)	100 (358)
D1	7.2 (22)	92.8 (283)	100 (305)
P2	7.5 (15)	92.5 (184)	100 (199)
C1	7.6 (20)	92.4 (242)	100 (262)
G1	13.6 (15)	86.4 (95)	100 (110)
O1	21.5 (43)	78.5 (157)	100 (200)
Mean	**9.1 (140)**	**90.9 (1402)**	**100 (1542)**

3.3.2 Urine test results by commodity group

When study mines were grouped according to commodity, the percentage of urine samples positive for cannabis ranged from 6.5% in commodity group 'P' to 21.5% in commodity group 'O' (table 3.9).

Table 3.9: Overview of urine test results by commodity group

Commodity group*	% of THC-positive urine samples (n)	% of THC-negative urine samples (n)	Total urine samples collected (n)
P	6.5 (20)	93.5 (287)	100 (307)
D	7.2 (22)	92.8 (283)	100 (305)
G	7.5 (35)	92.5 (433)	100 (468)
C	7.6 (20)	92.4 (242)	100 (262)
O	21.5 (43)	78.5 (157)	100 (200)

**P=P1 & P2, D=D1, G=G1 & G2, C=C1, O=O1.*

4.0 RESULTS OF STRUCTURED INTERVIEWS

This section describes the results of structured interviews. Section 4.1 describes the response proportion while section 4.2 describes the prevalence of substance use. Section 4.3 describes the socio-demographic profile of participants and its link to substance use, and section 4.4 describes the practice of substance use among mineworkers and its link to substance use. Section 4.5 describes participants' awareness of risks of substance use and its relationship to accidents, and section 4.6 describes perceptions about substance use and its link to substance use. Section 4.7 summarises study variables and their relationship to substance use.

In section 4.2 which describes the prevalence of substance use, participants were classified according to their substance use status (i.e. cannabis or alcohol). The relationship between variables of interest (such as level of education) and their link to alcohol and cannabis use in other sections in this chapter was evaluated by logistic regression analysis (i.e. univariate and multivariate models). P-values below 0.05 were regarded as statistically significant, while those below 0.001 were regarded as highly statistically significant.

In some sections in this chapter, categories of participants discussed varied depending on the variable under discussion (e.g. sections 4.4.1 to 4.4.3 on practice of substance use relates to current users only, while section 4.5 on awareness of risks of substance use in the workplace relates to all participants).

4.1 Response Proportion

The response proportion of structured interviews ranged between 84.7% and 99.4% in participating mines with a mean of 92.5% (section 3.1).

4.2 Prevalence of Substance Use

4.2.1 Estimated prevalence of alcohol dependence

In order to estimate the prevalence of alcohol dependence, participants were asked if they currently drink alcohol. These current users were subsequently asked questions from the CAGE questionnaire, a screening tool for alcohol misuse (Section 1.4.1), which classifies respondents who respond positively to at least two of four questions as likely to be dependent on alcohol. In this report, participants who are likely to be alcohol dependent according to the CAGE criteria have been described as "CAGE positive" while other participants are referred to as "CAGE negative".

Of all respondents, 46.9% said they currently drink alcohol (table 4.1). According to the CAGE criteria, 15.3% of all respondents are likely to be dependent on alcohol, with the estimated prevalence in mine G1 of 24.8% being more than double that of mine D1 where the estimated prevalence was 10.7% (table 4.2). The estimated prevalence of alcohol dependence by commodity mine ranged from 10.7% in commodity 'D', to 17.5% in commodity 'P' (table 4.3).

Table 4.1: Current users, ex-users & never users of alcohol by mine

Mine	% Ever users[a] (n)		% Never users[d] (n)	% Total (N)
	Current users[b]	Ex-users[c]		
P1	60.2 (65)	9.3 (10)	30.5 (33)	100 (108)
P2	48.8 (98)	5.0 (10)	46.2 (93)	100 (201)
G1	46.8 (51)	7.3 (8)	45.9 (50)	100 (109)
G2	35.1 (122)	7.5 (26)	57.4 (200)	100 (348)
D1	51.0 (158)	5.2 (16)	43.8 (136)	100 (310)
C1	48.0 (123)	8.6 (22)	43.4 (111)	100 (256)
O1	51.0 (105)	2.9 (6)	46.1 (95)	100 206)
Mean (N)	**46.9 (722)**	**6.4 (98)**	**46.7 (718)**	**100 (1538)**
	53.3% (820)			

[a]*Ever user: One who has used alcohol before irrespective of whether they currently use it or have stopped.*
[b]*Current user: One who currently uses alcohol.*
[c]*Ex-user: One previously used alcohol but has stopped.*
[d] *Never user: One who has never used alcohol.*

Table 4.2: Estimated prevalence of alcohol dependence by individual mine

Mine	% CAGE positive[a] (n)	% CAGE negative[b] (n)	% Total (N)
G1	24.8 (27)	75.2 (82)	100 (109)
P1	19.4 (21)	80.6 (87)	100 (108)
O1	17.0 (35)	83.0 (171)	100 (206)
C1	16.8 (43)	83.2 (213)	100 (256)
P2	16.4 (33)	83.6 (168)	100 (201)
G2	12.4 (43)	87.6 (305)	100 (348)
D1[c]	10.7 (33)	89.3 (277)	100 (310)
Mean (N)	**15.3 (235)**	**84.7 (1303)**	**100 (1538)**

[a]*CAGE positive: Participants likely to be dependent on alcohol*
[b]*CAGE negative: Participants unlikely to be dependent on alcohol*
[c]*See section 4.3.13.1 for evaluation of statistically significant differences between mines*

Table 4.3: Estimated prevalence of alcohol dependence by commodity mine

Commodity mine[a]	% CAGE positive (n)	% CAGE negative (n)	% Total (n)
D[b]	10.7 (33)	89.3 (277)	100 (310)
G	15.3 (70)	84.7 (417)	100 (457)
C	16.8 (43)	83.2 (213)	100 (256)
O	17.0 (35)	83.0 (171)	100 (206)
P	17.5 (54)	82.5 (255)	100 (309)
Mean (N)	15.3 (235)	84.7 (1303)	100 (1538)

[a]*P=P1 & P2, G=G1 & G2, D=D1, C=C1, O=O1.*
[b]*See section 4.3.13.1 for evaluation of statistically significant differences between mines*

4.2.2 Comparison of CAGE status to breathalyser results

CAGE positive results were compared to samples positive for alcohol above the 0.10mg/1000ml limit for professional drivers in order to evaluate any correlation in these findings between study mines. There was no correlation between CAGE positive results and samples containing alcohol above the limit of 0.10mg/1000ml (Spearman's rho=-0.2883, p-value=0.5307) (table 4.4 & figure 4.1).

Table 4.4: Comparison of CAGE positive respondents to breathalyser results

Mine	*CAGE positive %(n)	Samples at or above alcohol limit of 0.10mg/1000ml %(n)
G1	24.8 (27)	0.9 (1)
P1	19.4 (21)	Nil
O1	17.0 (35)	5.4 (11)
C1	16.8 (43)	1.1 (3)
P2	16.4 (33)	1.5 (3)
G2	12.4 (43)	1.9 (7)
D1	10.7 (33)	0.9 (3)
Mean	**15.3 (235)**	**1.8 (28)**

** CAGE results arranged in descending order*

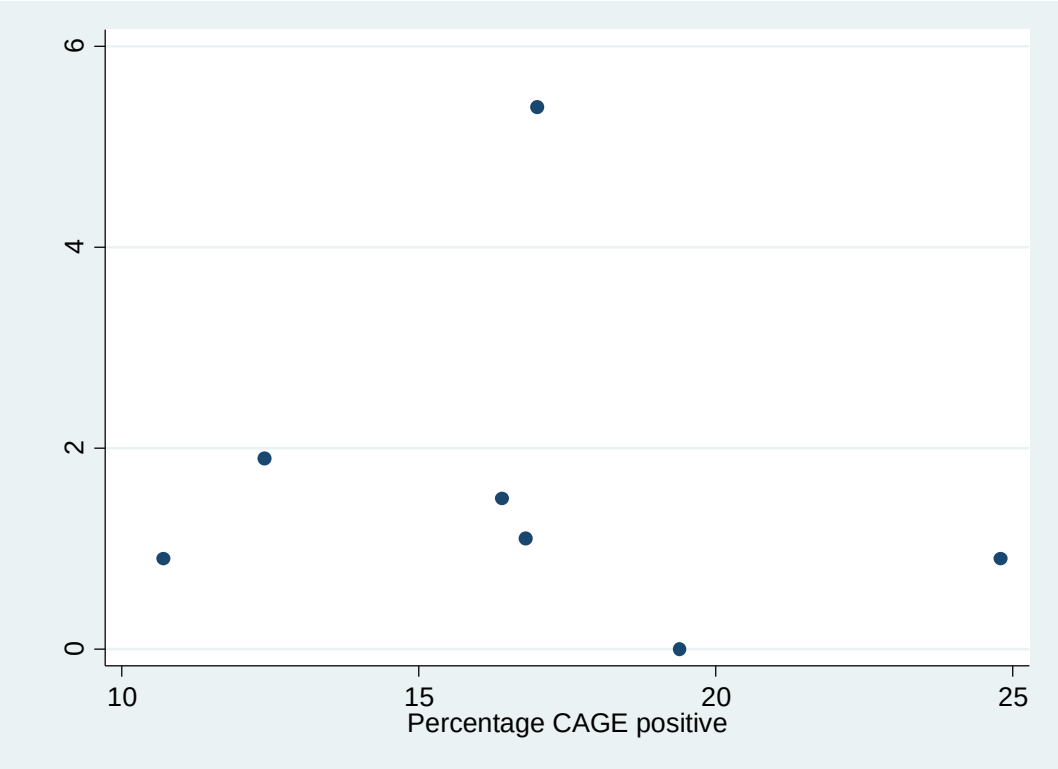

Figure 4.1: Scatter plot of CAGE positive results to breathalyser results above 0.10mg/1000ml by mine

4.2.3 Prevalence of cannabis use

The prevalence of cannabis use among study participants was determined by self-report and subsequently by urine tests for Tetra-Hydro-Cannabinol (THC). In this report, participants who reported that they used cannabis are referred to as self-reported cannabis users, while those who tested positive for cannabis are referred to as urine-positive cannabis users.

4.2.3.1 Prevalence of self-reported cannabis use

Of the 7.3% of participants who reported that they had ever used cannabis, 2.3% said they currently use cannabis (table 4.5).

Table 4.5: Current users, ex-users & never-users of cannabis by mine

Mine	% Ever users[a] (n)		% Never users[d] (n)	% Total (n)
	Current users[b]	Ex-users[c]		
P1	2.8 (3)	9.4 (10)	87.9 (94)	100 (107)
P2	2.5 (5)	5.0 (10)	92.6 (187)	100 (202)
G1	3.6 (4)	4.5 (5)	91.9 (102)	100 (111)
G2	0.6 (2)	6.1 (21)	93.4 (324)	100 (347)
D1	1.9 (6)	4.1 (13)	94.0 (298)	100 (317)
C1	1.9 (5)	3.1 (8)	95.0 (247)	100 (260)
O1	5.3 (11)	4.8 (10)	89.9 (186)	100 (207)
Mean	**2.3 (36)**	**5.0 (77)**	**92.7 (1438)**	**100 (1551)**
	7.3% (113)			

[a]*Ever user: One who has used cannabis before, irrespective of whether they currently use it or have stopped.*
[b]*Current user: One who currently uses cannabis.*
[c]*Ex-user: One who previously used cannabis but has stopped.*
[d]*Never user: One who has never used cannabis.*

4.2.3.2 Prevalence of cannabis use estimated by urine tests

About a tenth (9.1%) of urine samples collected from all study mines were positive for THC. This prevalence however ranged from 4.6% in mine P1 to almost five times this prevalence (21.5%) in mine O1 (table 4.6). The prevalence of cannabis use by commodity mine ranged from 6.5% in commodity group 'P', to 21.5% in commodity group 'O' (table 4.7).

Table 4.6: Prevalence of cannabis use in individual mines estimated by urine tests

Mine	% positive for cannabis (n)	% of negative for cannabis (n)	% Total (n)
P1	4.6 (5)	95.4 (103)	100 (108)
G2	5.6 (20)	94.4 (338)	100 (358)
D1	7.2 (22)	92.8 (283)	100 (305)
P2	7.5 (15)	92.5 (184)	100 (199)
C1	7.6 (20)	92.4 (242)	100 (262)
G1	13.6 (15)	86.4 (95)	100 (110)
O1	21.5 (43)	78.5 (157)	100 (200)
Mean	**9.1 (140)**	**90.9 (1402)**	**100 (1542)**

Table 4.7: Prevalence of cannabis use in commodity mines estimated by urine tests

Commodity group[a]	% positive for cannabis (n)	% negative for cannabis (n)	% Total (N)
P	6.5 (20)	93.5 (287)	100 (307)
D	7.2 (22)	92.8 (283)	100 (305)
G	7.5 (35)	92.5 (433)	100 (468)
C	7.6 (20)	92.4 (242)	100 (262)
O	21.5 (43)	78.5 (157)	100 (200)
Mean (N)	9.1 (140)	90.6 (1402)	100 (1542)

[a]*P=P1 & P2, D=D1, G=G1 & G2, C=C1, O=O1.*

4.2.3.3 Comparison of percentages of self-reported cannabis users to urine-positive cannabis users

Table 4.8 compares self-reported cannabis users (4.2.3.1) to urine-positive cannabis users (4.2.3.2). Self-reported users were consistently lower than urine-positive users in all mines. The percentage of urine positive cannabis users across mines (9.1%) was about four times that of self-reported users (2.3%).

Table 4.8: Comparison of percentages of self-reported cannabis users & urine-positive cannabis users

Mine	% Self-reported cannabis users (n)	% Urine-positive cannabis users (n)
P1	2.8 (3)	4.6 (5)
P2	2.5 (5)	7.5 (15)
G1	3.6 (4)	13.6 (15)
G2	0.6 (2)	5.6 (20)
D1	1.9 (6)	7.2 (22)
C1	1.9 (5)	7.6 (20)
O1	5.3 (11)	21.5 (43)
Mean	**2.3 (36)**	**9.1 (140)**

4.2.3.4 Evaluation of level of accuracy of self-reported cannabis use

The prevalence of cannabis use estimated by urine tests (9.1%) was almost four times that of self-report (2.3%) (section 4.2.3.3). In order to evaluate the level of accuracy of self report, sensitivity; specificity; positive predictive value; and negative predictive value estimations were done. The sensitivity of self-report was found to be 19.3% (i.e. a/a+c=26/135), while the specificity was 99.4% (i.e. d/b+d=9/1406).

The positive predictive value was 74.3% (i.e. a/a+b=26/35), and the negative predictive value was 92.8% (i.e. d/c+d=1397/1506) (table 4.9).

Table 4.9: Self-reported cannabis use by urine-positive cannabis use

	Urine-Cannabis Positive	Urine-Cannabis Negative	Total
Self-Report Positive	26 (a)	9 (b)	35
Self-Report Negative	109 (c)	1397 (d)	1506
Total	135	1406	1541

4.3 Socio-Demographic Profile & Substance Use

This section describes the socio-demographic profile of participants and evaluates its link to substance use through logistic regression analysis (i.e. univariate and multivariate models). Multivariate analysis was carried out by adjusting for socio-demographic and other variables. The specific sections related to these socio-demographic variables are noted where they have not been described before their use in multivariate analysis.

4.3.1 Age distribution of participants

The majority of participants (84.1%) are between 26 to 50 years of age (table 4.10: sum of age-groups between 26 and 50 years of age). The median age in all mines is 37 years (table 4.11).

Table 4.10: Age distribution of participants by mine

Age group (years)	P1 % (n)	P2 % (n)	G1 % (n)	G2 % (n)	D1 % (n)	C1 % (n)	O1 % (n)	Mean % (n)
16-20	2.8 (3)	1.5 (3)	Nil	0.6 (2)	0.6 (2)	2.7 (7)	1.4 (3)	**1.3 (20)**
21-25	8.3 (9)	9.1 (18)	5.4 (6)	4.3 (15)	6.0 (19)	6.6 (17)	8.7 (18)	**6.6 (102)**
26-30	12.0 (13)	9.1 (18)	33.3 (37)	12.4 (43)	18.2 (58)	12.4 (32)	20.7 (43)	**15.8 (244)**
31-35	15.7 (17)	20.7 (41)	11.7 (13)	21.4 (74)	14.8 (47)	20.9 (54)	24.0 (50)	**19.1 (296)**
36-40	18.5 (20)	19.2 (38)	13.5 (15)	24.6 (85)	26.1 (83)	12.0 (31)	14.0 (29)	**19.4 (301)**
41-45	20.4 (22)	18.2 (36)	20.7 (23)	15.3 (53)	16.0 (51)	18.2 (47)	13.5 (28)	**16.8 (260)**
46-50	9.3 (10)	14.7 (29)	9.9 (11)	13.6 (47)	10.7 (34)	20.5 (53)	8.2 (17)	**13.0 (201)**
51 & >	13.0 (14)	7.6 (15)	5.4 (6)	7.8 (27)	7.6 (24)	7.0 (18)	9.6 (20)	**8.0 (124)**
Total (N)	100 (108)	100 (198)	100 (111)	100 (346)	100 (318)	100 (259)	100 (208)	**100 (1548)**

Table 4.11: Mean age & median age of participants by mine

Mine	Mean age (years)	Median age (years)
P1	38	38
P2	38	38
G1	36	35
G2	38	37
D1	37	37
C1	39	40
O1	36	34
Mean	**37**	**37**

4.3.1.1 Substance use & age

There was no trend in the prevalence of alcohol dependence by age, with the percentage of CAGE positive respondents ranging from 20.5% in the 26 to 30-year age group, to 15% in the 46 to 50-year age group, and 10% in the 16 to 20-year age

group. Age was not statistically significant for alcohol dependence (p=0.430) (table 4.12). There was no clear trend in the prevalence of cannabis use which ranged from 15% in the 16 to 20-year age group, to 7% in the 46 to 50-year age group, and 9.9% in the ≥51 age group. Age was not statistically significant for cannabis use (p=0.775) (table 4.13).

Table 4.12: CAGE status by age

Age (years)	CAGE negative % row (n)	CAGE positive % row (n)	Total % row (n)
16-20	90.0 (18)	10.0 (2)	100 (20)
21-25	85.3 (87)	14.7 (15)	100 (102)
26-30	79.5 (194)	20.5 (50)	100 (244)
31-35	84.5 (250)	15.5 (46)	100 (296)
36-40	85.1 (256)	14.9 (45)	100 (301)
41-45	86.5 (255)	13.5 (35)	100 (260)
46-50	85.0 (170)	15.0 (30)	100 (200)
≥51	90.1 (109)	9.9 (12)	100 (121)
p-value	p=0.430		

Table 4.13: Cannabis use status by age

Age (years)	Cannabis negative % row (n)	Cannabis positive % row (n)	Total % row (n)
16-20	85.0 (17)	15.0 (3)	100 (20)
21-25	89.2 (91)	10.8 (11)	100 (102)
26-30	91.8 (224)	8.2 (20)	100 (244)
31-35	90.9 (269)	9.1 (27)	100 (296)
36-40	91.4 (275)	8.6 (26)	100 (301)
41-45	90.8 (236)	9.2 (24)	100 (260)
46-50	93.0 (186)	7.0 (14)	100 (200)
≥51	90.1 (109)	9.9 (12)	100 (121)
p-value	p=0.775		

4.3.2 Sex

The majority of participants (95.7%) were male, with 4.3% being female (table 4.14).

Table 4.14: Sex of participants by mine

Mine	% Male (n)	% Female (n)	% Total (n)
P1	98.2 (106)	1.9 (2)	100 (108)
P2	99.5 (202)	0.5 (1)	100 (203)
G1	94.6 (105)	5.4 (6)	100 (111)
G2	99.1 (345)	0.9 (3)	100 (348)
D1	87.0 (274)	13.0 (41)	100 (315)
C1	95.8 (249)	4.2 (11)	100 (260)
O1	98.6 (205)	1.4 (3)	100 (208)
Mean	**95.7 (1486)**	**4.3 (67)**	**100 (1553)**

4.3.3 Country of origin

More than three quarters of all participants (77.6%) were South Africans, while most other participants were from neighbouring countries in Southern Africa (table 4.15).

Table 4.15: Country of origin of participants by mine

Country of Origin	% (n)							
	P1	P2	G1	G2	D1	C1	O1	**Mean**
South Africa	99.1 (107)	70.9 (144)	95.5 (106)	50.1 (173)	95.9 (304)	81.9 (212)	75.6 (155)	**77.6 (1201)**
Mozambique	Nil	15.8 (32)	0.9 (1)	17.7 (61)	0.3 (1)	2.7 (7)	19.0 (39)	**9.1 (141)**
Lesotho	Nil	11.3 (23)	Nil	23.8 (82)	Nil	10.4 (27)	1.0 (2)	**8.7 (134)**
Swaziland	Nil	1.5 (3)	Nil	4.9 (17)	Nil	1.2 (3)	Nil	**1.5 (23)**
Zimbabwe	0.9 (1)	Nil	1.8 (2)	Nil	1.9 (6)	0.8 (2)	2.9 (6)	**1.1 (17)**
Britain	Nil	Nil	0.9 (1)	0.6 (2)	1.0 (3)	2.3 (6)	0.5 (1)	**0.9 (13)**
Botswana	Nil	Nil	Nil	2.6 (9)	0.3 (1)	0.4 (1)	Nil	**0.7 (11)**
Malawi	Nil	0.5 (1)	Nil	0.3 (1)	0.6 (2)	Nil	0.5 (1)	**0.3 (5)**
Namibia	Nil	Nil	0.9 (1)	Nil	Nil	0.4 (1)	0.5 (1)	**0.2 (3)**
Total	100 (108)	100 (203)	100 (111)	100 (345)	100 (317)	100 (259)	100 (205)	**100 (1548)**

4.3.4 Main languages spoken

Languages spoken varied across mines due to the cultural diversity of employees (table 4.16).

Table 4.16: Participants' main language by mine

Language	Mine % (n)							
	P1	P2	G1	G2	D1	C1	O1	**Mean**
Sotho	8.2 (9)	24.1 (42)	3.6 (4)	32.4 (113)	2.5 (8)	22.7 (58)	6.0 (11)	**16.3 (245)**
Tswana	2.7 (3)	16.7 (29)	70.3 (78)	8.6 (30)	3.2 (10)	Nil	35.3 (65)	**14.3 (215)**
Pedi	32.7 (36)	4.6 (8)	0.9 (1)	1.4 (5)	31.2 (99)	4.3 (11)	6.0 (11)	**11.4 (171)**
Xhosa	2.7 (3)	20.7 (36)	Nil	20.9 (73)	0.3 (1)	13.3 (34)	0.5 (1)	**9.9 (148)**
Tsonga	13.6 (15)	16.1 (28)	0.9 (1)	9.2 (32)	6.3 (20)	2.0 (5)	13.6 (25)	**8.4 (126)**
Zulu	2.7 (3)	6.3 (11)	3.6 (4)	8.0 (28)	1.6 (5)	24.6 (63)	3.8 (7)	**8.1 (121)**
English	0.9 (1)	0.6 (1)	8.1 (9)	0.9 (3)	21.1 (67)	8.6 (22)	7.1 (13)	**7.7 (116)**
Venda	3.6 (4)	Nil	9.9 (11)	0.3 (1)	25.2 (80)	0.8 (2)	9.2 (17)	**7.7 (115)**
Afrikaans	24.6 (27)	5.8 (10)	Nil	3.7 (13)	0.3 (1)	16.8 (43)	2.2 (4)	**6.5 (98)**
Swazi	2.7 (3)	1.7 (3)	2.7 (3)	3.7 (13)	7.3 (23)	3.1 (8)	0.5 (1)	**3.6 (54)**
Other	5.5 (6)	3.5 (6)	Nil	10.9 (38)	1.0 (3)	3.9 (10)	15.8 (29)	**6.1 (92)**
Total	100 (110)	100 (174)	100 (111)	100 (349)	100 (317)	100 (256)	100 (184)	**100 (1501)**

4.3.5 Location of workstation

More than a third of all respondents (40.5%) worked underground. However, mines P1, G1, D1, and O1 were surface mines and had no underground workers (table 4.17).

Table 4.17: Location of participants' workstations by mine

Mine	Underground % (n)	Aboveground % (n)	Both above & below ground % (n)	Total % (n)
P1	Nil	100 (108)	Nil	100 (108)
P2	68.0 (138)	28.6 (58)	3.5 (7)	100 (203)
G1	Nil	100 (111)	Nil	100 (111)
G2	92.0 (321)	6.9 (24)	1.0 (4)	100 (349)
D1	Nil	100 (322)	Nil	100 (322)
C1	67.1 (171)	30.2 (77)	2.8 (7)	100 (255)
O1	Nil	100 (208)	Nil	100 (208)
Mean	**40.5 (630)**	**58.4 (908)**	**1.2 (18)**	**100 (1556)**

4.3.5.1 Substance use & location of workstation

Of those who worked underground, 13.5% were CAGE positive while 20.1% of those who worked aboveground were CAGE positive (table 4.18), and 4.4% of those who worked aboveground were cannabis positive compared to 7.3% of those who worked underground (i.e. almost double the percentage of aboveground workers in this category) (table 4.19). There was, however, no statistical link between location of workstation and CAGE status (p=0.078) or cannabis use (p=0.426).

Table 4.18: CAGE status by location of workstation

Location of workstation[a]	CAGE negative % row (n)	CAGE positive % row (n)	Total % row (n)
Underground	86.5 (533)	13.5 (83)	100 (616)
Aboveground	79.9 (127)	20.1 (32)	100 (159)
Both	90.3 (28)	9.7 (3)	100 (31)
Total	85.4 (688)	14.6 (118)	100 (806)
p-value	p=0.078		

[a]*Mines with underground shafts only*

Table 4.19: Cannabis use status by location of workstation

Location of workstation[a]	Cannabis negative % row (n)	Cannabis positive % row (n)	Total % row (n)
Underground	92.7 (571)	7.3 (45)	100 (616)
Aboveground	95.6 (152)	4.4 (7)	100 (159)
Both	93.6 (29)	6.4 (2)	100 (31)
Total	100 (752)	100 (54)	100 (806)
p-value	0.426		

[a]*Mines with underground shafts only*

4.3.6 Level of education

About half of all respondents (51.4%) had a highest level of education of between standard 6 to standard 10, while over a tenth (12.9%) had post-matric qualification such as technikon diploma or university degree (table 4.20).

Table 4.20: Level of education of participants by mine

Mine	Level of education % (n)				
	No formal schooling	Std 1-5	Std 6-10	Post-matric	Total
P1	6.5 (7)	19.6 (21)	61.7 (66)	12.1 (13)	100 (107)
P2	3.2 (6)	45.3 (86)	47.9 (91)	3.7 (7)	100 (190)
G1	3.6 (4)	22.7 (25)	62.7 (69)	10.9 (12)	100 (110)
G2	12.5 (44)	40.1 (141)	41.5 (146)	5.9 (21)	100 (352)
D1	2.0 (6)	8.6 (26)	60.5 (184)	28.9 (88)	100 (304)
C1	3.1 (8)	25.1 (64)	54.1 (138)	17.7 (45)	100 (255)
O1	11.2 (23)	40.3 (83)	43.7 (90)	4.8 (10)	100 (206)
Mean	**6.4 (98)**	**29.3 (446)**	**51.4 (784)**	**12.9 (196)**	**100 (1524)**

4.3.6.1 CAGE status & level of education

Of those who had a post-matric qualification, 10.7% were CAGE positive compared to 15.9% of those who had a matric qualification or less. Level of education was not linked to CAGE status statistically (p=0.060) (table 4.21).

Table 4.21: CAGE status by level of education

Level of Education	CAGE Negative % row (n)	CAGE Positive % row (n)	Total % row (n)
Matric or less	84.1 (1,117)	15.9 (211)	100 (1328)
Post-matric qualification	89.3 (175)	10.7 (21)	100 (196)
Total	87.1 (1292)	12.9 (232)	100 (1524)
p-value	0.060		

4.3.6.2 Cannabis use & level of education

There were about four times more cannabis users among respondents with a matric or less qualification (9.9%) than those who had a post-matric qualification (2.5%) (table 4.22).

Table 4.22: Cannabis use status by level of education

Level of Education	Cannabis Negative % row (n)	Cannabis Positive % row (n)	Total % row (n)
Matric or less	90.1 (1196)	9.9 (132)	100 (1328)
Post-matric	97.5 (191)	2.5 (5)	100 (196)
Total	91.0 (1387)	9.0 (137)	100 (1524)
p-value	0.001		

Logistic regression was carried out to evaluate the relationship between level of education and cannabis use further. Findings of univariate analysis showed that the

difference in the level of education of those who were cannabis positive was highly statistically significant (p=0.0001), with those having a matric qualification or less, being 4.22 times more likely to use cannabis than those with a post-matric qualification. Multivariate analysis showed that those with matric qualification or less, are 2.99 times more likely to use cannabis than those with a post-matric qualification (p=0.020), adjusting for language (Zulu or Afrikaans), country (South Africa or Mozambique), and marital status (single or married) (table 4.23).

Table 4.23: Univariate & multivariate analysis of cannabis use by level of education

	Urine Cannabis Positive	
	Univariate Model	**Multivariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Level of Education		
Post-matric	**1**	**1**
Matric or less	4.22(1.70-10.43) 0.001	2.99(1.19-7.50) 0.020
Language		
Zulu		**1**
Afrikaans		0.08(0.01-0.55)0.011
Country		
South Africa		**1**
Mozambique		0.26(0.10-0.72)0.010
Marital Status[a]		
Single		**1**
Married		0.61(0.42-0.89)0.010
Log Likelihood (LR Chi, p-value)	-453.23(14.94, p< 0.0001)	-413.70(47.45, p<0.010)

[a]*See Section 4.3.8 for description of marital status*

4.3.7 Type of accommodation

Three of the seven study mines (P2, G2, and C1) had mine hostels. All other forms of lodging apart from mine hostels, such as shared housing and own housing, were

classified into 'other' category. In mines with no hostels, ‘other’ accommodation was also utilised by migrant workers who left their families behind to work at the mines. About a quarter of all participants (26.9%) lived in mine hostels (table 4.24).

Table 4.24: Type of accommodation by mine

Mine	Mine hostel % (n)	Other accommodation % (n)	Total % (n)
P1	Nil	100 (108)	100 (108)
P2	53.2 (108)	46.8 (95)	100 (203)
G1	Nil	100 (111)	100 (111)
G2	73.2 (256)	26.9 (94)	100 (350)
D1	Nil	100 (317)	100 (317)
C1	20.9 (54)	79.2 (205)	100 (259)
O1	Nil	100 (208)	100 (208)
Mean	**26.9 (418)**	**73.1 (1138)**	**100 (1556)**

4.3.7.1 CAGE status & type of accommodation

Of those who lived in other accommodation, 17.9% were CAGE positive compared to 11.7% of those who lived in hostels (table 4.25).

Univariate analysis showed that this difference was statistically significant (p=0.014) with those who lived in other accommodation being 1.64 times more likely to be CAGE positive than those who lived in hostels. Adjusting for language (Zulu, Afrikaans or Xhosa) and level of education (no formal education or standard 6 to 10) in the multivariate model, this finding remained significant (p=0.008) (table 4.26).

Table 4.25: CAGE status by type of accommodation

Type of Accommodation [a]	CAGE Negative % row (n)	Cage Positive % row (n)	Total % row (n)
Hostel	88.3 (369)	11.7 (49)	100.0 (418)
Other	82.1 (322)	17.9 (70)	100.0 (390)
Total	85.3 (691)	14.7 (119)	100.0 (810)
p-value	0.014		

[a] *Mines with hostels only*

Table 4.26: Univariate & multivariate analysis of CAGE status by type of accommodation

	CAGE Positive	
	Univariate Model	**Multivariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Type of Accommodation		
Hostel	**1**	**1**
Other	1.64(1.10-2.43) 0.014	1.76(1.16-2.67)0.008
Language		
Zulu		**1**
Afrikaans		0.29(0.11- 0.77) 0.012
Tsonga		0.17(0.04-0.72)0.016
Level of Education		
No formal education		**1**
Standard 6-10		1.84(1.22-2.79)0.004
Log Likelihood (LR Chi, p-value)	-334.98(6.09, p<0.0136)	-308.01(33.44, p< 0.00001)

4.3.7.2 Cannabis use & type of accommodation

Although more hostel dwellers (7.7%) used cannabis than those who lived in other accommodation (5.4%), the difference was not significant (p=0.186) (table 4.27).

Table 4.27: Cannabis use status by type of accommodation

Type of Accommodation[a]	Cannabis Negative % row (n)	Cannabis Positive % row (n)	Total % row (n)
Hostel	92.3 (386)	7.7 (32)	100.0 (418)
Other	94.6 (371)	5.4 (21)	100.0 (390)
Total	93.5 (757)	6.5 (53)	100.0 (810)
p-value	0.186		

[a]*Mines with hostels only*

4.3.8 Marital status

Almost three quarters of all participants (71.5%) were married, while about a quarter (22.8%) were single (table 4.28).

Table 4.28: Marital status of participants by mine

Mine	Marital Status % (n)						
	Single (never married)	**Married**	**Living Together**	**Divorced**	**Separated**	**Widowed**	**Total**
P1	20.4 22)	76.9 (83)	2.8 (3)	Nil	Nil	Nil	**100 (108)**
P2	22.2 (45)	73.4 (149)	2.0 (4)	1.5 (3)	Nil	1.0 (2)	**100 (203)**
G1	45.1 (50)	49.6 (55)	2.7 (3)	1.8 (2)	Nil	0.9 (1)	**100 (111)**
G2	12.4 (43)	84.7 (294)	1.7 (6)	0.3 (1)	Nil	0.9 (3)	**100 (347)**
D1	20.8 (66)	72.3 (230)	0.3 (1)	4.4 (14)	0.9 (3)	1.3 (4)	**100 (318)**
C1	21.5 (56)	70.0 (182)	2.3 (6)	2.3 (6)	1.9 (5)	1.9 (5)	**100 (260)**
O1	35.1 (73)	56.7 (118)	4.3 (9)	2.4 (5)	1.0 (2)	0.5 (1)	**100 (208)**
Mean	**22.8 (355)**	**71.5 (1111)**	**2.1 (32)**	**2.0 31)**	**0.6 (10)**	**1.0 (16)**	**100 (1555)**

4.3.8.1 CAGE status & marital status

There were almost two times more CAGE positive respondents among those who were single (23.4%) than among those who were married (12.9%) (table 4.29).

Table 4.29: CAGE status by marital status

Marital Status	CAGE Negative % row (n)	CAGE Positive % row (n)	Total % row (n)
Single	76.6 (272)	23.4 (83)	100 (355)
Married	87.1 (968)	12.9 (143)	100 (1,111)
Total	84.6 (1240)	15.4 (226)	100 (1466)
p-value	0.0001		

Univariate analysis showed that those who were married were less likely to be CAGE positive than those who were single (OR=0.48) and this difference was highly significant (p=0.0001). This finding was also significant with the multivariate model (p=0.001, OR=0.59), adjusting for type of accommodation (hostel or other), level of education (no formal schooling or standard 6 to 10), sex (male or female), and language (Zulu, Afrikaans, Venda, or Tsonga) (table 4.30).

Table 4.30: Univariate & multivariate analysis of CAGE status by marital status

	CAGE Positive	
	Univariate Model	**Multivariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Marital status		
Single	**1**	**1**
Married	0.48(0.36-0.66)0.000	0.59(0.43-0.81)0.001
Accommodation		
Hostel		**1**
Other		1.54(1.08-2.20)0.017
Level of Education		
No formal Schooling		**1**
Standard 6-10		1.53(1.13-2.07)0.006
Sex		
Male		**1**
Female		0.09(0.01-0.66)0.017
Language		
Zulu		**1**
Afrikaans		0.32(0.17-0.63)0.001
Venda		0.35(0.15-0.82)0.015
Tsonga		0.44(0.23-0.87)0.017
Log Likelihood (LR Chi , p-value)	-647.45(22.48, p<0.0002)	-590.27(71.70, p<0.0000)

4.3.8.2 Cannabis use & marital status

There were almost two times more cannabis positive respondents among those who were single (12.4%) than among those who were married (7.4%) and this difference was statistically significant (p=0.05). However, when univariate analysis was carried out, the model was not significant (p=0.06). Multivariate analysis was therefore not carried out. Table 4.31 shows the prevalence of cannabis use by marital status.

Table 4.31: Cannabis use status by marital status

Marital Status	**Cannabis Negative % row (n)**	**Cannabis Positive % row (n)**	**Total % row (n)**
Single	87.6 (311)	12.4 (44)	100 (355)
Married	92.6 (1,029)	7.4 (82)	100 (1,111)
Total	91.4 (1340)	8.6 (126)	100 (1466)
p-value	0.05		

4.3.9 Cohabitation status with wife

About half of all married male participants (47.5%) lived with their wives at the mines while the other half (52.5%) didn't live with their wives and visited them periodically (table 4.32).

Table 4.32: Cohabitation status of participants with their wives

Cohabitation status with wife	Total % (n)
Yes	47.5 (507)
No	52.5 (560)
Total	100.0 (1067)

4.3.9.1 CAGE status and cohabitation status with wife

The majority of married male participants who lived with their wives (84.8%) at the mines were CAGE negative and a similar percentage who did not live with their wives (88.2%) were also CAGE negative. Cohabitation status with wife was not found to be significant for alcohol dependence (table 4.33).

Table 4.33: CAGE status by cohabitation status with wife

Marital Status		CAGE Negative % row (n)	CAGE Positive % row (n)	Total % row (n)
Cohabitation status with wife	**Yes**	84.8 (430)	15.2 (77)	100.0 (507)
	No	88.2 (494)	11.8 (66)	100.0 (560)
Total		86.6 (924)	13.4 (143)	100.0 (1067)
p-value		0.103		

4.3.9.2 Cannabis use status and cohabitation status with wife

The majority of married male participants who lived with their wives (91.5%) at the mines and the majority of those who did not live with their wives (93%) were cannabis negative. Cohabitation status with wife was not found to be significant for cannabis use (table 4.34).

Table 4.34: Cannabis use status by cohabitation status with wife

Marital Status		Cannabis Negative % row (n)	Cannabis Positive % row (n)	Total % row (n)
Cohabitation status with wife	**Yes**	91.5 (464)	8.5 (43)	100.0 (507)
	No	93.0 (521)	7.0 (39)	100.0 (560)
Total		92.3 (985)	7.7 (82)	100.0 (1067)
p-value			0.353	

4.3.10 Job category

Employees' jobs were classified into four categories-officials, union men, grade 5 to 8 employees, and grade 3 to 4 employees. Officials include employees in leadership positions, such as managers and engineers, and certain employees who carry out administrative work, such as human resource officials. Union men are artisans such as boilermakers, electricians, fitters and turners. Grade 5 to 8 employees include those in supervisory positions such as team leaders and team supervisors, while grade 3 to 4 employees are those who carry out the more labour intensive jobs such as truck drivers, drillers, and operators.

Over half of all participants (59.1%) were in the grade 3 to 4 category while about a fifth of them (22.9%) were officials, about a tenth (11.3%) were union men/artisans and less than a tenth (6.7%) were grade 5 to 8 workers (table 4.35).

Table 4.35: Job category of participants by mine

Mine	Officials % (n)	Union men/ artisans % (n)	Grade 5 to 8 % (n)	Grade 3 to 4 % (n)	Total % (n)
P1	19.6 (21)	14.0 (15)	3.7 (4)	62.6 (67)	100 (107)
P2	21.5 (43)	3.0 (6)	16.5 (33)	59.0 (118)	100 (200)
G1	24.3 (26)	6.5 (7)	5.6 (6)	63.6 (68)	100 (107)
G2	17.9 (60)	11.0 (37)	8.7 (29)	62.4 (209)	100 (335)
D1	33.6 (99)	13.6 (40)	2.4 (7)	50.5 (149)	100 (295)
C1	31.6 (78)	18.2 (45)	4.1 (10)	46.2 (114)	100 (247)
O1	7.7 (16)	9.2 (19)	5.8 (12)	77.3 (160)	100 (207)
Mean	**22.9 (343)**	**11.3 (169)**	**6.7 (101)**	**59.1 (885)**	**100 (1498)**

4.3.10.1 CAGE status & job category

Of officials 11.7% were CAGE positive compared to 16.7% of participants in grade 3 to 4 job category. Job category was not statistically linked to CAGE status (p=0.089) (table 4.36).

Table 4.36: CAGE status by job category

Job Category	CAGE Negative % row (n)	CAGE Positive % row (n)	Total % row (n)
Officials	88.3 (303)	11.7 (40)	100 (343)
Union men/artisans	88.8 (150)	11.2 (19)	100 (169)
Grade 5 to 8	84.2 (85)	15.8 (16)	100 (101)
Grade 3 to 4	83.3 (737)	16.7 (148)	100 (885)
Total	**85.1 (1275)**	**14.9 (223)**	**100 (1498)**
p-value	0.089		

4.3.10.2 Cannabis use & job category

There were over two times more cannabis positive respondents among those who were in grade 3 to 4 job category (11.7%) than among officials (4.7%) (table 4.37).

Table 4.37: Cannabis use status by job category

Job Category	Cannabis Negative % row (n)	Cannabis Positive % row (n)	Total % row (n)
Officials	95.3 (327)	4.7 (16)	100 (343)
Union men/ artisans	94.7 (160)	5.3 (9)	100 (169)
Grade 5 to 8	95.1 (96)	4.9 (5)	100 (101)
Grade 3 to 4	88.3 (781)	11.7 (104)	100 (885)
Total	91.1 (1,364)	8.9 (134)	**100 (1498)**
p-value	P=0.0001		

Univariate analysis showed a highly statistically significant difference in cannabis use status among employees in group 3-4 (p=0.0001), with employees in this group being 2.72 times more likely to use cannabis compared to officials. Multivariate analysis also showed that this difference was significant (p=0.004, OR=2.29), adjusting for marital status (single or married), country of origin (South African or Mozambican) and language (Zulu or Afrikaans) (table 4.38).

Table 4.38: Univariate & multivariate analysis of cannabis use status by job category

	Urine Cannabis Positive	
	Univariate Model	**Multivariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Job Category		
Officials	**1**	**1**
Union men	1.14(0.49-2.64)0.755	1.31(0.55-3.08)0.541
Group 5 to 8	1.06(0.38-2.98)0.905	1.19(0.42-3.42)0.741
Group 3 to 4	2.72(1.58-4.68)0.0001	2.29(1.30-4.05)0.004
Marital Status		
Single		**1**
Married		0.64(0.43-0.93)0.019
Country		
South Africa		**1**
Mozambique		0.27(0.10-0.75)0.012
Language		
Zulu		**1**
Afrikaans		0.084(0.01-0.61)0.015
Log Likelihood (LR Chi, p-value)	-440.09 (22.61, p<0.000)	-399.96 (50.48, p<0.000)

4.3.11 Nature of employment

More than a tenth of all participants (16%) were contract workers (table 4.39).

Table 4.39: Nature of participants' employment by mine

Mine	**Full-time workers % (n)**	**Contract workers % (n)**	**Total % (n)**
P1	76.9 (83)	23.2 (25)	100 (108)
P2	84.2 (170)	15.8 (32)	100 (202)
G1	64.6 (71)	35.5 (39)	100 (110)
G2	89.0 (308)	11.0 (38)	100 (346)
D1	84.5 (268)	15.5 (49)	100 (317)
C1	74.8 (193)	25.2 (65)	100 (258)
O1	100 (208)	Nil	100 (208)
Mean	**84.0 (1301)**	**16.0 (248)**	**100 (1549)**

4.3.11.1 CAGE status & nature of employment

Of respondents who were CAGE positive, 17.3% were contract workers compared to 14.2% who were full-time workers. There was no significant link between nature of employment and CAGE status (p=0.216) (table 4.40).

Table 4.40: CAGE status by nature of employment

Nature of Employment[a]	CAGE Negative % row (n)	Cage Positive % row (n)	Total % row (n)
Contract	82.7 (205)	17.3 (43)	100 (248)
Full-time	85.8 (939)	14.2 (156)	100 (1,095)
Total	85.2 (1,144)	14.8 (199)	100 (1,343)
p-value	0.216		

[a]*Mines with contract workers only.*

4.3.11.2 Cannabis use & nature of employment

There were over two times more cannabis positive respondents among contract workers (12.5%) than among full-time workers (5.7%) (table 4.41).

Table 4.41: Cannabis use status by nature of employment

Nature of employment[a]	Cannabis negative % row (n)	Cannabis positive % row (n)	Total % row (n)
Contract	87.5 (217)	12.5 (31)	100 (248)
Full-time	94.3 (1,032)	5.7 (63)	100 (1,095)
Total	93.0 (1,249)	7.0 (94)	100 (1,343)
p-value	0.0001		

[a]*Mines with contract workers only.*

Univariate analysis showed that full-time workers were significantly less likely to be cannabis positive (OR=0.43) than contract workers and this difference was highly

significant (p<0.0001). This finding was also significant with multivariate analysis (p=0.004, OR=0.50) adjusting for language (Zulu, Xhosa or Afrikaans), marital status (single or married), and country (South Africa or Mozambique) (table 4.42).

Table 4.42: Univariate & multivariate analysis of cannabis use by nature of employment

	Urine Cannabis Positive	
	Univariate Model	**Multivariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Nature of participants' employment		
Contract worker	1	1
Fulltime worker	0.43(0.27-0.67)0.000	0.50(0.31-0.80)0.004
Language		
Zulu		1
Xhosa		1.91(1.12- 3.25)0.017
Afrikaans		0.08(0.01-0.60)0.014
Marital Status		
Single		**1**
Married		0.62(0.39-0.98)0.039
Country		
South Africa		1
Mozambique		0.22(0.05-0.94)0.040
Log Likelihood (LR Chi , p-value)	-334.48(12.26, p<0.0005)	-305.13(45.81, p< 0.0000)

4.3.12 Length of service

Participants were asked how long they had been working at their present jobs. About a tenth of respondents in all mines (11.1%) had been working at their present jobs for less than 1 year, 35.6% had been working for 1 to 5 years, 29.4% had been working at their jobs for 6 to 10 years and 23.9% had been working at their jobs for over 10 years (table 4.43).

Table 4.43: Length of service of participants

Length of service (years)	% of respondents (n)
<1	11.1 (170)
1-5	35.6 (548)
6-10	29.4 (453)
>10	23.9 (367)
Total	100.0 (1,538)

4.3.12.1 CAGE status & length of service

Of those who had been in service for less than one year, 18.2% were CAGE positive compared to 13.1% of participants who had been in service at the mine for longer than ten years. There was no significant link between length of service and CAGE status (p=0.375) (table 4.44).

Table 4.44: CAGE status by length of service

Length of Service (years)	CAGE Negative % row (n)	CAGE Positive % row (n)	Total % row (n)
<1	81.8 (139)	18.2 (31)	100 (170)
1-5	84.3 (462)	15.7 (86)	100 (548)
6-10	85.0 (385)	15.0 (68)	100 (453)
>10	86.9 (319)	13.1 (48)	100 (367)
Total	84.9 (1,305)	15.1 (233)	100 (1,538)
p-value	0.375		

4.3.12.2 Cannabis use & length of service

There were almost three times more cannabis positive respondents among participants who had been in service for less than one year (15.3%) than among those who had been in service for more than 10 years (5.4%) (table 4.45).

Table 4.45: Cannabis use status by length of service

Length of Service (years)	Cannabis Negative % row (n)	Cannabis Positive % row (n)	Total % column (n)
<1	84.7 (144)	15.3 (26)	100 (170)
1-5	88.9 (487)	11.1 (61)	100 (548)
6-10	93.6 (424)	6.4 (29)	100 (453)
>10	94.6 (347)	5.4 (20)	100 (367)
Total	91.2 (1,402)	8.8 (136)	100 (1,538)
p-value	0.0001		

As displayed in table 4.46, univariate analysis showed that those who had been in service for 6 to 10 years (p=0.001) and those who had been in service for more than 10 years (p=0.0001) were less likely to use cannabis compared to those who had been in service for less than one year (OR 0.38 and 0.31 respectively). These differences were statistically significant although that of those who had been in service for more than 10 years was highly significant. A Mantel-Haenzel test showed that this trend was highly statistically significant (p<0.00001, OR=0.76, confidence interval: 0.67-0.87).

Findings of univariate analysis were also significant with multivariate analysis (p=0.001) adjusting for perceived level of work-related danger ('never', 'sometimes' or 'most-times to always'), level of education (no formal schooling or standard 1 to 5), language (Zulu, Afrikaans of Xhosa), location of workstation (belowground or aboveground), and country (South Africa or Mozambique) (table 4.46).

Table 4.46: Univariate & multivariate analysis of cannabis use status by length of service

	Urine Cannabis Positive	
	Univariate Model	**Multivariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Length of Service (years)		
<1	**1**	**1**
1-5	0.69(0.42-1.14)0.148	0.73(0.43-1.23)0.232
6-10	0.38(0.22-0.67)0.001	0.36(0.20-0.66)0.001
>10	0.31(0.17-0.57)0.0001	0.34(0.18-0.65)0.001
Perceived level of work-related danger[a]		
Never		**1**
Sometimes		1.83(1.11-3.02)0.018
Most-times to always		1.89(1.10-3.25)0.021
Level of Education		
No formal schooling		**1**
Standard 1-5		0.32(0.13-0.81)0.016
Language		
Zulu		**1**
Afrikaans		0.08(0.01-0.55)0.011
Xhosa		1.79(1.09-2.93)0.022
Location of workstation		
Belowground		**1**
Aboveground		1.69(1.13-2.55)0.011
Country		
South Africa		**1**
Mozambique		0.34(0.12-0.94)0.038
Log Likelihood (LR Chi , p-value)	-450.06(21.08, p<0.0001)	-398.33(75.92, p<0.0000)

[a]*See section 4.6.1 for perceived level of work-related danger*

4.3.13 Type of study mine

Differences were observed in the prevalence of substance use in study mines. The estimated prevalence of alcohol dependence (according to the CAGE criteria) in mine G1 of 24.8% was found to be more than double that of mine D1 where the estimated

prevalence was 10.7% (table 4.2), while the prevalence of urine-positive cannabis users in mine O1 (21.5%) was almost five times that of mine P1 (4.6%) (table 4.6).

In order to determine if these differences were due to a cluster effect, logistic regression analysis using univariate models was carried out. Findings of this analysis showed that with regard to CAGE status there was no cluster effect, with the exception of mines P1 and D1, and mines P1 and G2. Relative to mine P1, mine D1 was 52% less likely to be CAGE positive (OR=0.48, p=0.016) and mine G2 was 48% less likely to be CAGE positive (OR=0.56, p-value=0.05). According to the pseudo-coefficient 'R^2' which was estimated as 0.0136, type of mine accounted for 1.36% of the variability in CAGE status. With regard to cannabis use status, there was no cluster effect, with the exception of mines P1 and O1, and mines P1 and G1. Relative to mine P1, mine O1 was 5.37 times more likely to be cannabis positive (OR=5.37, p=0.001), and mine G1 was 3.22 times more likely to be cannabis positive (OR=3.22, p=0.029). According to the pseudo-coefficient 'R^2' which was estimated as 0.0454, type of mine accounted for 4.54% of the variability in cannabis status (table 4.47).

Table 4.47: Univariate analysis of substance use by mine

	CAGE Positive	**Cannabis Positive**
	Univariate Model	**Univariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Study Mine		
P1	**1**	**1**
P2	0.80(0.44-1.47)0.480	1.64(0.58-4.65)0.349
D1	0.48(0.26-0.87)0.016	1.38(0.51-3.78)0.528
C1	0.82(0.46-1.46)0.503	1.62(0.59-4.47)0.348
O1	0.84(0.46-1.53)0.564	5.37(2.06-14.0)0.001
G1	1.33(0.70-2.54)0.384	3.22(1.13-9.19)0.029
G2	0.56(0.32-1.00)0.050	1.22(0.45-3.32)0.704
Log Likelihood (LR Chi, p-value)	-653.31(17.98, p<0.0063)	**-443.57 (42.23, p<0.0001)**
R^2	0.0136	0.0454

When multivariate analysis was carried out, workers in mine D1 remained less likely to be CAGE positive than workers in mine P1 (p=0.013), adjusting for sex (male or female), marital status (single or married), language (Zulu, Afrikaans or Tsonga), type of accommodation (hostel or other), and level of education (no formal schooling or standard 6-10) (table 4.48). With regard to cannabis use, workers in mine O1 were highly statistically significantly more likely to use cannabis compared to those in mine P1 (p=0.0001) adjusting for nature of employment (contract or fulltime worker), country of origin (South Africa or Mozambique) and language (Zulu, Xhosa or Afrikaans). The differences observed in mine G1 were however not significant following multivariate analysis (p=0.124) (table 4.49).

Table 4.48: Multivariate analysis of CAGE status by mine

	CAGE Positive
Variable	**Odds Ratio(CI)p-value**
Study Mine	
P1	**1**
P2	0.92(0.47-1.77)0.796
D1	0.45(0.24-0.85)0.013
C1	0.85(0.46-1.55)0.591
O1	0.60(0.32-1.16)0.129
G1	0.97(0.49-1.89)0.918
G2	0.76(0.39-1.48)0.424
Sex	
Male	**1**
Female	0.09(0.01-0.69)0.020
Marital Status	
Single	**1**
Married	0.63(0.46-0.86)0.004
Language	
Zulu	**1**
Afrikaans	0.34(0.17-0.67)0.002
Tsonga	0.47(0.24-0.93)0.030
Accommodation	
Hostel	**1**
Housing other than hostel	1.62(1.03-2.55)0.036
Level of Education	
No formal Schooling	**1**
Standard 6-10	1.62(1.19-2.21)0.002
Log Likelihood (LR Chi, p-value)	-584.28(73.80, p<0.00001)

Table 4.49: Multivariate analysis of cannabis use by mine

	Urine Cannabis Positive
Variable	**Odds Ratio(CI)p-value**
Study Mine	
P1	1
P2	1.60(0.55-4.62)0.390
D1	1.55(0.56-4.27)0.401
C1	1.36(0.48-3.83)0.557
O1	6.10(2.26-6.52)0.0001
G1	2.31(0.80-6.74)0.124
G2	1.16(0.41-3.26)0.779
Nature of Employment	
Contract worker	1
Full-time worker	0.47(0.29-0.76)0.002
Country of origin	
South Africa	1
Mozambique	0.22(0.08-0.61)0.004
Language	
Zulu	1
Xhosa	1.86(1.12-3.10)0.017
Afrikaans	0.081(0.01-0.59)0.13
Log Likelihood (LR Chi, p-value)	**-397.59 (81.56, p<0.0001)**

4.4 Practice of Substance Use

This section describes the practice of substance use among current users of alcohol and their fellow workers. Where relevant, links to substance use were also evaluated.

4.4.1 Frequency of substance use

4.4.1.1 Frequency of alcohol consumption

More than half of current alcohol users (55.8%) drink alcohol on at least one day a week, and about one tenth of these participants (9.3%) drink alcohol everyday (table 4.50).

Table 4.50: Frequency of current users' alcohol consumption by mine

Mine	Every day % (n)	5-6 days / week % (n)	3-4 days / week % (n)	1-2 days / week % (n)	1-3 days / month % (n)	Less often % (n)	Total % (n)
P1	25.0 (16)	Nil	6.3 (4)	26.6 (17)	35.9 (23)	6.3 (4)	100 (64)
P2	23.2 (22)	Nil	2.1 (2)	23.2 (22)	44.2 (42)	7.4 (7)	100 (95)
G1	4.1 (2)	32.7 (16)	10.2 (5)	Nil	28.6 (14)	24.5 (12)	100 (49)
G2	4.2 (5)	29.7 (35)	10.2 (12)	1.7 (2)	46.6 (55)	7.6 (9)	100 (118)
D1	10.7 (16)	32.9 (49)	14.1 (21)	2.7 (4)	28.2 (42)	11.4 (17)	100 (149)
C1	Nil	51.3 (58)	14.2 (16)	1.8 (2)	17.7 (20)	15.0 (17)	100 (113)
O1	2.3 (2)	42.1 (37)	10.2 (9)	3.4 (3)	10.2 (9)	31.8 (28)	100 (88)
Mean	**9.3 (63)**	**28.9 (195)**	**10.2 (69)**	**7.4 (50)**	**30.3 (205)**	**13.9 (94)**	**100 (676)**
	55.8 (377)						

4.4.1.2 Frequency of cannabis use by current users

Almost two thirds of current cannabis users (60.6%) reported daily use of cannabis (table 4.51).

Table 4.51: Current users' frequency of cannabis use by mine

Mine	Frequency of cannabis use % (n)						
	Every day	**5-6 days / week**	**3-4 days / week**	**1-2 days / week**	**1-3 days / month**	**Less often**	**Total**
P1	33.3 (1)	Nil	Nil	Nil	Nil	66.7 (2)	100 (3)
P2	50.0 (2)	Nil	Nil	25.0 (1)	Nil	25.0 (1)	100 (4)
G1	75.0 (3)	Nil	Nil	Nil	25.0 (1)	Nil	100 (4)
G2	Nil	Nil	50.0 (1)	Nil	50.0 (1)	Nil	100 (2)
D1	20.0 (1)	Nil	Nil	60.0 (3)	20.0 (1)	Nil	100 (5)
C1	75.0 (3)	Nil	Nil	25.0 (1)	Nil	Nil	100 (4)
O1	90.9 (10)	Nil	Nil	9.1 (1)	Nil	Nil	100 (11)
Mean	**60.6 (20)**	**Nil**	**3.0 (1)**	**18.2 (6)**	**9.1 (3)**	**9.1 (3)**	**100 (33)**

4.4.2 Drinking partners

The majority of current alcohol users drink with their friends (72.7%), while about a fifth drink alone (22.8%) (table 4.52).

Table 4.52: Drinking partners of current alcohol users

Mine	Who do you usually drink with? % (n)						
	Alone	**Friends only**	**Family members only**	**Alone & with friends**	**Alone & with family members**	**Family members & friends**	**Total**
P1	20.0 (13)	64.6 (42)	4.6 (3)	7.7 (5)	1.5 (1)	1.5 (1)	100 (65)
P2	34.2 (38)	61.3 (68)	Nil	3.6 (4)	0.9 (1)	Nil	100 (111)
G1	31.4 (16)	68.6 (35)	Nil	Nil	Nil	Nil	100 (51)
G2	26.2 (32)	73.0 (89)	0.8 (1)	Nil	Nil	Nil	100 (122)
D1	15.0 (25)	79.0 (132)	3.0 (5)	2.4 (4)	Nil	0.6 (1)	100 (167)
C1	14.6 (18)	79.7 (98)	2.4 (3)	Nil	3.2 (4)	Nil	100 (123)
O1	26.5 (26)	73.5 (72)	Nil	Nil	Nil	Nil	100 (98)
Mean	**22.8 (168)**	**72.7 (536)**	**1.6 (12)**	**1.8 (13)**	**0.8 (6)**	**0.3 (2)**	**100 (737)**

4.4.3 Practice of substance use among participants' fellow workers

4.4.3.1 Reported alcohol use status of fellow workers

Almost three quarters of participants (70.6%) said their fellow workers use alcohol (table 4.53).

Table 4.53: Reported alcohol use status of respondents' fellow workers

Mine	Do your fellow workers use alcohol? % (n)			
	Yes	**No**	**Don't know**	**Total**
P1	81.1 (86)	5.7 (6)	13.2% (14)	100 (106)
P2	70.3 (142)	14.9 (30)	14.9% (30)	100 (202)
G1	76.6 (85)	6.3 (7)	17.1% (19)	100 (111)
G2	57.0 (199)	13.8 (48)	29.2% (102)	100 (349)
D1	66.7 (206)	12.6 (39)	20.7% (64)	100 (309)
C1	76.5 (199)	11.5 (30)	11.9% (31)	100 (260)
O1	83.7 (174)	6.7 (14)	9.6% (20)	100 (208)
Mean	**70.6 (1091)**	**11.3 (174)**	**18.1% (280)**	**100 (1545)**

4.4.3.2 Participants' CAGE status & reported alcohol use status of fellow workers

There were about three times more CAGE positive respondents among those who said their fellow workers used alcohol (18.3%) compared to those who said their fellow workers did not use alcohol (6.3%) (table 4.54).

Table 4.54: Participants' CAGE status by fellow workers' reported alcohol use status

Reported alcohol use status of fellow workers	CAGE Negative % row (n)	CAGE Positive % row (n)	Total % row (n)
Yes	81.7 (891)	18.3 (200)	100 (1,091)
No	93.7 (163)	6.3 (11)	100 (174)
Don't know	92.1 (258)	7.9 (22)	100 (280)
Total	84.9 (1312)	15.1 (233)	100 (1545)
p-value		0.0001	

Univariate analysis showed that participants who said their fellow workers did not use alcohol (OR=0.30) and those who didn't know if their fellow workers used alcohol (OR 0.38) were less likely to be CAGE positive than those who reported that their fellow workers used alcohol and these differences were highly significant (p=0.0001). These findings were also significant with multivariate analysis adjusting for level of education (no formal education or standard 6 to 10), sex (male or female), marital status (single or married), and language (Zulu, Tsonga or Afrikaans) (table 4.55).

Table 4.55: Univariate & multivariate analysis of participants' CAGE status by fellow workers' reported alcohol use status

	CAGE POSITIVE	
	Univariate Model	**Multivariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Reported alcohol use by fellow workers		
Yes	**1**	**1**
No	0.30(0.16-0.56)0.0001	0.33(0.17-0.62)0.001
Don't know	0.38(0.24-0.60)0.0001	0.38(0.24-0.62)0.0001
Level of education		
No formal education		**1**
Standard 6-10		1.56(1.15-2.12)0.004
Sex		
Male		**1**
Female		0.09(0.01-0.66)0.018
Marital status		
Single		**1**
Married		0.62(0.45-0.84)0.002
Language		
Zulu		**1**
Tsonga		0.43(0.21-0.87)0.019
Afrikaans		0.34(0.17-0.66)0.001
Log Likelihood (LR Chi , p-value)	-637.83(34.84, p<0.00001)	-571.29(86.96, p<0.0000)

4.4.3.3 Reported cannabis use status of fellow workers

All participants were asked if they knew fellow workers who use cannabis. More than a quarter of all respondents (27.6%) said their fellow workers use cannabis. Mine O1 which had the highest prevalence of cannabis use (21.5%) (section 4.2.3.2) also had the highest prevalence of reported cannabis use by fellow workers (47.3%) as shown in table 4.56 which compares the prevalence of cannabis use with reported cannabis use of fellow workers.

Table 4.56: Prevalence of cannabis use & reported cannabis use status of fellow workers

Mine	Prevalence of cannabis use [a] % (n)	Do your fellow workers use cannabis? %(n)			
		Yes	No	Don't know	Total
D1	7.2 (22)	15.2 (48)	38.0 (120)	46.8 (148)	100 (316)
G2	5.6 (20)	16.1 (56)	27.6 (96)	56.3 (196)	100 (348)
C1	7.6 (20)	26.9 (70)	40.8 (106)	32.3 (84)	100 (260)
P1	4.6 (5)	30.3 (30)	41.4 (41)	28.3 (28)	100 (99)
G1	13.6 (15)	38.7 (43)	18.0 (20)	43.2 (48)	100 (111)
P2	7.5 (15)	40.3 (81)	36.8 (74)	22.9 (46)	100 (201)
O1[b]	21.5 (43)	47.3 (98)	23.7 (49)	29.0 (60)	100 (207)
Mean	**9.1 (140)**	**27.6 (426)**	**32.8 (506)**	**39.6 (610)**	**100 (1542)**

[a] *See section 4.2.2.2 for prevalence of cannabis use*
[b] *See section 4.3.12 for differences between mines*

4.4.3.4 Reported cannabis use status of fellow workers & participants' cannabis use status

Close to a tenth of respondents who said their fellow workers use cannabis (8.9%) were cannabis positive compared to 9.1% of those respondents who said their fellow workers did not use cannabis. There was no association between use of cannabis by fellow workers and participants' cannabis use status (p=0.903) (table 4.57).

Table 4.57: Participants' cannabis use status by fellow workers' reported cannabis use status

Reported cannabis use by fellow workers	Cannabis Negative % row (n)	Cannabis Positive % row (n)	Total % row (n)
Yes	91.1 (388)	8.9 (38)	100 (426)
No	90.9 (460)	9.1 (46)	100 (506)
Don't know	91.6 (559)	8.4 (51)	100 (610)
Total	91.3 (1407)	8.8 (135)	100 (1542)
p-value		0.903	

4.4.4 Help-seeking practice & its relationship to substance use

4.4.4.1 Help-seeking practice & CAGE status

Participants who reported that they currently use alcohol were asked if they had ever sought any kind of help to control their use of alcohol. Over a tenth of current users (13.6%) said they had sought help compared to 86.4% of respondents who had not (table 4.54, % column). Close to two-thirds of those who had ever sought help were CAGE positive (63.8%) compared to 45% of those who had never sought help (table 4.58, % row).

Table 4.58: Help-seeking practice & its relationship to CAGE status

Have you ever sought help to decrease your use of alcohol?	**CAGE negative % row(n)**	**CAGE positive % row(n)**	**Total % row(n)**
Yes	36.2 (21)	63.8 (37)	100 (58)
No	55.0 (202)	45.0 (165)	100 (367)
Total	52.5 (223)	47.5 (202)	100 (425)
Have you ever sought help to decrease your use of alcohol?	**CAGE negative % column (n)**	**CAGE positive % column (n)**	**Total % column (n)**
Yes	9.4 (21)	18.3 (37)	13.6 (58)
No	90.6 (202)	81.7 (165)	86.4 (367)
Total	100 (223)	100 (202)	100 (425)
p-value	0.008		

Univariate analysis showed that those who had sought help for alcohol use were 2.16 times more likely to be CAGE positive compared to those who didn't seek help and this difference was statistically significant (p=0.009). This finding was also significant with multivariate analysis (p=0.034, OR=1.98) adjusting for level of education (no formal schooling, grade 6 to 10, or post-matric), location of workstation (underground or both above & below ground), and language (Zulu, English, Tsonga or Afrikaans) (table 4.59).

Table 4.59: Univariate & multivariate analysis of CAGE status by help-seeking practice for alcohol use

	CAGE positive	
	Univariate Model	**Multivariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Have you ever sought help to decrease your use of alcohol?		
No	**1**	**1**
Yes	2.16(1.22-3.83)0.009	1.98(1.05-3.71)0.034
Level of Education		
No formal schooling		**1**
Grade 6 to 10		2.20(1.36-3.56)0.001
Post-matric qualification		2.73(1.11-6.72)0.029
Location of workstation		
Underground		**1**
Both above & below ground		0.07(0.01-0.60)0.012
Language		
Zulu		**1**
English		0.16(0.04-0.57)0.005
Tsonga		0.35(0.14-0.85)0.021
Afrikaans		0.11(0.05-0.27)0.000
Log Likelihood (LR Chi , p-value)	-290.48348(7.17, 0.0074)	-239.02482(66.46, 0.0000)

4.4.4.2 Help-seeking practice & its relationship to cannabis use

Participants who reported that they used cannabis were asked if they had ever sought help to stop its use. The majority of respondents (71%) had not sought help for cannabis use (table 4.60, % column). More than three quarters (77.8%) of those who had sought help were cannabis positive, a percentage close to that of those who had not sought help (81.8%) (table 4.56, % row). There was no significant difference between these two groups of participants (p=0.796).

Table 4.60: Help-seeking practice & its relationship to cannabis use

Have you ever sought help to decrease your use of cannabis?	Cannabis negative % row(n)	Cannabis positive % row(n)	Total % row(n)
Yes	22.2 (2)	77.8 (7)	100 (9)
No	18.2 (4)	81.8 (18)	100 (22)
Total	19.4 (6)	80.6 (25)	100 (31)
Have you ever sought help to decrease your use of cannabis?	**Cannabis negative % column (n)**	**Cannabis positive % column (n)**	**Total % column (n)**
Yes	33.3 (2)	28.0 (7)	29.0 (9)
No	66.7 (4)	72.0 (18)	71.0 (22)
Total	100 (6)	100 (25)	100 (31)
p-value	0.796		

4.4.5 Practice of multiple substance use

There were over two times more cannabis positive respondents among those who were CAGE positive (17.5%) than those who were CAGE negative (7.4%) (table 4.61).

Table 4.61: Participants' CAGE status by cannabis use status

CAGE Status	Cannabis Negative % row (n)	Cannabis Positive % row (n)	Total % row (n)
CAGE Negative	92.6 (1,207)	7.4 (96)	100 (1303)
CAGE Positive	82.5 (194)	17.5 (41)	100 (235)
Total	91.1 (1401)	8.9 (137)	100 (1538)
p-value	0.0001		

Univariate analysis showed that those who tested positive for cannabis are 2.72 times more likely to also be dependent on alcohol (i.e. CAGE positive) than those who tested negative for cannabis and this difference was highly statistically significant (p=0.0001). This finding was also highly significant with multivariate analysis

(p=0.0001, OR=2.29), adjusting for type of accommodation (hostel or other), level of education (no formal education or standard 6-10), sex (male or female), language (Zulu, Tsonga, Venda or Afrikaans), and marital status (single or married) (table 4.62).

Table 4.62: Univariate & multivariate analysis of CAGE status by cannabis use

	CAGE Positive	
	Univariate Model	**Multivariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Urine cannabis test result		
Urine negative	**1**	**1**
Urine positive	2.72(1.83-4.04)0.0001	2.29(1.51-3.47)0.0001
Accommodation		
Hostel		**1**
Other		1.53(1.07-2.18)0.020
Level of education		
No formal education		**1**
Standard 6-10		1.59(1.18-2.16)0.003
Sex		
Male		**1**
Female		0.10(0.01-0.72)0.023
Language		
Zulu		**1**
Tsonga		0.46(0.23-0.90)0.023
Venda		0.33(0.14-0.78)0.012
Afrikaans		0.35(0.18-0.69)0.002
Marital status		
Single		**1**
Married		0.66(0.48-0.90)0.009
Log Likelihood (LR Chi, p-value)	-651.33 (21.93, p<0.00001)	-584.35(83.56, p<0.0000)

4.5 Awareness of Link between Substance Use & Work-Related Accidents

4.5.1 Awareness of link between alcohol use & accidents

All participants were asked if they felt there was a link between alcohol use and mine accidents. The majority of them (97%) felt there was a link. Participants who did not feel there was a link however ranged from 0.6% in mine G2 to 11.1% in mine O1, with a mean of 2.6% (table 4.63).

Table 4.63: Awareness of relationship between alcohol consumption & accidents

Mine	Do you think drinking alcohol can lead to accidents in the mine? % (n)			
	Yes	**No**	**Don't know**	**Total**
P1	97.1 (101)	2.9 (3)	Nil	100 (104)
P2	98.5 (197)	1.0 (2)	0.5 (1)	100 (200)
G1	98.2 (108)	1.8 (2)	Nil	100 (110)
G2	98.8 (341)	0.6 (2)	0.6 (2)	100 (345)
D1	98.1 (304)	1.9 (6)	Nil	100 (310)
C1	98.5 (256)	0.8 (2)	0.8 (2)	100 (260)
O1[a]	88.4 (183)	11.1 (23)	0.5 (1)	100 (207)
Mean	**97.0 (1490)**	**2.6 (40)**	**0.4 (6)**	**100 (1536)**

[a]***See section 4.3.12 for differences between mines***

4.5.1.1 CAGE status & awareness of link between alcohol use & accidents

Of those who were aware of a link between alcohol and accidents, 15.5% were CAGE positive compared to 7.5% who were unaware of a link. This difference was however not statistically significant (p=0.221) (table 4.64).

Table 4.64: CAGE status by awareness of link between alcohol use & accidents

Awareness of link between CAGE status & accidents	CAGE Negative % row (n)	CAGE Positive row (n)	Total % row (n)
Yes	84.5 (1,259)	15.5 (231)	100 (1,490)
No	92.5 (37)	7.5 (3)	100 (40)
Don't know	100 (6)	0.0 (0)	100 (6)
Total	84.8 (1,302)	15.2 (234)	100 (1,536)
p-value	0.221		

4.5.2 Awareness of link between cannabis use & accidents

All participants were asked if they felt that cannabis use could lead to accidents in the mine. While the majority of participants (85.6%) were aware of the relationship between cannabis use and mine accidents, about a tenth of them (12.9%) said that cannabis could not lead to accidents at work and this varied from 3.6% of respondents in mine C1 to about a third of respondents (31.2%) in mine O1 (table 4.65).

Table 4.65: Awareness of relationship between cannabis use & accidents

Mine	Do you think cannabis use can lead to accidents on the mine? % (n)			
	Yes	**No**	**Don't know**	**Total**
P1	92.1 (93)	5.0 (5)	3.0 (3)	100 (101)
P1	91.4 (181)	6.6 (13)	2.0 (4)	100 (198)
G1	88.3 (98)	10.8 (12)	0.9 (1)	100 (111)
G2	80.6 (279)	18.8 (65)	0.6 (2)	100 (346)
D1	90.5 (276)	9.2 (28)	0.3 (1)	100 (305)
C1	94.8 (235)	3.6 (9)	1.6 (4)	100 (248)
O1	64.9 (131)	31.2 (63)	4.0 (8)	100 (202)
Mean	**85.6 (1293)**	**12.9 (195)**	**1.5 (23)**	**100 (1511)**

4.5.2.1 Cannabis use & awareness of its link to accidents

There were almost three times more cannabis positive respondents among those who were unaware of a link between cannabis and accidents (20.5%) than among those who were aware of a link (7.3%) (table 4.66).

Table 4.66: Cannabis use status by awareness of link between cannabis use & accidents

Awareness of link between cannabis use & accidents	Cannabis Negative % row (n)	Cannabis Positive row (n)	Total % row (n)
Yes	92.7 (1,199)	7.3 (94)	100 (1,293)
No	79.5 (155)	20.5 (40)	100 (195)
Don't know	91.3 (21)	8.7 (2)	100 (23)
Total	91.0 (1,375)	9.0 (136)	100 (1,511)
p-value	0.0001		

Univariate analysis showed that workers who were unaware that cannabis use could lead to accidents were 3.29 times more likely to use cannabis compared to those who were aware of this link and this difference was highly significant (p=0.0001).

Multivariate analysis showed similar findings (p=0.0001, OR=3.24) adjusting for nature of employment (contract or full-time), location of workstation (underground or aboveground), and language (Zulu, Xhosa or Afrikaans) (table 4.67).

Table 4.67: Univariate & multivariate analysis of cannabis use by awareness of positive link between cannabis use & accidents

	Urine Cannabis Positive	
	Univariate Model	**Multivariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Awareness of positive link between cannabis use & accidents		
Aware	**1**	**1**
Unaware	3.29(2.11-4.96)0.0001	3.24(2.11-4.96)0.0001
Don't know	1.22(0.28-5.52)0.780	1.24(0.28-5.52)0.780
Nature of Employment		
Contract worker		**1**
Full-time worker		0.53(0.34-0.83)0.006
Location of workstation		
Underground		**1**
Aboveground		1.56(1.05-2.32)0.027
Language		
Zulu		**1**
Xhosa		2.09(1.27-3.45)0.004
Afrikaans		0.08(0.01-0.55)0.010
Log Likelihood (LR Chi , p-value)	-442.66 (29.01, p<0.0000)	-399.18 (64.66, p<0.0000)

4.6 Participants' Perceptions & Its Relationship to Substance Use

4.6.1 Perceived level of work-related danger

Participants were asked about their perceived level of danger associated with their jobs. About half of all respondents (46%) felt their jobs were sometimes dangerous, while about a quarter (27.5%) of all respondents (i.e. sum of "always" and "most times" categories) felt they were always or most times exposed to danger at work. 19% of all respondents said their jobs were never dangerous. This however ranged from 17.3% in mine P2 to 47.9% in mine D1 (table 4.68).

Table 4.68: Perceived level of work-related danger

Mine	Would you say your job is dangerous? % (n)				
	Never	**Sometimes**	**Most times**	**Always**	**Total**
P1	19.6 (21)	40.2 (43)	10.3 (11)	29.9 (32)	100 (107)
P2	17.3 (35)	44.1 (89)	13.9 (28)	24.8 (50)	100 (202)
G1	24.6 (27)	50.0 (55)	15.5 (17)	10.0 (11)	100 (110)
G2	24.1 (83)	48.0 (165)	13.4 (46)	14.5 (50)	100 (344)
D1[a]	47.9 (151)	39.7 (125)	7.3 (23)	5.1 (16)	100 (315)
C1	21.4 (44)	49.5 (102)	13.1 (27)	16.0 (33)	100 (206)
O1	19.0 (49)	50.4 (130)	15.5 (40)	15.1 (39)	100 (258)
Mean	**26.6 (410)**	**46.0 (709)**	**12.5 (192)**	**15.0 (231)**	**100 (1542)**

[a]*See section 4.3.12 for differences between mines*

4.6.1.1 CAGE status & perceived level of work-related danger

There were over one and a half times more CAGE positive respondents (18.9%) among those who felt their jobs were most times to always dangerous than those who felt their jobs were never dangerous (11.7%) (table 4.69).

Table 4.69: CAGE status & perceived level of work-related danger

Perceived level of work-related danger	CAGE Negative % row (n)	CAGE Positive % row (n)	Total % row (n)
Never dangerous	88.3 (362)	11.7 (48)	100 (410)
Sometimes dangerous	85.1 (603)	14.9 (106)	100 (709)
Most times to always dangerous	81.1 (343)	18.9 (80)	100 (423)
Total	84.8 (1308)	15.2 (234)	100 (1542)
p-value	0.015		

Univariate analysis showed that those who said their jobs were most times to always dangerous were 1.75 times more likely to be CAGE positive than those who felt their jobs were never dangerous and this difference was significant (p=0.004). This finding was also significant with multivariate analysis (p=0.013), adjusting for marital status (single or married), sex (male or female), language (Zulu, Tsonga, Venda or Afrikaans), and type of accommodation (hostel or other) (table 4.70).

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Table 4.70: Univariate & multivariate analysis of CAGE status by perceived level of work-related danger

	CAGE Positive	
	Univariate Model	**Multivariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Perceived level of work-related danger		
Never dangerous	**1**	**1**
Sometimes dangerous	1.33(0.92-1.91)0.130	1.26(0.86-1.86)0.164
Most times to always dangerous	1.75(1.19-2.58)0.004	1.68(1.11-2.52)0.013
Marital Status		
Single		**1**
Married		0.61(0.45-083)0.002
Sex		
Male		1
Female		0.10(0.01-0.74)0.024
Language		
Zulu		1
Tsonga		0.42(0.21-0.82)0.011
Venda		0.40(0.17-0.94)0.035
Afrikaans		0.32(0.17-0.63)0.001
Accommodation		
Hostel		1
Other		1.65(1.15-2.36)0.006
Log Likelihood (LR Chi , p-value)	-652.47(8.36, p<0.0153)	-581.39(65.13, p<0.00001)

4.6.1.2 Cannabis use status & perceived level of work-related danger

There were almost two times more cannabis positive respondents (10.6%) among those who felt their jobs were “most times to always dangerous” than among those who felt their jobs were “never dangerous” (5.8%) (table 4.71).

Table 4.71: Cannabis use status by perceived level of work-related danger

Perceived level of work-related danger	Cannabis Negative % row (n)	Cannabis Positive row (n)	Total % row (n)
Never dangerous	94.2 (386)	5.8 (24)	100 (410)
Sometimes dangerous	90.4 (641)	9.6 (68)	100 (709)
Most times to always dangerous	89.4 (378)	10.6 (45)	100 (423)
Total	91.1 (1,405)	8.9 (137)	100 (1,542)
p-value	0.036		

Univariate analysis showed that those who felt their jobs were sometimes dangerous, and those who felt their jobs were always dangerous, were 1.71 times and 1.91 times respectively, more likely to use cannabis compared to those who felt their jobs were not at all dangerous and these differences were significant (p=0.030 & 0.014 respectively). These findings were also significant with multivariate analysis (p=0.012), adjusting for location of workstation (underground or aboveground), language (Zulu, Xhosa or Afrikaans), nature of employment (contract or fulltime worker), level of education (no formal schooling or post-matric qualification), and country of origin (South Africa or Mozambique) (table 4.72).

Table 4.72: Univariate & multivariate analysis of cannabis use by perceived level of work-related danger

	Urine Cannabis Positive	
	Univariate Model	**Multivariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Perception of level of work-related danger		
Never dangerous	**1**	**1**
Sometimes dangerous	1.71(1.05-2.76)0.030	1.91(1.15-3.18)0.012
Most times to always dangerous	1.91(1.14-3.20)0.014	2.01(1.17-3.47)0.012
Always dangerous		
Location of workstation		
Underground		**1**
Aboveground		1.71(1.15-2.55)0.008
Language		
Zulu		1
Xhosa		1.80(1.10-2.97)0.020
Afrikaans		0.07(0.01-0.52)0.009
Nature of Employment		
Contract worker		**1**
Full-time worker		1.67(1.07-2.62)0.024
Level of Education		
No formal schooling		1
Post-matric qualification		0.38(0.15-0.95)0.038
Country		
South Africa		**1**
Mozambique		0.30(0.11-0.83)0.021
Log Likelihood (LR Chi , p-value)	-458.59(7.77, p<0.051)	-405.75(60.71, p<0.00001)

4.6.2 Perceptions of reasons why mineworkers use alcohol

About one fifth of participants (19.7%) said the reason mineworkers use alcohol was to relieve stresses related to their jobs (such as perceived danger at work, and heavy workload), finances, and families, while 5.5% said it was used to relieve boredom (table 4.73).

Table 4.73: Perceptions of reasons why mineworkers drink alcohol[a]

Reasons why mineworkers drink alcohol	P1 (n)	P2 (n)	G1 (n)	G2 (n)	D1 (n)	C1 (n)	O1 (n)	Mean %(n)
Don't know	36	100	43	206	139	48	76	**41.4 (648)**
Reduce stress[b]	6	24	24	62	64	83	46	**19.7 (309)**
Relax/unwind	53	51	9	28	46	34	33	**16.2 (254)**
Have fun/ socialise/ entertainment	4	20	32	38	50	39	54	**15.1 (237)**
Reduce boredom	3	11	2	17	21	25	7	**5.5 (86)**
Habit/ Addiction	Nil	5	3	3	6	3	1	**1.3 (21)**
Other[c]	Nil	3	2	2	1	2	Nil	**0.6 (10)**
Total	102	214	115	356	327	234	217	**100 (1565)**

[a]*Multiple-answer question, so 'n' may not be equal to number of participants per mine*
[b]*Stress due to dangerous & demanding jobs, financial difficulties, and family-related problems.*
[c]*Other reasons include: 'irresponsibility', 'influence of friends', 'because they have money', 'because alcohol is available', and 'ignorance about dangers of alcohol'.*

4.6.2.1 Evaluation of relationship between 'relaxation' as reason for alcohol use & CAGE status

Responses of those who reported 'relaxation' as a reason for alcohol use (table 4.73) were compared to that of those who did not. Almost 21% of those who reported relaxation as a reason why mineworkers use alcohol were CAGE positive compared to 15.1% of those who did not report relaxation as a reason for alcohol use (table 4.74).

Table 4.74: CAGE status by 'relaxation' as reason for alcohol use by mineworkers

Report of relaxation as reason for use of alcohol by mineworkers	CAGE Negative % row (n)	CAGE Positive row (n)	Total % row (n)
Yes	79.1 (200)	20.9 (53)	100 (253)
No	84.9 (773)	15.1 (137)	100 (910)
Total	83.7 (973)	16.3 (190)	100 (1,163)
p-value	0.025		

Univariate analysis showed that those who reported relaxation as a reason why mineworkers use alcohol were 1.5 times more likely to be CAGE positive than those who didn't report relaxation as a reason and this difference was significant (p=0.026). This finding was also significant with multivariate analysis (p=0.018, OR=1.57) adjusting for level of education (no formal schooling or grade 6 to 10), marital status (single or married), sex (male or female), and language (Zulu, Tsonga or Afrikaans) (table 4.75).

Table 4.75: Univariate & multivariate analysis of CAGE status by 'relaxation' as reason for alcohol use by mineworkers

	CAGE Positive	
	Univariate Model	**Multivariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Report of relaxation as reason for use of alcohol by mineworkers		
No	**1**	**1**
Yes	1.50(1.05-2.13)0.026	1.57(1.08-2.28)0.018
Level of Education		
No formal schooling		**1**
Grade 6-10		1.50(1.07-2.10)0.019
Marital status		
Single		**1**
Married		0.60(0.42-0.84)0.003
Sex		
Male		**1**
Female		0.12(0.017-0.90)0.039
Language		
Zulu		**1**
Tsonga		0.47(0.22-0.99)0.048
Afrikaans		0.30(0.14-0.66)0.003
Log Likelihood (LR Chi , p-value)	-515.39(4.79, p<0.0285)	-461.00(49.02, p<0.0000)

4.6.2.2 Evaluation of relationship between 'fun' as reason for alcohol use & CAGE status

Responses of participants who reported 'fun' as a reason for alcohol use among mineworkers (table 4.73) were compared to that of participants who did not report relaxation as a reason. About a fifth of respondents (21.1%) reported fun as a reason for alcohol use compared to 15.2% who did not (table 4.76).

Table 4.76: CAGE status by 'fun' as reason for alcohol use by mineworkers

Report of fun as reason for alcohol use by mineworkers	CAGE Negative % row (n)	CAGE Positive row (n)	Total % row (n)
Yes	78.9 (187)	21.1 (50)	100 (237)
No	84.8 (782)	15.2 (140)	100 (922)
Total	83.6 (969)	16.4 (190)	100 (1159)
p-value		0.040	

Univariate analysis showed that those who reported fun as a reason for alcohol use among mineworkers were 1.46 times more likely to be CAGE positive than those who did not and this difference was significant (p=0.038). This finding was also significant with multivariate analysis (p=0.046, OR=1.47) adjusting for language (Zulu or Afrikaans), marital status (single or married), sex (male or female), and level of education (no formal education or grade 6 to 10) (table 4.77).

Table 4.77: Univariate & multivariate analysis of CAGE status by 'fun' as reason for alcohol use by mineworkers

	CAGE Positive	
	Univariate Model	**Multivariate Model**
Variable	**Odds Ratio(CI)p-value**	**Odds Ratio(CI)p-value**
Report of fun as reason for alcohol use by mineworkers		
No	**1**	**1**
Yes	1.46(1.02-2.10)0.038	1.47(1.01-2.15)0.046
Language		
Zulu		**1**
Afrikaans		0.34(0.15-0.74)0.007
Marital status		
Single		**1**
Married		0.59(0.42-0.83)0.002
Sex		
Male		**1**
Female		0.12(0.02-0.87)0.036
Level of Education		
No formal schooling		**1**
Grade 6-10		1.54(1.10-2.15)0.012
Log Likelihood (LR Chi , p-value)	-515.73(4.12, p<0.0423)	-463.88(43.25, p<0.0000)

4.6.2.3 Evaluation of relationship between CAGE status & other reasons for alcohol use

The relationship between other reasons for alcohol use (table 4.73) and CAGE status were evaluated. Stress (p=0.099), boredom (p=0.535), addiction (p=0.667) were not significant for alcohol dependence.

4.6.3 Perceptions of reasons why mineworkers use cannabis

Participants who said they knew fellow workers who use cannabis (section 4.4.3.3) were asked why they felt their co-workers used cannabis. About a quarter of respondents (27.8%) said it gives strength and helps to work better (table 4.78).

Table 4.78: Participants' perceptions of reasons why mine workers use cannabis[a]

Reasons for cannabis use	P1 (n)	P2 (n)	G1 (n)	G2 (n)	D1 (n)	C1 (n)	O1 (n)	Mean % (n)
Gives strength[b]	7	29	9	9	10	8	36	**27.8 (108)**
Don't know	Nil	Nil	16	16	6	9	36	**21.3 (83)**
Relieve stress/forget problems	3	16	5	7	6	9	9	**14.1 (55)**
To enjoy/ have fun	3	3	4	8	14	17	5	**13.9 (54)**
Addiction	2	3	1	3	6	9	6	**7.7 (30)**
Helps think & plan strategically	Nil	2	2	3	Nil	7	1	**5.4 (15)**
Medicinal/ cultural value[c]	2	1	4	Nil	1	3	Nil	**2.8 (11)**
Boredom/far from home	Nil	3	Nil	2	1	1	2	**2.3 (9)**
Makes job easier	Nil	3	Nil	Nil	1	2	Nil	**1.5 (6)**
Because their friends smoke	2	Nil	Nil	Nil	Nil	2	1	**1.3 (5)**
Reduces fear of going underground	Nil	1	Nil	Nil	1	1	2	**1.3 (5)**
Other[d]	1	2	Nil	1	4	Nil	Nil	**2.1 (8)**
Total % (n)	20	63	41	49	50	68	98	**100 (389)**

[a]*Multiple-answer question for respondents who reported that their fellow workers use cannabis*
[b]*Gives strength to work better*
[c]*Medicinal/cultural value in treatment of insomnia and problems related to eyesight*
[d]*Other reasons include 'experimentation', 'to be high', 'lack of morals', and 'as an alternative to alcohol because it is difficult to drink on duty'.*

4.6.3.1 Evaluation of relationship between cannabis use & reasons for cannabis use

The relationship between cannabis use and reported reasons for cannabis use was evaluated. None of the reported factors were found to be statistically significant ('strength': p=0.89, 'stress': p=0.44, 'fun': p=0.87, 'addiction': p=0.97, 'think better': p=0.65, 'medicinal/cultural': p=0.931, 'boredom': p=0.90, 'makes job easier': p=0.118, 'use by friends'-p=0.46, 'reduce fear of going underground': p=0.51). The number of respondents for some of these variables was, however, low (table 4.78).

4.6.4 Perceptions of how to control alcohol use among mineworkers

About one fifth of participants (21.18%) felt that awareness programmes about dangers of alcohol could help control alcohol use among mine workers, while 4.64% felt those who use alcohol need to take responsibility in controlling their use of alcohol (table 4.79).

Table 4.79: Participants' recommendations for control of alcohol use by mine[a]

Recommendations	P1	P2	G1	G2	D1	C1	O1	Mean % (n)
Don't know	Nil	2	45	197	51	19	58	**25.2 (372)**
Awareness programs[b]	34	41	23	34	55	77	42	**20.8 (306)**
Breathalyser tests	28	50	12	27	50	68	21	**17.4 (256)**
Rehabilitation programs[c]	2	18	17	21	50	21	24	**10.4 (153)**
Disciplinary measures[d]	4	43	5	7	15	6	29	**7.4 (109)**
Recreational facilities to reduce boredom	4	11	2	10	21	15	6	**4.7 (69)**
Self control[e]	12	17	4	6	15	4	9	**4.5 (67)**
Checks by security officials to detect users	9	5	Nil	8	21	4	6	**3.6 (53)**
Nothing can be done (alcohol is readily available)	Nil	1	2	16	7	8	6	**2.7 (40)**
Reduction of access[f]	Nil	4	Nil	15	1	3	3	**1.8 (26)**
Happy, stress free workplace	Nil	4	1	3	9	3	2	**1.5 (22)**
Total	93	196	111	344	295	228	206	**100 (1473)**

[a]Multiple-answer question, so 'n' may not be equal to number of participants per mine
[b]Awareness programmes suggested include dissemination of information about effects of alcohol use and display of signs as prohibiting drinking at the mine
[c]Rehabilitation programmes suggested include counselling, Employee Assistance Programs (EAP), support of churches
[d]Disciplinary measures suggested include pay-cuts, suspension, and termination of employment
[e]Self control i.e. those who mis-use alcohol should take responsibility for their actions and exercise self control
[f]Reduction of access through ways such as closure of hostel bars during working hours

4.7 Summary of Study Variables & Their Relationship to Substance Use

Table 4.80 displays variables that are significantly linked to substance use. Variables positively associated to alcohol dependence include other accommodation, use of cannabis, positive history of seeking help for alcohol use, perception that their jobs are 'most times to always dangerous', and 'relaxation' & 'fun' as reasons for alcohol use. Variables protective from alcohol use include marital status, reported lack of use

of alcohol by fellow workers or lack of awareness of fellow workers use of alcohol, and working in mine D1. Variables positively associated with cannabis use include level of education of 'matric or less', group 3 to 4 job category, working in mine O1, lack of awareness of relationship between cannabis use and accidents, and perception that their jobs are 'sometimes dangerous' & 'most times to always dangerous'. Variables protective from cannabis use include being a full time worker and length of service of '6-10 years' & 'above 10 years'.

Table 4.80: Summary of variables significantly linked to substance use

Variables & nature of link to substance use		Odds Ratio(CI[a])p-value for multivariate model	Level of significance
Variables positively associated with alcohol dependence	Other accommodation	1.76(1.16-2.67)0.008	Significant
	Use of cannabis	2.29(1.51-3.47)0.0001	Highly significant
	Positive history of seeking help for alcohol use	1.98(1.05-3.71)0.034	Significant
	'Relaxation' as reason for substance use	1.57(1.08-2.28)0.018	Significant
	'Fun' as reason for substance use	1.47(1.01-2.15)0.046	Significant
	Perception that work is 'most times to always dangerous'	1.68(1.11-2.52)0.013	Significant
Variables positively associated with cannabis use	Level of education of 'matric or less'	2.99(1.19-7.50) 0.020	Significant
	Group 3 to 4 job category	2.29(1.30-4.05)0.004	Significant
	Mine O1	6.10(2.26-6.52)0.0001	Highly significant
	Lack of awareness of relationship between cannabis use & accidents	3.24(2.11-4.96)0.0001	Highly significant
	Perception that work is 'sometimes dangerous'	1.91(1.15-3.18)0.012	Significant
	Perception that work is 'most times to always dangerous'	2.01(1.17-3.47)0.012	Significant
Variables protective from alcohol dependence	Married status	0.59(0.43-0.81)0.001	Significant
	Reported lack of use of alcohol by fellow workers	0.33(0.17-0.62)0.001	Significant
	Reported lack of awareness of use of alcohol by fellow workers	0.38(0.24-0.62)0.0001	Highly significant
	Mine D1	0.45(0.24-0.85)0.013	Significant
Variables protective from cannabis use	Being a full time worker	0.50(0.31-0.80)0.004	Significant
	Length of service of 6-10 years	0.36(0.20-0.66)0.001	Significant
	Length of service of >10 years	0.34(0.18-0.65)0.001	Significant

[a]*CI-Confidence Interval*

5.0 FINDINGS OF FOCUS GROUP DISCUSSIONS

This section describes focus group discussion findings. Section 5.1 describes the socio-demographic profile of participants. The practice, attitudes, and perceptions of mineworkers about alcohol (section 5.2) and cannabis use (section 5.3) are also described. Section 5.4 describes their awareness of health and safety risks associated with substance use, and section 5.5 describes their perceptions about challenges of controlling substance use and related recommendations. These findings are described using emerging themes from discussion groups. A summary of focus group discussion findings is presented in section 5.6.

In order to preserve anonymity, quotes of participants' responses have not been identified by group [i.e. Union/Health & Safety (H&S) representatives, and management representatives/supervisors]. In general, there was agreement between groups on the majority of issues discussed. Differences in opinions are noted where relevant.

5.1 Socio-demographic Profile of Participants

5.1.1 Age of participants

The mean age of Union/H & S representatives was 35 years, while that of management representatives/supervisors was 42 years (table 5.1).

Table 5.1: Mean age of participants by mine

Mine		P2	G1	G2	D1	C1	O1	Mean age (years)
Mean age (years)	Union/H & S reps	38	29	38	NA	37	35	35
	Management reps/supervisors	NA	40	NA	45	40	42	42

NA: Not applicable as focus group discussions for this category of employees were not carried out.

5.1.2 Sex of participants

The majority of participants were male (tables 5.2 & 5.3).

Table 5.2: Sex of union/H & S representatives by mine

Gender	Percentage of participants (n)						
	P2	G1	G2	D1	C1	O1	Total
Male	100 (7)	80 (4)	100 (8)	NA	100 (10)	100 (11)	97.6 (40)
Female	Nil	20 (1)	Nil	NA	Nil	Nil	2.4 (1)
Total	100 (7)	100 (5)	100 (8)	NA	100 (10)	100 (11)	100 (41)

NA: Not applicable as focus group discussions for this category of employees were not carried out.

Table 5.3: Sex of management representatives/supervisors by mine

	Percentage of participants (n)						
Gender	**P2**	**G1**	**G2**	**D1**	**C1**	**O1**	**Total**
Male	NA	85.7 (6)	NA	90.9 (10)	100 (15)	80 (8)	90.7 (39)
Female	NA	14.3 (1)	NA	9.1 (1)	Nil	20 (2)	9.3 (4)
Total	NA	100 (7)	NA	100 (11)	100 (15)	100 (10)	100 (43)

NA: Not applicable as focus group discussions for this category of employees were not carried out.

5.1.3 Level of education

Educational levels of the two groups differed significantly. The majority of Union/H & S representatives (78%) had standard 6 to 10 qualification, and the majority of management representatives and supervisors (60.5%) had post-matric qualification (tables 5.4 and 5.5).

Table 5.4: Higehest level of education of union/H & S representatives by mine

Highest level of education	**Percentage of participants (n)**						
	P2	**G1**	**G2**	**D1**	**C1**	**O1**	**Total**
Std 1-5	Nil	Nil	Nil	NA	Nil	Nil	Nil
Std 6-10	85.7 (6)	80 (4)	75 (6)	NA	50 (5)	100 (11)	78 (32)
Post-matric	14.3 (1)	20 (1)	25 (2)	NA	50 (5)	Nil	22 (9)
Total	100 (7)	100 (5)	100 (8)	NA	100 (10)	100 (11)	100 (41)

NA: Not applicable as focus group discussions for this category of employees were not carried out.

Table 5.5: Highest level of education of management representatives/supervisors by mine

Highest level of education	**Percentage of participants (n)**						
	P2	**G1**	**G2**	**D1**	**C1**	**O1**	**Total**
Std 1-5	NA	Nil	NA	Nil	Nil	Nil	Nil
Std 6-10	NA	57.1 (4)	NA	9.1 (1)	40 (6)	60 (6)	39.5 (17)
Post-matric	NA	42.9 (3)	NA	90.9 (10)	60 (9)	40 (4)	60.5 (26)
Total	NA	100 (7)	NA	100 (11)	100 (15)	100 (10)	100 (43)

NA: Not applicable as focus group discussions for this category of employees were not carried out.

5.2 Perceptions, Practice & Attitudes of Mineworkers Towards Alcohol Use

5.2.1 Perceptions about alcohol use

5.2.1.1 First thoughts about alcohol

"Alcohol has a significant entertainment value but there are consequences for misusing it"

When describing their first thoughts on alcohol, there was a consensus across all discussion groups of union/H & S representatives and supervisors/management representatives, regarding its link to its entertainment value. In a very jocular mood, participants described alcohol with phrases such as *"partying"*; *"relaxation"*; *"entertainment"*; *"jollying with friends"*; *"lekker"* (Afrikaans word for "good"); and *"bonding"*. Some however also referred to a confidence-boosting attribute.

There was however a change in the mood across all groups to a sober one, when they alluded to the consequences of alcohol misuse, with phrases such as "*getting drunk"*; *"babalaas"* (Afrikaans slang for "hangover"); *"alcoholism"*; *"not thinking properly"*; and *"out of control"*. Consequences in the workplace were also noted, with phrases such as *"drunken driving"* (at work and in other public places), *"accidents"*; *"absenteeism"*; *"decreased productivity"*; "*human relations problems"*; and *"dismissals"*. Alcohol was also associated with consequences in other environments like the home and the general public, with phrases such as *"crime"*; "*assault"*;

"*police"* (being on the wrong side of the law); "*domestic violence"*; "*financial strain*" (from spending money excessively on alcohol); "*divorce"*; and *"suicide"* (figure 5.1).

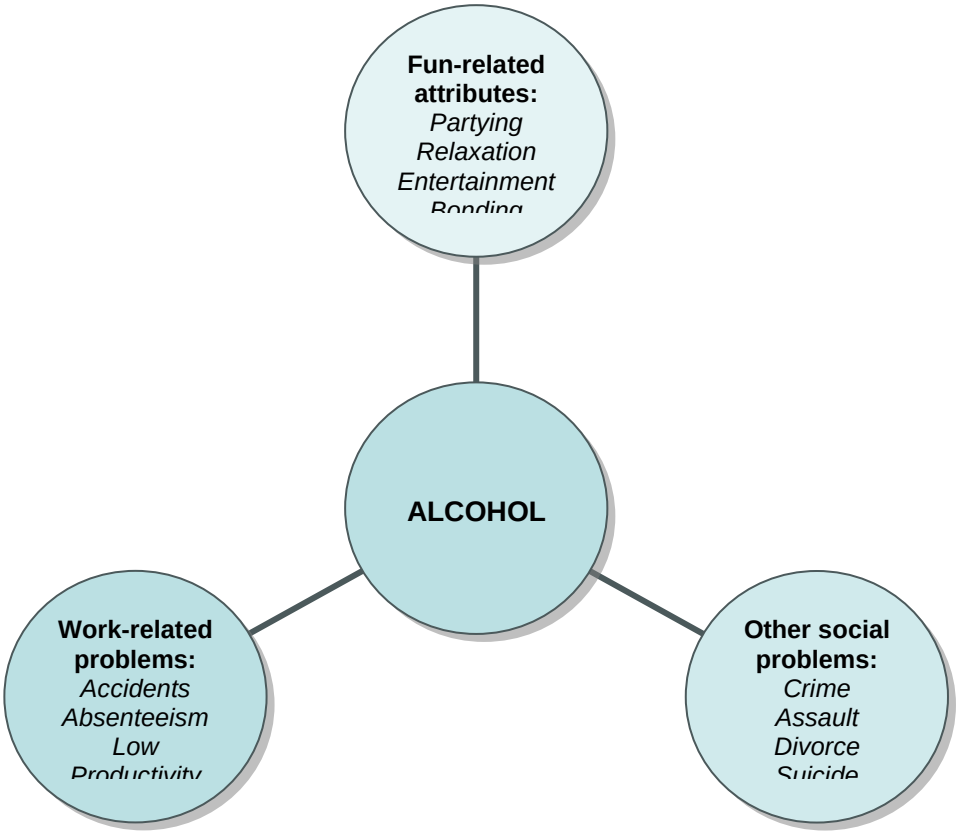

Figure 5.1: Associations made by participants to alcohol

5.2.1.2 Why some mineworkers misuse alcohol

Alcohol as stress reliever/relaxant: "Alcohol is a way of dealing with your problems but it can lead to a vicious cycle of more stress"

There was consensus in all discussion groups that alcohol was being used as a coping mechanism for dangerous and stressful working conditions. Other stressors cited include pressure to meet production targets and get bonuses; low salaries; boredom; and frustration due to separation from family members.

"In deep mines, people drink more due to stress and job conditions. Alcohol is an alternative to fear of danger. You are constantly confronted with this idea at the back of your mind that a rock could fall. You are pushed to produce more and get your bonuses. The place is dusty, noisy and moist. Underground is not the best working environment, not at all. You drink to calm down and relieve stress. And whether that is right is debatable. What could you say?"

"A lot of them (mineworkers) drink a lot to occupy their minds. We live in single sex hostels. No family responsibilities. You were home two weeks ago and had experienced problems. Come back having not solved it. You are avoiding thinking about your problems. It (alcohol) is a way of dealing with your obstacles."

"Lower level staff lives in hostels. No cooking. No children. No responsibility. No wife to scold you. You do not do gardening. No family responsibility. 'U ma e hlulu' (Zulu for someone who lives in a cage/camp)."

Some participants in both groups of union/H & S representatives and supervisors/management representatives however noted that using alcohol as a coping mechanism for stress (Fig 5.2-stress A) paradoxically compounds problems because it often led to alcohol addiction and a vicious cycle of more stress (Fig 5.2-stress B). They said that for instance where someone resorts to alcohol to cope with financial stress, he was likely to eventually develop more stress because the money that could have been used to solve financial problems would be spent on purchasing alcohol, leading to more financial stress and additional problems such as disciplinary problems at work.

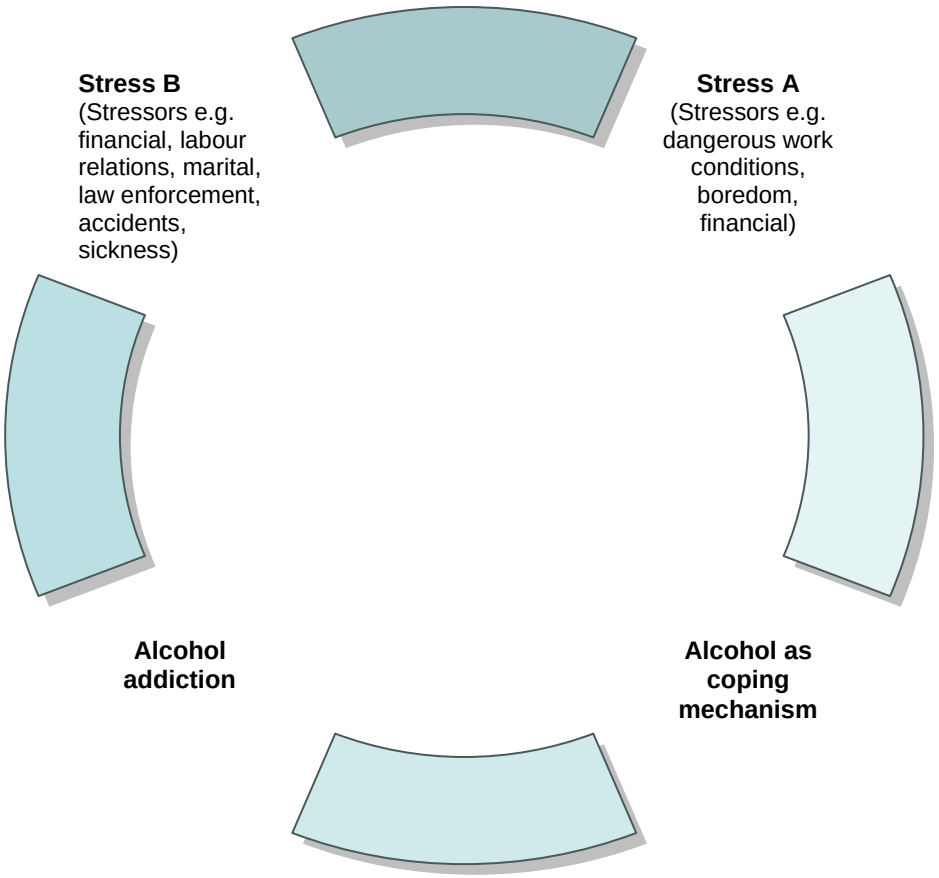

Figure 5.2: Vicious cycle of alcohol misuse

5.2.1.3 Why some mineworkers do not misuse alcohol

"Some mineworkers are able to find alternative activities to alcohol & others want to uphold their moral values"

Some participants across different groups felt that some mineworkers do not misuse alcohol despite being exposed to similar stresses as those who do, because they engage in other leisure activities such as soccer and chess to prevent boredom. Other deterrents cited include strong family values, religious beliefs, a need to meet financial obligations, and awareness of effects of misuse such as labour relations problems and marital conflict.

A few participants however felt that EAP also had a role to play in controlling alcohol misuse as counselling was offered to some select people who were bored and confused and their drinking habits were regularly monitored.

5.2.2 Attitudes towards mineworkers who misuse alcohol

"Those who misuse alcohol 'break' team spirit but they can behave responsibly when not under the influence of alcohol"

The majority of participants in both groups of Union/H & S representatives and supervisors/management representatives expressed disapproval of mineworkers who misuse alcohol as they were said to 'break' team spirit. They were said to take short cuts while carrying out their duties exposing others to accidents, and sometimes

overloaded other mineworkers with work due to absenteeism when they had alcohol-related problems, all of which culminated in lack of trust in such employees by their colleagues.

However, a few participants seemed sympathetic towards those who misuse alcohol because they felt that that those who misuse alcohol behaved responsibly when sober.

"Addicted people have the ability to be good. It is excessive usage of alcohol that makes them bad guys. Most of them are good guys when sober. If he starts drinking, he loses it within a short time. Alcohol is not the problem, addiction is."

5.2.3 Practice & patterns of alcohol use

5.2.3.1 "Most mineworkers drink in bars with their friends"

There was consensus in all discussion groups that most mineworkers usually drink in commercial establishments such as pubs; taverns; *'shebeen'* (local slang for bars in informal settlements) in surrounding areas; and mine hostel bars where available. They were also said to drink in other social settings like parties (including mine functions) and at home. Their usual drinking partners were said to be friends, but they sometimes drank alone or with family members.

5.2.3.2 "Most mineworkers drink alcohol after work but some drink before and during the shift"

The majority of participants across different groups said that most mineworkers drink alcohol after their work shift, while others said that some employees drink alcohol before their shift or during the shift when they are able to bring these undetected into the mine.

"Some drink at work."

5.2.3.3 "Day shift workers usually drink alcohol in the evening after their shift but night shift workers find it difficult to sleep during the day and sometimes end up drinking before their shift"

Some participants in different groups said that day shift workers usually drink alcohol after their shift (i.e. evening/night), while night shift workers usually drink during the day.

"Night staff drinks during the day. Day staff goes immediately after shifts straight to the bars."

Participants linked this practice to work-shift cycle and availability of leisure time. Some participants felt that night shift workers found it difficult to sleep during the day when most people are traditionally busy, and so have more leisure time compared to day shift workers who can only drink for a limited time in the evening after a hard

day's work. A few participants noted that disturbances in the hostel rooms by workers in other shifts also compounded this disruption in circadian rhythm and encouraged daytime alcohol consumption which continued till it was time to resume their duty.

"You (night shift workers) are at home for the whole day. One may say let me grab two (cans of beer) before work and it leads to more. You have more leisure time comparatively. When you work during the day, you go home at night and sleep."

Some participants however felt that less supervision during night shift compared to day shift also encouraged alcohol misuse among night shift workers due to the belief that their use of alcohol was less likely to be discovered at this time.

5.2.3.4 "Mineworkers who work under more stressful conditions tend to drink more"

Most participants in both groups of union/H & S representatives and supervisors/management representatives, said that alcohol misuse was more common among mineworkers in lower job categories, including those who work underground, those who carry out more physically demanding jobs (e.g. drillers and operators), and those who have more stressors in their social environment such as financial difficulties and separation from family members, compared to workers in higher job categories.

A few participants from both groups of union/H & S representatives and supervisors/management representatives however noted that employees in higher job

categories who live with their family members, and employees who work on surface were not exempt from alcohol misuse.

5.2.3.5 "People drink more after pay-day"

Some participants in different discussion groups said that there was increased drinking after pay-day which was at the "month end" for some workers and at weekends for others. This was linked to availability of more funds but was sometimes out of a need for self-gratification on completion of another month of hard work.

"People drink at the month end to thank the body for hard labour."

5.2.3.6 "Drinking increases during festive seasons"

Some participants noted that there was increased drinking during festive seasons.

5.3 Practice, Perceptions & Attitudes of Mineworkers towards Cannabis Use

Cannabis is locally referred to as '*dagga'* and was by described as such by participants during discussions.

5.3.1 Perceptions about cannabis use

5.3.1.1 First thoughts about cannabis

"Dagga gives you extra energy to carry out strenuous tasks"

When describing their first thoughts of dagga, participants across different groups linked cannabis to an energy-boosting attribute with phrases such as *"extra energy"*, *"can operate heavy machines alone"*, *"can do what (more strenuous work) he cannot do under normal circumstances", "stamina",* and *"powerful to do the work"*. Other participants linked cannabis to quickening of the mind with phrases such as *"more clever"* (quick thinking in problem solving), and *"tree of knowledge"*.

Unlike alcohol which the majority of participants linked to adverse outcomes, fewer participants linked cannabis to negative effects on behaviour, describing it with phrases such as *"confused"*, *"aggressive"* and *"rash in thinking"*. Like alcohol misuse, some participants linked cannabis to crime and clashes with the law but unlike alcohol, there was no immediate link of cannabis to workplace accidents, although a few participants said that it slows down one's reaction time in cases of accidents. A few participants however linked cannabis to medicinal properties. It was said to be used locally to treat illnesses such as flu and some ailments in babies, which affect the fontanelle. Figure 5.3 describes the major associations made by participants to *'dagga'*.

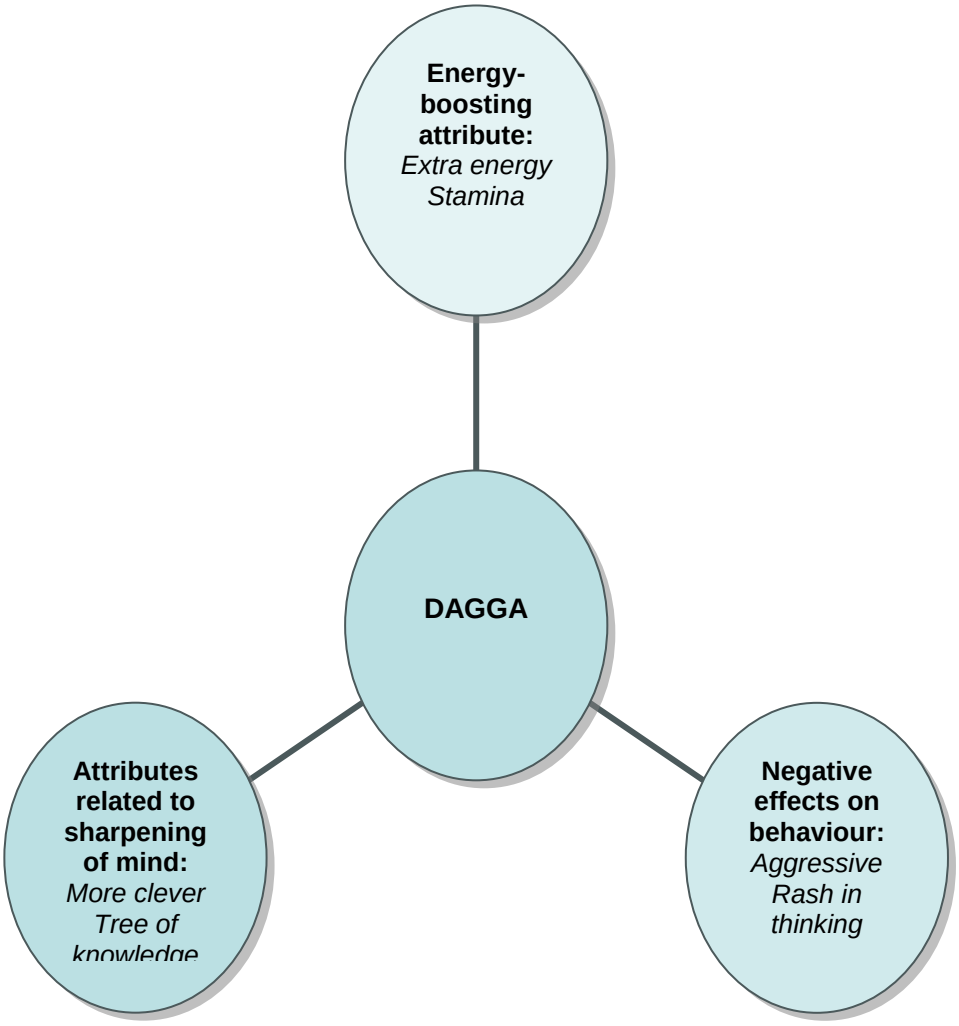

Figure 5.3: Main associations made by participants to dagga

5.3.1.2 Why some mineworkers use cannabis

Reasons for cannabis use discussed by participants include its use as energy booster, stress reliever/anxiolytic, alternative to alcohol as coping strategy, and pre-existing use before working at the mine.

- **Dagga as energy booster: "Dagga gives people an energy boost"**

The main reason for cannabis use discussed by participants was similar to their first thoughts about cannabis (section 5.3.1.1). Most participants across different groups said cannabis was widely believed to give users extraordinary strength. Although some participants felt that cannabis actually boosts physical energy, a few others suggested that it increases mental stamina, making workers able to cope with very physically demanding jobs for longer periods than they would ordinarily have been able to. A few participants however said that cannabis helped users think better and enhanced problem solving skills.

"They (dagga users) can work through the night without a break. I know someone who could not get anything done before he smokes. After smoking, he will be way ahead of you. It gives adrenaline."

- **Dagga as anxiolytic/stress reliever: "Dagga calms people and makes them bold to face dangerous underground working conditions but it makes them more prone to accidents"**

Some participants said that cannabis makes people bolder to work underground in conditions that are considered dangerous (Fig 5.4-A).

"They (dagga users) become braver. They can think well. It gives them strength. I think dagga is useful. That is why it is used mainly by those who work in dangerous areas like hanging rocks. It makes them brave to work underground."

However, a few of them added that like alcohol (section 5.2.1.2), it paradoxically exposed such people to more danger, as they were more prone to accidents (Fig 5.4-B) due to slow reaction time.

"Dagga has a way of making underground not to look dangerous anymore. But it makes them not to react as quickly as they would have if sober. It is like someone who is in the street and a car is coming but he is not running away. Dagga increases production but in this industry, production with blood is failure. We produce ……. (name of mine product), not blood."

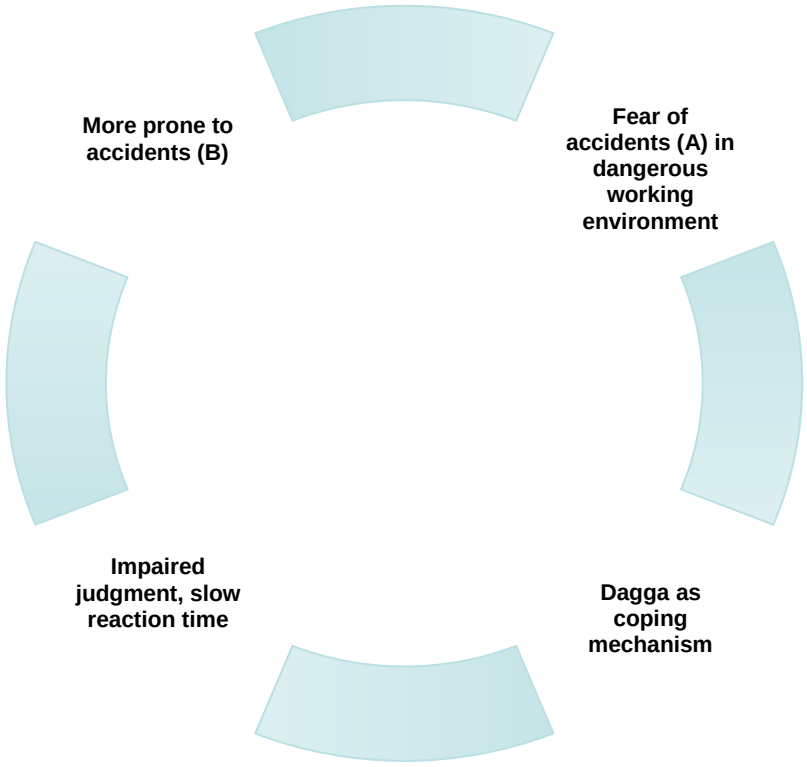

Figure 5.4: Vicious cycle of dagga use

- **Dagga as alternative to alcohol as coping strategy: "Dagga is easily accessible and is an alternative way of coping with stress but without the overt physical manifestations associated with alcohol intoxication"**

Some participants said that some people use cannabis because it is cheap (cheaper than alcohol), can be used to relax and relieve stress like alcohol, but signs of use may be 'hidden', unlike alcohol where signs of a hangover such as vomiting could give away the alcohol use status of an individual.

"If you're taking alcohol the next day you have a heavy 'babalaas' (hangover) and you throw up and stuff like that. Dagga is not the same."

- **Pre-existing dagga use: "Some people were already using dagga before they came to the mines"**

A few participants said that some mineworkers had been using dagga before they started working at the mine due to early use from peer pressure or use by family members.

5.3.1.3 Why some mineworkers do not use cannabis

"Those who do not use dagga have strong moral values and are aware of consequences of using dagga"

There was agreement between participants in different groups about reasons why some mineworkers did not use cannabis although they were in the same environment as their colleagues who use this substance. These reasons were similar to those given for not using alcohol and include self-determination; self-discipline; strong moral values and ability to differentiate between right and wrong; religious reasons; and awareness of consequences of use such as health problems, brushes with the law, and family problems.

5.3.2 Attitudes of participants towards those who use cannabis

5.3.2.1 "Those who use dagga are usually hard working and do not cause problems unlike those who use alcohol, so we are tolerant of them"

Some participants across different groups seemed to be tolerant of cannabis users because they were perceived as hard workers who quietly got their jobs done, unlike alcohol dependent workers who showed overt signs of misuse and were less productive.

"If it (dagga) gets him working harder, why not? I've seen the guy working, I know he's gonna deliver the goods."

"Dagga smokers are better (than alcoholics). Alcoholics are useless; they sleep underground. Dagga smokers are hard workers."

5.3.2.2 "Those who use dagga jeopardise safety, can be aggressive, and give a bad reflection of the mine"

Some participants across different groups said that although they were unaware of cannabis-related accidents at their mine, cannabis increased the risk of injuries and accidents due to lack of clarity of mind, especially if used too frequently. They also felt that cannabis users could be aggressive, and gave the mine a bad image.

"Obviously if you overdo it (dagga use), it becomes a safety hazard".

"The guy is not altogether there, he can't think straight, he can't drive vehicles, he can't do anything. It's a safety issue".

5.3.3 Practice of cannabis use

5.3.3.1 "It is sometimes difficult to know when others use dagga as it is not always used publicly, but some people smoke it openly before and during the shift"

Some participants across different discussion groups said it was difficult to know when mineworkers usually use cannabis because it was not always used openly. Others however said that though they may not actually witness smoking, they sometimes perceived its characteristic smell in change rooms and among some groups of people.

Few participants however said that cannabis was sometimes openly smoked during working hours by miners working on surface as it could easily be accessed where they had hidden it on the mine, while use of cannabis before the shift was more common among underground workers as they are unable to take it underground.

"Let's say they (underground workers) arrive here in the morning; before going underground, they smoke."

"But for some of the surface people it's easily available like he said, somewhere in the stockyard. So during the shift they have access to get the stuff and smoke it."

5.3.3.2 "Dagga use is more common among those who carry out more physically demanding jobs"

The majority of participants in different discussion groups felt that cannabis use was more common among underground workers who needed boldness to face dangerous conditions; those whose jobs were the most physically demanding (such as operators, drillers, and drivers), who felt they needed an energy boost from cannabis; and those who needed to be alert for long periods.

"Operators use dagga, those who use heavy machines and do heavy work. It makes them feel more energetic. They are often overwhelmed by work. After using dagga, the work is as easy as ABC."

"Those who do mechanical jobs, who need to be awake for a long time and whose jobs are perceived as dangerous, like drivers (use dagga). It is known as the 'tree of knowledge'."

A few participants in some mines however felt that contract workers at their mines commonly use cannabis. They also noted that contract workers did not undergo the same induction procedures on substance use at the mine, as fulltime workers. Most participants were however not aware of substance use status of contract workers. These participants said that they, as fulltime workers, were not very closely associated with part-time workers, most of whom lived in different lodgings.

5.4 Participants' Perceptions of Challenges of Working at Mines

5.4.1 "Working at the mine exposes you to physical hazards and psychological stress"

When asked to discuss effects of working at the mine, the majority of participants laid emphasis on the adverse health effects. While there was more emphasis by management representatives in some mines on mental stress related to reaching production targets, the majority of Union/Health and Safety representatives laid more emphasis on physical hazards at the mine such as dust, lung diseases, noise which could cause deafness, and wet conditions and gases, which they were exposed to underground. They also referred to injuries from accidents at the mine such as rock falls and locomotor accidents.

"(The effect of working in mines on our health is) Very bad. There is high risk underground. The gases. We breathe artificial air. The air is poor and we inhale gases. If you start working (in the mine) at the age of 30, by 65 (years of age), you are scrap."

Some participants in groups comprised of Union/Health & Safety representatives also said that mineworkers who live apart from their families in single-sex hostels experienced some psychological stress from feelings of diminished masculinity. Some of these participants also felt that prolonged separation from spouses encouraged

infidelity and increased the risk of contracting Acquired Immunodeficiency Syndrome (AIDS).

"Separating men from women takes their dignity. You live 600km from your wife and only go home after three months. Your family is destroyed. It is like Robben Island. It is abusive. We are no longer people but baboons."

5.4.2 "Relatively decent pay and team spirit are positive things about working in the mine, but they come at a price"

When probed about anything at all that was positive about working in the mine, some participants in groups comprised of Union/Health & Safety representatives said that even for miners with no educational background, the pay was comparatively better than those with similar or even higher educational backgrounds in other industries. They also said they got production bonuses and death benefits whether or not a miner died due to work-related causes. Other participants however said they paid too high a price for these benefits, because they were not available to mentor their children who now lacked respect for them, and did not perform well academically.

"Mineworkers' children do not get educated. They are dropouts. My children see me once a year for 30 days. They do not respect me. They are destroyed."

Some participants in groups comprising Union/Health & Safety representatives also noted that development of team spirit was a positive aspect of working in the mine.

"Positive things about working in the mine. Yes, teamwork. You can't survive in a mine if you can't look after yourself and your buddies. So it's just buddy-buddy system. You can't survive if you don't look after your mate or he doesn't look after you."

5.5 Participants' Awareness of Health & Safety Risks Linked to Alcohol & Cannabis Use

Unlike alcohol where there was a general consensus about its link to accidents in all discussion groups, fewer participants linked cannabis to accidents. Although some participants noted that cannabis use was associated with lack of concentration and coordination and memory loss, others felt the relationship between cannabis and accidents was dose-related. Alcohol was also linked to security issues at the mine such as assault and damage to company property.

5.6 Perceptions of Challenges of Controlling Substance Use & Recommendations

Participants were asked about the types of substance use control measures at their mines and how they perceived the effectiveness of these programmes. The measures described varied from mine to mine and include awareness programmes, random breathalyser testing, disciplinary measures, and Employee Assistance Programmes (EAP). Their perceptions of challenges faced in implementing control measures were grouped into three categories including those relating to the mines' approach to

controlling substance use (section 5.6.1); knowledge, attitudes and perceptions about substances (section 5.6.2); and perceptions of the general public about substances (section 5.6.3).

Due to variations in current practices at different mines, some of the challenges described are more relevant in some mines than others. Participants' recommendations for control are included where discussed.

5.6.1 Challenges & recommendations relating to the approach of mines in controlling substance use

5.6.1.1 "There is need for more mine commitment towards control of dagga use"

The majority of participants across different discussion groups felt that not enough emphasis was laid on cannabis use compared to alcohol use and it did not carry commensurate punitive consequences. Some participants felt there was a need for a zero tolerance policy regarding cannabis use.

"(Approach to dagga should be) same as alcohol on the mine, zero tolerance."

5.6.1.2 "In order to influence behaviour, we need a holistic approach"

The majority of participants across different discussion groups felt that stand-alone measures such as disciplinary actions could not effectively deter substance use, as they did not have lasting effects.

"Quick warnings do not affect behaviour. It has to be a couple of strategies."

"You see, if you shoot the birds, they run away and come back again."

They suggested a holistic approach with programmes geared towards investigating and managing root causes of substance misuse with rehabilitation of users, in a continuous and evaluative process.

"The mining industry has been very weak at treating employees as a whole being. They neglect where he comes from and his family and culture. To them he is another piece of machinery. They exercise punitive measures during disciplinary hearing instead of coming up with programmes that investigate why the person is behaving in this way. They are only interested in production."

"In order to influence behaviour, you need to implement a continuous process."

5.6.1.3 "There is a need for sound EAP which work closely with employees & other role-players"

There was consensus among groups about a need for sound EAP. Some participants said that these EAP should work closely with employees in their social environment unlike current programmes. Participants suggested the following key role players to assist with EAP-hostel dwellers as monitors of their colleagues, social workers and welfare officers allocated to different hostels and family members who can give an accurate account of mineworkers' progress to counsellors.

"Do not develop programmes and put them far. Do not take bread and hang it there and ask the dog to jump for it."

5.6.1.4 "Alternative activities to substance use can help keep employees constructively occupied"

Some participants in different groups felt that in order to minimise boredom and keep workers constructively occupied in their leisure time, there was a need to provide facilities for extracurricular activities such as libraries, soccer, athletics fields, and chess, especially for mineworkers who live in single-sex hostels and those undergoing rehabilitation for substance use. Some participants felt that employees at management level should also participate in these sporting activities. Other participants suggested provision of skills development programmes such as bricklaying training and certification, boiler making, and driving lessons.

"..... When you take dagga from them, put something productive, replace it with something, otherwise it won't work…. ."

5.6.1.5 "Counselling of substance users should be done on a continuous basis by trained personnel"

Some participants felt that counselling that was being given to cannabis users at some mines was ineffective as it was carried out on a one-off basis by supervisors who were not trained to do so and who did not have time for follow-up.

"The problem with our counselling is that the supervisors that do it are lay people who have not been trained. They do not have the time for follow-up because their main task is production. Constructive counselling takes place over a duration of time."

5.6.1.6 "Awareness programmes are important but they are not as effective as they should be"

Some participants felt that even though awareness programmes on substance use were available at their mines, the majority of mineworkers had become indifferent to them. While participants in supervisor/management representative groups expressed frustration because much effort had been put into awareness programmes, participants in Union/H & S groups felt that they were sometimes implemented with a "top-down" approach and comprised of rigid instructions, with inadequate involvement of mineworkers.

"The education here is not education but instruction. The induction when you come here is about do's and don'ts. Education is being made to understand the consequences."

A few participants noted that awareness programmes did not adequately address target certain employees such as those who could not read or write, and contract workers who, unlike fulltime workers, did not go through adequate induction courses on substance use.

"Writing on paper is also not effective. Some of us cannot read or write."

5.6.1.7 "It is possible to bring substances into the mine as employees are not usually searched on their way in"

A few participants felt that because employees are only searched on the way out of the mine for theft of mine property and not when they are going in, some workers bring cannabis into the premises (sometimes in their lunch boxes) and smoked it there.

"One more thing; when the people go into the gate, nobody checks you when you go inside, they just check you when you come out. They don't worry what you take in; they worry what you take out. So the guys can carry weed (dagga) as much as they like into the mine. If he wants to smoke, he would bring it in and smoke."

5.6.1.8 "The supervisor is not always present throughout the shift so an employee who wants to smoke dagga during the shift can do so"

Some participants felt that it was difficult to control cannabis use at all times because it was not always possible for supervisors to be with employees throughout the work shift and that those who wanted to use cannabis could do so when supervisors had left.

"I mean if your supervisor is sitting in the office and you are working…I mean he is not gonna be there for eight hours of the shift; you will see him in the morning and that's it. So you've got basically from eight o'clock in the morning until one o'clock in the afternoon; you can smoke whenever you please."

5.6.1.9 "The selection process for random breathalyser tests is not transparent"

Participants at some mines said that although random testing was being carried out at their mines, the majority of mineworkers felt that the selection process was not transparent and that it targeted certain categories of workers.

5.6.1.10 "We need to expand substance-testing protocols to include dagga"

Some participants said they did not think that cannabis was being tested at their mines unlike alcohol, and that this contributed to the perception that employees could use cannabis without getting caught. They suggested that mines should ensure that

cannabis-testing services were provided and employees notified about it. A few participants felt that cannabis testing should be part of pre-employment and periodic examinations.

"I think one of the things; firstly before you even get into a problem of having somebody smoking dagga; do dagga tests on initial examination and also periodical examinations and when you come for your annual medical examinations."

5.6.1.11 "Hostel bars stay open beyond their stipulated operating hours"

Some participants said that there was a need to enforce opening hours of hostel bars because operators of these bars did not usually adhere to their stipulated hours and stayed open for as long as there were people willing to buy alcohol. They felt this encouraged people to drink for longer hours and increased the possibility of people coming to work under the influence of alcohol.

5.6.1.12 "Incentives can motivate people to maintain a good safety record"

Some participants expressed pride in an award their mine was given for an outstanding safety record and said this was an incentive to maintain their record, which could otherwise be broken by cannabis users.

"At this mine, we are very safety conscious; and we don't want people on the mine smoking dagga. You go underground, for instance with the machine operator. If he is under the influence of dagga, he can destroy our safety record."

5.6.1.13 "Improvement in working and living conditions have a role to play in controlling substance use"

A few participants felt that improvement in working conditions and a move away from single-sex hostels to family units with priority for those undergoing rehabilitation for substance use, will decrease stress and give them more responsibilities and minimise drinking of alcohol during their leisure time.

"Stop separating mineworkers from the general population."

"We need to build family units. Be close to children so that we can have responsibilities."

5.6.2 Challenges & recommendations relating to knowledge, attitudes & perceptions about substance use

5.6.2.1 "It is not the responsibility of individual mineworkers whose co-workers are using dagga, to take action"

Some participants felt that it was not their responsibility, but that of the supervisor and security officials, to take any action if they found their co-workers using cannabis.

"When you are smoking dagga it has got nothing to do with me. I think when you are a supervisor and some of your subordinates are smoking, you've got a responsibility

to ensure that you call security and they would be able to handle the situation because dagga is still illegal on the premises."

5.6.2.2 "We need to prove to people that dagga use is not innocuous"

A few participants felt that there was insufficient awareness among their colleagues about adverse health effects of cannabis and that proving these effects (for example through those who have experienced these problems) might discourage some people from using it.

"We've got a lot of people that are working for us and most of them smoke it; but if we can prove that this thing [messes] up your lungs, most of them would stop."

5.6.2.3 "We need clarity about the relationship between actual alcohol intake & effect on blood alcohol levels"

A few participants said that while some mineworkers were aware of the alcohol limit for breathalyser testing at their mines, they did not know how much alcohol they could drink that would not exceed the stipulated limit.

5.6.3 Challenges relating to perceptions of the public about cannabis

Some participants felt that cannabis use among mineworkers could not be taken in isolation from other issues surrounding its use in the wider community.

5.6.3.1 "Substances are easily accessible in the community"

Some participants felt that cannabis was cheaply available, even more so than alcohol, and was easy to access in the community where some people also planted it in their homes.

"You can get it (dagga) anytime, anywhere."

A few participants said that an increase in the price of alcohol could help minimise access to it.

5.6.3.2 "There is public uncertainty about adverse effects of dagga"

Some participants felt that a move in some quarters to legalise cannabis in South Africa might have made its use seem innocuous. They felt made it also made it difficult to send a clear message about its control in the workplace.

"Why I say people believe in dagga is because about seven or eight months back they tried to make dagga legal in South Africa. So the people totally believe in dagga."

"The workplace cannot control dagga effectively if the legal standpoint on dagga is unresolved."

5.6.3.3 "The legal disciplinary measures for offences related to dagga use among the general public are inadequate"

Some participants across different groups felt that the South African law was not appropriately tough on people found to be using cannabis, contributing to a perception that cannabis use is not a serious offence.

5.7 Summary of Focus Group Discussion Findings

5.7.1 Practice of substance use among mineworkers

When participants were asked about when mineworkers usually use substances, post-shift alcohol consumption was said to be more common among day shift workers, while pre-shift alcohol consumption was said to be more common among night shift workers who usually found it difficult to sleep during the day when people are traditionally awake. Some participants however said that both cannabis and alcohol were sometimes used during the shift, as some employees were able to bring these into the mine unnoticed. Alcohol consumption was said to increase after payday and during festive periods.

5.7.2 Perceptions about why mineworkers use substances

Substances were said to be used among mineworkers as a coping mechanism for stress due to factors such as inadequate financial resources and increased workload. Substance use was said to be more common among those who work under more stressful conditions such as underground workers and those who carry out more physically demanding jobs like drillers and operators. Participants however noted that substance use led to a vicious cycle of more stress as it predisposed to problems such as accidents, and more financial stress where scarce funds were used to purchase alcohol. Reasons why some mineworkers do not use substances include self-discipline, and awareness of consequences of use, such as health problems, brushes with the law, and family problems.

5.7.3 Attitudes of mineworkers towards those who use substances

When asked about attitudes of mineworkers towards those who misuse substances, the majority of participants said that those who misuse alcohol disrupt team spirit through factors such as absenteeism, and predisposition of others to accidents. On the other hand, some participants seemed to be more tolerant of cannabis users who were seen to be hard working, although other participants said that those who use cannabis jeopardise safety.

5.7.4 Knowledge about hazards of substance use

When participants were asked about the effects of alcohol misuse on health, emphasis was laid on safety and security issues at the mine such as those involving accidents, assault, and damage to company property. However with respect to cannabis, there was less emphasis on its link to accidents.

5.7.5 Perceptions of challenges of controlling substance use among mineworkers & recommendations

When asked about their perceptions of challenges and recommendations related to substance use control among mineworkers, participants described challenges related to three main factors including that of the mines' approach to control of substances; knowledge, attitudes and perceptions of mineworkers about control of substance use; and perceptions of the public about substances. Recommendations discussed in relation to the mines' approach include the need for a holistic approach and increased mine commitment towards control of cannabis use as for alcohol use. In relation to knowledge, attitudes and perceptions of mineworkers about control of substance use, challenges which participants highlighted include the perception among some mineworkers that cannabis use is innocuous, and that an individual mineworker who finds his colleague using substances has no obligation to take action. Challenges relating to perceptions of the public about cannabis, include easy access to cannabis in the community, and inadequate legal disciplinary measures for offences related to cannabis use.

6.0 FINDINGS OF RECORD REVIEW

This section describes findings of the record review of post-accident and medical surveillance tests for alcohol and cannabis use at participating mines (P1, P2, G2, D1, C1 and O1) between 1999 and 2003. Section 6.1 discusses the availability of these tests at study mines and section 6.2 describes mine protocols for the tests, while section 6.3 describes the prevalence of positive substance tests related to accident cases and medical surveillance. Section 6.4 discusses the relationship between Lost Time Injury Frequency Rates (LTIFR) at study mines and substance use, while section 6.5 summarises the findings of this chapter.

Mines which did not carry out all aspects of post-accident and medical surveillance-related substance tests (section 6.1) have been excluded from relevant tables in this chapter. Instances where information was not available have been noted as such in these tables.

6.1 Availability of Post-Accident & Medical Surveillance Tests for Substance Use at Study Mines

Participating mines were asked whether tests for alcohol and cannabis were being carried out after accidents (excluding natural disasters) and as part of a medical surveillance programme. The types of tests being carried out varied from mine to

mine, with some mines carrying out all categories of tests (P1 & D1), while others carried out none (P2) (table 6.1).

Table 6.1: Availability of post-accident & medical surveillance tests for alcohol & cannabis use at study mines

Mine	Post-accident alcohol tests/year initiated	Post-accident cannabis tests/year initiated	Medical surveillance tests for alcohol/year initiated	Medical surveillance-tests for cannabis/year initiated
P1	Yes (1999)	Yes (1999)	Yes (1999)	Yes (INA)
P2	No	No	No	No
G2	No	No	Yes (2002)	Yes (2002)
D1	Yes (1997)	Yes (1997)	Yes (1997)	Yes (1997)
C1	Yes (INA)	No	Yes (2004)	Yes (1994)
O1	No	No	Yes (INA)	No

INA: Information Not Available.

6.2 Mine Protocol for Post-Accident & Medical Surveillance-Related Substance Tests

6.2.1 Mine protocol for post-accident substance tests

Criteria for carrying out post-accident and medical surveillance tests for substances, and test methods used, were evaluated as part of mine protocols for substance tests.

Mine P1 carried out tests for both alcohol & cannabis in all accident cases while mine D1 carried out these tests using four criteria including motor vehicle accidents. Mine C1 did not carry out post-accident cannabis tests but carried out post-accident alcohol tests in cases of motor vehicle accidents. Alcohol use was usually detected in all study

mines through an on-site breathalyser test. In mines P1 and D1, blood sampling for alcohol was also done for confirmation of breathalyser tests. In mine D1, blood sampling was also done where an employee is unable to blow into the breathalyser due to injury, pain, or loss of consciousness. An on-site urine dipstick test was the method used for detecting cannabis use in mines P1 and D1, however in mine P1, confirmatory tests were also carried out where dipstick tests were positive (table 6.2).

Table 6.2: Mine protocol for post-accident alcohol & cannabis tests

Substance	Mine protocol for post-accident tests	Mine[a]		
		P1	**D1**	**C1**
Alcohol	**Criteria for tests**	All accident cases irrespective of type	• Motor vehicle accidents • Severe property damage • Injury to people • Suspicion of intoxication	Motor vehicle accidents
	Usual test method	On-site breathalyser sampling	On-site breathalyser sampling	On-site breathalyser sampling
	Additional test method	Blood sampling in mine clinic	Blood sampling in hospital	INA
	Level of blood/breath alcohol classified as positive	0.02g/100ml of blood or 0.10mg/1000ml of breath	0.05g/100ml of blood or 0.24mg/1000ml of breath	0.02g/100ml of blood or 0.10mg/1000ml of breath
Cannabis	**Criteria for tests**	All accident cases irrespective of type	• Motor vehicle accidents • Severe property damage • Injury to people • Suspicion of intoxication	Accident-related cannabis testing not practised
	Usual test method	On-site urine dipstick testing	On-site urine dipstick testing	Not done
	Additional test method	Confirmatory lab urine test where dipstick test is positive	Not done	Not done

[a]*Mines P2, G2 & O1 did not carry out accident-related alcohol and cannabis tests. Mine C1 carried out accident-related alcohol tests but not accident-related cannabis tests*

6.2.2 Mine protocol for medical surveillance-related substance tests

Table 6.3 describes mine protocols for medical surveillance-related substance tests including eligibility criteria, periodicity of tests, and test methods used. While mines P1, D1 and O1 estimated alcohol levels using breath samples, G2 and C1 used blood samples. Mines P1, G2, D1 and C1 tested for cannabis using urine dipstick while mine D1 carried out confirmatory tests in positive cases. Mine P1 carried out tests for alcohol & cannabis on randomly selected employees on a weekly basis while mine O1 carried out random alcohol tests thrice weekly.

Table 6.3: Mine protocol for medical surveillance-related alcohol & cannabis tests

Mine[a]	Substance tested	Periodicity of tests	Eligibility criteria	Test method
P1	Alcohol	Random (Weekly)	Any employee may be selected	Breathalyser
	Cannabis	Random (Weekly)	Any employee may be selected	Urine dipstick
G2	Alcohol	Annually (As part of annual medical test)	• Drivers of heavy & light vehicles • Operators of heavy machinery	Blood tests
	Cannabis	Annually (As part of annual medical test)	• Drivers of heavy & light vehicles • Operators of heavy machinery	Urine dipstick
D1	Alcohol	Six-monthly	All truck operators	Breathalyser
	Cannabis	Six-monthly	All truck operators	• Urine dipstick • Lab test[b]
C1	Alcohol	Pre-employment	All new employees	Blood tests
	Cannabis	Annually	All employees	Urine dipstick
O1	Alcohol	Random (Thrice-weekly)	Any employee may be selected	Breathalyser
	Cannabis	Medical surveillance for cannabis not done		

[a] *Mine P2 did not carry out medical surveillance–related substance tests..*
[b] *Laboratory cannabis tests done for confirmation of positive results & estimation of metabolite levels to monitor progress during rehabilitation*

6.3 Prevalence of Positive Post-Accident & Medical Surveillance-Related Substance Tests

Section 6.3 describes the prevalence of positive post-accident & medical surveillance-related substance tests in study mines between 1999 and 2003. As substance tests were not always carried out in all cases of accidents (section 6.2.1), prevalence of positive substance tests in this section is estimated based on the total number of accidents that occurred in a particular year, and also according to the number of accidents in which tests were actually carried out. The prevalence of positive tests could however not be estimated for most mines due to unavailability of required information.

6.3.1 Prevalence of positive post-accident alcohol & cannabis tests

6.3.1.1 Prevalence of positive accident-related alcohol tests

In mine D1, alcohol tests were negative in all accident cases tested according to mine criteria (section 6.2.1) between 1999 and 2003. In mine P1, all alcohol tests carried out were negative between 2001 and 2002, however in 2003, 1% of all accident cases tested according to mine criteria were positive for alcohol. Records of actual levels of alcohol in these positive cases were unavailable (table 6.4).

Table 6.4: Prevalence of positive post-accident alcohol tests in study mines

Year & Mine[a]		Total No of accident cases/yr (A)	[b]No of accident cases tested for alcohol/yr (B)	% of accident cases tested for alcohol/yr (B/A)	No of accident cases positive for alcohol/yr (C)	% of total accident cases positive for alcohol/yr (C/A)	% of tested accident cases positive for alcohol/yr (C/B)
1999	P1	[c]INA	INA	[d]_	INA	_	_
	D1	INA	INA	_	Nil	Nil	Nil
2000	P1	INA	INA	_	INA	_	_
	D1	INA	INA	_	Nil	Nil	Nil
2001	P1	168	160	95.2%	Nil	Nil	Nil
	D1	INA	INA	_	Nil	Nil	Nil
2002	P1	224	205	91.5%	Nil	Nil	Nil
	D1	INA	INA	_	Nil	Nil	Nil
2003	P1	227	205	90.3%	2	0.9%	1%
	D1	INA	INA	_	Nil	Nil	Nil

[a]*Mines P2, G2 & O1 did not carry out post-accident alcohol tests. Mine C1 carried out this category of tests but results were unavailable.*
[b]*Eligible accident cases*
[c]*INA=Information Not Available.*
[d] _ *=Information not available to carry out estimation.*

6.3.1.2 Prevalence of positive post-accident cannabis tests

In mine D1, tests for cannabis were negative in all accident cases tested according to mine criteria between 1999 and 2003. In mine P1, cannabis tests were positive in 4.9% of accident cases tested according to mine criteria in 2002, with a slight decrease to 3.9% of cases in 2002 (table 6.5).

Table 6.5: Prevalence of positive post-accident cannabis tests in study mines

Year & Mine[a]		Total No of accident cases/yr (A)	[b] No of accident cases tested for cannabis/yr (B)	% of accident cases tested for cannabis/yr (B/A)	No of accident cases positive for cannabis/yr (C)	% of total accident cases positive for cannabis/yr (C/A)	% of tested accident cases positive for cannabis/yr (C/B)
1999	P1	INA[c]	INA	[d] _	INA	_	_
	D1	INA	INA	_	Nil	Nil	Nil
2000	P1	INA	INA	_	INA	_	_
	D1	INA	INA	_	Nil	Nil	Nil
2001	P1	168	160	95.2%	INA	_	_
	D1	INA	INA	_	Nil	Nil	Nil
2002	P1	224	205	91.5%	10	4.5%	4.9%
	D1	INA	INA	_	Nil	Nil	Nil
2003	P1	227	205	90.3%	8	3.5%	3.9%
	D1	INA	INA	_	Nil	Nil	Nil

[a] *Mines P2, G2, O1 &C1 did not carry out accident-related cannabis tests.*
[b] *Eligible accident cases*
[c] *INA=Information Not Available.*
[d] *_ =Information not available to carry out estimation.*

6.3.2 Prevalence of positive medical surveillance-related substance tests

In mine D1, the only mine for which results were available, none of the employees tested were positive for alcohol during medical surveillance between 1999 and 2003. Although mines P1, G2, C1 & O1 carried out this category of tests, records were unavailable. Mine P2 did not carry out this category of tests.

With regards to cannabis tests, none of the employees tested in mine D1 was positive for cannabis during medical surveillance between 1999 and 2003. The prevalence of positive tests could not be estimated for mines P1, G2, C1 due to unavailability of information, while mines P2 and O1 did not carry out this category of tests.

6.4 Lost Time Injury Frequency Rates & Substance Use

Information on Lost Time Injury Frequency Rates (LTIFR*) between 1999 and 2003 was obtained from study mines. Section 6.4.1 describes LTIFR of these mines and Section 6.4.2 evaluates statistical differences in LTIFR between mines, while section 6.4.3 evaluates the link between LTIFR of study mines and substance use.

6.4.1 Lost time injury frequency rates by mine

The mean LTIFR varied from 0.4 in mine D1 to 2.2 in mine G2 (table 6.6).

Table 6.6: Lost Time Injury Frequency Rate (LTIFR) by mine

	Lost Time Injury Frequency Rate (LTIFR) by Mine					
Year	**P1**	**P2**	**G2**	**D1**	**C1**	**O1**
1999	[a]NA	NA	3.2	0.5	1.6	NA
2000	NA	NA	2.1	0.3	1.3	NA
2001	NA	0.6	2.4	0.2	1.3	NA
2002	0.7	0.5	1.5	0.4	0.3	NA
2003	0.3	0.5	1.6	0.6	0.6	NA
Mean	0.5	0.5	2.2	0.4	1.0	NA

[a]*NA=Data not available*

**LTIFR=Number of injuries resulting in one or more shifts being lost X 200 000/ total man hours worked*

6.4.2 Evaluation of differences in LTIFR between mines

ANOVA (Analysis of Variance) techniques were used to evaluate differences in LTIFR between study mines. Findings of this analysis showed that G2 which had the highest mean LTIFR of 2.2 was statistically significantly different from other mines including mines C1 (p=0.012), D1 (p=0.000), P1 (p=0.006) and P2 (p=0.002) (figure 6.1, Appendix L: tables L1 & L2). Mine G2 also had the highest percentages of samples above (1.9%) and below the limit of 0.10mg/1000ml (1.4%) among mines for which LTIFR was available (table 6.7).

Figure 6.1: Evaluation of differences in LTIFR between mines using ANOVA techniques

Row Mean- Column Mean	C1	D1	G2	P1
D1	-0.604 0.560			
G2	1.158 ***0.012***	1.762 ***0.000***		
P1	-0.505 1.000	0.099 1.000	-1.663 ***0.006***	
P2	-0.486 1.000	0.118 1.000	-1.643 ***0.002***	0.019 1.000

6.4.3 Evaluation of link between lost time injury frequency rates & substance use

The link between LTIFR for 2002 and other indicators of substance use obtained in 2002 during the structured interviews phase of this study (i.e. prevalence of alcohol

dependence according to CAGE criteria, prevalence of cannabis use, and prevalence of positive breath alcohol at work) (sections 3.2 & 4.2), was evaluated using Pearson's correlation analysis.

LTIFR was found to be positively correlated with levels of alcohol which exceeded the driving limit for professional drivers of 0.10mg/1000ml (Pearson's correlation coefficient 'r'=0.6755, p<0.0001) and also found to be positively correlated with levels of alcohol below this limit (r=0.7440, p=<0.0001). LTIFR was found to be negatively correlated with positive urine tests for cannabis (r=-0.7568, p<0.0001) and also negatively correlated to positive CAGE status (-0.2886, p<0.0001). Table 6.7 displays an overview of the indicators evaluated and figure 6.2 shows findings of correlation analysis.

Table 6.7: Overview of LTIFR & indicators of substance use

Study Mines	LTIFR 2002	Indicators of substance use			
		Prevalence of positive breath alcohol at work[a]		% CAGE Positive[b]	% Cannabis Positive[c]
		% Samples with alcohol >0.10mg/1000ml	% Samples with alcohol <0.10mg/1000ml		
C1	0.3	1.1	1.1	16.8	7.6
D1	0.4	0.9	0.6	10.7	7.2
P2	0.5	1.5	0.5	16.4	7.5
P1	0.7	Nil	0.9	19.4	4.6
G2	1.5	1.9	1.4	12.4	5.6

[a] *See table 3.10*
[b] *See table 3.12*
[c] *See table 4.2*

Figure 6.2: Evaluation of link between LTIFR & indicators of substance use by correlation analysis

	LTIFR 2002	Alcohol >0.10mg/1000ml	Alcohol <0.10mg/1000ml	Cannabis Positive	CAGE Positive
LTIFR 2002	1.0000				
Alcohol 0.10mg/1000ml	***0.6755*** ***0.0000***	1.0000			
Alcohol <0.10mg/1000ml	***0.7440*** ***0.0000***	0.4996 0.0000	1.0000		
Cannabis Positive	***-0.7568*** ***0.0000***	-0.0351 0.2147	-0.5628 0.0000	1.0000	
CAGE Positive	***-0.2886*** ***0.0000***	-0.3605 0.0000	-0.0183 0.5181	-0.0143 0.6141	1.0000

Regression analysis was also carried out. This showed similar trends to that of correlation analysis with regard to levels of alcohol above 0.10mg/1000ml and positive cannabis status. Samples above 0.10mg/1000ml were found to be statistically significantly linked to LTIFR (p=0.030), while positive cannabis status was also statistically linked to LTIFR (p=0.023) but with a protective effect (coefficient: -37.49). CAGE positive status was however not significantly linked to LTIFR (p=0.237) unlike findings of correlation analysis (table 6.8 & Appendix L: table L3).

Table 6.8: Evaluation of link between LTIFR & indicators of substance use by regression analysis

LTIFR 2002	Coefficient	Standard Error	t	P>|t|	95% [a]CI
Alcohol levels >0.10mg/1000ml	59.4	2.8	20.9	0.030	23.3-95.4
Cannabis Positive	-37.5	1.3	-28.0	0.023	-54.5- -20.5
CAGE Positive	-1.4	0.6	-2.6	0.237	-8.3-5.5
Cons	2.7	0.1	20.2	0.031	1.0-4.4

[a]*CI=Confidence Interval*

6.5 Summary of Findings

6.5.1 Types of post-accident/medical surveillance-related substance tests & modality of testing

While mines P1 and D1 carried out both post-accident and medical surveillance-related substance tests, others such as G2 carried out medical surveillance–related tests but did not carry out post-accident tests, while mine P2 carried out none of these categories of tests.

Among mines which carried out these tests, the test criteria varied from mine to mine, with mine P1 carrying out tests for both alcohol and cannabis in all accident cases irrespective of the type, while mine D1 limited these tests to motor vehicle accidents (MVA), accidents involving severe property damage, injury to people, and where those involved were suspected to have been under the influence of alcohol.

The modality of testing for substances also varied from mine to mine. While some mines carried out breathalyser tests to detect alcohol use, others also carried out blood tests to confirm results. On-site urine dipstick test was the method used for detecting cannabis use in mines which carried out this category of tests, however, some mines also carried out confirmatory laboratory tests where dipstick tests were positive.

6.5.2 Prevalence of positive post-accident & medical surveillance-related substance tests

In mine D1, none of the employees tested was positive for alcohol or cannabis following accidents or medical surveillance during the five-year period of this record review (1999 to 2003). In mine P1, no positive post-accident alcohol tests were recorded between 2001 and 2002, however 1% of accident cases tested was positive in 2003. In mine P1, cannabis tests were positive in 4.9% of accident cases tested according to mine criteria in 2002 and in 3.9% of cases in 2003.

The prevalence of positive post-accident and medical surveillance-related substance tests could not be estimated for most mines either because the category of tests being evaluated was not being carried out by the mine, or where these tests were been carried out, records were unavailable (table 6.9).

Table 6.9: Prevalence of positive post-accident & medical surveillance-related alcohol and cannabis tests in study mines

		Accident-related tests		Medical surveillance-related tests	
Year & Mine		**% of tested accident cases positive for alcohol (n)**	**% of tested accident cases positive for cannabis (n)**	**% of tested employees positive for alcohol (n)**	**% of tested employees positive for cannabis (n)**
1999	P1	[a]_	_	_	_
	P2	[b]NA	NA	NA	NA
	G2	NA	NA	_	_
	D1	Nil	Nil	Nil	Nil
	C1	_	NA	_	_
	O1	NA	NA	_	NA
2000	P1	_	_	_	_
	P2	NA	NA	NA	NA
	G2	NA	NA	_	_
	D1	Nil	Nil	Nil	Nil
	C1	_	NA	_	_
	O1	NA	NA	_	NA
2001	P1	Nil	_	_	_
	P2	NA	NA	NA	NA
	G2	NA	NA	_	_
	D1	Nil	Nil	Nil	Nil
	C1	_	NA	_	_
	O1	NA	NA	_	NA
2002	P1	Nil	4.9% (10)	_	_
	P2	NA	NA	NA	NA
	G2	NA	NA	_	_
	D1	Nil	Nil	Nil	Nil
	C1	_	NA	_	_
	O1	NA	NA	_	NA
2003	P1	1% (2)	3.9% (8)	_	_
	P2	NA	NA	NA	NA
	G2	NA	NA	_	_
	D1	Nil	Nil	Nil	Nil
	C1	_	NA	_	_
	O1	NA	NA	_	NA

[a]_ = *Test carried out by mine but records not available to carry out estimation.*
[b]*NA = Not Applicable (Test not carried out by mine).*

6.5.3 Relationship between LTIFR & substance use

LTIFR was found to be positively correlated with levels of alcohol below the driving limit for professional drivers of 0.10mg/1000ml limit ($r=0.7440$, $p=<0.0001$) and also positively correlated with levels of alcohol which exceeded this limit ($r=0.6755$, $p<0.0001$). The latter finding was also significant with regression analysis ($p=0.030$). LTIFR was found to be negatively correlated with positive urine tests for cannabis ($r=-0.7568$, $p<0.0001$), a finding which was also significant with regression analysis ($p=0.023$). Mine G2 which had the highest average LTIFR and the highest levels of alcohol above and below the 0.10mg/1000ml limit (among mines for which LTIFR data was available), was found to be significantly different from other mines.

7.0 DISCUSSION & CONCLUSIONS

This chapter draws conclusions in line with the aims and objectives of this study. It compares the findings of the structured interviews, focus group discussions, and record review, and also discusses the findings of this study in the context of local and international experience by drawing on literature. However, due to variations in the circumstances in which available local and international studies evaluating substance use have been done, it is challenging to make comparisons between these studies and the findings of this current study. A similar challenge in comparing data on substance use has also been noted by previous researchers (section 7.2) (30,72).

7.1 Response Proportion

The overall response proportion of participants in this study varied from mine to mine between 84% and 99%. Collaboration of stakeholders, including mine management representatives and union representatives, through a lengthy consultation process over several months before the study commenced was key to winning the trust of employees at the study mines (section 2.3.6.1), and contributed to the study response rate. This response rate is higher than that of 70% obtained in the U.S. study on substance use among 500 randomly physicians (16). Union groups were however not involved in this U.S study and the level of education of participants is higher than that of the majority of participants in this current study.

Four of the eleven mines initially selected for this study declined participation after a lengthy consultation process. This might have introduced a selection bias and

underestimated the study findings as the mines which declined participation may have disproportionately included employees who used substances.

7.2 Prevalence of Substance Use among Mineworkers

7.2.1 Prevalence of alcohol use and alcohol dependence

Almost half of all the participants in this study (with a range of 35.1% in mine G2 to 60.2% in mine P1) which was carried out among a predominantly male population reported current use of alcohol (46.5%), a prevalence higher than that of 24.5% (males 39.2%, females 15.7%) among those 15 years of age and above in the 2005 South African National HIV Prevalence and Behaviour Survey (SABSSM II) which was carried out among those two years of age and above (73). However, while this study among mineworkers was carried out among those in the working age group with 7.9% in the 16 to 25-year age group and 84.1% in the 26 to 50-year age group (the age group within which more people may be more likely to consume alcohol), the randomly drawn sample of the SABSSM was representative of the national population with 21.6% of participants being between 15 to 24 years of age and 33.8% between 25 to 49 years of age, and this may have accounted for the differences observed in both studies.

The prevalence of alcohol dependence of 21% reported among male adults in the general population (7% for females) in the 2003 South African Demographic and Health survey (SADHS) which also used similar CAGE criteria (10) is higher than the

prevalence of alcohol dependence of 15.3% across all study mines but lower than the prevalence of 24.8% in mine G1 in this study. The CAGE estimation from the SADHS was however for those who had ever used alcohol (current and ex-users) unlike this current study which only estimated the CAGE status of current alcohol users and this might have accounted for the higher prevalence rate in the SADHS. The prevalence of alcohol dependence of 15.3% is higher than the 2003 prevalence of heavy alcohol use of 8.6% among employees in the U.S (14). The U.S study was however done among full-time employees in various occupations and not only among mineworkers.

The highest prevalence of alcohol dependence of 24.8% in this study among mineworkers is lower than that of 32% in the 1992 study among South African gold mine workers (12). The range of alcohol prevalence of 10.7% to 24.4% among mineworkers in this study however suggests variation in patterns of alcohol misuse across different mines in the country.

In the study among 107 randomly selected high altitude miners in Argentina (13), 34% were found to be weekly alcohol users, a prevalence lower than that of 55.8% among current alcohol users in this study, suggesting a higher rate of weekly use among mineworkers in study mines. The Argentinean study was however carried out in one mine and was not a national study.

Alcohol misuse is associated with decreases in concentration, reaction time, and decision-making ability (27,28,29), factors which may increase the risk of human error and accidents (30,31). In the mining industry, where heavy and dangerous

machinery and vehicles are often used and where the Department of Minerals and Energy in South Africa reported a fatality rate of 0.56 deaths per thousand employees in 2005 (74), highlighting the high risk nature of the job, high levels of concentration are needed. In this study among mineworkers, almost two in ten participants (15.3%) are likely to be dependent on alcohol, a finding which may be an underestimation as it was carried out at the workplace and despite reassurance of confidentiality and job security some respondents may not have reported their alcohol use, in which case, they would not have been eligible to answer the CAGE questions used to estimate alcohol dependence and would have been missed. In addition to this, some mines declined participation in this study, and in mines which agreed to participate, about 3% to 8% of selected employees declined participation or did not respond to "parades" (section 2.3.4.1). Although specific reasons were not given for refusal, it is possible that this population disproportionately included employees who used substances. Effective local programmes to control substance use among the study population are needed.

7.2.2 Prevalence of cannabis use

The prevalence of self-reported cannabis use in the 2005 South African National HIV Prevalence and Behaviour Survey (SABSSM II) among those 15 years of age and above was found to be 2% (males-4.4%, females-0.3%) (73), which is close to the prevalence of self report of current cannabis use of 2.4% in this study. The current study was however carried out among a working age group while the SABSSM sample was representative of the general population (section 7.2.1). This prevalence is similar to that of 3% who reported a history of drug dependence in the U.S. study

among 500 randomly selected physicians which evaluated different substances unlike the current study which only evaluated cannabis.

The prevalence of cannabis use of 9.1% obtained following urine testing in this study among mineworkers was almost four times the prevalence of self-report of 2.4%. Urine testing was not however not carried out in the SABSSM (II). Findings of this study among mineworkers where about two in ten respondents (19.3%) who tested positive for cannabis are likely to have correctly reported their use of cannabis (section 4.2.3.4) highlight the inadequate levels of accuracy of self report in this study and the importance of validating self-report with objective tests where possible. This clearly also applied to the self-reported prevalence of alcohol dependence in this study and may also be the case for the SABSSM (II) study.

In the 2005 National Survey on Drug Use and Health (NSDUH) in the U.S., 4.1% of adults (males-8.2%, females-4%) aged 26 or older reported current use (past month) of cannabis (20). This prevalence is twice that of the prevalence of cannabis use of 2% among the general population in South Africa and also that of 2.4% from self report in this study but is about half the prevalence of 9.1% from urine testing in this study among mineworkers. There may however also have been under-reporting in the NSDUH study and urine testing for cannabis was not done. In other findings of this U.S. study, 8.2% of those employed full-time and 10.4% of those employed part-time were found to be current users of illicit drugs (20). This is higher than the self-reported prevalence of 2.4% in this study among mineworkers but similar to the prevalence of cannabis use from urine testing of 9.1% in this current study which comprised of both full-time and contract workers. The U.S. study however included

not only cannabis but also other types of illicit drugs, and was carried out among those in various occupations (20)

The prevalence of positive tests of 9.1% obtained from this study is lower than that of 12% in the U.S. study among tractor trailer drivers (17). However, the U.S study was carried out among 317 randomly selected participants in a different occupational category in one truck weighing station. It was not representative of the transport industry and was different from this study which was carried out among mineworkers where 1542 samples were tested from mineworkers across seven mines. However, this prevalence of 12% is lower than the upper range of cannabis use of 4.6% to 21.5% in this current study. As with the range of alcohol dependence of 10.7% in mine D1 to 24.4% in mine G1 (section 7.2.1), the range of positive cannabis tests of 4.6% in mine P1 to 21.5% in mine O1, also suggests a variation in cannabis use across mines.

The finding of a prevalence of 11.6% of positive cannabis tests in the 2005 review of 1617 urine samples submitted for workplace drug testing from 82 sources in the United Kingdom (U.K.) (19), is slightly higher than the average of 9.1% for positive cannabis tests in this study carried out among mineworkers in seven mines, although the results of individual mines ranged from 4.6% to 21.5%. However, samples from the U.K. study not only included random samples but also those collected following an incident at work. Although the kind of incident was not specified, it may have included those suspected of substance use and may have contributed to the higher prevalence of substance use observed, compared to the study among mineworkers where samples were randomly collected. Also the U.K. study evaluated samples from

different workplaces (which were not specified) unlike the current study which was only among mineworkers.

In the 1989 survey of 107 high altitude miners by Schinder & Ruder in Argentina, 65% of participants were found to chew coca leaves, which contain many alkaloids including cocaine, daily (13). Cannabis use was however not evaluated in the study.

In this study among mineworkers, 60.6% (n=20) of self-reported cannabis users use it everyday implying use during work days. Some focus group discussion (FGD) participants reported the practice of on-site cannabis use before and during the shift among some mineworkers. Cannabis use is associated with impairment of attention and loss of coordination (47,48,49), which can increase the risk of accidents. Findings of this study where one in ten respondents (9.1%) tested positive for cannabis with possible use during work days, highlight the need for effective control of cannabis use among mineworkers in order to improve the health and safety of this population. Mine security systems may also need to be evaluated to ensure that illicit substances are not brought into the mine.

7.2.3 Prevalence of positive pre-shift alcohol tests

The percentage of breath samples in this study, which contained alcohol at or above the legal driving limit of 0.10mg/1000ml of breath for professional drivers in South Africa [equivalent to blood alcohol concentration (BAC) 0.02g/100ml] (section 1.4.1.2), varied across mines from 0.9% in mines D1 & G1 to 5.4% in mine O1, with a mean of 1.8%. However, the highest percentage of samples positive for alcohol at or

above the limit of 0.10mg/1000ml (7.3%) was collected on Monday (table 3.5) compared to other days of the week, with most of these positive samples being collected from mine O1. Day of sample collection was found to be a confounding factor with respect to positive breathalyser results and suggests that the prevalence of positive breathalyser tests may have been lower if sample collection was proportionally distributed between the different days of the week.

However, with more than half of the positive samples (60.7%) containing alcohol at levels which were double or more than double the limit of 0.10mg/1000ml, and the breath sample containing the highest level of alcohol (0.88mg/1000ml) being at a level almost nine times this limit, these breathalyser results give some indication of the low levels of sobriety of some employees at work at the time and the risk of accidents. These findings also corroborate FGD participants' reports about pre-shift alcohol consumption among some mineworkers.

Higher pre-shift (and mid-shift) alcohol consumption has been documented in the Zambian study among copper mine workers where one third of those subjected to a pre-shift random breathalyser test were positive for alcohol (22), unlike the current study among mineworkers where 3% of samples were positive for alcohol. In 9% of cases in the Zambian study, alcohol levels were over 17.6mmol/l (i.e. 0.08g/100ml of blood) which is 4 times the legal driving limit of professional drivers in South Africa of 0.02g/100ml of blood (i.e. 0.10mg/1000ml of breath). Although information about samples containing alcohol above the 0.02g/100ml limit was not available for the Zambian study to facilitate comparison with this current study where 1.8% of samples

contained alcohol above 0.10mg/1000ml of breath, this finding also suggests higher prevalence rates among Zambian mineworkers in the study.

In other findings of this Zambian study, two-thirds of another group of employees who had been suspected to be under the influence of alcohol and referred for alcohol testing, had alcohol levels exceeding 35.2mmol/l (i.e. 1.6g/100ml of blood) which is eight times the legal driving limit of professional drivers in South Africa of 0.02g/100ml of blood (i.e. 0.10mg/1000ml of breath). However, this finding was for a group of employees who had been suspected to be under the influence of alcohol unlike the findings of the current mine study which was carried out among a random sample, and this selection bias may have accounted for the much higher levels in this aspect of the Zambian study. Day of sample collection was not available for the Zambian study and could have been a confounding factor should samples have been taken on a Monday as was found in this study. Also, the Zambian study was carried out in one copper mine and may not be representative of substance use among Zambian mineworkers in general.

In a 2006 national survey by Frone in the United States, an estimated 1.8% of the study population reported that they drink before work, 7.1% said they drink during the workday, 1.7% said they work under the influence of alcohol and 9.2% said they work with a hangover (75). Due to ethical concerns and fears of jeopardising labour relations, substance use in relation to the workplace was not evaluated through interviewer administered questionnaires utilised in this current study, a compromise that may have contributed to high response rates obtained in this study. Although pre-shift alcohol levels were measured in this current study, test results were not visible to

the researcher and the participant during the breathalyser test. These tests showed that 0.9% to 7.8% of samples with an average of 3% contained alcohol which is higher than the reported prevalence of pre-shift alcohol consumption of 1.8% in this U.S. study (75). The U.S study was however carried out among employees in various occupations unlike this current study which was carried out only among mineworkers.

Alcohol has a depressant effect on the central nervous system (27) and acute alcohol intoxication can lead to decrease in concentration, reaction time and decision-making ability (27,28,29), factors that can increase the risk of human error & work-related accidents (30,31,32) and road traffic accidents (33,34,35,36). In the mining industry, where high levels of concentration are needed with little room for error, findings of this study where some samples contained alcohol at levels which were double or more than double the limit of 0.10mg/1000ml, with the breath sample containing the highest level of alcohol (0.88mg/1000ml) being at a level almost nine times this limit], coupled with the prevalence of alcohol dependence and cannabis use, suggest the need for more rigorous measures to control alcohol misuse among this population, including pre-shift detection of intoxicated employees.

The majority of positive alcohol samples were obtained on a Monday at a mine where most samples (positive and negative) were collected on Monday. While day of sample collection was found to be a confounding factor, highlighting the need for future researchers to distribute sample collection in individual mines proportionately between the different days of the week, it also suggests excessive alcohol use over the weekend at mine O1, a practice reported by some focus group discussion participants. This and other patterns of alcohol consumption discussed by FGD participants (such

as increased consumption after payday) may also need to be taken into account when planning control programmes.

7.2.4 Comparison of CAGE results to breathalyser results

There was no correlation between CAGE positive results and breathalyser results at or above the 0.10mg/1000ml limit for professional drivers in South Africa. This is likely due to the fact that breathalyser tests are like a 'snapshot' which measure acute intoxication and give insight to immediate risk of accident, while the CAGE questionnaire is used to evaluate the likelihood of being alcohol dependent (i.e. 'chronic use') and it is possible that participants who are dependent on alcohol according to the CAGE questionnaire may not necessarily have taken alcohol before the shift on the day of sample collection. Data from both sources (CAGE questionnaire & breathalyser test) however have a role to play in contributing information towards substance use and its relation to health & safety.

7.2.5 Accidents & substance use

7.2.5.1 Accidents & alcohol use

In mine D1 where positive alcohol tests were defined by the mine as alcohol levels over 0.05mg/100ml of blood (i.e. 0.24mg/1000ml of breath), all the accident-related tests carried out during the period of this record review (1999-2003) were negative for alcohol. In mine P1, where any level of alcohol irrespective of the concentration was regarded as positive, all tests were negative for alcohol in 2001 and 2002. However,

in 2003, 1% of tests carried out at this mine in cases of accidents were positive for alcohol (section 6.3.1.1). The prevalence of positive accident-related alcohol tests could not be estimated for other mines, either because accident-related alcohol tests were not being carried out at that mine, or the necessary records were not available.

In the review of trauma patients in a large mine hospital in South Africa, blood alcohol concentration was over the 0.08g/100ml limit (i.e. over four times the South African limit for professional drivers of 0.02g/100ml of blood or 0.10mg/1000ml of breath) in 5% of cases of occupational injuries (21). In the study among Zambian copper miners, blood alcohol was measurable in 30% of accident cases (22). In a 1993 review of several studies on occupational injuries, the majority of which were done in the United States, Zwerling reported that 4.9% of non-fatal non-transport related occupational injuries had BAC of 0.05g/100ml (i.e. two and a half times the BAC limit for professional drivers in South Africa) or greater, and another 10.6% had BAC levels between 0.01g/100ml and 0.04g/100ml (72). In 1993, Stallones & Kraus also reviewed several studies from different parts of the world on alcohol-related occupational injuries (30) including that of Shain in 1982 in which alcohol was reported to be a contributing or major cause of 7-10% of all industrial accidents in West Germany (76).

In the study of different workplaces including that of the mining industry over an eight-year period in Alberta, Canada, alcohol levels were greater than 0.08g/100ml of blood, the legal limit for driving a car in Alberta, in 4.3% of cases of fatalities (8). In the 1993 review of several studies on occupational injuries, blood alcohol was present

in about 10% of fatal occupational injuries, and this percentage reduced to about 7.3% if only cases with BAC greater than or equal to 0.08g/100ml are considered (72).

It is however challenging to make comparisons between the findings of these studies and the present study among South African mineworkers, and difficult to make comparisons between the participating mines in this study due to variations in circumstances in which alcohol tests were carried out. While most reports regarded the BAC limit as 0.08g/100ml, some used 0.05g/100ml, and others reported on cases containing alcohol irrespective of the level. Variations also exist in BAC limits among the mines in this study among mineworkers and actual individual alcohol readings, which might have helped to facilitate this comparison between mines were not available.

While some studies reported on alcohol levels in cases of fatalities, others reported on occupational injuries. In this study among mineworkers, criteria for determining which cases of occupational injuries will be tested for alcohol vary from mine to mine. In other studies reviewed, circumstances in which occupational injuries were carried out were not outlined. A similar challenge regarding comparison of study findings has also been noted by previous researchers who reviewed several studies which evaluated alcohol use and work-related injuries (30,72).

However, considering studies which used 0.08g/100ml as BAC limit, alcohol levels at or above this limit were reported in 4.3% (8) to 7.3% (72) of fatalities, and about 5% of occupational injuries (21). This limit of 0.08g/100ml is over four times the South African limit for professional drivers of 0.02g/100ml of blood or 0.10mg/1000ml of

breath and suggests that if the later stricter limit (of 0.02g/100ml of blood) was used, the percentages of injuries and fatalities from other studies reviewed (8,21,72) would be higher. These percentages would be even higher if any sample containing alcohol was included in this percentage and would suggest that the prevalence of 1% obtained from accident-related testing in mine P1 [where any level of alcohol irrespective of the concentration was regarded as positive (section 6.3.1.1)] is much lower than that obtained from these other studies. However, given that alcohol testing was carried out in mine P1 in all cases of accidents irrespective of the type, and these criteria are not discussed for other studies reviewed, it may be difficult to make definitive conclusions from these comparisons.

LTIFR, an indicator of accidents severe enough to lead to the loss of one or more work shifts, was found to be positively correlated with presence of alcohol in breath samples irrespective of whether the level was above or below the limit of 0.10mg/1000ml for professional drivers. There are however limitations to this analysis because LTIFR evaluated were general mine values and these accidents were not linked to substance use results of specific study participants (section 2.6). Also circumstances surrounding these accidents were not evaluated and factors other than substances may have been implicated. However, mine G2 which had the highest LTIFR and which also had the highest percentage of breath samples containing alcohol (among mines for which LTIFR data was available) was found to be statistically different from other mines.

Despite the challenges in evaluating the role of alcohol in occupational injuries, there is consensus that alcohol plays a major role in road traffic accidents (33,34,35,36),

and by extension the transportation industry, with a study by Papoz et al in 1986 of injured patients in an emergency unit of a hospital in France reporting blood alcohol levels of 0.08mg% or more in 30.9% of motor vehicle injuries among men (77). In the 1982 review of substance use and management strategies in the workplace, Shain reported that safety risks of alcohol misuse are likely to vary from one industry to another and within industry from one type of job classification to another (76). However, in the mining industry where heavy machinery and vehicles are often used, this risk is likely to be significant.

Further local studies to evaluate the extent of the role of alcohol in accidents among mineworkers in South Africa are needed. Studies which research the true magnitude of alcohol and work-related injuries have been challenging because of inadequate evaluation of confounding variables which might have a role to play in an accident such as job hazards, and pre-existing health problems like impairment of hearing and vision (30). Control populations which do not use alcohol have not been properly factored into study designs (30). Ethical concerns and fears of jeopardising labour relations have also contributed to this challenge (8). This current study has however helped to gain trust among stakeholders, especially the employees, and will help facilitate future studies among this population in South Africa.

Findings of this study also highlight inadequate record-keeping and lack of uniformity regarding protocols for post-accident & medical surveillance-related substance tests among mines (e.g. cut-off for positive alcohol test results, circumstances in which accident-related substance testing is carried out), factors which need to be taken into consideration in developing effective substance use control programmes.

7.2.5.2 Accidents & cannabis use

With regard to accident-related cannabis tests, none of the employees in mine D1 tested positive for cannabis between 1999 and 2003. Information was however not available on the percentage of total accidents in which cannabis tests were carried out.

In mine P1, cannabis was positive in 4.9% of cases tested according to mine criteria in 2002 and 3.9% of cases tested in 2003. As with findings of this study related to post-accident and medical surveillance-related alcohol tests, unavailability of results in most mines as well as inter-mine variations in testing criteria make it difficult to make comparisons between mines in this study.

LTIFR was found to be negatively correlated with positive urine tests for cannabis, a finding which was also significant with regression analysis. This finding is however subject to several limitations (section 7.2.5.1). LTIFR evaluated was not linked to cannabis use results of specific study participants and criteria for accident-related cannabis testing varied from mine to mine. In addition to this, qualitative tests which detect cannabis in urine at the time of an accident do not confirm recent use unlike breathalyser tests, and may not sufficiently prove its link to the accident, and quantitative tests which might have evaluated levels of metabolite to help support this link were not carried out in this study. Also, the cause of the accidents may have been multi-factorial.

Cannabis use however increases the risk of road traffic accidents (47,50,51), impairs occupational functioning (48) and can increase the risk of workplace accidents.

Findings of this study not only highlight the need for industry-regulated protocols for substance testing, but also the need for adequate investigation of accident cases (including causes other than those that are substance-related), as this can help in improving overall health and safety among this population. Further studies which utilise different methodologies are however also needed to evaluate the link between cannabis use and work-related accidents in South Africa.

7.2.5.3 Prevalence of positive medical surveillance-related alcohol & cannabis tests

In mine D1, no employee tested positive for alcohol or cannabis during medical surveillance between 1999 and 2003. This estimation could not be made for other study mines either because these tests were not being carried out, or where they were being carried out, records were not available. Medical surveillance has a role to play in early detection and monitoring of substance use among employees. There is a need to emphasise this role and develop industry regulation on how substance use-related medical surveillance should be carried out among mineworkers.

7.3 Probable Influence of Substance Use Policies on Substance Use

Although day of sample collection was found to be a confounding factor with respect to positive breathalyser results, most mines which have substance use policies (P1, D1, C1) have lower proportions of breathalyser results which exceed the

0.10mg/1000ml legal driving limit (0%, 0.9%, and 1.1% respectively) for professional drivers, than other mines (P2, O1) which abide by a general code of conduct (1.5%, and 5.9% respectively). As part of the alcohol policy in mines P1, D1, and C1, employees may be randomly selected for breathalyser tests when they report for work and this among other factors may be a deterrent to pre-shift alcohol consumption. This finding suggests that having some policy is better than having no policy at all.

There does not however appear to be any differences between the percentages of employees who may be alcohol dependent in mines P1, D1, C1, and G1 (19.4%, 10.7%, 16.8%, and 12.4% respectively) which have substance use policies, compared to mines P2, G1, and O1 (16.4%, 24.8%, and 17% respectively) which do not. However, the mean prevalence of alcohol dependence of mines which do not have policies (19.4%) is higher than that of mines which have policies (14.8%). Mine D1, one of the mines with a mine policy has the lowest prevalence of alcohol dependence (10.7%).

There also does not seem to be any clear trend in the prevalence of cannabis use among mines P1, D1, C1, and G1, which have policies (4.6%, 7.2%, 7.6%, and 13.6 respectively), compared to mines P2, G1, and O1 which do not (7.5%, 5.6%, 21.5% respectively). However, the mean prevalence of cannabis use of mines which do not have policies (11.5%) is one and a half times more than that of mines which have policies (8.3%). Also, the highest rate of cannabis use (21.5%) and breathalyser results above the driving limit (5.4%) were obtained in mine O1, which has a code of conduct in relation to substance use, but no mechanisms in place to implement these measures. Employees in this mine (O1) were found to be 5.37 times (p=0.001) more

likely to be cannabis positive and employees in mine D1 which had a mine policy were less likely to be alcohol dependent, although mine D1 also had other characteristics which made them different from other mines (section 7.4.9).

Due to unavailability of pre-existing data in participating mines for comparison, it is difficult to establish a trend in substance use in individual mines, in relation to substance use policy. In 2002, Bush & Autry reviewed studies done in the United States on epidemiology of substance use in the workplace, its effects and industry response (78) and reported on the 1997 household survey of workers 18 to 49 years of age by the Substance Abuse and Mental Health Services Administration (SAMHSA) which found that U.S., workplaces which had a written policy for substance use and which provided substance use-related health promotion were found to have lower levels of self-reported illicit drug use among employees compared to workplaces which did not (79).

Findings of this study among mineworkers suggest that in general, having a written mine policy is better than having no policy at all. However, due to variations in the level of control of substance use achieved among mines with policies (with regard to prevalence of substance use), these findings also suggest that a mine policy on its own does not ensure a reduction in substance use among employees. This raises the question of what the essential elements of a successful programme should be (such as health promotion, monitoring and surveillance, employee assistance programmes), and how these can be successfully implemented as part of a comprehensive programme.

7.4 Factors Which May Be Linked To Substance Use

7.4.1 Low job categories & low levels of education

There was no statistically significant association between low job categories and low levels of education and alcohol dependence, although more low category workers (i.e. 16.7% of grade 3 to 4 participants) were CAGE positive compared to workers in high job categories (i.e. 11.7% of officials). More workers with low levels of education (i.e. 15.9% of participants with matric or less qualification) were also CAGE positive compared to participants with higher levels of qualification (i.e. 10.7% of participants with post-matric qualification). Low job categories and low levels of education may however be related as employees with low levels of education are more likely to be in lower category jobs. While the majority of FGD participants agreed that alcohol and cannabis use were more common among mine workers with low job categories and low levels of education, others noted that some workers in higher job categories were also dependent on alcohol, a finding that seems to have been reflected in the findings of structured interviews in this study.

Higher levels of alcohol misuse have also been reported in those in low job categories in other studies carried out among miners in South Africa (12) and Argentina (13), and in studies carried out among the general population in South Africa (26) and among employees in various occupations in the U.S. (11). In other studies carried out in the U.S., heavy alcohol use was also found to be more common among those with low levels of education (14,20).

Findings of structured interviews in this study showed a positive association between cannabis use and low levels of education, and also between cannabis use and low job categories. This is similar to findings of the 1997 review by Rocha of substance use among South Africans where cannabis use was reported to be common among those in poor socio-economic conditions (80). These findings suggest a need to target different groups of employees in control programmes.

7.4.2 Location of workstation & levels of perceived work-related danger

Although higher rates of alcohol use have been reported among underground mineworkers in Argentina (13), this was not found to be so in this study. Higher levels of those who worked underground were however found to be cannabis positive (7.3%) compared to those who worked on aboveground (4.4%). Although this finding was not statistically significant, it is in agreement with FGD participants who said that more underground workers use cannabis than aboveground workers to overcome the fear of working underground and to cope with the more stressful conditions underground. Use of cannabis to cope with stress ($p=0.44$) and to overcome the fear of working underground ($p=0.51$) were not statistically significant. High levels of perceived work-related danger were, however, found to be statistically significant for cannabis use in this study even when adjusted for location of workstation with multivariate analysis. High levels of perceived work-related danger were also found to be positively linked to alcohol dependence.

Low job category and low levels of education were found to be associated with cannabis use in this study. Employees with low levels of education are more likely to be in low job categories and are more likely to be in job positions that are perceived as more dangerous, such as operators and drillers, job categories which exist underground and also in pits in aboveground mines. Although the working conditions underground may be more fraught with danger than aboveground, these findings suggest that participants' perception of level of work related danger is a more important factor for substance use irrespective of the location of workstation.

This finding seems to support the use of substances as a coping mechanism in uncomfortable and dangerous working conditions. This, however, unfortunately predisposes users to more danger due to diminished precision in carrying out tasks, impaired judgment, and inability to respond appropriately in emergencies. There is a need for systems to ensure that employees are well prepared for and suited to their jobs and that coping mechanisms are made available.

7.4.3 Nature of employment & length of service

Being a full-time worker was not linked to alcohol use in this study. However, full-time workers and those with longer length of service were found to be less likely to use cannabis than contract workers and those with shorter length of service (<1 year). This finding is in agreement with that of a few FGD participants who said that contract workers at their mines commonly use cannabis while noting that this category of employees did not undergo the same induction procedures on substance use at the mine, as fulltime workers.

Although contract workers may be more likely to be in the shorter length of service category due to possible high turnover, shorter length of service may also apply to newly employed full-time workers suggesting a need to effectively incorporate contract workers and new employees into substance use control programmes.

7.4.4 Hostel dwellers, marital status & cohabitation status with wife

This study set out to evaluate the influence of migrant work and separation from families on substance use. Findings of this study did not however show a positive link between these variables and substance use as those who live in other accommodation were found to be more likely to be dependent on alcohol than those who live in hostels. This may be because those in other accommodation may have more unrestricted access to alcohol than those in hostels although FGD participants noted that some hostel bars were open for longer than the appointed times. In related findings, those who were married were found to be less likely to be dependent on alcohol than those who were single.

Although singleness may be related to migrancy and separation from families, there was no difference between those who were married and living with family members and those who were married and didn't live with family members but visited them periodically. These findings were not in agreement with FGD findings where participants said that boredom and stress, resulting from separation from family members were major reasons for alcohol misuse among mineworkers. In the study

among South African gold mine workers, living apart from families for prolonged periods was also said to encourage alcohol consumption (12).

Further studies are needed to evaluate the relationship between marital status, migrant work and separation from families and substance use. The majority of FGD participants in this study however described living in hostels as dehumanising. Some participants also discussed feelings of diminished masculinity from living in single-sex hostels, and poor educational achievements in their children who were usually left for long periods without the supervision of a father figure. These findings may need to be taken into consideration by mines due to its potential role in improving the overall wellness of employees.

A practice of pre-shift alcohol consumption was reported among some mineworkers, (especially night shift workers), a finding corroborated with breathalyser tests in this study (section 7.2.3). Factors thought to be linked to this practice include boredom and difficulty of night shift workers in sleeping during the day when most people are traditionally awake, and disturbance of night shift workers' sleep by day shift workers in mine hostels. There may be a need to give more consideration to the allocation of hostel rooms to permanent night-shift workers where possible, such that their post-shift rest period is not disturbed by workers in other shifts. As many employees work on night shift on a rotatory basis, it may be difficult to allocate permanent accommodation based on shift. This may also support the need to further studies to evaluate the role of accommodation in the overall wellness of employees and its possible role in substance use.

7.4.5 Reported reasons for substance use

7.4.5.1 Fun, relaxation & stress relief

The major reasons cited by FGD participants for alcohol use among mineworkers include relief of stress (due to factors such as dangerous working conditions, pressure to meet production targets & financial problems), relaxation and boredom, findings which suggest that alcohol may be a coping mechanism as has been reported by Parry and Bennet in a review of alcohol policy and health in South Africa (24). These reasons are similar to those reported in the study among mine workers in a gold mine in South Africa, where the majority of participants used alcohol to cope with stresses of living, and to relieve boredom and loneliness (12). In the study by Rocha of substance use among the South African population, drinking to cope with hardship was reported as a common reason for alcohol use among drinkers living in poor socio-economic conditions (80).

Findings of structured interviews in this study showed that fun and relaxation were statistically linked to alcohol use in agreement with FGD findings. Other reasons cited by participants of structured interviews for alcohol use such as stress and boredom were not statistically linked to alcohol dependence. The need to drink for fun and relaxation may however not be unrelated to the need to relieve stress and boredom.

These findings highlight the need for a holistic approach (9) which takes into account factors within and outside the workplace that may influence substance use and incorporates systems for relaxation and recreation into control programmes.

7.4.5.2 Perceived energy-boosting attribute of cannabis

Although strength to carry out work was not statistically significant for cannabis use, the majority of FGD participants cited a widespread belief in the energy-boosting attribute of cannabis as the major reason why mineworkers use cannabis. Unlike alcohol which is used to cope with psychological stressors related to working at the mine such as boredom, cannabis seems to be used to cope with physical stressors related to heavy workload. In a review of substance use among South Africans, which evaluated offenders, the use of cannabis also seemed to be particularly associated with energy/stamina (80) and the ability to work, and was thought to facilitate coping.

In studies carried out among women in South Africa in Kayelitsha, Cape town by Marks & Elefthenai (81), and in Mabopane, North West Province by Ajani (82), a link was found between misconceptions about the 'medicinal' properties of snuff (such as stress relief) and snuff use. Several theories address how attitudes and beliefs influence behaviour. The psychosocial model describes drug use and users as a complex dynamic relationship of psychosocial need and actual or perceived effects of the drug (83). This suggests that misconceptions about attributes of cannabis may have a role to play in its use among mineworkers, if they feel that it will give them extraordinary strength to complete difficult tasks or that it will bolster their confidence to work in dangerous conditions. Although it may be that the relaxant properties of cannabis (47) contribute to the perception that heavy tasks and a dangerous underground environment are less intimidating than they would otherwise have been, cannabis can lead to impairment of attention, and loss of coordination

(47,48,49) which can increase the risk of accidents. This theory can also explain the use of alcohol as a coping mechanism among this population.

Findings of this study suggest that there is a need for a health promotion programme to debunk these misconceptions in order to discourage its use for any perceived benefits. Other dangerous beliefs about uses of cannabis such as 'it helps to think better' (contrary to its property of diminished concentration), 'it gives better eyesight', 'it helps to sleep in insomnia', and 'it helps in the treatment of fontanelle problems in children'); although held by few participants of FGD and structured interviews in this study, also need to be debunked in these programmes.

7.4.6 Awareness of effects of substance use on health & safety

Although the majority of respondents of structured interviews were aware of the relationship between substance use and workplace accidents, more respondents were unaware of the link between cannabis use and accidents (12.9%) compared to the link between alcohol use and accidents (2.6%). These findings are not unlike that of the focus group discussions where more participants readily linked alcohol to accidents than cannabis. Lack of awareness of the relationship between cannabis use and accidents was found to be positively linked to cannabis use, and employees in mine O1 which had highest levels of participants who were unaware of the link between cannabis use and accidents (31.2%), were more likely to be cannabis positive, highlighting the need for effective health promotion programmes about the link between cannabis use and accidents.

Other FGD participants felt that the relationship of cannabis to accidents was dose-related and that if it was not used too frequently, it would not predispose to accidents. This suggests a need to adopt a zero-tolerance attitude to cannabis, coupled with dissemination of information that there are no safe levels of cannabis.

7.4.7 Use of substances by participants' fellow workers

The majority of respondents of structured interviews (72.7%) in this study who use alcohol drink with their friends, a practice corroborated by participants of all the focus groups. In the 1998 survey by Rocha-Silva et al of substance use among South Africans, drinking was reported to be particularly a group activity, with friends and relatives being mostly the company of choice (80). On the other hand, findings of structured interviews in this study among mineworkers showed that those whose friends did not use alcohol were significantly less likely to use alcohol. Provision of alternative activities which employees can enjoy with their friends may have a role to play in alcohol consumption in this community.

7.4.8 Attitudes towards those who use substances

FGD participants across different groups were more tolerant of cannabis users compared to those who misuse alcohol because cannabis users were, in general, seen to be people who worked hard quietly, compared to those who misuse alcohol who sometimes reported to work drunk, unable to perform their duties, overloading other team members and obviously constituting safety risks. A perception of the positive attributes of cannabis including energy-boosting properties, and the 'hidden' nature of

its adverse effects seems to play a role in the comparative tolerance of cannabis use in this population when compared to alcohol (section 5.3.2.1). There is a need to substitute positive attitudes to cannabis with negative ones among this community.

7.4.9 Differences in characteristics between mines

Findings of this study show that participants in mine D1 were less likely to be dependent on alcohol and those in mine O1 more likely to be positive for cannabis. There are many differences between these two mines including that mine D1 has a written mine policy while mine O1 has a code of conduct. Mine D1 which had lower levels of those who are dependent on alcohol and those who use cannabis, also has lower levels of reported cannabis and alcohol use by fellow workers, than mine O1. Mine D1 has higher levels of respondents who were aware of the link between substance use and accidents than mine O1, and mine D1 has lower levels of those who perceive their jobs as dangerous, than mine O1.

These findings may be an indication of efforts in mine D1 to carry out effective awareness programmes about substance use and to ensure that employees are well suited to their jobs in addition to employing good safety practices. Some of these factors including use of alcohol by fellow workers and awareness of relationship between cannabis use and accidents were found to be statistically significant for substance use and may have contributed to lower levels of substance use in mine D1. However, although there may be some lessons to be learnt from substance use control at mine D1, more efforts are needed in all mines to ensure lower rates of substance use.

7.5 Recommendations for Controlling Substance Use

Recommendations cited by participants of structured interviews for control of alcohol misuse include awareness programmes, breathalyser tests, rehabilitation programmes for those who misuse alcohol, disciplinary measures, recreational facilities, and checks by security officials to detect those who use alcohol at work. These approaches were also alluded to by FGD participants who highlighted the challenges of the current substance use control programmes at the mines including inadequate mine commitment towards control of cannabis use, lack of commensurate disciplinary measures for cannabis use-related offences, lack of sound EAPs, and lack of a holistic approach to substance control. These findings reflect the need for a multi-approach system in controlling substance use.

Reasons given by FGD participants on why some mineworkers do not use substances, such as self-discipline, strong moral values, and awareness of consequences of substance use, are positive values which can be promoted in mine control programmes. The vicious cycle of substance use where the use of substances to cope with problems ironically leads to more problems (such as disciplinary & financial problems) also needs to be highlighted in these programmes as this may discourage some people from using substances if they can see the end result of substance use even before they contemplate using it, although this needs to form part of a comprehensive programme. Some FGD participants noted team spirit as a positive aspect of working in the mine. This can be highlighted in health promotion programmes as part of a concept where people feel a boost in morale from being part of a community where people care for each other's safety.

Findings of this study show that those who are CAGE positive are significantly more likely to have sought some form of help for their use of alcohol highlighting the need to provide adequate help for those who are dependent on substances. As cannabis users in this study were found to be significantly more likely to also be dependent on alcohol (p=0.0001), there is a need to evaluate employees for multiple addictions.

7.6 Conclusions

In this study, the prevalence of alcohol use was found to be 46.9%. The prevalence of alcohol dependence according to the CAGE criteria ranged from 10.7% to 24.4% across mines with a mean of 15.3%. Between 0.9% and 7.8% of all breath samples contained alcohol irrespective of the level, while 0.9% to 5.4% of all samples contained alcohol equal to or above the legal driving limit for professional drivers of 0.10mg/1000ml, with a mean of 1.8% for all mines. However, day of sample collection was found to be a confounder with the majority of positive samples containing alcohol being collected on Monday at mine O1 where the majority of samples (positive and negative) were collected on Monday, highlighting the need for future researchers to distribute sample collection proportionately between the different days of the week.

The prevalence of cannabis use varied between 4.6% and 21.5% across mines, with a mean of 9.1%. The mean prevalence of alcohol dependence and cannabis use of mines which do not have policies (19.4% and 11.5% respectively), was found to be higher than that of mines which have policies (14.8% and 8.3% respectively) and employees in mine O1 which has no policy were found to be more likely to be

cannabis positive (p=0.0001) while those in mine D1 with a mine policy were less likely to be alcohol dependent (p=0.013), findings which suggest that having a mine policy has a role to play in control of substance use among this population.

In mine P1 in 2003, 1% of samples tested in cases of accidents were positive for alcohol, and in 2002 and 2003, cannabis tests were positive in 4.9% and 3.9% of accident cases tested, respectively. Variations in testing protocols and lack of records however prevented an adequate evaluation of the role of substance use in accidents in study mines. LTIFR was found to be positively correlated with the presence of alcohol in breath samples while it was negatively correlated with cannabis use. LTIFR evaluated were however overall mine rates and were not related to the substance use results of specific individuals.

This study set out to test the hypothesis that social factors, some related to the migrant labour system, have a role to play in substance use. This study proved that several social factors related to participants' work and personal life are associated with substance use. Substances seem to be used as a coping mechanism, with the majority of FGD participants reporting that alcohol was being used to cope with stress (related to work and personal problems), to relax and to have fun, and cannabis was being used to cope with the physical demands of working at the mine. Findings of structured interviews also support the use of substances as a coping mechanism, with 'fun' (p=0.046) and 'relaxation' (p=0.018) being found to be statistically significant reasons for alcohol use, and the perception that work is 'most times to always dangerous' being positively linked to alcohol dependence (p=0.013), and cannabis (0.0012). Social factors such as low levels of education (p=0.020), low job categories

(p=0.004), which may be related to lack of awareness of link between cannabis use and accidents (p=0.0001), were also found to be positively associated with cannabis use. On the other hand, social factors such as being married (p=0.001), and reported lack of use of alcohol by fellow workers (0.001) were protective from alcohol use.

However, although FGD participants reported that separation from family members, boredom and stress associated with hostel dwelling were linked with substance use, hostel dwelling, one of the factors being tested as part of the study hypothesis, was not found to be statistically significant. On the contrary, married mineworkers who lived with their wives were not found to be significantly different from those who didn't, and living in accommodation other than hostels was found to be statistically linked to substance use. Although use of substances for 'fun' and 'relaxation' may suggest that substances are being used out of boredom, more studies are needed to evaluate the relationship between hostel dwelling, separation from families and substance use.

Multiple substance dependence was observed in this study, with those who also use cannabis (0.0001) being more likely to be dependent on alcohol than other participants. Being a full-time worker compared to a contract worker (0.004), and having a length of service of 6-10 years (p=0.001) & >10 yrs (p=0.001) compared to length of service of <1year, were protective from cannabis use.

Participants of structured interviews felt that alcohol and cannabis use can be controlled among mineworkers through awareness programmes (21.2%), breathalyser testing (17.7%), rehabilitation programmes for those who misuse alcohol (10.6%),

disciplinary measures (7.5%), recreational facilities (4.8%), and checks by security officials to detect those who use alcohol at work (3.7%). FGD participants were also in agreement about the need for inclusion of these components in substance use control programmes.

This study is the first comprehensive study of alcohol and cannabis in different mines in South Africa. Although more research needs to be done, its findings will provide background information on substance use among this community and play a role in improving the health and safety of mineworkers.

8.0 RECOMMENDATIONS

Substance use can increase workplace accidents, morbidity, mortality, and health care utilisation, and costs (7). There is a need for a comprehensive and holistic approach to substance use among mineworkers in South Africa, which aims at prevention and control of substance use, while also managing substance use-related problems.

This chapter discusses recommendations for substance use control among mineworkers including the following:

- Renew commitment of stakeholders to substance use control
- Develop industry regulations for substance control
- Develop individual mine policies which incorporate essential components
- Improve monitoring & surveillance systems for substance use
- Effectively involve different categories of employees in programmes
- Strengthen health promotion programmes
- Adopt holistic approach to substance use control
- Review disciplinary procedures
- Ensure sustainability of programmes
- Control substance use in the wider community
- Carry out further studies on substance use among mineworkers
- Continuously monitor & evaluate programmes

8.1 Renew Commitment of Stakeholders to Substance Control

There is need for renewed commitment of stakeholders such as the tripartite alliance of employees (i.e. Union representatives, employers, and Government) towards the control of substance use of all types, including cannabis. Non-Governmental-Organisations (NGO) involved in substance use control may also be involved as necessary. There may be a need for national regulatory bodies on health & safety among mineworkers to form a committee which specifically addresses substance use among mineworkers.

Early involvement of stakeholders, utilisation of a consultative approach instead of a dictatorial one, a holistic approach, clear objectives, clear roles of stakeholders, and open lines of communication among stakeholders will facilitate success.

8.2 Develop Industry Regulations for Substance Control

Given the lack of policy in some mines and the seeming ineffectiveness of policy in others, there is a need for industry-regulated legislation on substance use control among mineworkers, which specifies essential elements that must be incorporated into individual mine programmes. In determining these regulations, there is a need to evaluate local findings (such as that of this study), local needs, local guidelines & also

international guidelines such as those developed in Australia (66), and those of the ILO (section 1.5) (68), and the U.S. Federal Drug-Free Workplace Programme, the U.S. Substance Abuse and Mental Health Services Administration (SAMHSA), and the U.S Department of Transportation (78,84,85,86). Regulatory bodies can offer technical assistance to individual mines on how to implement these regulations. Regulations will however require "policing" which is in itself a challenge. Therefore an effective monitoring and evaluation system has to be incorporated into these regulations from inception.

The essential areas which need to be addressed by these regulations include clear written mine policy; health promotion; monitoring & surveillance of substance use; Employee Assistance Programmes (EAP); programmes which address recreation as well as living & working conditions; disciplinary procedures; research; programme sustainability; and programme monitoring & evaluation.

8.3 Develop Individual Mine Policies which Incorporate Essential Components

Individual mine polices which incorporate essential components (section 8.2) should be developed in collaboration with regulatory bodies and in line with industry regulations, although other components may be added from mine to mine based on local needs without compromising legislated standards. These policies should be committed to paper as policy documents and information formally disseminated to stakeholders. An evaluation of how similar programmes were implemented in other

places, including common pitfalls, may help to facilitate the success of these programmes.

8.4 Improve Monitoring & Surveillance Systems for Substance Use

8.4.1 Develop industry regulated standards for surveillance of substance use

There is a need for written industry regulations on surveillance of substance use. The following are issues that need to be addressed in developing necessary protocols:

- **Determine types of surveillance programmes for which substance testing will be mandatory:** These include pre-employment tests, periodic tests, post-accident tests, and random tests (such as pre-shift breathalyser tests, pre-shift/mid-shift cannabis tests & tests for employees suspected to be under the influence of substances). Voluntary pre-shift breathalyser tests are additional tests that have been offered in some workplaces for workers who have reason to believe their alcohol levels may be over the prescribed limit. This however needs to be coupled with a protocol for managing such employees such as waiver of disciplinary action for initial positive test and entry into a rehabilitation programme.

- **Establish protocols which clearly outline the types of accidents in which substance tests will be carried out:** Procedures for adequate evaluation of accidents to determine other possible causes are however needed.

- **Determine categories of employees that will be eligible for tests under different surveillance programmes & frequency of tests**: For instance all employees should be eligible for random tests which may be carried out weekly on any three randomly selected days which vary from week to week.

- **Determine which substances will be tested under the different surveillance programmes:** This should include cannabis as well as alcohol.

- **Establish protocols for carrying out tests:** Standards for collection, storage & testing of samples are needed to maintain the integrity of samples and accuracy of results. Issues to be addressed include when to use dipstick tests for cannabis (e.g. for screening) versus urine lab test (e.g. for confirmation) and what types of dipstick tests have acceptable accuracy levels. Circumstances for carrying out blood alcohol tests instead of breath alcohol tests also need to be determined. For alcohol dependence screening, the CAGE questionnaire can be incorporated into pre-employment & periodic tests to facilitate early detection of alcohol dependence (86). Psychometric tests can also be carried out as part of pre-employment & periodic tests to evaluate how new employees who will be working in potentially dangerous jobs will adapt/are adapting to their new jobs to facilitate early detection of

maladjustments so that employees can be helped to cope or alternative employment/solutions provided.

- **Determine upper limits of permissible breath/blood alcohol levels:** Although there is currently no industry benchmark for breath/blood alcohol levels of miners on duty, it is advisable that a similar limit for all mines be stipulated by industry to avoid confusion and facilitate comparison between mines. Currently some mines use the South African legal driving limit for non-professional drivers of 0.24mg/1000ml of breath (59). However, it may be necessary to consider stipulating the legal limit as 0.10mg/1000ml of breath (the legal limit for professional drivers) (59), as heavy and complex machinery is often used in mines. Alternatively, different limits may be stipulated for different categories of employees such as 0.24mg/1000ml of breath for administrative workers and 0.10mg/1000ml of breath for employees working with heavy machinery such as operators.

- **Determine protocols for dealing with positive substance tests:** To ensure clarity about subsequent steps including rehabilitation and disciplinary measures.

- **Establish ethical guidelines to ensure fairness and transparency:** Determine how employees will be selected for random tests and ensure that employees in all job categories are eligible for selection. A computerised random selection system may be utilised at the mine entrance. Regular audit of this selection process with employee representatives will be necessary.

8.4.2 Incorporate other ways into monitoring of substance use

8.4.2.1 Increase vigilance for signs of substance use during night shift & following weekends

While it is important that mine officials, supervisors and security men monitor substance use on all shifts, specific attention should be given to shifts that may traditionally have fewer employees on duty such as night shifts, to address the belief that intoxicated employees on these shifts are less likely to be discovered. Increased vigilance is also required following weekends and holidays and during festive seasons.

8.4.2.2 Improve random security checks

There may be a need for random searches of employees on entry into the mine for substances which could be used on the mine premises. Unlikely hiding places such as lunch boxes may be searched. Random checks can also be carried out during the shift. The selection process for these searches should be transparent and should include all job categories.

8.4.2.3 Encourage involvement of co-workers in substance use control

There is a need to encourage employees to take up a more prominent role in the control of substance use as they spend considerable time at work and sometimes at home (e.g. in hostels) in the company of co-workers and can assist in monitoring their

colleagues. The buy-in process of this group of stakeholders can be facilitated by highlighting values such as team spirit and a buddy system where the welfare of a fellow miner is the concern of all. The consequences of working with co-workers who are dependent on substances, such as increased risk of accidents and increased workload when these employees are absent due to ill health or are not able to work effectively, also need to be highlighted.

Although employees should be encouraged to notify appropriate personnel where they suspect that their co-workers are under the influence of substances at work or have substance dependence problems, some employees may find it difficult to balance concerns for safety with loyalty towards their fellow workers. Adequate care should be taken in outlining what to do in such situations such that employees who notify appropriate authorities are not victimised by other employees. A telephone line for giving information anonymously may also be set up.

A prize/award system can be instituted for teams in which there are no substance use related incidents such as positive tests for substances during random tests, accidents, or routine medical surveillance. This may also help to facilitate the buddy system, with team members encouraging each other not to use substances. However, a holistic approach by mines to substance use, with a good rehabilitation programme to assist those who are substance dependent, may help employees build trust in the system and assist them in taking decisions involving colleagues who misuse substances.

8.4.3 Strengthen database for substance use-related medical surveillance

Good record keeping of findings of substance use-related surveillance should be mandatory at all mines, with periodic checks to ensure compliance. Length of storage of such records should also be stipulated by industry. Specification of relevant information to be stored (such as results of positive tests), creation of a database for these records, data collection at mine level and pooling of these records into a central database for all mines, will help facilitate monitoring of findings at individual mines, comparison between mines, substance use control efforts and future studies.

8.5 Effectively Involve Different Categories of Employees in Programmes

There is a need to ensure that different categories of employees are adequately involved in substance use control programmes. For instance contract workers need to be included in induction programmes about substance use & other ongoing programmes as appropriate. These programmes may however be tailored to meet the needs of those who will be working at the mine for very brief periods. Programmes also need to be designed in a way that conveys messages effectively to low job category workers with low levels of education.

8.6 Strengthen Health Promotion Programmes

Perceived benefits of substance use seem to play an important role in substance use among the study population. The psychosocial model of health behaviour (83) (section 7.4.5.2) that describes drug use and users as a complex dynamic relationship of psychosocial need and actual or perceived effects of a the drug, can be used as a basis for a health promotion programme which aims to clarify misconceptions about benefits of substance use, while highlighting their adverse effects.

Table 8.1 displays a proposed intervention model for a health promotion programme for the control of substance use among the study community. This was adapted from a model developed by the Centre for Health Promotion, University of Toronto, Canada (88).

Table 8.1: Algorithm of proposed health promotion programme on alcohol & cannabis use among mineworkers

Task	Outline of Activities	Outcome
1. Situational analysis of health promotion needs	Recap health promotion needs from survey findings: -Debunk myths about energy/stamina-giving properties of cannabis -Emphasise link between substance use (especially cannabis) & accidents -Emphasise vicious cycle of substance use whereby the use of substances to cope with stress invariably leads to more problems in areas such as finances, family, work, health & safety, clashes with the law. -Highlight positive values for not misusing substances such as strong moral values, self-discipline, self-determination, and awareness of consequences of substance use -Prevent boredom by ensuring programmes are kept fresh, interactive, and adequately varied -Effectively target different categories of employees including contract workers & low category employees -Emphasise buddy system & need to be brother's keeper but highlight burden substance users place on co-workers when unable to safely & effectively carry out duties	Health promotion needs clarified
2. Engage stakeholders early	Organise feedback sessions of survey findings & health promotion needs with tripartite alliance of government, mine management & employees through union groups Facilitate collaboration of stakeholders & emphasise ultimate gains e.g. improvement in health & safety and minimisation of related costs.	Stakeholder buy-in
3. Determine main goals of programme	To increase awareness of link between substance use & accidents (especially cannabis) To highlight other risks of substance use including vicious cycle of use, reiterating that risks far outweigh perceived benefits To debunk myths about perceived benefits of substance use e.g. energy/stamina-giving properties of cannabis To raise awareness about where & how to get help for substance dependence To decrease substance use among mineworkers (other control strategies are however needed).	Programme goals generated

Task		Outline of Activities	Outcome
4. Determine indicators for monitoring success		% of mineworkers who do not believe that cannabis improves energy/stamina to work better % who are aware of the link between alcohol/cannabis use and accidents % who are aware of the vicious cycle of substance use and who believe that the risks of use far outweigh perceived health benefits % who are aware of how to get help for substance dependence Prevalence of substance misuse	Indicators developed
5. Plan for programme	**5.1 Incorporate audience needs into programme**	Incorporate audience needs in view of study findings [recap of health promotion needs in (1) above]. Ensure all employee groups are included in control programmes including contract workers. Where contract period is relatively short, design abridged programmes which retain relevant information. Ensure programmes targeted for low category employees are in appropriate languages and format	Programme tailored to suit audience
	5.2 Develop identity/message of the programme through an interactive process	Create an identity that will clearly communicate the intended message through e.g. -Depiction of an apparently quiet, hardworking cannabis user, and a dishevelled, drunken mineworker, both involved in accidents, and both unable to respond appropriately in emergencies *(this can be captured in a way that reflects focus group discussion participants' comparison of a cannabis user to someone who is on the street and who sees a car coming towards him but doesn't run away)* -Depiction of the vicious cycle of substance use (figures 5.2 & 5.4) Coin a locally suitable slogan for the health promotion programme and give fictitious local names to the cannabis user/drunk mineworkers and vicious cycle above Involve mineworkers through inter-team competitions with rewards for coining of programme slogans and themes, naming of fictitious characters above, and development of programme posters/logo which reflect programme themes above	Identity/message developed through an interactive process

Task		Outline of Activities	Outcome
5. Plan for programme	**5.3 Determine communication vehicles**	Use a mix of short- and long-lived vehicles by commencing with a big programme launch and integrating it into ongoing programmes such as health & safety programmes, pre-employment and periodic training programmes, and pre-existing employee gatherings such as Union meetings Choose the best mix of channels based on factors such as reach and effectiveness e.g. audio-visual presentations at programme gatherings, pamphlets & posters Ensure materials/communication media cover relevant languages, are easy to understand, and are presented in different ways for different occasions to avoid boredom	Communication vehicles determined
	5.4 Carry out inventory of available resources, assess needs, and make efforts to acquire deficit	Evaluate resources available such as: -human resources (including recovering substance users who can act as programme champions and talk about their real-life experiences of the consequences of substance use during presentations), -existing dedicated funds for health promotion -existing materials such as audio-visual aids Determine resources needed and make efforts to acquire them	Needed resources generated
	5.5 Task allocation	Outline clear roles for different stakeholders & designate tasks	Tasks designated
	5.6 Facilitate communication between stakeholders	Establish clear channels of communication and feedback	Clear channels of communication & feedback established
	5.7 Time scheduling	Establish a clear timeline for accomplishment of tasks and implementation of campaign including periodicity of top-up programmes on ongoing basis	Clear timeline established
6.0 Implement programme		Carry out tasks outlined above and implement programme	Programme implemented
7.0 Ongoing monitoring & evaluation of programme		Evaluate indicators for success above & modify programmes as required	Monitoring & evaluation done with modification of programmes as required

8.7 Adopt Holistic Approach to Substance Use Control

In addition to development of rehabilitation programmes for employees with substance use problems, there is a need to address factors both within and outside the workplace, which influence or have a potential to influence substance use among employees.

8.7.1 Renew commitment to Employee Assistance Programmes

EAP which provide services including rehabilitation programmes for those dependent on substances of all kinds should be mandatory at all mines. There is a need for protocols which address medical and non-medical management (including coping skills) of those with substance use-related problems (89), and screening for multiple substance dependence. Measures should also be put in place to ensure confidentiality such that employees feel trusting enough to voluntarily discuss their problems without fear of victimisation.

Counseling of workers with substance use related problems should be carried out by trained personnel such as counselors, social workers and welfare officers, although additional support may be provided by supervisors where appropriate. This should not be done on a once-off basis but should be tailored to meet the needs of the individual.

Family members should also be involved in the rehabilitation process. Where mineworkers live with their family members or see them on a regular basis, family members may serve as a positive influence and may be able to give a frank assessment of the mineworkers' progress and should be encouraged to do so, with reassurance that the mineworker in question will not be victimised should progress not be as expected. Where mineworkers live apart from their families, close friends and co-workers may be able to play this role through a buddy system whereby they can also encourage substance users who are yet to seek help to do so and support them. Mineworkers undergoing rehabilitation for substance use may also form a support group to encourage each other.

Employees can be divided into groups and welfare officers appointed to look after the general well-being of these groups of employees with due consideration of stressors which may predispose to substance use. Where hostels are available, it may be beneficial to have these officers live in or have their offices located in hostels where they would be closer and more accessible to the people they serve. However, those who misuse substances will also need to make a firm commitment towards change.

8.7.2 Teach alternative coping strategies for problems

There is a need for renewed efforts to provide alternative coping mechanisms to help mineworkers deal with issues such as perception of level of danger in the work place and to help them relax. Clear lines of communication through which employees can discuss their problems with management are needed. Coping techniques can be taught

by trained personnel with programmes designed to meet the needs of different categories of employees.

8.7.3 Provide adequate leisure activities

A variety of leisure activities should be provided for mineworkers, with special consideration for those who live in hostels to help minimise boredom. These activities could include football, chess, and gardening. Adequate facilities for these activities such as football fields & gymnasiums need to be provided. In order to facilitate interest, intra- and inter-mine competitions can be organised and prizes given to winners. Team building outings/weekends can also be organised and can act as social events as well as facilitate interaction between employees.

Scheduling of activities during weekends/month end when mineworkers get paid and when alcohol consumption is said to increase may help provide alternative entertainment. These activities can also help improve levels of physical fitness and mental well-being, and may assist employees to cope better with the demands of their jobs and may minimise the need for substances to help increase energy levels. Employees who are undergoing rehabilitation for substance use should be especially encouraged to participate in these activities.

8.7.4 Continuously improve working conditions

Although there are inherent dangers involved in mining, ongoing efforts should be made by mines to minimise these risks both above ground and underground, and

make employees aware of measures that are being taken in a transparent manner. Ongoing efforts to make the mining environment as safe as possible will not only help to minimise work-related stress, but can also help to decrease the risk of accidents in general, including those that are not related to substances.

8.7.5 Improve living conditions

Consideration should be given to room allocation of hostel dwellers such that those who work permanently in the same shift should as much as possible live in similar quarters to prevent undue disturbance during sleep. Where workers do not permanently work on the same shift, making it logistically difficult to allocate hostel rooms according to shift, it is important to encourage mineworkers to give due consideration to other mineworkers while they are asleep. Although hostel dwelling was not found to be statistically significantly associated with substance use, it was said to diminish workers' sense of dignity and may have a role to play in improving the general well being of employees which may influence the need to drink for entertainment and fun, factors which were found to be statistically significant for substance use. Further studies are needed to evaluate the link between accommodation and substance use status among this population.

8.8 Review Disciplinary Procedures

Although disciplinary procedures are important in substance use control, they should not be carried out as stand-alone measures and should exist alongside comprehensive

programmes. There should a zero tolerance attitude to all substances including cannabis and disciplinary procedures should follow a laid down progression.

8.9 Ensure Sustainability of Programmes

Dedicated funds & other resources are needed to ensure sustainability of programmes. A specific percentage of mine revenue can be earmarked annually for control of substance use annually. A specific amount of revenue from alcohol products (e.g. taxation) nationally may also be invested annually in control of substance use. Similar strategies have been incorporated into national legislation and used for tobacco control in other parts of the world (90). This will however need to be audited to ensure compliance.

8.10 Control Substance Use in the Wider Community

National efforts are needed to control substance use in the general community as this can have an influence on substance use among subgroups such as mineworkers. Alcohol is cheaply available in the community and ways of limiting access such as through taxation & pricing need to be considered. Access to cannabis and perception that its use is innocuous also need to be addressed. Programmes by government (and other stakeholders such as community groups) to increase the level of awareness about the adverse effects of substance use through mass campaigns, to rehabilitate substance users while ensuring that commensurate disciplinary measures apply to violations related to substances (including cultivation, sale and use of cannabis) are

needed. There also needs to be a resolution of the national debate on legalisation of cannabis, as discussed in a 1992 review by Parry in South Africa (91), to clarify the stand of the government on cannabis use and related offences.

8.11 Carry Out Further Studies on Substance Use Among Mineworkers

Although findings of focus group discussions in this study suggest that separation from families & living in hostels play a major role in substance dependence, findings of structured interviews showed that this was not statistically significant. Further studies are required in South Africa to evaluate the role of type of accommodation on substance use (section 7.4.4).

This study did not provide any statistical link between substance use and accidents. Further studies are required to provide such local empirical evidence. Two models are proposed for such a study. These include a case-control study which evaluates substance use among injured cases and non-injured controls, or a prospective study which follows cohorts of workers (i.e. those who use substances and those who do not), after they have been tested for substances as has also been proposed by Zwerling in the 1993 review of workplace substance testing (72). Ethical concerns will have a role to play in determining the most suitable method.

This proposed study should take into consideration variables which may confound an observed relationship between injuries and alcohol, such as job hazards and medical conditions such as deficits in hearing or visual acuity, which may predispose to accidents (30). In view of this, adequate investigation into the causes of accidents involving users and non-users of substances, have to be carried out. Aside from accidents other factors that can be evaluated among those who use substances and those who do not, include absenteeism rates, and disciplinary problems.

There is however, a need to ensure that a good substance monitoring and surveillance programme is in place, such that there is uniformity among mines with regard to standards for levels of alcohol which constitute positive tests, types of accidents in which substance tests will be carried out, what types of tests will be done, and how records will be kept. This will also facilitate comparison between mines.

This present study among mineworkers has however, helped to gain the trust of employees and union officials through the measures that were taken to ensure confidentiality of results (section 2.3.2.2), with no repercussions for those who tested positive for substances, and will help pave the way for further studies. The project management model that was developed based on the experience of this study (Appendix B) can also assist future researchers in carrying out studies among this population (7.2.5.1).

8.12 Continuously Monitor & Evaluate Programmes

It is imperative that substance use control programmes are audited both internally by individual mines, and externally by industry appointed bodies on a continuous basis to ensure adherence to industry regulations and to evaluate which programmes are working, those which are not and reasons for such, to facilitate modification of programmes as required. The development of an audit checklist will help facilitate this monitoring process.

The evaluation process should include periodic research projects with which comparison can be made with existing data. An assessment of input, process, and output should be done. Where possible, economic evaluations can also be done to determine the cost effectiveness of intervention programmes which may serve as evidence to support future programmes. Successes and challenges should be shared with stakeholders to encourage them and also help improve control programmes. A reward system can be considered for mines which adhere to these regulations and penalties for mines which do not following a window period for compliance.

8.13 Conclusion

Recommendations to improve substance use control among mineworkers range from a need for renewed commitment among stakeholders to ongoing monitoring & evaluation of control programmes (table 8.2). Involvement of regulatory bodies in developing standards and ensuring that these standards are met and provision of

adequate resources to ensure sustainability of programmes, will have major roles to play in facilitating success.

Table 8.2: Intervention model for control of substance use among mineworkers

Task	Outline of Activities	Outcome
1. Stakeholders to renew commitment to prevention & control of substance use among mineworkers and form national committee to move agenda forward	Involve stakeholders early through consultative approach (i.e. representatives of union groups, employers, government & community groups). Place adequate emphasis on control of all substances including cannabis use Have clear objectives & channels of feedback of information to stakeholders Form committee with regulatory powers	Committee formed
2. Develop industry regulations for substance control	Evaluate findings of this & other local studies, local needs & existing local & international guidelines, and incorporate them into industry regulations Establish essential elements to be incorporated into written individual mine policies Incorporate monitoring & evaluation systems to ensure adherence to policies	Industry regulations developed
3. Develop written individual mine policies	Develop written individual mine policies which incorporate industry regulations At mine level, incorporate additional elements which reflect local needs but which do not contradict industry regulated elements Disseminate information about mine policy to employees	Written individual policies which incorporate industry regulations developed in all mines in the country & information disseminated to stakeholders

Task	Outline of Activities	Outcome
4. Improve monitoring & surveillance systems for substance use	4.1 Develop & adhere to industry regulated standards on the following: -Types of surveillance systems that will be mandatory -How tests will be done -Categories of employees that will be eligible for tests under different surveillance programmes & frequency of tests -Upper limits of permissible breath/blood alcohol levels: -Standards for collection, storage & testing of samples: -Protocols for dealing with positive substance tests -Ethical issues 4.2 Incorporate other ways into monitoring of substance including the following: -Increase vigilance for signs of substance use -Improve random security checks -Improve involvement of co-workers in substance Use control 4.3 Strengthen database for substance use-related medical surveillance	Standards for monitoring & surveillance of substance use developed
5. Effectively involve different categories of employees in programmes	Involve contract workers in induction courses (& other programmes) on substance control at the mines although this may be shortened depending on the length of stay at mine Tailor programmes to meet needs of low job category employees & those with low levels of education (see table 8.1)	Contract workers effectively included in control programmes Programs tailored to meet needs of low job category employees & those with low levels of education (see table 8.1)

Task	Outline of Activities	Outcome
6. Strengthen health Promotion Programmes	See table 8.1	See table 8.1
7. Adopt holistic approach to substance use control	Renew commitment to employee assistance programmes including rehabilitation programmes for managing those with substance use problems Teach alternative coping strategies for problems Provide adequate leisure activities so that alternative activities to substance use are easily available Improve safety levels as much as is reasonably possible to address perceptions about dangers of working at the mine which were linked to substance use	Standard EAP available at all mines Employees taught coping strategies Varied leisure activities available and accessible to different groups of employees on ongoing basis Safety records at mines which meet standards
8. Review disciplinary procedures	Develop clear procedures for disciplinary action as part of comprehensive substance use control programme and not as stand alone measures Increase awareness among employees about disciplinary procedures Develop zero tolerance attitude to all substances including cannabis and follow a laid down progression for disciplinary procedures	Clear disciplinary protocols developed for violations related to all types of substances

Task	Outline of Activities	Outcome
9. Ensure sustainability of programmes	Regulate resources to be dedicated annually to substance use control among mineworkers which may be obtained from mine revenue and/or national taxation on alcoholic drinks	Dedicated budget utilised by individual mines for substance use control on ongoing basis
10. Control substance use in the wider community	Government to make national efforts to control substance use in the following ways: -limit access to alcohol through taxation/pricing -control access to cannabis by monitoring local cultivation & sale of cannabis -Carry out national awareness campaigns -Provide adequate national rehabilitation programmes and facilitate access -Clarify stand of government on legalisation of cannabis -Apply commensurate disciplinary measures for offences related to substances	Decrease in prevalence of substance use among the general population
11. Carry out further studies on substance use among mineworkers	Carry out further studies to evaluate link between separation from families & substance use Carry out further studies to evaluate link between substances & accidents. Consider: -A case-control study by evaluating substance use among injured cases & non-injured controls -Or a prospective study by following cohorts of workers (i.e. those who use substances and those who do not), after testing them for substance use Incorporate an evaluation of other characteristics of substance users such as absenteeism rates & disciplinary problems into these studies	Further studies carried out

Task	Outline of Activities	Outcome
12. Continuously monitor & evaluate programmes	Audit programmes for adherence to regulations on a continuous basis both internally by individual mines & externally by industry appointed bodies Develop audit checklist to facilitate monitoring process Evaluate input, process, and output of programmes Where possible carry out economic evaluations to determine the cost effectiveness of intervention programmes Carry out periodic research projects with which comparison can be made with existing data. Ensure these are carried out on ongoing basis. Determine indicators to be monitored such as prevalence of substance use and access to rehabilitation programmes. Share successes and challenges with stakeholders to encourage further achievements & help improve programmes Consider rewards for mines whose programmes are commendable and penalties for those that do not adhere to regulations	Annual internal & external audits of substance use control programmes carried out at all mines & shortfalls in adherence to regulations documented & followed through Progress of programmes evaluated periodically through research on specified indicators Rewards given to mines which adhere to regulations & those which have made commendable progress in indicators monitored Penalties applied to mines which do not adhere to regulations

APPENDIX A

Table A1: Minimum sample sizes for prevalence studies at 95% precision

Margin of error	Maximum expected prevalence rate (%)*							
	1%	**2.5%**	**5%**	**10%**	**20%**	**30%**	**40%**	**50%**
0.5%	1 522	3 746	7 300	13 830	-	-	-	-
1%	381	937	1 825	3 458	6 147	8 068	9 220	9 604
2%	-	235	457	865	1 537	2 017	2 305	2 401
5%	-	-	73	139	246	323	369	385
10%	-	-	-	35	62	81	93	97
15%	-	-	-	-	28	36	41	43

**If the prevalence is greater than 50%, use 100 minus the percentage.*

APPENDIX B

A PROJECT MANAGEMENT MODEL FOR CARRYING OUT STUDIES ON SUBSTANCE USE AMONG MINEWORKERS IN SOUTH AFRICA

1.0 INTRODUCTION

This is a project management model that may be of use to future researchers who wish to carry out similar studies on alcohol and cannabis use among mineworkers, and is based on the experience of this current study. In general, this model highlights issues that may be peculiar to this kind of study and does not address general project management issues like budgeting. Although the project management aspects in this report have been presented in a serial order, some of the activities described in the following sections will be carried out concurrently.

2.0 ESTABLISH CONTACT WITH MINE

Establish initial contact telephonically with the major stakeholders (i.e. mine management and union representatives) at selected mines and invite them to participate. Follow up with official letters giving details of the study. Compile a list of all contacts for easy access.

2.1 Contact Mine Management

Contact the mine management of individual mines and invite them to participate in the study. Contact details can be obtained from the Safety in Mines Research Advisory Committee (SIMRAC). In this study selected mines had been previously notified by SIMRAC. Enquire about a specific mine management contact person with whom to liaise for all enquiries and assistance relating to the research. In this study (i.e. health and safety-related research), the mine liaison was usually in the Health or Safety Department.

2.2 Contact Union Representatives

Although other Union groups exist, the National Union of Mineworkers (NUM) is the largest union group of mineworkers in South Africa. In this study, while first contact with union groups other than NUM was made at mine level, initial contact with NUM was better facilitated through respect of their management hierarchy. Therefore, it is advisable to contact NUM representatives at national, regional and local mine levels, in that order, after which local NUM representatives at the mine level will likely become the primary liaison. Contact details of the national representatives of NUM that sit on the relevant SIMRAC sub-committee for mine health and safety-related research may be obtained from SIMRAC, while contact details of union groups other than NUM can be obtained from the mine management liaison.

3.0 OBTAIN COLLECTIVE CONSENT FROM STAKEHOLDERS ABOUT MINE PARTICIPATION IN STUDY

Request for collective consent from the mine management and union representatives of individual mines about participation in the study. Only when this is obtained can plans successfully proceed for data collection at a particular mine and consent obtained from participants on an individual level.

3.1 Organise Mine Presentation

Organise presentations at mines according to stakeholder preference and at their convenience. Give more information about study objectives, highlight gains to stakeholders (e.g. in terms of health & safety, and savings in substance-use related costs), and address concerns as best as possible (e.g. anonymity of participants and selection criteria for participation). Ensure that all mine clearance protocols for entry of visitors to mines are met before the mine visit for the presentation. Obtain clear directions/map to the mine which may be located in a rural area.

3.2 Arrive at Consensus

The success of the study depends on consensus and the process for achieving this may differ from mine to mine. While some mines may arrive at consensus following the presentation, some Union officials may request time for further consultation with

their regional or national officials, in which case there is need to ensure that the consent issue is on their next meeting's agenda. Further presentations may sometimes be requested for other audiences (e.g. Shop Steward Council).

In this study, consent was obtained from most mines after several months of consultation. Diplomacy, patience, reassurance about confidentiality of study findings, and respect of organisational structures and systems of decision making among the different stakeholders, played a key role in this consultative process.

4.0 SET TENTATIVE DATE FOR COMMENCEMENT OF DATA COLLECTION

Where collective consent has been obtained, set a tentative date for data collection and begin necessary preparations. In order to prevent bias, do not schedule data collection during traditional festive periods such as New Year, or local festivals near study mines.

5.0 PLAN FOR DATA COLLECTION

5.1 Order Necessary Tools/Consumables

Place timely orders in adequate quantities depending on the study sample size. The following is a checklist of major items:

- Breathalyser certified by an accredited body with extra set of batteries: Ensure re-calibration as necessary when study is underway.
- Disposable breathalyser mouthpieces
- Laptop for downloading breathalyser results
- Wide-necked urine sample bottles for specimen collection (liaise with laboratory for specifications)
- Narrow sample bottles for freezing specimens before delivery at lab for testing (liaise with laboratory for specifications)
- Racks for organising and storing urine samples (liaise with laboratory)
- Cooler box for temporary storage of urine samples at data collection site
- Ice for cooler box for sample storage
- Disposable gloves for handling urine specimens
- Stickers for labelling urine samples by mine (liaise with laboratory)
- Questionnaires and relevant appendices
- Stationery
- Bags for all research assistants (for keeping questionnaires, stationery etc)

5.2 Obtain Background Information about Study Mine

This information will help to give a better insight into the mine and also facilitate data collection. The mine management liaison for the study will help facilitate collection of the information from relevant sources. Find out the following:

- History of the mine.
- If the mine is a surface mine or underground mine.
- How many premises/work-sites the mine has.
- How many shafts/pits the mine operates.
- Mine substance use policy, including Employee Assistance Programs (EAP), where available. Obtain a written policy or draft policy or current code of practice about substance use as applicable.
- If health workers in the mine clinic, or mine Employee Assistance Programs (EAP) or other centres in the area, may be included as one of the support structures for study participants who want to seek help or want more information about substance use (Appendix G).
- Shift rooster, shift timings and shift patterns (including shift overlaps and rest cycle shifts) to ensure access to different groups of employees.
- If there is a mine hostel and if not, where most employees live.
- Mode of transportation to mine and commuting patterns of the participants to estimate the number of employees that will arrive for data collection at a particular time
- Facilities that can be used for interviews, data collection, and sample collection and storage at study mines.

5.3 Request for List of Employees

- Request for hard copies of updated employee lists, and where possible electronic copies, reasonably close to the date scheduled for commencement of collection. How this list is ordered has a major role to play in determining the ease of accessing employees. Therefore, categorise employees in an order that will best suit data collection at the particular mine. In this study, requests were made for employees to be classified by permanency of job (i.e. regular contract worker/fulltime workers) into two separate lists, and then employees in each of these lists were classified by shift, workstation and job category to facilitate simultaneous access to employees in the same work areas. These lists may be obtained from the mine central HR system or from HR offices in individual shafts.

5.4 Select Study Participants from Employee List

Select participants from employee lists according to the study methodology.

5.5 Determine Data Collection Strategy

5.5.1 Plan logistics of data collection

Organise data collection points at the mine and develop plans which will not cause undue disruption of productivity and mine activities with assistance of the mine

management liaison. In this study, the method used for accessing employees depended in general on whether there was an electronic access gate at the mine or not. Employees can be accessed as follows:

- **Surface mines with no electronic access gate:** Approach employees' at their workstations and invite them to participate in the study on arrival for duty.
- **Surface & underground mines with electronic access gate:** Access employees who work at the pit or underground by "parade" technique. This involves pre-shift entry of selected employees' identity numbers into the mine computerised security system. On clocking in for duty, such employees would not be immediately allowed access into the mine and would have to make enquiries from the mine HR officer in charge of controlling access to the shaft/pit. This HR officer, who would have been previously informed about the study and the research team's whereabouts, would then direct the employee to the research team where he would be invited to participate in the study. Employees who work on the 'surface' can be accessed directly at their workstations or through the 'parade' technique.

5.5.2 Estimate target for data collection rate

Estimate the number of interviews that will need to be carried out per day in order to proportionately distribute data collection over the different days of the week and facilitate completion within one week. This will depend on factors such as sample size, number of research assistants available, estimated length of interview per participant (including adequate time to obtain individual consent and reassure employees about confidentiality of individual results, and to administer questionnaires

and collect urine and breath samples), and the window of access to participants before the shift (i.e. interval between employees' arrival before the shift and commencement of duty).

Where the mine runs a shift system, divide the estimated number of interviews to be carried out per day between shifts. As the morning shift is usually the largest shift and more participants are likely to have been selected on that shift than on any other shift, set a higher target for interviews to be completed during the morning shift. This estimation will also help in determining how many research assistants will be needed for the study. Although this rate may change when data collection starts due to unforeseen circumstances, it can help to plan resources & logistics.

5.6 Compile List of "Where to Obtain More Information about Alcohol/Dagga Use"

Contact organisations near individual mines (Appendix B, section 5.2) which provide information on substance use and support for those who want to quit. Ask for their support and compile relevant contact details and names of contact persons in these organisations into a list. Include different types of organisations, so that participants can choose whichever is most suitable for them (Appendix G). In this study, organisations that provided support include:

- South African National Council on Alcoholism & Drugs (SANCA), Johannesburg.
- Individual mine clinics

- Alcoholics Anonymous
- Department of Health and Welfare in regions of individual mines

5.7 Recruit & Train Research Assistants

Recruit suitable research assistants who speak relevant local languages and train them appropriately. The estimated data collection rate (Appendix B, section 5.5.2) will have a role to play in deciding the number of assistants required.

5.8 Organise Pre-Data Collection Mine Trip

A pre-data collection trip can help facilitate tasks such as finalising and obtaining hard copies of employee lists where applicable, and assessment of mine facilities that will be used for data collection.

5.9 Periodically Review Tentative Date for Commencement of Data Collection & Set Actual Date and Shift

Periodically review the tentative date that was earlier set for commencement of data collection (Appendix B, section 4.0) in view of progress regarding preparations being made. Set an actual date for commencement of data collection and inform research assistants. Plan to start data collection on a working day when the mine management liaison will be available to help sort out any teething problems that may arise during the initial data collection stage. Determine which shift to commence data collection

with, and arrive at the mine a few hours before this shift to allow for orientation through the mine (Appendix B, section 6.2) and any other last minute preparations.

5.10 Commence Mine Entry Clearance Process for Research Team

At most mines, there will be a need to fax the identity documents of all the members of the research team, including research assistants, to the mine management liaison before the actual data collection date. These will be used for preparation of mine security clearance and entry permits.

5.11 Book Accommodation for Research Team Close to Mine

Phone the tourism information centre of the area in which individual mines are located. These numbers can be obtained from the telephone enquiry service. Request that the information centre fax a list of lodgings in the area. Contact these lodgings and enquire about their proximity to the mine. The help of the mine management liaison can also be enlisted in identifying lodgings that are close to individual mines, as some lodgings may not be aware of their proximity to the mine. Proximity to the mine is important because, where data collection is based on employee shift, quick access to the mine may be required at odd hours such as 12 midnight, and 3am. In this study, self-catering facilities were found to be more convenient because the research team was sizeable and the arrival times at the lodgings did not always fit in with hotel meal times.

5.12 Finalise All Arrangements and Depart to Mine for Data Collection

Finalise all necessary arrangements in preparation for data collection. Revise data collection tools with research assistants and notify them about departure date. Revise background information about study mine (Appendix B, section 5.2), and the data collection strategy (Appendix B, section 5.5). Pack essentials on the checklist (Appendix B, section 5.1) and other necessary items such as employee lists, and leave for the study mine.

In this study, where the mine was far from the departure point, the research team planned to arrive at the lodgings a day before data collection so that team members could have an early start for data collection the next day. Where the mine was close to the departure point, the team sometimes left the same day and went straight to the mine to begin arrangements for data collection.

6.0 COLLECT DATA

6.1 Obtain Clearance for Research Team on Arrival at Mine

On arrival at the mine entrance, contact the management liaison. Where written clearance must be obtained before entering the mine, enquire from the management liaison about the possibility of obtaining clearance for the research team that will last

the entire duration of the data collection instead of daily renewals. This will save time as the research team may need to enter and exit the mine several times a day, and filling forms for several people each time can be time consuming.

6.2 Request for Orientation of Mine for Research Team

It is beneficial to have the mine management liaison organise a drive round the mine for the team, especially in a large mine, to facilitate orientation of the different parts of the mine where employees will be accessed, such as the shafts/pits, administrative sections, and workshops.

6.3 Review Data Collection Strategy

Review the data collection strategy (Appendix B, section 5.5) and make amendments based on any new information.

6.4 Access Participants & Carry Out Interviews

In this study, some mines appointed an employee to chaperone and assist the research team, during regular working hours, for the entire duration of the trip. Outside regular working hours (i.e. afternoon and night shifts), contact details of who to ask for assistance was given to the research team. This also facilitated introduction to the heads of some of the sections where employees were selected. At some mines, union

officials also visited data collection posts and reassured participants of confidentiality of results.

6.4.1 Accessing of employees who work at the shaft (underground mines) or pit (surface mines) in mines which have electronic access gates

6.4.1.1 Submit list of employees to be 'paraded' to Human Resource (HR) Officers

Employees who work at the shaft in underground mines, and the pit in surface mines, can be accessed by the 'parade' method (Appendix B, section 5.5.1). HR officers at the 'crash' office (i.e. HR office) located at the mine/shaft entrance, play a crucial role in helping to access this category of participants. Before each shift, submit a list of employees to be 'paraded' to the HR officer at the crash office of the shaft, or in case of open pit mines to the relevant HR offices, based on your estimate of the number of employees the research team can interview per shift (Appendix B, section 5.5.2). However, you may need to over-estimate the number of workers to be paraded based on the non-response rate to the 'parade'. This will become apparent soon after commencement of data collection.

The HR officers will be able to estimate how long before each shift this list needs to be submitted to them, so that system activation can be done without undue disruption of mine duties.

6.4.1.2 Arrive early before the shift

For underground mines, the shaft entrance where employees will be paraded is usually inside the mine proper, while for surface mines, the entrance is usually that of the main mine entrance. It is better for the research team to arrive about 45 minutes before employees are due to arrive for the shift, especially in large mines. Timing is crucial especially for underground workers who leave for underground at fixed intervals.

Confirm that employees on the employee list earlier submitted to HR officers have been 'paraded' (Appendix B, 6.4.1.1). Set up the data collection stations in the areas allocated by the mine. These areas should afford participants privacy and also be in close proximity to rest rooms for collection of urine samples. In this study, where mine union officers volunteered the use of their offices for data collection, participants' fears about confidentiality of results were more easily allayed.

6.4.1.3 Invite randomly selected employees to participate

Ensure that there is always at least one member of the team who can speak local languages near the 'crash' office (i.e. HR office), until all employees have gone into the mine, so that employees who make enquiries from HR officers about the reason for the 'parade' can be taken to the interview post and invited to participate in the research without delay. Ensure that the HR officers at the 'crash' office also know the data collection post and the team's whereabouts, in case for some reason the team member at the HR office is temporarily unavailable when some employees make

enquiries about the ‘parade’. Otherwise, these employees will be allowed into the mine without being invited to participate in the study.

6.4.1.4 Commence interview and obtain samples

Where employees agree to participate in the study, cross off their employee number from the list of ‘paraded’ employees. Keep this list as employees who did not respond to the parade in the first instance will have to be re-paraded. Assign a research assistant per participant. This assistant will obtain consent, carry out the interview, and request for urine and breath samples. In this study it was useful to assign one researcher permanently for conducting breathlyser tests when employee flow was at its peak. Do not underestimate the amount of time it will take to obtain consent. In this study, some participants felt suspicious about why they in particular had been selected. Address their concerns and explain the random selection process where management staff will also be eligible to participate, and reassure them that breathalyser results will not show on the breathalyser screen, and that results will be kept confidential. After the interview, thank employees for participating in the study.

6.4.1.5 Store urine samples as directed by the lab

Store the samples in a way that will preserve the integrity of results as directed by the laboratory that will analyse these samples. In this study, in order to prevent the metabolites of cannabis in these samples from becoming unstable in room temperature, urine samples (which had been collected in a wide-necked sample bottle) were stored onsite in a cooler box at a temperature of less than 4°C. Within 48 hours,

these samples were transferred into narrow-necked tubes, arranged into racks and kept in a frozen state in a freezer, until delivery at the laboratory.

The amount of ice needed will depend on the size of the cooler box and the optimal temperature to be attained. However, it is best to purchase more ice than is required per day. This can be stored in a freezer at the lodging or the mine, as facilities which sell ice may not be close to the mine and may not be open for business when ice is needed.

Place ice cubes in the cooler box. Place sample bottles in a container before placing them in the cooler box to prevent seepage of water into sample bottles, where sample bottles are placed directly on the ice.

6.4.1.6 Compile 'parade' list for next shift

Before leaving the mine after each shift, compile a list of employees to be 'paraded' in the next shift and make necessary arrangements with HR officers in charge (Appendix B, section 6.4.1.1).

6.4.2 Accessing of employees who work in locations other than the shaft in underground mines and the pit in surface mines (i.e. 'surface' workers)

This category of employees includes administrative workers and those who work in areas such as workshops and laboratories. Accessing these workers can be more time

consuming, as they are located in different workstations spread throughout the mine, unlike those who work at the shaft/pit who can be accessed in the same area in large numbers (Appendix B, section 6.4.1).

Find out when 'surface' workers arrive. Arrive early before the shift with the research team. Go to the relevant workstation and obtain permission from the section head where necessary. In this study, as there was a lot of ground to cover in some mines, after an employee had consented to participate in this research, we found it useful to leave a research assistant per participant to conduct these interviews and obtain urine samples. The rest of the research team then went to the next workstation/building and repeated this process depending on the number of research assistants available. As research assistants completed their interviews, the rest of the team went back to them, breath samples were obtained (one breathalyser was used for this study), respondents were thanked, and urine samples were stored (Appendix B, section 6.4.1.5).

Although in some mines, some 'surface' employees were asked to come to a specific data collection post, at larger mines where the distance between workstations was far apart and employees arrived only shortly before duty, accessing this group of employees directly at their workstation facilitated data collection.

6.5 Review Data Collection Process Daily

This process should include the following:

- Review successes and challenges of the day with the research team and address their implications for further data collection.
- Review the list of ‘paraded’ employees, and include the names of those who did not respond to the ‘parade’, in future ‘parade’ lists (Appendix B, section 6.4.1.4).
- Ensure urine samples have been appropriately stored (Appendix B, section 6.4.1.5).
- Download breathalyser results obtained during the day.

6.6 Complete Data Collection

Repeat the processes above daily (Appendix B, sections 6.4 & 6.5) until data collection is completed. On completion, visit/phone those who played major roles in assisting the data collection team to thank them.

7.0 CARRY OUT POST-DATA COLLECTION TASKS

Some of the major post-data collection tasks include the following:

- Deposit urine samples at the lab on arrival.
- Download any outstanding breathalyser results.
- Write an official letter to mine management liaison and union representatives thanking them for their hospitality.

- Meet with research assistants and relive experiences, successes, challenges encountered and how to improve data collection at the next study mine.
- Re-evaluate the data collection process, write a report on this including information on pertinent issues that arose, and how these will influence data collection at the next study mine.

8.0 GIVE FEEDBACK TO STAKEHOLDERS ON ONGOING BASIS

During the research process, give relevant formal and informal feedback to stakeholders, including the project sponsors, in an ongoing manner about progress so far and problems encountered. On completion of the project, disseminate findings to stakeholders through channels that would have been previously agreed upon.

APPENDIX C

INTRODUCTORY REMARKS FOR INTERVIEWERS

1) **Obtain signed consent from participant.**
   - **Introduce yourself.**
   - **Explain that you have come to find out more about alcohol and dagga use among mine workers and its relation to health and safety, and that recommendations will be made to stakeholders to improve health and safety of mine workers.**
   - **Inform respondent about random selection of participants.**
   - **Assure of confidentiality and anonymity.**
   - **Explain samples: urine for dagga and breath for alcohol only. Breathalyser will not reflect results on monitor.**
   - **Explain need for <u>signed</u> consent (requirement by Wits Ethics Committee to protect rights of participant and ensure participation is voluntary).**

2) Number questionnaire as directed and fill other details at beginning of form (time and date of interview etc).

2) Read notes for interviewers in questionnaire and follow prompts as appropriate.

3) In multiple-answer questions with "other" option, always ask participant if there's anything else.

4) Where specified, fill in responses clearly.

5) Ensure all questions that apply to participant are filled. Where respondent declines to answer any question, indicate as such.

6) Thank each participant after interview and give letter about where to get more information about alcohol and dagga use.

7) Give each participant a urine sample bottle. Instruct to collect "first catch" and fill three quarters of sample bottle with urine.

8) Accompany participant to interviewer in charge of breathalyser tests and wait till procedure is completed.

APPENDIX D

SUBJECT INFORMATION & CONSENT FORM FOR STRUCTURED INTERVIEWS

Dear Worker,

My name is …… I have come to conduct a study in your mine. The aim of this study is to find out about alcohol and dagga use, and perceptions with regard to health and safety on mines in South Africa.

A list of all mine employees was obtained from the mine. You were selected by chance, and I would like to invite you to participate in this study. A questionnaire on alcohol and dagga use among mineworkers will be administered to you by trained researchers. Urine and breath samples will be obtained from each participant. Urine samples will be tested for dagga, and breath samples will be tested for alcohol. No other tests besides these will be carried out on your samples. These tests will not cause you any discomfort.

Every participant will be given a list of facilities in the area (including your mine clinic) which provide information and other services relating to alcohol and dagga use.

I reassure you that the results of the study will be completely confidential and anonymous. Your name will not be written on the questionnaire or on the samples that

will be obtained from you. The person interviewing you and taking samples from you will not be the same person analyzing the questionnaire that you will answer, and tests that have been done on you. The results will not be linked to you. Only group results will be made available to all stakeholders involved in the accident prevention and promotion of health and safety in the mines in South Africa, so that relevant policy to provide safer working environment will be developed.

Participation in this study is voluntary and you are free to refuse to participate or to withdraw your consent and to discontinue participation at any time. You can also refuse to answer any of the questions, if you so wish. Such refusal or discontinuance will not affect your status and benefits as an employee.

Participation in the study will take about 20 minutes. If you agree to participate, please answer the questions as honestly as you can. Your opinions are very important, so feel free to express them.

I have fully explained the procedures, including the investigations, and have explained their purpose. I have asked if participant has questions regarding the procedures and have answered the questions to the best of my ability.

Date _____ Researcher _____

Date _____ Participant (sign or thumbprint) _____

I have been fully informed about the aim, objectives and procedure involved in this study, including the investigations.

In signing this consent, I agree to participate in this study by:

- Answering a questionnaire that will ask me about my knowledge, attitudes and practice regarding alcohol and dagga use and how these are related to mine accidents.
- Giving one sample of urine to test for dagga, and a sample of my breath to test for alcohol. No other tests will be performed on these samples.

I understand that I am free to participate or not participate in this study. Any information about me is confidential and cannot be traced back to me. Questions that I have regarding this study have been answered to my satisfaction and I understand that if I have further questions at any time, they will be answered. I am also free to withdraw from this study at any time, or to refuse to answer any of the questions if I so wish, and this will not influence my status and benefits as an employee.

Date _____ Researcher _____

Date _____ Participant (sign or thumbprint) _____

APPENDIX E

QUESTIONNAIRE FOR STRUCTURED INTERVIEWS ON ALCOHOL AND CANNABIS USE AMONG MINEWORKERS

Questionnaire No: _____ Date: ___/___/ 2002 Day: _____

Time: _____am/ pm Interviewer: _____

Interviewer, please CIRCLE appropriate responses, and FILL IN participant's responses where specified.

SECTION 1: SOCIO-DEMOGRAPHIC INFORMATION

(1) What was your age at your last birthday? _____ (years)

(2) Is participant: (i) Male? (ii) Female?

(3) Are you a: (i) Contract worker? (ii) Full-time employee?

(4) What is your country of origin? _____

(5) What is your main language?

(i) Zulu (ii) Tswana (iii) Sotho (iv) Pedi

(v) Tsonga (vi) Venda (vii) Xhosa (vii) Swazi

(viii) English (ix) Afrikaans (ix) Other ***(specify)***_____

(6) What is your religion?

(i) Christianity (ii) Islam (iii) Traditional worship

(iv) Hinduism (v) Other ***(specify)*** _____

(7) What is your highest level of education? ***(Interviewer, if high school, please specify last standard passed)*** _____

(8) What is your marital status?

(i) Single, **NEVER MARRIED** (ii) Married (iii) Living together

(iv) Divorced (v) Separated (vi) Widow/widower

(9) What type of sleeping accommodation do you have?

(i) Hostel (ii) Single hired room (iii) More than one hired room

(iv) Own housing (v) Shared off-site housing (vi) Other*(specify)*_____

(10a) Does any member of your family live with you? (i) Yes (ii) No

(10b) If yes, please specify relationship *(Interviewer, circle more than one response, if appropriate):*

(i) Wife (ii) Husband (iii) Child/Children

(iv) Brother/Sister (v) Parent (vi) Other ***(specify)***_____

(10c) If no, how often do you see your family? (specify) _____

(11) Where do you work? (i) Underground (ii) Aboveground

(12) Tell me in your own words what type of job you do _____

_____

(13) How long have you been doing your present work? _____

(14a) Would you say your job is dangerous? ***(Interviewer, read out options)***

(i) Never (ii) Sometimes (iii) Most of the Time (iv) All of the Time

(14b) Why? ***(Interviewer, also probe for reasons such as previous accidents experienced by participant or co-workers, and specify type of accident)***

_____

_____

SECTION 2: ALCOHOL USE

(15a) Most of us have tried alcohol at one time or the other for different reasons. Have you ever used alcohol for any reason such as experimentation, relaxation? *(Interviewer, probe for all kinds of alcohol including home-made brew such as umqombothi, sorghum beer etc)*

(i) Yes → Why? (specify)_____

(ii) No ***(If no, please go to Q28 on page 5)***

(15b) If yes, do you currently drink alcohol?

(i) Yes (***If yes, please go to Q16 below)***

(ii) No

(15c) If no, how long ago did you stop? _____

(15d) Why did you stop? ***(Interviewer, probe for reasons such as health effects, advice of friends/health worker, accidents etc)***_____

_____

(16) For how long have you been using/did you use alcohol? ***(Interviewer, ask respondent to estimate)*** _____

(17) Did you start taking alcohol:

(i) Before starting work on this mine, or any other mine?

(ii) After starting work on this mine, or any other mine?

(Interviewer, if respondent has stopped taking alcohol, go to Q28)

(18) Who are you usually with when you drink?

(i) Alone (ii) With friends (iii) Other ***(specify)***_____

(19) Where do you usually go for a drink? _____

(20) What type or types of alcohol do you drink? ***(Interviewer, read out options and circle more than one, if appropriate)***

(i) Beer (such as castle) (ii) Wine (iii) Spirits (such as whisky)

(iv) **TRADITIONAL** beer (v) Other ***(specify)*** _____

(21) When do you usually drink?

(i) Evenings (ii) Weekends (iii) Daytime (iv) Other ***(specify)***_____

(22a) How often do you have a drink containing alcohol?

(i) _____times per day (ii) _____times per week

(iii) _____times per month (iv) Other ***(specify)***_____

(22b) Estimate as accurately as possible, how much and what type of alcohol you have drunk in the last two weeks. *(Interviewer, in communal drinking, try to estimate. Show participant containers provided to assist estimation).*

DAY (fill in day of week)	Beer-cans (specify if 450mls/ 340mls)	**Beer-bottles (750mls)**	**Wine-bottles (750mls)**	**Wine**	**Traditional beer**	**Other e.g. spirits, sorghum beer (specify)**
(Wk 2)						
(Wk 1)						
yesterday						

(23) Have you ever felt you ought to cut down on your alcohol drinking?

(i) Yes (ii) No

(24a) Have people criticized your drinking of alcohol?

(i) Yes (ii) No

(24b) If yes, does it annoy you?

(i) Yes (ii) No

(25) Have you ever felt bad or guilty about your drinking of alcohol?

(i) Yes (ii) No

(26) Have you ever had a drink of alcohol first thing in the morning to steady your nerves and get rid of a hangover/"*babalas*"? ("eye-opener").

(i) Yes (ii) No

(27) **Interviewer, if respondent answered yes to any of the questions above (Q23 to Q26) ask him this:** Have you ever sought help to decrease your use of alcohol?

(i) Yes (please specify type of help)_____

(ii) No

(28) Do your fellow workers use alcohol?

(i) Yes (ii) No (iii) Don't know

(29) Are there specific times when miners drink a lot of alcohol? ***(Please explain)***

_____

(30) Why do you think mine workers take alcohol? *(Please explain)*

_____

_____

(31a) Do you think that drinking alcohol can lead to accidents in the mine?

(i) Yes (ii) No

(31b) Do you think anything can be done to influence alcohol use among miners?

(i) Yes (ii) No (iii) Don't Know

(31c) Please explain your answer _____

_____

_____

SECTION 3: DAGGA USE

I am now going to ask you questions about dagga. Remember that all the answers you give are anonymous and cannot be traced back to you.

(32a) Some people have used dagga at one time or the other for reasons such as experimentation, treatment of illnesses. Have you ever used dagga *(pache, lebake)?*

(i) Yes. Why?(specify)_____

(ii) No ***(If no, please go to Q41)***

(32b) If yes, do you currently use dagga?

(i) Yes ***(If yes, please go to Q33 below)***

(ii) No

(32c) If no, how long ago did you stop? _____

(32d) Why did you stop? ***(Interviewer, probe for reasons such as health effects, advice of friends, accidents etc)*** _____

_____

(33) For how long have you been taking/did you take dagga? ***(Interviewer, ask respondent to estimate)*** _____

(34) Did you start taking dagga

(i) Before starting work in this mine, or any other mine?

(ii) After starting work in this mine, or any other mine?

(Interviewer, if respondent has stopped taking dagga please go to Q41)

(35) How often do you take dagga?

(i) _____times per day (ii) _____times per week

(iii) _____times per month (iv) Other ***(specify)***_____

(36) When do you usually use dagga? ***(Please explain)*** _____

---

(37) Can you stop using dagga if you want to? (i) Yes (ii) No

(38) Do you ever feel bad or guilty about using dagga? (i) Yes (ii) No

(39a) Have people complained about your use of dagga? (i) Yes (ii) No

(39b) If yes, does this annoy you? (i) Yes (ii) No

(40) **<u>Interviewer, if respondent answered yes to any of the questions in 37 to 39 above, ask him this</u>**: Have you ever sought help to stop the use of dagga?

(i) Yes (please specify type of help)_____

(ii) No

(41a) Do your fellow workers use dagga?

(i) Yes (ii) No (iii) Don't know

41b) If yes, why do you think they use it? ***(Please explain)*** _____

_____

_____

(41c) If no, why do you think they do not use it? ***(Please explain)*** _____

_____

_____

42) Are there specific times when miners take **A LOT OF** dagga? ***(Please explain)*** _____

_____

(43a) Do you think that using dagga can lead to accidents in the mine?

(i) Yes (ii) No

(43b) Do you think anything can be done to influence dagga use among miners?

(i) Yes (ii) No (iii) Don't know

(43c) Please explain your answer _____

_____

(44a) Do you think that working in the mines is dangerous to your health?

(i) Yes (ii) No (iii) Don't Know

(44b) If yes, how is it dangerous to your health? ***(Interviewer, also probe for reasons such as previous accidents in participants and colleagues and ask for type of accident)*** _____

_____

(45a) Are there any recreation facilities (such as sports fields) available at your mine? (i) Yes (ii) No (iii) Don't know

(45b) If yes, please specify type _____

_____

(46a) Do you think that sport and recreation facilities influence the use of alcohol and dagga? (i) Yes (ii) No (iii) Don't know

(46b) Give an explanation for your answer _____

_____

THANK YOU FOR YOUR COOPERATION AND YOUR TIME

APPENDIX F

MINI QUESTIONNAIRE FOR BREATHALYSER TESTS

Questionnaire No _____

Interviewer, please read instructions & circle response as appropriate.

Question			**Response**	
Question 1: **Have you used/done any of the following in the past 15 minutes?**	a)	Mouth sprays	Yes	No
	b)	Medicines and drops such as cough syrups or *QUIT	Yes	No
	c)	Vomited	Yes	No
(Interviewer, alcohol residues in the mouth may give false measurements, and in high concentrations can shorten the lifespan of breathalyser sensor. Such residues may be left in the mouth in the circumstances described above. If yes to any of the above, ensure that an interval of at least 15 minutes has elapsed since the activity/last use, before you take a reading)				
Question 2: **Have you smoked any tobacco products in the past 2 minutes?**			Yes	No
(Interviewer, tobacco smoke in expired air may damage the breathalyser. If yes to above question, please ensure that an interval of at least 2 minutes has elapsed since last use, before doing breathalyser testing)				

**QUIT is a spray which assists in smoking cessation and contains considerable amounts of alcohol.*

APPENDIX G

WHERE TO OBTAIN MORE INFORMATION/HELP ABOUT ALCOHOL/DAGGA USE

Dear participant,

If you or any one you know would like to obtain more information about alcohol/dagga use, including information about how to quit, please contact the following people/organisations*:

- Mine clinic
- Alcoholics Anonymous and other local support groups
- South African National Council on Alcoholism and Drug Dependence (SANCA)
- Department of Health and Welfare
- Department of Social Services and Population Development
- Department of Mental Health
- Centre for Human Development
- Clinical psychologists in private local clinics
- Private local rehabilitation Centres

If you wish to ask any further questions about this research, please kindly contact the research team on this telephone number: _____

Thank you for taking part in this study.

**The list of organisations included varied from mine to mine depending on proximity to specific mines. Contact names, phone numbers and addresses of the organisations which were included on the information lists given to participants have not been included here to preserve the anonymity of the mines as this information reflects the location of each mine.*

APPENDIX H

INFORMATION & CONSENT FORM FOR PARTICIPANTS OF FOCUS GROUP DISCUSSIONS

Dear Worker,

My name is …….

We are asking you to participate in a research for the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg. This study is being carried out in six other mines in South Africa, and will help us to learn more about alcohol and dagga use among miners. It will also contribute towards informing services, and will help to improve the health and safety of miners. There will be two focus group discussions in each mine, with nine to twelve people per group. One group will comprise of Union and Health and Safety representatives from your mine, while the other group will be of supervisors and management representatives.

(Explain what a focus group discussion means).

I am going to ask you a few questions before we start the discussion, which will help us to know you, better. This discussion today will take an hour. I am going to ask your opinion on different things. There are no right or wrong answers. As we would like to hear the opinion of everybody, could we agree to respect everyone present in this group. A tape recorder will be used to record the proceedings of the discussion, but the tapes will be destroyed as soon as the data is analysed.

I reassure you that all the information obtained through this project will be treated with the strictest of confidence. Participants are not required to disclose their

individual alcohol/dagga use status, however, should such information become known during the discussion, it would be kept completely confidential. Only group results will be made available to stakeholders involved in accident prevention and health and safety promotion in mines in South Africa, so that relevant policies to provide safer working environment can be developed. If you do not wish to participate in this study, you are free to do so. If at any time during our interaction, you wish to discontinue, you are free to leave. You will not bear any consequences, if you do not wish to participate in this research.

I have fully explained the procedure. I have asked whether or not participants have any questions regarding the procedure, and have answered the questions to the best of my ability.

Date: ---------- Researcher: ----------

I have been fully informed about the procedure. I agree to participate in this research. I understand that I am free to refuse to participate, or to withdraw my consent and discontinue my participation in this study at any time.

Date: ---------- Participant: ----------

I understand that the discussion will be tape-recorded, and that the tapes will be destroyed as soon as the data is analysed. I have no objection to the tape recorder being used, and I understand that all information obtained will be treated as strictly confidential.

Date: ---------- Participant: ----------

APPENDIX I

SOCIO-DEMOGRAPHIC INFORMATION QUESTIONNAIRE FOR PARTICIPANTS OF FOCUS GROUP DISCUSSIONS

Please write out responses in questions 1-4 below.

1) What was your age at your last birthday? (specify) .....

2) What is your highest level of education? (specify) ……..

3) What is your job? (specify) …….…….…….....

4) What is your main language? (specify) ……..

Please circle the appropriate response in questions 5-6 below

5) Are you a
   (a) Management representative?
   (b) Supervisor?
   (c) Health and Safety representative?
   (d) Union representative?

6) Are you
   (a) Male?
   (b) Female?

APPENDIX J

FOCUS GROUP DISCUSSION GUIDELINES

Section 1: Attitudes towards the use of alcohol and dagga

1) What comes to mind when you hear the word alcohol?

   *(Probe **briefly**: To mention all types of alcohol such as beer, wine, local brew).*

2) Where do people who work in this mine drink?

   [Probe: when they usually drink (after or before work, weekends etc) and who they usually drink with]

3) Who on the mine gets drunk often/excessively consumes/misuses alcohol?

   (Probe: does this differ for different jobs)

   a) Why do they drink too much?

   b) What makes miners use more or less?

   c) Why do some miners not misuse alcohol?

4) What do you think about mineworkers who get drunk/misuse alcohol?

We are now going to change a bit from talking about alcohol to talking about dagga

5) What comes to mind when you hear the word "dagga"?

   (Probe briefly: Is it a "drug", cultural connotations/healing attributes).

6) Who uses dagga at this mine?

(Probe for different categories of miners i.e. in different types of jobs, underground / aboveground workers, contract / fulltime workers, workers with heavy workload, workers in more "dangerous" jobs)

7) What do you think about mineworkers who use dagga?

8) What are the reasons that lead to the use of dagga in miners?

(Probe: Helps cope with heavy workload, gives "strength" for heavy workload/"boldness", relieves stress and insomnia, cultural beliefs in medicinal properties)

9) Why do you think some miners do not use dagga?

[Probe for concerns about safety (at work) and disciplinary measures such as job loss, better coping mechanisms, living with family on mine]

10) What increases or decreases the amount of dagga used from day to day?

(Probe: boredom, weekends, public holidays, before shifts, after shifts, income/ bonuses, transferring to a new work section)

Section 2: Alcohol and dagga, and health/ill-health

I am now going to ask you a very general question:

1) Would you say that working in mines has any impact on your health (positive or negative)?

(Probe for stresses associated with work, perception of danger, diseases)

2) What have you heard around your mine (if anything) about the health consequences of alcohol misuse?

[Probe: Positive and negative health effects, stress management, violence, accidents (work-related, vehicle accidents)].

4) What have you heard around your mine (if anything) about the health consequences of dagga use?

[Probe: Positive and negative health effects, stress management, violence, accidents (work-related, vehicle accidents)].

Section 3: Recommendations for control of substance use

1) You have mentioned these health consequences/risks **(list those previously mentioned in section 2)**. Given this, do you think there is a need to control alcohol misuse on the mines? Would this be the same for dagga?

2) Is there anything that your mine is doing to control alcohol and dagga use on the mine?

(Probe for each aspect that they mention: Is it working? Why? Why not?)

3) How would you control dagga use and alcohol misuse on this mine?

APPENDIX K

QUESTIONNAIRE FOR RECORD REVIEW OF POST-ACCIDENT & MEDICAL SURVEILLANCE-RELATED ALCOHOL & CANNABIS TESTS

Please fill in responses in spaces provided below or tick appropriate box. Where specified, please give information per year for the past five years (1999 to 2003) or for as long as the mine programme has been in existence, should it have been in existence for less than five years.

Section 1: Post-accident substance tests

1. What is the total number of accidents that occurred at your mine per year over the past five years from 1999–2003 and what was the mine population at the time? *(Please exclude natural disasters/non-manmade accidents).*

Year	Total number of accidents	Total mine population
1999		
2000		
2001		
2002		
2003		

Section 1.1: Alcohol use

1. When accidents occur at your mine, do you test employees involved for alcohol use? (i) Yes (ii) No, ***please go to section 1.2***
2. How many years ago did you start this practice? _____

3 a) Do you carry out this tests in all cases, irrespective of the type of accident?

(i) Yes (ii) No

b) If no, in what types of accidents are employees tested for alcohol use?

_____

_____

4. Please fill in information about the alcohol test procedures used at your mine in the table below.

Usual test method	Where is usual test done?	When is usual test done?	Other test methods used	When is other method used?	Where is other test done?	When is other test done?	Where is other test analysed

5. What level of alcohol do you classify as a positive test at your mine? __

6. What was the number of accidents in which alcohol tests were carried out per year and in how many cases of accidents was the test positive for alcohol (irrespective of the level of alcohol)?

Year	Total number of accidents in which alcohol tests were carried out	Number of cases of accidents with positive alcohol tests	Number of workers who tested positive for alcohol in these accident cases
1999			
2000			
2001			
2002			
2003			

Please kindly attach the results of all samples that contained alcohol (irrespective of the level of alcohol) so that comparison can be made with results from other mines, should the level regarded as positive at your mine be different from that of other mines.

Section 1.2-Cannabis use

1. When accidents occur at your mine, do you test employees involved for *dagga* use? (i) Yes (ii) No, ***please go to section 2***

2. How many years ago did you start this practice? _____

3. Do you carry out this test in all cases, irrespective of the type of accident?

   (i) Yes (ii) No

4. If no, in what types of accidents are employees tested for *dagga* use?

   _____

   _____

5. Please fill in information about the *dagga* test procedures used at your mine in the table below.

Usual sampling method	
Kit used between 1999 and 2003 (if applicable)	
Where done	
How long after accident is test done	
How stored if test not immediately done (if applicable)	
Other sampling methods	
Test method	
Where done	
How long after accident is sample taken	
How stored if test not immediately done	

6. What was the number of accidents in which *dagga* tests were carried out per year and in how many cases of accidents did the employees involved test positive for *dagga*?

Year	Total No of accidents in which *dagga* tests were carried out	No of accidents with positive *dagga* tests	No of workers positive for dagga in these accident cases
1999			
2000			
2001			
2002			
2003			

Section 2: Medical surveillance for substance use

Section 2.1-Alcohol use

1. Aside from accident-related substance use tests, does the mine carry out alcohol tests as part of a medical surveillance programme?

   (i) Yes (ii) No, ***please go to section 2.2***

2. Which year did this programme commence? _____

3. What category of workers does the programme involve? (e.g. truck drivers)

   _____

4. How often are tests done? _____

5. What method is used for alcohol tests during medical surveillance?

   ☐Breathalyser ☐Blood test

6. What was the total number of workers for whom alcohol tests were carried out during medical surveillance per year and how many workers tested positive during surveillance (irrespective of the level of alcohol)?

Year	Total number of workers for whom alcohol tests were carried out	Number of cases that tested positive for alcohol
1999		
2000		
2001		
2002		
2003		

Please kindly attach the results of all samples that contained alcohol (irrespective of the level of alcohol) so that comparison can be made with results from other mines, should the level regarded as positive at your mine be different from that of other mines.

Section 2.2-Dagga use

1. Aside from accident-related substance use tests, does the mine do dagga tests as part of a medical surveillance programme?

   (i) Yes (ii) No, ***please stop here***

2. Which year did this programme commence? _____

3. What category of workers does the programme involve (e.g. truck drivers)

   _____

   _____

4. How often are tests done for each category of workers? _____

5. a) How are dagga tests done for medical surveillance?

   (i) Urine dipstick

   (ii) Confirmatory lab test

   (iii) Both dipstick and confirmatory lab test

   b) In what instances would both dipstick and lab test be done?

   _____

   _____

6. What was the total number of workers for which dagga tests were carried out during the medical surveillance per year and how many of these workers tested positive?

Year	Total number of workers for whom dagga tests were carried out	Number of cases that tested positive for dagga
1999		
2000		
2001		
2002		
2003		

Section 3: Lost Time Injury Frequency Rates

1. Please fill in the Lost Time Injury Frequency Rate (LTIFR) for your mine between 1999 to 2003.

Year	Lost Time Injury Frequency Rate (LTIFR) by Mine
1999	
2000	
2001	
2002	
2003	

Thank you for completing this questionnaire

APPENDIX L

EVALUATION OF RELATIONSHIP BETWEEN LTIFR & SUBSTANCE USE

Table L1: Standard deviation of LTIFR

Mine	[a]Frequency of LTIFR	[b]Mean LTIFR	Standard Deviation
D1	5	**0.41**	0.16
P1	2	**0.51**	0.25
P2	3	**0.52**	0.04
C1	5	**1.01**	0.55
G2	5	2.17	0.68
Total/Mean	20	**1.03**	0.82

[a]Frequency of LTIFR=number of entries for LTIFR per mine. See table 6.9.
[b]Mean LTIFR. See table 6.9.

Table L2: Analysis of Variance in LTIFR between mines

Source	Sum of Squares (SS)	Degree of freedom (df)	Mean Sum of Squares (MS)	Fischer Value (F)	Prob > F
Between groups	9.74	4	2.44	11.45	0.0002
Within groups	3.19	15	0.21		
Total	12.93	19	.680305818		

Bartlett's test for equal variances: chi2(4) = 12.9162 Prob>chi2 = 0.012

Table L3: Regression analysis of link between LTIFR & substance use

Source	Sum of Squares (SS)	Degree of freedom (df)	Mean Sum of Squares (MS)
Model	1.04	3	0.35
Residual	0.00	1	0.00
Total	1.04	4	0.26

Number of obs= 5, F(3, 1) = 334.31, Prob > F= 0.0402, R-squared= 0.9990,
Adj R-squared= 0.9960, Root MSE= 0.03218

REFERENCES

1. Van der Spuy JW. Alcohol-related trauma. VMO. CME 1991 Jul;9(7):859-68.
2. Kyriacou DN, Anglin D, Taliaferro E, Stone S, Tubb T, Linden JA, et al. Risk factors for injury to women from domestic violence. N Engl J Med 1999 Dec;341(25):1892-8.
3. Matzopoulos R. "Violent deaths in SA-The 2003 National Injury Mortality Surveillance System." SA Crime Quarterly 2005 Sept;13:29-36. <http://www.iss.co.za/pubs/CrimeQ/No.13/Matzopoulos.pdf> (1 Feb 2007).
4. Bhana A, Parry CDH, Myers B, Pluddermann A, Morojele NK, Flisher AJ. The South African Community Epidemiology Network on Drug Use (SACENDU) project. Phases 1 to 8 (July 1996-December 2000): Cannabis and Mandrax.
5. Nahas GG. Hashish and drug abuse in Egypt during the 19th and 20th centuries. Bull. N.Y. Acad. Med 1985 Jun;61(4):428-44.
6. United Nations Office for Drug Control and Crime Prevention. World Drug Report 2000. United Nations Office of Drug Control and Crime Prevention, 2000: 22-36.
7. Van der Linde JA. The cost of alcohol abuse at a Free State mine. Occupational Health SA 1997 May/Jun;3(3):9-14.
8. Alleyne BC, Stuart P, Copes R. Alcohol and other drug use in occupational fatality. Journal of Occupational Medicine 1991 Apr; 33(4):494-500.

9. Ronelle S. Alcohol and drug use in the workplace-implications of the amended Labour Relations Act. Review. Occupational Health SA 1996 Jul/Aug;2(14):14-5.

10. Department of Health, Pretoria, South Africa. "South Africa Demographic and Health Survey 2003: Full Report". 2007. <http://www.measuredhs.com/pubs/pdf/FR206/FR206.pdf> (31 Mar 2010)

11. United States National Institute on Drug Abuse. National Household Survey on Drug abuse (Rockville, Maryland, National Institute on drug abuse, 1991).

12. Kew G. A descriptive study of alcohol consumption patterns on a South African gold mine. Urbanisation and Health Newsletter 1992;(21):39-42.

13. Schinder EO, Ruder AM. Epidemiology of coca and alcohol use among high-altitude miners in Argentina. Am J Ind Med 1989;15(5):579-87.

14. Substance Abuse and Mental Health Services Administration. Office of Applied Studies. United States. "Results from the 2003 National Survey on Drug Use and Health: National Findings". 2004. <http://www.oas.samhsa.gov/nhsda/2k3nsduh/2k3Results.htm> (30 Jan 2007).

15. Osterloh JD, Becker CE. Chemical dependency and drug testing in the workplace. West J Med 1990 May;152 (5):506-13.

16. McAuliffe WE, Rohman M, Santangelo S, et al. Psychoactive drug use among practicing physicians and medical students. N Engl J Med 1986;315:805-10.

17. Lund Ak, Preusser DF, Blomberg RD, et al: Drug use by tractor-trailer drivers. J Forensic Sci 1988;33:648-61.

18. Verstraete AG, Pierce A. Workplace drug testing in Europe. Forensic Sci Int 2001 Sep;121(1-2): 2-6.

19. George S. A snapshot of workplace drug testing in the UK. Occupational Medicine 2005;55(1):69-71.

20. Substance Abuse and Mental Health Services Administration. *Results from the 2005 National Survey on Drug Use and Health: National Findings.* Office of Applied Studies, NSDUH Series H-30, DHHS Publication No. SMA 06-4194. 2006. Rockville, MD. <http://www.oas.samhsa.gov/NSDUH/2k5NSDUH/2k5Results.htm#2.4> (31 Mar 2010)

21. Tibbs J et al. Research in Brief. Alcohol-related trauma at the Ernest Oppenheimer Hospital. Urban Health and Development Bulletin;2(1): 81-2.

22. Buchanan DJ. Studies on blood alcohol in the workers of a Zambian copper mine. Alcohol Alcohol 1988;23(3):239-42.

23. London L. The "dop"system, alcohol abuse and social control amongst farm workers in South Africa: a public health challenge. Social Science & Medicine 1999;48:1407-14.

24. Parry CDH, Bennets Al. Alcohol Policy and Public health in South Africa. Oxford University Press. 1998.

25. San Jose B. van de Mheen H, van Oers JA, Mackenbach JP, Garretsen HF. Adverse working conditions and alcohol use in men and women. Alcohol Clin Exp Res 2000 Aug;24(8):1207-13.

26. Yach D, Joubert G. Determinants and consequences of alcohol abuse and cigarette consumption in Mamre. SAMT 1988 Oct;74(1):348-51.

27. Cooper DB. British Journal of Nursing 1995;4(14):804-8.

28. Jacobson M. An alcohol agenda for the 90's. EAP Digest 1990; 10(6):24-6.

29. Horner MD, Waid LR, Johnson DE, Latham PK, Anton RF. The relationship of cognitive functioning to amount of recent and lifetime alcohol consumption in outpatient alcoholics. Addictive Behaviors 1999;24(3):449-53.

30. Stallones L, Kraus JF. The occurrence and epidemiological features of alcohol-related occupational injuries. Addiction 1993;88:945-51.

31. Guiterrez-Fisac JL, Regidor E, Ronda E. Occupational accidents and alcohol consumption in Spain. Int J Epidemiol 1992;21:1114-20.

32. Dawson DA. Heavy drinking and the risk of occupational injury. Accid Anal Prev 1994;5:655-65.

33. Muller R, Van Rensburg LCJ. Alcohol levels in trauma victims. SAMJ 1986 Nov;70;592-3.

34. Carmen del Rio M, Gomez J, Sancho M, Alvarez FJ. Alcohol, illicit drugs and medicinal drugs in fatally injured drivers in Spain between 1991 and 2000. Forensic Sci Int. 2002 Jun;127(1-2):63-70

35. Mura P, Kintz P, Ludes B, Gaulier JM, Marquet P, Martin-Dupont S, et al. Comparison of the prevalence of alcohol, cannabis, and other drugs between 900 injured drivers and 900 control subjects: results of a French collaborative study. Forensic Sci Int. 2003 Apr;133(1-2):79-85.

36. Drummer OH, Gerostamoulos J, Batziris H, Chu M, Caplehorn JR, Robertson MD, et al. The incidence of drugs in drivers killed in Australian road traffic crashes. Forensic Sci Int. 2003 Jul 8;134(2-3):154-62.

37. Harwood HJ, Reichman MB. The cost to employers of employee alcohol abuse: a review of the literature in the United States of America. Bulletin on Narcotics 2000;52(1-2).

38. Ames GM, Grube JW, Moore RS. The relationship of drinking and hangovers to workplace problems: an empirical study. J Stud Alcohol. 1997 Jan;58(1):37-47.

39. Bennett JB, Lehman WEK. Workplace Drinking Climate, Stress, and Problem Indicators: Assessing the Influence of Teamwork (Group Cohesion). Journal of studies on alcohol 1998;59(pt 5):608-17.

40. Roman PM, Blum TC. Alcohol: A review of the impact of worksite interventions on health and behavioural outcomes. Amer J Hlth Prom 1996;11:136-49.

41. Walsh DC, Rudd RE, Biener L, Mangione T. Researching and preventing alcohol problems at work: Toward an integrative model. Amer J Hlth Prom 1993;7:289-95.

42. Howard G. Alcoholism and drug abuse-some legal issues for employers. British Journal of Addiction 1990;85:593-603.

43. Van der Spuy J, Strydom M, Abrahams N. Home violence: 'The Cape Metropolitan Study'. MRC Trauma Review 1994;2(3):2-3.

44. Hocking B, Grain H and Gordon J. Cost to Industry of illnesses related to alcohol and smoking. The medical journal of Australia 1994;161:407-12.

45. Maykut MO. Health Consequences of acute and chronic marijuana use. Progress in Neuropsychopharmacology and Biological Psychiatry 1985;9:209-38.

46. Agurell S, Halldin M, Lindgren JE, Ohlsson A, Widman M, Gillespie H, et al. Pharmacokinetics and metabolism of delta 1-tetrahydrocannabinol and other cannabinoids with emphasis on man. Pharmacol Rev 1986;38:21-43.

47. Ashton HC. Pharmacology and effects of cannabis: a brief review. The British Journal of Psychiatry 2001 Feb;178:101-6.

48. Central Drug Authority, South Africa. "Cannabis and Mandrax use in South Africa". Fact Sheet. 3. 2001.

49. Hall W. Adverse effects of cannabis. Lancet 1998;352:1611-6.

50. McBay AJ. Drug concentrations and traffic safety. Alcohol, Drugs and Driving 1986;2:51-9.

51. Gjerde H, Kinn G. Impairment in drivers due to cannabis. Forensic Science International 1991;50:57-60.

52. Johns A. Psychiatric effects of cannabis. British journal of Psychiatry 2001;178:116-22.

53. Hall W, Solowij N. Reducing the harms caused by cannabis use: the policy debate in Australia. Drug Alcohol Depend 2001;62:163-74.

54. Ewing JA. Detecting alcoholism, the CAGE questionnaire. JAMA 1984;252:1905-7.

55. Aertgeerts B, Buntinx F, Ansoms S, Fevery J. Screening properties of questionnaires and laboratory tests for the detection of alcohol abuse or dependence in a general practice population. British Journal of General Practice 2001 Mar:206-17.

56. Seppa K, Makela R, Sillanaukee P. Effectiveness of the Alcohol Use Disorders Identification Test in Occupational Health Screenings. Alcoholism: Clinical and Experimental Research 1995 Aug;19(4):999-1003.

57. Wilson D. Routine screening tests for alcoholism. SAMJ 1999 Sept;89(9):949-51.

58. Montalto NJ, Bean P. Use of contemporary biomarkers in the detection of chronic alcohol use. Med Sci Monit 2003 Dec;9(12):RA285-90.

59. The Medical Council on Alcoholism. Medical Students' Handbook: Alcohol and Health. <http://www.medicouncilalcol.demon.co.uk/handbook/hb_meta.htm> (26 Jul 2001).

60. National Road traffic Act 93 of 1996. South Africa.

61. Kiso S, Kawata S, Imai Y, Tamura S, Inui Y, Ito N, et al. Efficacy of ursodeoxycholic acid therapy in chronic viral hepatitis C with high serum gamma-glutamyltranspeptidase levels. J Gastroenterol 1996;31(1):75-80.

62. Lemberger L, Tamarkin NR, Axelrod J, Kopin IJ. Delta-9-tetrahydrocannabinol: metabolism and deposition in long-term marijuana smokers. Science 1971; 173(3991):72-74.

63. Hawks RL. Chiang CN editors. Urine testing for drugs of abuse. National Institute on Drug Abuse (NIDA) Research Monograph 1986; 73.

64. Buchan BJ, Walsh JM, Leaverton PE. Evaluation of the accuracy of on-site multi-analyte drug testing devices in the determination of the prevalence of illicit drugs in drivers. J Forensic Sci. 1998;43(2):395-9.

65. Mine Health and Safety Act No 29 of South Africa 1996; Chapter 2, Section 5; Chapter 7, Section 22.

66. Minerals Act 50 of 1991. South Africa.

67. WorkSafe Victoria. Victorian WorkCover Authority, Australia. Alcohol in the workplace-guidelines for developing a workplace alcohol policy. 1st edition. May 2005. <http://www.worksafe.vic.gov.au/wps/wcm/resources/file/ebcbac435c9a4e1/alcohol_workplace.pdf> (15 Mar 2007).

68. International Labour Organisation. Code of practice on the management of alcohol and drug related issues in the workplace. 1995. <http://www.ilo.org/public/english/protection/safework/drug/codepr.htm> (25 Jul 2001).

69. Hocking B, Grain H, Gordon I. Cost to industry of illnesses related to alcohol and smoking. A study of Telecom Australia employees. Med J Aust. 1994 Oct 3;161(7):407-12.

70. Department of Minerals & Energy. South Africa. Award Scheme-Definitions. <http://www.dme.gov.za/mhs/awards_def.stm> (2 Jan 2009).

71. Minerals Council of Australia. Safety performance report of the Australian minerals industry: 2004–2005. <http://www.minerals.org.au/__data/assets/pdf_file/0004/18616/mca2004_05_safetyperformancereport_151206revised.pdf> (2 Jan 2009).

72. Zwerling C. Current practice and experience in drug and alcohol testing in the workplace. Bulletin on Narcotics 1993;45(2):155-96.

73. Shisana O, Rehle T, Simbayi LC, et al. "*South African National HIV Prevalence, HIV Incidence, Behaviour and Communication Survey, 2005."* Cape Town: HSRC press. 2005. <http://www.hsrcpress.ac.za/product.php?productid=2134&freedownload=1> (31 Mar 2010).

74. Department of minerals and energy. South Africa. Mine Safety. "Overview-Occupational Health and Safety Performance." <http://www.dme.gov.za/mhs/mine_safety.stm> (3 Mar 2007).

75. Frone MR. Prevalence and distribution of alcohol use and impairment in the workplace: A U.S. national survey. J Stud Alcohol. 2006 Jan;67(1):147-56.

76. Shain M. Alcohol, drugs and safety: an updated perspective on problems and their management in the workplace. Accident Analysis & Prevention 1982;14:239-46.

77. Papoz L, Weill J, L'Hoste J, Chich Y, Got C, Goehrs Y. Biological markers of alcohol intake among 4796 subjects injured in accidents. Br Med J (Clin Res Ed) 1986 May;292(6530):1234-7.

78. Bush DM, Autry JH. Substance abuse in the workplace: epidemiology, effects, and industry response. Occupational Medicine: State of the Art Reviews 2002 Jan-Mar;17(1):13 to 25.

79. Substance Abuse and Mental Health Services Administration (SAMHSA). Worker Drug Use and Workplace Policies and Programs. Results from the 1994 and 1997 Household Survey. DHHS Publication Number (SMA) 99-3252. September 1999.

80. Rocha-Silva L. "The nature and extent of drug use and related problems in South Africa: SARPA national surveillance project." 1997. <http://www.nrf.ac.za/netpro/docs/lee_sarpa_project_1997.doc> (26 Feb 2007).

81. Marks AA. Elefthenai EM. The determinants of tobacco usage by black females in Cape Town area townships. Graduate School of Business. University of Cape Town. 1998 (Unpublished).

82. Ajani AF. The prevalence and determinants of snuff use in adult females in Mabopane, North West Province [dissertation]. Johannesburg, South Africa: University of the Witwatersrand, 2001.

83. McGuire WJ. The handbook of social psychology. In: Lundzey G, Aronsen EE, editors. Attitudes and attitude change. New York, 1985.

84. United States Department of Health and Human Services. Substance Abuse and Mental Services Administration. Division of workplace programmes. "Model Plan for a Comprehensive Drug-Free Workplace Program." 1986. <http://dwp.samhsa.gov/FedPgms/Pages/Model_Plan/Appendix_A.aspx> (6 Mar 2007).

85. United States Department of Health and Human Services. Substance Abuse and Mental Services Administration. Division of workplace programmes. "Federal Drug-free workplace programmes." <http://dwp.samhsa.gov/index.aspx> (4 Mar 2007).

86. U.S Department of Transportation. Office of Drug & Alcohol Policy & Compliance. "DOT Agency Information-Operating Administrations' Drug and Alcohol Program Information." <http://www.dot.gov/ost/dapc/oamanagers.html?inf> (4 Mar 2007).

87. Lawner K, Doot M, Gausas J, Doot J,See C. Implementation of CAGE alcohol screening in a primary care practice. Fam Med 1997;29(5):332-5.

88. University of Toronto, Canada. The Centre for Health Promotion. "Health communication campaigns in 12 steps". <http://www.thcu.ca/infoandresources/12stepshealth_communication.htm> (3 Mar 2007).

89. Mead M. Identifying and managing patients with an alcohol problem. UPDATE 2004 Jun:531-35

90. Guindon GE, Tobin S, Yach D. Trends and affordability of cigarette prices: Ample room for tax increases and related health gains. Tobacco Control 2002;11:35-43. Special communication.

91. Parry CDH. Critical issues in the debate on decriminalisation or legalisation of cannabis in South Africa. SAMJ 2002 Sept;92(9):696-697.