

Workplace Drug Testing: Evidence and issues

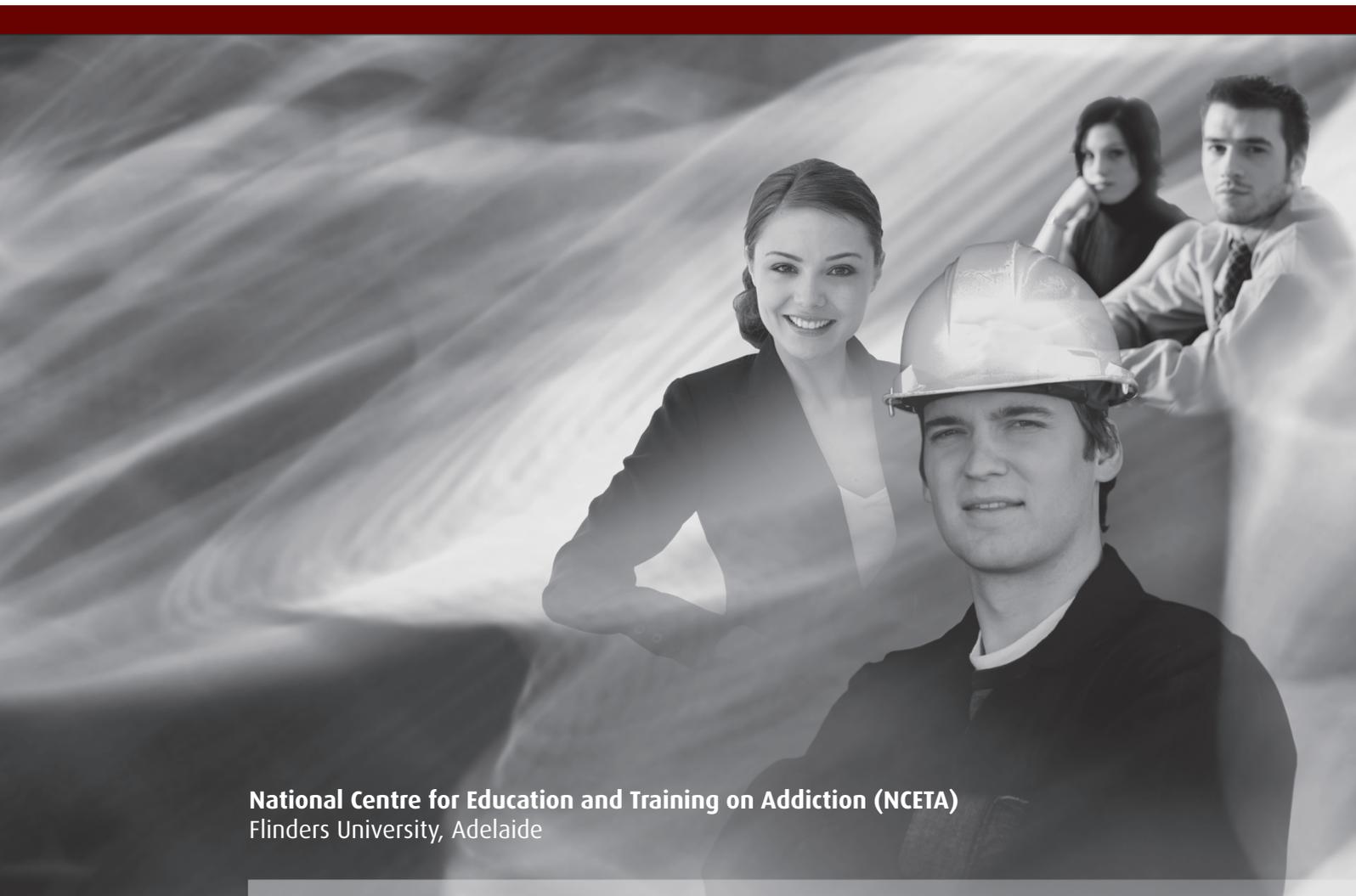
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The National Centre for Education and Training on Addiction (NCETA) is an internationally recognised research centre that works as a catalyst for change in the alcohol and drugs (AOD) field. The Centre works to influence systems that affect workers through policy change, legislation, recruitment and best practice guidelines. The Centre was established in 1992 and is a collaborative venture between Flinders University, the South Australian Department of Health and the Australian Government Department of Health and Ageing.

This resource is part of a suite of materials produced by NCETA in relation to workplace alcohol and drug issues. Readers are invited to visit the NCETA website to locate further research and resources that may be of interest and relevance.

Visit: www.nceta.flinders.edu.au

¹ This project was part of a larger project commissioned by SafeWork SA that also examined the availability and accessibility of toxicological data for fatally and non-fatally injured workers in South Australia. The report for this larger project, titled 'Workplace alcohol and drug testing: An examination of potential for improving workplace safety', is available at: www.nceta.flinders.edu.au



Executive summary

Drug testing may hold potential to improve workplace safety by eliminating or minimising risks associated with alcohol or other drug use. However, to date the extent of its effectiveness remains indeterminate. Moreover, for employees to endorse drug testing there needs to be evidence of real safety benefits. In order to achieve this, the efficacy of workplace testing needs to be examined and the features of 'good practice' workplace testing practices need to be identified.

To examine these issues, the National Centre for Education and Training on Addiction (NCETA) undertook an investigation of the role of workplace drug testing in improving workplace safety. The methodology for this investigation is described in Appendix A.

The investigation involved a critical review of relevant literature and identified the extent and nature of alcohol or drug related risk to workplace safety. The specific objectives of the review were to:

- examine evidence of the effectiveness of workplace drug testing, particularly its ability to improve safety
- identify best practice testing programs and implementation processes.

In general, the research literature indicates:

- an association between alcohol and drug use and workplace accidents and injuries
- a stronger association for younger workers, males, and certain industries and occupations
- the proportion of injuries caused by alcohol or drug use is likely to be relatively small.

While there is evidence that alcohol and drugs play a role in workplace accidents and injuries, there is also a growing body of evidence indicating other factors may play a more important role such as:

- fatigue
- noise
- dirt
- dangerous working conditions
- conflict at work
- poor working conditions and procedures
- poorly maintained equipment
- insufficient training and supervision of employees.

Key findings

Alcohol and drug use prevalence

The prevalence of workplace alcohol or drug use is relatively low in Australia. However, some industry and occupational groups have much higher prevalence rates compared to the general working population. Drinking at risky levels and drinking at work is more prevalent among the workforce than drug use.

For most workplaces, alcohol is more likely to be a workplace safety issue than other drugs.

What is the impact of alcohol and drug use on workplace safety?

Research indicates an association between workers' alcohol and drug use and workplace accidents and injuries. However, the proportion of accidents and injuries related to alcohol or drug use is likely to be:

- relatively small
- higher among
 - younger workers
 - males
 - certain industries and occupations.

Does testing detect alcohol or drug related risk to workplace safety?

In general, research indicates that testing can detect alcohol and drug use. However, the risk of false positives and false negatives with on-site screening is relatively high. This risk is reduced, but not eliminated, by laboratory confirmations of positive on-site screens. While the risk of false positives may be dealt with by subsequent laboratory analysis, false negatives are likely to go undetected.

Drug testing can also mask the true extent of alcohol or drug related workplace safety risk through drug use displacement effects or by increasing workers' reluctance to report near misses and minor accidents or injuries for fear of a positive test. In addition, apart from breath analysis, which can detect alcohol intoxication, no other workplace drug test can detect intoxication or impairment.

Does testing improve workplace safety?

Evidence is inconclusive regarding the efficacy of drug testing in reducing workplace accidents and injuries. While there is some limited evidence that testing can reduce injury and accident rates, more rigorous studies indicate testing has only a small effect or no effect at all.

Evidence of any deterrent effect of workplace testing is also inconclusive. The few studies that have utilised rigorous methodologies indicate that workplace testing has either no deterrent effect, or only a very small deterrent effect.

Is it cost effective?

There is little evidence to support the cost effectiveness of drug testing as a workplace safety strategy.

Best practice workplace testing programs

In spite of these limitations, testing may have a role to play in improving workplace safety. However, for testing to have any impact on workplace safety, testing programs needed to be based on 'best practice'. Best practice programs are those based on principles of quality practice, and readily accepted and endorsed by employees.

Any testing program, therefore needs to:

- be justified as a mechanism to address an identified risk
- adopt procedures that are applied in a procedurally fair manner
- result in counselling, treatment, and rehabilitation rather than punitive outcomes
- target safety-sensitive rather than non-safety-sensitive work roles
- allow for employee input into the development and implementation of the program
- allow for a right of appeal
- adequately disseminate associated policy and procedures
- incorporate appropriate education and training.

Contents

Executive summary	v
1 Introduction	1
1.1 Background and rationale	1
1.2 Aims and objectives	1
2 Alcohol and other drugs prevalence data	3
2.1 Workforce alcohol and drug use	3
2.2 Alcohol and drug use in the workplace	7
2.3 Summary	9
3 Workplace impact	11
3.1 Accidents	11
3.2 Workplace injuries	12
3.3 Workplace fatalities	14
3.4 Absenteeism	15
3.5 Productivity	15
3.6 Summary	16
4 Drug testing techniques, technologies, and programs	17
4.1 Workplace drug testing techniques	17
4.1.1 Point Of Collection Tests (POCT)	17
4.1.2 Laboratory testing	18
4.2 Detecting drug use: reliability and accuracy	19
4.2.1 POCTs	21
4.2.2 Laboratory analysis	21
4.2.3 Summary	22
4.3 Workplace drug testing technologies	23
4.3.1 Breath analysis	24
4.3.2 Urinalysis	24
4.3.3 Saliva testing	25
4.3.4 Summary	26
4.4 Workplace drug testing programs	27

5	Workplace drug testing efficacy	29
5.1	Drug testing rationale, cost and effectiveness	29
5.2	Testing as a deterrence strategy	30
5.2.1	Summary	32
5.3	Testing as a strategy to reduce workplace accidents and injuries	32
5.3.1	Summary	34
5.4	The cost effectiveness of drug testing as a workplace safety strategy	35
5.4.1	Summary	36
6	Best practice workplace drug testing	37
6.1	Employee acceptability of workplace testing	37
6.2	Best practice approach to testing	38
6.3	Summary	40
7	Summary and recommendations	41
7.1	Workers' alcohol and drug use	41
7.2	The extent of alcohol or drug related injuries in Australian workplaces	41
7.3	The relationship between workers' alcohol or drug use and workplace safety	42
7.4	Drug testing to detect alcohol or drug related risk to workplace safety	42
7.5	Drug testing as a strategy to reduce workplace accidents and injuries	43
7.6	Drug testing as a strategy to deter use	44
7.7	Best practice workplace drug testing programs	44
	References	47
	Appendix A: Methodology	55

1 Introduction

1.1 Background and rationale

Workplace drug testing is becoming increasingly prevalent in Australian workplaces. This growth in workplace testing is largely driven by employer concerns about alcohol and drug related risk to workplace safety and productivity. While these are legitimate concerns, impartial information concerning the effectiveness of testing in addressing alcohol and drug related risk to safety and productivity is scarce. Much of the available information is provided by manufacturers of drug testing devices or providers of drug testing services. There is potential for such information to be selective, or presented in a way that overstates the potential of drug testing.

Moreover, there is little information available concerning what constitutes 'best practice' workplace drug testing program and procedures. Ready access to such information is important as best practice programs and procedures are more likely to be accepted and endorsed by employees.

To address this lack of information, the National Centre for Education and Training on Addiction (NCETA) undertook a comprehensive review of the literature to identify the efficacy of workplace drug testing for improving workplace safety and the features of best practice workplace drug testing.² The methodology for this review is described in Appendix A.

1.2 Aims and objectives

The specific aims of the literature review were to:

- Identify the prevalence of workers' alcohol and drug use and the extent to which it is associated with negative workplace consequences in terms of accidents, injuries and productivity
- Examine the effectiveness of drug testing to reduce occupational accidents, injuries and deter alcohol and drug use
- Identify the features of drug testing programs that effect their acceptability to employees.

The first step in meeting these aims was to identify salient issues relevant to an examination of workplace drug testing. A summary of these issues is provided below.

1. Workforce vs workplace use

At the outset, it is crucial to distinguish *workforce* from *workplace* AOD use. *Workforce* use is that which occurs within a given workforce population, regardless of time or place. *Workplace* use only alludes to use at work, or during work hours. The distinction between workforce and workplace use is of pivotal importance as workforce use is generally less likely to directly affect workplace safety, while workplace use may have a direct impact on workplace safety.

² This report stems from of a larger project commissioned by SafeWork SA that also examined the availability and accessibility of toxicological data for fatally and non-fatally injured workers in South Australia. The report for the larger project, titled 'Workplace alcohol and drug testing: An examination of potential for improving workplace safety', is available at: www.nceta.flinders.edu.au

2. Use vs impairment

It is also important to be clear about the difference between alcohol or drug use and impairment. Whether alcohol or drug use is sufficient to impair an individual's ability to safely perform a task depends on a range of individual (e.g., gender, age, body weight, health), drug (e.g., type drug, amount consumed, method of ingestion) and environmental factors (e.g., type of task, environmental conditions).

This is a particularly relevant issue for drug testing. While there is a large body of evidence indicating a blood alcohol content level of 0.05g/100mL or greater is likely to indicate impairment, no such measure exists for other drugs. Workplace tests for drugs other than alcohol have no objective criteria by which to determine impairment.

3. Association vs causality

The ability to differentiate between association and causality is crucial. Detection of alcohol or drugs in an injured worker is not conclusive evidence that alcohol or drugs played a causal role in the injury. An injured worker may have been drinking or using drugs, but the accident may have been caused by any one of a number of other factors or combination of factors (e.g., fatigue, unsafe work conditions, lack of training/instruction).

Alternatively, the injured worker may not have been drinking or using drugs, but the accident may have been caused by another worker who was drinking or using drugs. Similarly, alcohol or drugs may be detected in a fatally injured worker's post-mortem, but may be the result of post-mortem putrefaction or drugs administered post-accident while trying to treat/revive the fatally injured worker. Hence, any attribution of causality needs to be undertaken with caution.

4. Comparable (relative) risk

Another important consideration is the risk of workplace accidents caused by alcohol or drug use compared to other causal factors. In general, the prevalence of drug use among workers is likely to be similar to the relatively low prevalence of use among the wider community. It is also likely that the vast majority of workers only drink or use drugs outside work hours. If this is the case, the prevalence of alcohol or drug related accidents is likely to be low. It is also likely that most workplace accidents are caused by factors other than alcohol or drugs. This is an important consideration when allocating resources to address workplace safety risks.

5. A targeted vs universal approach

There is also the question of whether a narrow targeted or a broad universal approach is warranted when addressing alcohol and drug related threats to workplace safety. While the prevalence of risky alcohol or drug use is relatively low overall, prevalence rates vary across demographic groups.

Both risky alcohol and drug use are known to be associated with demographic factors such as age, education and location and there is a growing body of evidence indicating that use is also associated with specific workplace factors. Thus, a workforce profile can be examined to identify those most likely to be at risk of alcohol or drug related harm in the workplace. Such information can then be used to develop tailored, targeted, and cost effective interventions.

2 Alcohol and other drugs prevalence data

Before examining the potential for drug testing to enhance workplace safety, it is important to establish the extent and nature of alcohol or drug related risk to workplace safety. A key factor in determining this risk is the identification of workers' consumption patterns and the relevance of these patterns to workplace safety.

Much of the research regarding alcohol and other drugs and the workplace examines use that occurs amongst the *workforce*, not necessarily use that occurs in the context of the *workplace*.

Workforce alcohol and drug use refers to the overall alcohol and drug use patterns of a given workforce population or group, and includes use that occurs at anytime but largely outside work hours and away from the *workplace*.

Workplace use, in contrast, is defined as workers' alcohol and other drug use that occurs during work hours, just prior to commencing work, or just after work but before going home. While alcohol or drug use just after work occurs outside formal work hours, it nonetheless has implications for workplace safety and duty of care obligations as it often occurs on the employer's premises in their car parks, lunch rooms, or change rooms. Accidents that occur while travelling to and from work are often recorded as work-related (commuting) accidents and in some cases are compensable through workers' accident compensation insurance.

Distinguishing between workplace and workforce use is important when establishing workplace safety risk. Workers who consume alcohol or drugs away from the workplace and who do not return to work until the effects of consumption (e.g., intoxication, hangover, fatigue) have dissipated are unlikely to be a direct risk to safety. By contrast, consumption during (or just prior to) work hours or consumption at the workplace after work hours, is more likely to produce a direct safety and/or productivity risk.

Past research concerning workers' alcohol and drug use has generally failed to adequately differentiate *workforce* from *workplace* alcohol and other drug use. Similarly, *substance use* and *substance impairment* are very different, as use alone does not automatically infer impairment. These issues are not new. Some time ago, Manley and Gibson (1990) highlighted that drug use, impairment and associated impacts on performance are often, and inappropriately, treated as synonymous.

2.1 Workforce alcohol and drug use

Until recently, little was known about the prevalence or nature of alcohol or drug consumption among the Australian workforce. Apart from recent studies that have investigated the alcohol consumption patterns of the national workforce (Berry, Pidd, Roche, & Harrison, 2007; Pidd, Berry, Harrison, et al., 2006), most research that has examined Australian workers' consumption patterns involved relatively small sample sizes and/or focused on workforce sub-populations within specific occupations or industries (e.g., Banwell, Dance, Quinn, Davies, & Hall, 2006; Davey, Obst, & Sheehan, 2001; Evans, Tait, Harvey, & Newbury, 2005; Midford, Marsden, Phillips, & Lake, 1997; Pidd, Boeckmann, & Morris, 2006).

To address this limitation, Pidd, Shtangey and Roche (2008a, 2008b) undertook secondary analyses of the 2004 National Drug Strategy Household Survey (NDSHS) to identify the overall alcohol and drug consumption patterns of the Australian workforce. The 2004 NDSHS collected data from nearly 30,000

Australians, of whom around half (14,850) were employed. The majority of these employed Australians (90.7%) were drinkers. Using the then current Australian alcohol guidelines (NHMRC, 2001) to determine levels of consumption associated with risk of harm in the short- and long-term,³ Pidd et al., (2008a) found nearly one in 10 workers (9.8%) frequently (at least weekly) drank at levels associated with risk of harm in the short-term and 11.5% drank at levels associated with risk of harm in the long-term.

In general, workers who were more likely to drink at levels associated with harm were young, male, single, had no dependent children and resided in rural areas (Table 1).

Table 1. Proportions of the workforce who drink at levels associated with risk of harm in the short-term (at least weekly) and the long-term by demographic characteristics*

	Demographic	Drinkers	ST risk ¹ (≤ weekly)	LT risk ²
Age	14–19	87%	20.0%	17.7%
	20–29	92.5%	16.2%	16.6%
	30–39	91.3%	8.0%	10.3%
	40–49	91.6%	7.9%	10.1%
	50–59	89.3%	4.9%	8.8%
	60+	85.3%	3.0%	8.0%
Gender	Male	92%	11%	10.8%
	Female	89%	7.1%	12.3%
Marital status	Single	90.5%	18%	17.9%
	Divorced, separated or widowed	91.1%	9.7%	14.7%
	Married	92%	6.3%	8.8%
Dependent children	Yes	91.8%	8%	9.9%
	No	90.3%	10.5%	12.9%
Location	Rural/regional	92%	11.1%	11.5%
	Capital city/metro	90%	8.3%	10.7%
	All	91.7%	9.3	11.5%

*Adapted from Pidd et al. (2008a)

¹ ST risk (short term harm) = ≥7 std drinks (males) or ≥5 std drinks (females) per drinking occasion.

² LT risk (long term harm) = ≥ 29 std drinks (males) or ≥ 15 std drinks (females) weekly average.

Shading denotes industry/occupation groups with the largest proportion of workers who drink at levels associated with short- and long-term harm.

³ Risk of harm in the short-term refers to harms that can result from a single occasion of drinking (e.g., injury, accidents, stroke). According to 2001 Australian alcohol guidelines, drinking more than 7 (for males) or 5 (for females) standard drinks on any drinking occasion is associated with risk of harm in the short-term.

Risk of harm in the long-term refers to harms that can result from long term drinking patterns (e.g., heart disease, liver cirrhosis). According to 2001 Australian alcohol guidelines, regularly drinking more than 29 (for males) or 15 (for females) standard drinks a week is associated with risk of harm in the long-term.

Significant industry and occupational differences were observed among the proportions of workers who reported drinking at levels associated with short- and long-term harm (Table 2). Hospitality industry workers and tradespersons were the industry and occupational groups with the highest prevalence of risky alcohol use.

Table 2. Proportions of the workforce who drink at levels associated with risk of harm in the short-term (at least weekly) and the long-term by industry and occupation*

	Industry			Occupation			
	Drinkers	ST risk ¹ (≤ weekly)	LT risk ²	Drinkers	ST risk (≤ weekly)	LT risk	
Mining	95.4%	9.2%	6.6%	Managers	93.5%	8.9%	11.8%
Construction	95%	14.3%	14.3%	Trades	92.8%	16.3%	16.3%
persons	92.8%	16.3%	16.3%	Professionals	91.7%	5.8%	8.7%
Wholesale	94.3%	14.4%	16.9%	Skilled worker	90.3%	9.8%	12.4%
Admin/ defence	92.4%	7.4%	9.5%	Unskilled worker	88.7%	12.4%	13.5%
Transport	92%	9.5%	11.9%				
Finance	91.7%	7.9%	11.0%				
Hospitality	91.4%	16.0%	18.9%				
Manufacturing	90.8%	9.9%	10.8%				
Agriculture	90.7%	12.6%	16.6%				
Education	90.1%	3.2%	7.2%				
Retail	89.6%	11.0%	12.5%				
Services	89.6%	8.0%	10.5%				

*Adapted from Pidd et al. (2008a)

¹ ST risk (short-term harm) = ≥7 std drinks (males) or ≥5 std drinks (females) per drinking occasion.

² LT risk (long-term harm) = ≥ 29 std drinks (males) or ≥ 15 std drinks (females) weekly average.

Shading denotes industry/occupation with the largest proportion of workers who drink at levels associated with short- and long-term harm.

It was also identified that 17.4% of the paid workforce had used some type of drug for non-medical reasons at least once in the 12 months prior to the survey, while 10.2% had used in the last month (Pidd et al., 2008b). The drugs used 12 months prior to the survey by the largest proportions of the workforce were:

- cannabis (13.4%)
- ecstasy (4.4%)
- methamphetamines (3.9%)
- painkillers/analgesics (2.8%).

In general, young single male workers with no dependent children were more likely to use drugs for non-medical purposes (Table 3).

Table 3. Proportions of the workforce who had used some type of drug for non-medical purposes at least once in the last 12 months & last month by demographic characteristics*

	Demographic	Use last 12 months	Use last month
Age	14–19	35.2%	18.8%
	20–29	31.8%	19.1%
	30–39	25%	12.8%
	40–49	11.9%	7.3%
	50–59	5.9%	3.0%
	60+	3.9%	2.4%
Gender	Male	20.4%	12.6%
	Female	13.6%	7.6%
Marital status	Single	33.1%	20.2%
	Divorced, separated or widowed	17%	10.9%
	Married	17.5%	6.8%
Dependent children	Yes	14.4%	8.4%
	No	24.1%	11.7%
	All	17.5%	10.4%

*Adapted from Pidd et al. (2008b)

Shading denotes group with the largest proportion of workers who have used an illicit drug at least once in the last 12 months and/or last month.

Significant industry and occupational differences were observed in the proportions of workers using drugs, with drug use most prevalent among hospitality industry workers and tradespersons (Table 4).

Table 4. Proportions of the workforce who had used some type of drug for non-medical purposes at least once in the last 12 months & last month by industry and occupation*

Industry	Use last 12mths months	Use last month	Occupation	Use last 12mths months	Use last month
Hospitality	31.8%	21.5%	Tradespersons	26.5%	16.5%
Construction	24.2%	14.4%	Skilled worker	21.7%	10.5%
Retail	20.7%	11.9%	Unskilled worker	17.4%	13.5%
Transport	18.3%	11.1%	Managers	14.5%	7.7%
Finance	17.4%	9.8%	Professionals	13.7%	9.8%
Manufacturing	17.2%	10.1%			
Wholesale	16.4%	8.1%			
Agriculture	15.8%	9.6%			
Services	15.1%	9.2%			
Admin/defence	12.4%	8.6%			
Mining	12%	5.6%			
Education	9.2%	5.4%			

*Adapted from Pidd et al. (2008b)

Shading denotes industry/occupation with the largest proportion of workers who have used an illicit drug at least once in the last 12 months and/or last month.

2.2 Alcohol and drug use in the workplace

An examination of relevant research identified seven Australian studies that had examined workplace alcohol or drug use (i.e., use that occurs either just prior to starting work, during work hours, or just after work hours). Bush, Smith and Dawes (1992) examined the workplace alcohol consumption of 337 Sydney urban train drivers and found 3.1% drank in the one to three hours prior to starting work and 2% drank during actual work hours. A more recent study of 300 South Australian building trades apprentices found 19% drank alcohol and 6.6% used cannabis during work-related hours (before work, during work hours, after work but before going home) (Pidd, Boeckmann, et al., 2006). The largest proportions of apprentices drank alcohol or used cannabis after work but before going home (17.5% & 4.3% respectively), with substantially smaller proportions using during actual working hours (Pidd, Boeckmann, et al., 2006).

Davey, Obst and Sheehan (2000) investigated the workplace alcohol consumption of 4,193 Queensland police officers and found 26% occasionally drank at work. Carruthers, Boots and Midford (2002) examined the workplace alcohol and illicit drug use of 116 Western Australian fishing industry workers and found 56% drank alcohol and 46% used cannabis while at sea. Much lower proportions (less than 2.6%) used other types of illicit drugs while at sea.

Hensher et al. (1991) surveyed 820 long-distance truck drivers and found 46.1% used stimulants at least on some trips, while 8.8% used stimulants on every trip. A survey of 1,007 long-distance truck drivers found that 22.3% used 'stay awake' drugs to deal with fatigue at work (Williamson, Feyer, Friswell, & Saural, 2001). More recently, Davey, Richards and Freeman (2007) examined the consumption patterns of 35 long-distance truck drivers in South East Queensland and found 40% used illicit drugs at work.

These seven studies indicate that workplace alcohol and drug consumption varies widely between industry and occupational groups. While useful, such industry-specific information is limited for several reasons. First, the studies involved relatively small sample sizes and/or their findings were restricted to particular industry and occupational groups. Second, the studies were conducted over a period of 16 years, and alcohol and drug consumption patterns can change substantially over time (AIHW, 2008). Finally, the alcohol and drug consumption measures and research methodologies utilised by different studies varied substantially. These factors may have contributed to the large variations in reported prevalence rates between studies and limit the degree to which these findings can be generalised to the wider workforce.

Pidd, Roche and Buisman-Pijlman (2011) recently examined national data collected as part of the 2007 NDSHS to identify the prevalence of workplace alcohol and drug use across the Australian workforce overall. Data obtained from nearly 10,000 Australian workers indicated the prevalence of alcohol or drug use at work, while relatively low, varied across different industry and occupational groups. Nearly one in 10 workers (8.7%) drank alcohol at work; nine times more than those who used drugs at work (0.9%). Around 5.6% reported attending work under the influence of alcohol, while 2% of the workforce had attended work under the influence of drugs. The drugs used at work by the largest proportion of workers were painkillers/analgesics (0.3%), methamphetamine (0.3%), and cannabis (0.2%).

Alcohol and/or drug use and attending work under the influence of alcohol or drugs was significantly more likely among young, male, never married workers with no dependent children. In addition, the proportions of workers who engaged in these behaviours

Alcohol and/or drug use and attending work under the influence of alcohol or drugs was significantly more likely among young, male, never married workers with no dependent children.

varied according to industry and occupation (Table 5). The hospitality industry had the highest proportion of workers who used alcohol at work or attended work under the influence of alcohol or drugs, while the transport industry had the highest proportion of workers who used drugs at work. Other high risk industries and occupations included construction, financial services, tradespersons and unskilled workers.

The hospitality industry had the highest proportion of workers who used alcohol at work or attended work under the influence of alcohol or drugs.

Table 5. Proportions of the workforce aged 14 years or over, who used alcohol or drugs at work, or attended work under the influence of alcohol or drugs, by industry and occupation

Industry	Used at work		Worked under the influence	
	Alcohol	Drugs	Alcohol	Drugs
Hospitality	18.6%	1.4%	12.0%	5.9%
Financial services	14.7%	0.8%	7.8%	1.4%
Services	11.0%	0.3%	7.5%	2.5%
Construction	10.6%	1.5%	6.0%	4.8%
Wholesale	9.0%	1.0%	5.4%	0.5%
Agriculture	7.4%	0.6%	5.3%	0.4%
Education	7.6%	0.2%	1.1%	0.6%
Mining	7.1%	0	5.8%	2.3%
Manufacturing	6.5%	0.6%	5.9%	1.4%
Retail	4.8%	1.2%	6.2%	2.4%
Transport	2.5%	1.9%	7.2%	2.5%
Health & community services	2.0%	0.3%	1.0%	0.6%
Occupation	Alcohol	Drugs	Alcohol	Drugs
Manager	12.6%	1.3%	7.6%	1.9%
Professional	10.9%	0.1%	4.7%	1.1%
Tradesperson	9.7%	1.8%	7.4%	4.3%
Skilled worker	6.8%	0.7%	5.6%	1.8%
Unskilled worker	5.3%	1.5%	5.9%	2.9%
All workers	8.7%	0.9%	5.6%	2.0%

Shading denotes industry/occupation with the largest proportion of workers who had used alcohol or drugs at work or had attended work under the influence.

*Adapted from Pidd et al. (2011)

2.3 Summary

Australian prevalence data indicate that, compared to alcohol use, only a small proportion of the workforce has used drugs. Similarly, compared to the proportions of the workforce who have used alcohol at work, or attended work under the influence of alcohol, relatively few workers have used drugs at work or attended work under the influence of drugs.

In general, the prevalence of alcohol or drug use in the workplace appears relatively low. However, some industry and occupational groups have much higher prevalence rates compared to the general working population. In addition, workers in particular demographic groups are also more likely to have used alcohol or drugs at work; this includes single young males with no dependents.



3: Workplace impact

3 Workplace impact

The alcohol and drug use of workers can have negative consequences for the workplace in terms of:

- accidents
- injuries
- productivity.

However, when examining the impact of alcohol and drugs on the workplace it is important to remember prevalence data in most cases indicates that only a small proportion of the workforce drink at risky levels, use drugs or attend work under the influence of alcohol or drugs. Thus, the overall prevalence of alcohol or drug related negative consequences are likely to be low and in turn result in relatively sparse data on this issue.

3.1 Accidents

While a linear relationship between alcohol or drug use and workplace accidents might be expected, the limited evidence in this area is not consistent with this proposition (Frone, 2004). However, this does not mean that alcohol or drug use does not play a causal or contributory role in workplace accidents. Rather, much of the available evidence suffers from conceptual and methodological limitations that restrict the ability to draw specific conclusions regarding the role of alcohol and other drugs in workplace accidents and injuries.

Some of these conceptual and methodological issues were identified above. For example, the majority of alcohol or drug related risk to workplace safety is likely to be due to use at work or use during work hours (workplace use) that results in impairment. However, most prevalence studies focus on workers' overall alcohol and drug consumption patterns that largely occur outside working hours (workforce use).

While workforce use may have an indirect relationship with workplace safety and productivity, it is unlikely to play a direct causal role. This proposition is supported by an Australian study of manufacturing industry employees (Webb, Redman, Hennrikus, Kelman, Gibberd, & Sanson-Fischer, 1994). Webb et al. (1994) found no relationship between workers' overall alcohol consumption levels and workplace injury, however, workers identified as 'problem drinkers' were 2.7 times more likely to have injury-related absences compared to non-problem drinkers.

Webb et al. (1994) outlined several reasons why indicators of problem drinking, but not measures of overall consumption, may be related to workplace injury. First, workers who consume large quantities of alcohol may absent themselves from work, rather than face the risk of an accident or detection. Second, workers may mainly drink at times and places that are temporally and geographically distant from the workplace. Third, it may not be the direct effects of a worker's overall alcohol consumption that produce a higher risk of accidental injury in the workplace, but rather the social and psychological consequences of drinking such as family and relationship problems, financial difficulties, or personal problems (e.g. guilt or low self-esteem).

Workers identified as 'problem drinkers' were 2.7 times more likely to have injury-related absences compared to non-problem drinkers.

International research has identified that a worker's overall pattern of alcohol consumption can be negatively or positively associated with risk. In a study of more than 9,000 US workers, Zwerling and colleagues (1996) found those who drank more than 5 drinks per day were 4.5 times more likely to report a workplace injury than those who drank 1-2 drinks a day. However, workers who did not drink were also more likely (1.6 times) to report a workplace injury than those who drank 1-2 drinks a day. A similar relationship was evident in a study of more than 6,500 workers of all ages, employed across 16 different U.S. worksites, that found that both non-drinkers and heavy drinkers had higher injury rates compared to light drinkers (Mangione et al., 1999).

No Australian studies were identified that examined the relationship between alcohol or drug use and workplace accidents. However, some international research has examined this issue. Hoffman and Larison (1999) examined the U.S. National Household Survey on Drug Abuse data and found no relationship between cannabis use, cocaine use, episodes of drunkenness, or symptoms of drug dependence and the likelihood of a workplace accident.

Similarly, Kaestner and Grossman (1995) compared working drug users to non-users and found no evidence of a relationship between drug use and workplace accidents. However, Kaestner and Grossman (1998) later examined the effect of young workers' drug use on workplace accidents and found drug use significantly increased the probability of having a workplace accident (among males only). They also found that drug use contributed to only one percent of all workplace accidents and concluded that reducing drug use to zero would be costly, difficult, and likely to result in only a small safety benefit (Kaestner & Grossman, 1998).

Some international research has also examined alcohol and drug use that occurs during work hours. In a study of U.S. municipal employees, Holcom, Lehman and Simpson (1993) examined the impact of overall patterns of consumption and on-the-job drug use on workplace accidents. Results indicated that both recent and on-the-job drug use were associated with workplace accidents, but only for workers employed in jobs with an inherently high risk of accidents. Importantly, they also found that dysfunctional personal backgrounds and job dissatisfaction were the most salient predictors of workplace accidents regardless of whether workers were employed in jobs with a high or low risk of accidents.

Cunradi, Ragland et al. (2005) undertook a secondary analysis of federally mandated post-accident and random alcohol and drug test results to estimate the impact of worker alcohol and drug use on vehicle accidents in the U.S. transit industry from 1995 to 2000. Results indicated that alcohol and drug use was associated with workplace accidents, but the incidence of alcohol or drug related accidents was low, with one in 1,000 cases associated with alcohol use and four to six in 1,000 associated with drug use.

3.2 Workplace injuries

Perhaps of more concern for workplace safety and worker welfare is the potential impact that alcohol or drug use may have on the incidence and severity of injuries resulting from workplace accidents. However, few Australian studies have examined the relationship between alcohol or drug use and workplace non-fatal injuries. Of those that have, most focused on alcohol and, apart from the previously described study undertaken by Webb et al. (1994), all examined workplace injuries that presented at hospital Emergency Departments.

A review of these studies indicated that between 4% and 15% of all workplace injuries treated at hospital Emergency Departments were associated with alcohol use (Pidd, Berry, Harrison, et al., 2006). However, these studies are limited in two respects. First, they were

Between 4% and 15% of all workplace injuries treated at hospital Emergency Departments were associated with alcohol use (Pidd, Berry, Harrison, et al., 2006).

mainly conducted outside normal working hours (e.g., from Friday night to Monday morning). Second, the focus was on alcohol related injuries in general, not workplace injuries. These limitations may result in an underestimation of the proportion of work-related injury that is associated with alcohol use (Pidd, Berry, Harrison, et al., 2006).

Less is known about the extent of non-fatal workplace injuries associated with drug use. A recent South Australian study (Griggs et al., 2007) found 24.2% of all Emergency Department presentations resulting from an incident at industrial sites tested positive to alcohol or drugs. However, from the results reported it is not possible to differentiate the proportion of alcohol positive presentations from drug positive presentations. The study was conducted over a 12 month period and data collection was not restricted to times outside normal working hours. This may explain the comparatively higher prevalence rate reported by Griggs et al. in contrast to other studies. Alternatively, the higher proportion of alcohol and drug positive workplace presentations may be due to the inclusion of alcohol detected at levels lower than .05g/mL or the failure to distinguish medically prescribed drug use from illicit drug use.

Studies undertaken in the workplace (as opposed to Emergency Departments) have largely been conducted in the U.S. Most have focused on overall alcohol or drug use (workforce use) and produced inconsistent and conflicting results. Veazie and Smith (2000) for example investigated the relationship between heavy drinking and alcohol dependence and traumatic, non-fatal work injuries among young U.S. workers and found no association between alcohol use and work injuries. The authors highlighted that alcohol consumption generally occurs outside the workplace and therefore may not be causally related to injuries at work. Similarly, Stallones and Xiang (2003) explored the relationship between alcohol consumption patterns and injuries among farm workers in Colorado (U.S.). They found that when other risk factors were considered, the relationship between alcohol and injuries among farm workers was weak.

By contrast, Dawson (1994) examined a large nationally representative sample of U.S. workers and found that the odds of a workplace injury increased with the frequency of heavy drinking (i.e., more than 5 drinks), and daily heavy drinkers were 1.7 times more likely to experience a workplace injury compared to workers who did not drink heavily. Similarly, Spicer, Miller and Smith (2003) examined the relationship between substance use problems⁴ and workplace injury. Results indicated that workers with a substance use problem had higher risk of workplace injury than those with no substance use problem. However, when other problem behaviours (e.g., absenteeism, theft, dishonesty) were controlled for, the relationship was weak.

The relationship between alcohol or drug use and workplace injury may be most evident among young workers. Shipp and colleagues (Shipp, Tortolero, Cooper, Baumler, & Weller, 2005) examined the overall alcohol and drug use of employed high school students in Texas, United States and found an association between workplace injury and overall substance use. Moreover, this relationship was dose related (i.e., the odds of injury increased with amount consumed). Similarly, Frone (1998) found the alcohol and drug on-the-job (workplace) use, but not overall (workforce) use, of young workers aged 16-19 years significantly predicted workplace injury. However, Frone also identified other significant

Most studies have produced inconsistent and conflicting results.

Workers with a substance use problem had higher risk of workplace injury than those with no substance use problem. However, when other problem behaviours were controlled for, the relationship was weak.

⁴ Substance use problems were defined as substance use disciplinary action, substance use related Employee Assistance Program (EAP) engagement, or absenteeism due to substance use impairment.

predictors of workplace injury among young workers, the most important of which were physical hazards and workload.

In general, reviews of relevant research (e.g., Macdonald, 1995; MacDonald, 1997; Ramchand, Pomeroy, & Arkes, 2009) conclude that there is an association between alcohol and drug use and workplace accidents and injuries. This research indicates that the association is stronger for younger workers, males, and certain industries and occupation. This research also indicates that the proportion of injuries caused by alcohol or drug use is relatively small, and there is a growing body of evidence indicating other factors such as fatigue, noise, dirt, dangerous working conditions, conflict at work, poor working conditions and procedures, poorly maintained equipment, and insufficient training and supervision of employees play a more important role.

3.3 Workplace fatalities

Australian data on the extent and nature of alcohol or drug related workplace fatalities are also limited. In most cases, blood alcohol content (BAC) levels and information on drug levels are limited. For example, Hollo et al. (1993) examined workplace fatalities that occurred between 1982-1984 and found that raised BAC levels ($> 0.05\text{g/mL}$) were evident in 10.4% of all fatalities. However, BAC levels were only available for 60% of all fatalities (Hollo et al., 1993). Driscoll et al. (2001; 1998) examined 1,787 workplace fatalities that occurred between 1989-1991 and found that raised BAC levels of greater than 0.05g/mL were evident in 3.7% of cases, while drugs were present in 1.7%, of all fatalities. However, information on BAC and drug levels was only available in 70% and 40% (respectively) of all cases (Driscoll et al., 2001). Similarly, Pidd et al. (2006) examined workplace fatalities that occurred in the financial year 2000-2001. BAC levels were available for only 49 of the 100 reported fatalities and raised BAC levels ($> 0.05\text{gm/L}$) were evident in only two of these fatalities.

The National Occupational Health and Safety Commission (1999) identified that during the period 1989-1992, 125 work-related deaths occurred in South Australia. Of these 7.9% had a BAC level greater than $.05\text{g/mL}$ and 3.2% tested positive for drugs. Again, these data are limited in that BAC levels were available for only 80% of fatalities, while information on drug levels was available for only 27% of cases.

More recently, the Victorian Institute of Forensic Medicine examined 355 Victorian working deaths that occurred from 2001-2006 (McNeilly, Ibrahim, Bugeja, & Ozanne-Smith, 2010). Of these fatalities, 11 (3.1%) had a BAC level of greater than 0.05g/mL and 20 (5.6%) tested positive for either cannabis or amphetamines. Coronial information indicated that alcohol or drug use was a contributory factor in 12 (3.4%) of the 355 cases.

...other significant predictors of workplace injury among young workers were physical hazards and workload.

The proportion of injuries caused by alcohol or drug use is relatively small. Other factors such as fatigue, noise, dirt, dangerous working conditions, conflict at work, poor working conditions and procedures, poorly maintained equipment, and insufficient training and supervision of employees play a more important role.

3.4 Absenteeism

Alcohol and other drug use can also negatively affect workplace absenteeism and productivity. Increased levels of absenteeism and lower levels of productivity among alcohol and drug using workers may be indirectly associated with workplace safety by increasing the workloads and work stress levels of co-workers.

Australian research indicates that alcohol use is a more significant contributor to absenteeism compared to other drug use. Pidd, Berry, Roche et al. (2006) calculated that in 2001, 3.5% of the workforce (more than 267,000 workers) took one day or more off in a three month period as a result of their alcohol use. This equates to an estimated 2.6 million work days lost due to alcohol related absenteeism at a cost of more than \$400 million (Pidd, Berry, Roche, et al., 2006). By contrast, only 0.9% of the workforce (53,000 workers) took one day or more off work in a three month period in 2004 due to their drug use (Pidd et al., 2008b).

Similarly, while international research has identified a clear negative relationship between workers' alcohol use and absenteeism (e.g., Norstrom & Moan, 2009) and workers' drug use and absenteeism (e.g., Bass et al., 1996), the extent of drug related absenteeism appears to be comparatively less than absenteeism related to alcohol use (Foster & Vaughan, 2005; French, Zarkin, & Dunlap, 1998).

In general, Australian (Roche, Pidd, Berry, & Harrison, 2008) and international (Bacharach, Bamberger, & Biron, 2010) research has identified a linear relationship between the quantity and frequency of alcohol consumption and absenteeism.

Australian research also indicates that alcohol related absenteeism is not just restricted to heavy drinkers. More than half the cost of alcohol related absenteeism in 2001 was incurred by the much larger proportion of low risk drinkers who only drank heavily on occasion (Pidd, Berry, Roche, et al., 2006).

Research has identified a linear relationship between the quantity and frequency of alcohol consumption and absenteeism.

3.5 Productivity

Evidence concerning the relationship between alcohol or drug use and on-the-job productivity is extremely limited. Most research has been undertaken in the context of the U.S. workplace and focuses on alcohol use. In general, research results are equivocal with some studies finding a modest negative relationship (e.g., Ames, Grube, & Moore, 1997) and some finding no relationship (e.g., Moore, Grunberg, & Greenberg, 2000). These inconsistent findings may be due in part to the difficulty of identifying and measuring on-the-job productivity.

Only two Australian studies were identified that had examined this issue. In both cases, decrements in on-the-job performance were measured in terms of the impact of workers' alcohol use on co-workers. Zinkiewicz and colleagues (Davey, Zinkiewicz, & Obst, 2000; Zinkiewicz, Davey, Obst, & Sheehan, 2000) surveyed nearly 5,000 Australian railway employees and found that almost 20% of employees reported that they had previously helped a workmate with a drinking problem. The most commonly reported alcohol related problems were absenteeism, health problems, poor quality work and poor safety.

More recently, Dale and Livingstone (2010) surveyed 1,677 Australian workers and found:

- 8% had been negatively impacted by a co-worker's drinking in the previous 12 months
- 3.5% reported that they had to work additional hours due to a co-worker's alcohol consumption
- over 4% reported that their ability to work was compromised more than once in the past year by a co-worker's alcohol consumption.

3.6 Summary

The available evidence indicates that workers' alcohol and other drug use can have a negative impact on workplace safety and productivity. However, the extent of this impact and the precise nature of the relationship between consumption patterns and workplace safety are unclear.

The evidence indicates that for most workplaces the prevalence of alcohol or drug related injuries is likely to be relatively low. The evidence also highlights that while alcohol and drug use can play a role, other factors such as workloads, fatigue and poor working conditions may play a more important role.

4 Drug testing techniques, technologies, and programs

Before examining evidence for the efficacy of testing as a strategy to improve workplace safety, it is important to outline the different types of testing techniques and technologies currently utilised in the workplace. The nature and purpose of different techniques and technologies, and their relevance to workplace safety, vary substantially.

4.1 Workplace drug testing techniques

Workplace drug testing is a two-stage process. The first stage is an initial screen to detect the presence of a drug. This is then followed by a confirmatory test to assess (confirm) the accuracy of any initial positive results from the screening test. Consistent with Australian standards, initial positive screens must be confirmed by a validated analytical procedure using mass-spectrometry techniques (Standards Australia, 2001, 2006).

To carry out this two-stage process, two methods of drug testing are available:

1. on-site analysis using Point of Collection Test (POCT) devices, and
2. laboratory analysis.

As most POCT devices use immunoassay techniques and are less reliable and accurate than laboratory analysis, POCT devices are useful for initial screening only. However, laboratory testing can be utilised for both initial screening and confirmatory testing. Apart from this fundamental difference, POCT devices and laboratory testing each have unique advantages and disadvantages as methods for detecting drug use. These are outlined below.

4.1.1 Point Of Collection Tests (POCT)

There is a large number of POCT devices commercially available in Australia. In general, these devices use immunoassay techniques and are recommended for use as an initial screening test only.

While Australian standards currently exist for drug testing, none specifically relate to POCT devices (apart from breath analysis devices). However, a substantial proportion of POCT devices that are currently available in Australia have received U.S. Food and Drug Administration approval. Some POCT devices reliably produce test results that are consistent with more sophisticated laboratory testing, but there is wide variability in accuracy and reliability across devices (Verstraete & Raes, 2006).

In addition, the use of POCT devices potentially introduces variability in the expertise and qualifications of individuals who may conduct on-site tests. This is important given that even medical general practitioners can have limited expertise concerning technical and ethical issues related to testing (Evans & Thornett, 2003; Levy, Harris, Sherritt, Angulo, & Knight, 2006).

POCT advantages:	POCT disadvantages:
<ul style="list-style-type: none"> • POCT screening is usually less expensive than laboratory testing • POCT screening is relatively easy to administer with little training required • POCT screening results are generally available within a few minutes of the screen being conducted. 	<ul style="list-style-type: none"> • Most POCT devices have a lower level of accuracy and reliability compared to laboratory analyses • The range of drugs that can be detected by most POCT devices is limited (a number of devices may be required to test for a range of different drugs) • POCTs cannot distinguish between prescribed drugs or over-the-counter medications and illicit drug use • Most POCT devices do not allow for a permanent record of the raw test results to be kept for medical or legal reasons • Visual display markers utilised by POCT devices vary widely and are subject to misinterpretation • POCTs increase the potential for staff with limited training in drug testing to be exposed to health and safety hazards, inappropriately conduct the test, or misinterpret results.

4.1.2 Laboratory testing

There is also a large number of drug testing services that offer laboratory testing, however, only a few Australian laboratories are accredited to Australian standards. Laboratory testing can involve a range of immunoassay and chromatography methods to detect drug use.

A detailed description of the different types of immunoassay and chromatography analysis methods utilised by laboratories is available elsewhere (Lu & Taylor, 2006; Simpson et al., 1997). In general, these methods give much more reliable and accurate results compared to POCT devices.

Laboratory test advantages:	Laboratory test disadvantages:
<ul style="list-style-type: none"> • Laboratory analysis is more reliable and accurate than POCTs • Laboratory analysis can detect a much wider range of drugs than POCTs • Laboratory analysis is better able to distinguish between prescription or over-the-counter drugs and illicit drugs (however, the medical history of the specimen donor may still be required to definitively distinguish between some drug types) • Laboratory analysis can detect the adulteration or dilution of specimen samples • Laboratory testing has the ability to store raw data and results of tests for future medical or legal access • Laboratory staff are likely to have more expertise in the administration of tests and the interpretation of test results compared to those using POCT devices. 	<ul style="list-style-type: none"> • Laboratory testing is generally more expensive than POCTs • Laboratory testing also involves a chain of custody procedure that increases the financial and time costs of the testing process • Laboratory analysis provides a slower turnaround time for test results compared to testing with POCT devices.

4.2 Detecting drug use: reliability and accuracy

The assessment of how good or reliable a drug test is for detecting drug use involves a number of different technical calculations. Each of these calculations provides information about different aspects of the test. It is important to be familiar with these technical calculations and what they are attempting to assess, how this informs the determination of how good a particular drug test is and how useful, or otherwise, it might be in the workplace setting.

For any drug test on a given population sample, there are four potential outcomes (Table 6):

- A true positive (a drug is detected and a drug is present)
- A false positive (a drug is detected, but no drug is present)
- A false negative (no drug is detected, but a drug is present)
- A true negative (no drug is detected and no drug is present).

Table 6. Possible outcomes of a drug test

		Drug present?	
		YES	NO
Drug detected?	YES	True positives (a)	False positives (b)
	NO	False negatives (c)	True negatives (d)

An ideal test accurately measures what it is supposed to measure. That is, an ideal test indicates drug use when drugs have been taken (a true positive) and shows no use of drugs when drugs have not been taken (a true negative). The higher the proportion of the true positives and true negatives the better the test. The ability of any test to accurately detect drug use is determined by three criteria – sensitivity, specificity, and accuracy. Each of these three key criteria is explained below.

Sensitivity

Sensitivity refers to how good a test is at correctly identifying drug use. Sensitivity is calculated as the number of true positives detected by the test, expressed as a percentage of all actual positive cases (both true positives and false negatives) and can be described algebraically as:

$$\text{Sensitivity (\%)} = \frac{\text{true positives (a)}}{\text{true positives (a) + false negatives (c)}}$$

For example, of 100 samples that are known to contain drugs, a test that correctly classifies 90 samples as positive for drugs (true positives) and incorrectly classifies 10 samples as negative for drugs (false negatives) drugs would have a sensitivity of 90%.

$$\text{i.e., } \frac{90 \text{ (a)}}{90 \text{ (a) + } 10 \text{ (c)}} = \frac{90}{100} = 90\%$$

Specificity

Not only is it important for a test to be able to correctly identify those that have used drugs, it is equally important that it can distinguish between those who have used drugs and those who have not used drugs. This is called specificity.

Specificity refers to how good the test is at identifying people who do not use drugs. Specificity is the number of true negatives detected by the test, expressed as a percentage of all actual negative cases (both true negatives and false positives), and can be described algebraically as:

$$\text{Specificity (\%)} = \frac{\text{true negatives (d)}}{\text{true negatives (d)} + \text{false positives (b)}}$$

For example, of 100 samples that are known not to contain drugs, a test that correctly classifies 90 samples as negative for drugs (true negatives) and incorrectly classifies 10 samples as positive for drugs (false positives) would have a specificity of 90%.

$$\text{i.e., } \frac{90 \text{ (d)}}{90 \text{ (d)} + 10 \text{ (b)}} = \frac{90}{100} = 90\%$$

Accuracy

The third key test criterion is accuracy. Accuracy is an indicator of how good a test is overall, taking into account the sensitivity and specificity of the test. Accuracy is determined by the number of correctly classified as positive or negative expressed as a percentage of all test results. It can be described algebraically as:

$$\text{Accuracy (\%)} = \frac{\text{true positives (a)} + \text{true negatives (d)}}{\text{true positives (a)} + \text{false positives (b)} + \text{false negatives (c)} + \text{true negatives (d)}}$$

For example, from 100 samples, a test that correctly classifies 10 samples as positive for drugs (true positives), correctly classifies 80 samples as negative for drugs (true negatives), and incorrectly classifies 10 samples as being positive or negative (false positives or false negatives) would have an accuracy of 90%.

$$\text{i.e., } \frac{10 \text{ (a)} + 80 \text{ (d)}}{10 \text{ (a)} + 5 \text{ (b)} + 5 \text{ (c)} + 80 \text{ (d)}} = \frac{90}{100} = 90\%$$

The sensitivity, specificity, and accuracy of any test can vary greatly and is dependent on various conditions and circumstances. To ensure appropriate, rigorous, and reliable tests are used, standards need to be set for acceptable levels of sensitivity, specificity, and accuracy. Evaluations of the effectiveness of various test devices, such as those outlined below, have generally established minimum acceptable levels for different drug testing settings as: $\geq 90\%$ sensitivity, $\geq 90\%$ specificity, and $\geq 95\%$ accuracy.

4.2.1 POCTs

Evidence concerning the effectiveness of urine and saliva POCT devices in detecting drug use is mixed. While some studies have concluded that urine and saliva devices are effective (Crouch et al., 2005; Moody, Fang, Andrenyak, Monti, & Jones, 2006; Walsh, 2007), others have cautioned against the use of these devices, particularly in clinical settings (George & Braithwaite, 1995; George & Braithwaite, 2002).

Evidence concerning the effectiveness of urine and saliva POCT devices in detecting drug use is mixed.

Research on the effectiveness of urine and saliva POCTs raises two main issues of concern.

- First, while some devices have been found to be relatively accurate and reliable, there is wide variability between devices (Peace, Tarnai, & Poklis, 2000; Verstraete & Raes, 2006; Walsh, Flegel, Crouch, Cangianelli, & Baudys, 2003). In particular, research indicates saliva POCT devices are limited in their ability to detect cannabis use (Crouch et al., 2005; Walsh et al., 2003).
- Second, the ease of using urine and saliva POCT devices and the degree of difficulty in interpreting the test results also varies widely (Gronholm & Lillsunde, 2001; Verstraete & Raes, 2006).

A comprehensive evaluation of urine and saliva POCT devices was provided by two studies conducted on behalf of the European Police Services Commission (Verstraete & Puddu, 2000; Verstraete & Raes, 2006). The first of these studies evaluated 15 urine and three saliva POCT devices that were commercially available. This study conducted tests on 2,968 individuals across eight European countries and identified several urinalysis devices that met the evaluation criteria of $\geq 95\%$ accuracy, $\geq 90\%$ sensitivity and $\geq 90\%$ specificity when compared to laboratory gas chromatography/mass spectrometry analysis (Verstraete & Puddu, 2000). However, none of the urinalysis devices scored highly for all drug categories and there was wide variability between different devices and drug types. For example, accuracy for amphetamine detection varied from 66% to 100%, sensitivity from 16% to 100%, and specificity from 56% to 100% across urine devices. For cannabis, accuracy varied from 85% to 97%, sensitivity from 70% to 99%, and specificity from 90% to 100% across urine devices.

A second evaluation of nine commercially available saliva POCT devices was subsequently conducted by the same researchers on 2,046 individuals across Europe and the U.S. from 2003 to 2005 (Verstraete & Raes, 2006). No saliva POCT device tested met the evaluation criteria of $\geq 95\%$ accuracy, $\geq 90\%$ sensitivity, and $\geq 90\%$ specificity for three of the main drug types used in Australia (i.e., amphetamines, cannabis, and benzodiazepines). For amphetamine detection, accuracy varied from 75% to 98%, sensitivity from 40% to 83%, and specificity from 80% to 100% for different devices. For cannabis, accuracy varied from 55% to 96%, sensitivity from 0% to 74%, and specificity from 70% to 100% for different devices.

4.2.2 Laboratory analysis

Due to the risk of POCT devices producing false positive test results, it is a requirement of Australian standards (Standards Australia, 2001, 2006) that any positive test is confirmed by laboratory analysis.

Laboratory analysis is likely to be more accurate and reliable than field analysis with a POCT device for a variety of reasons including:

- more advanced and sophisticated immunoassay and gas chromatography/mass spectrometry analysis can be undertaken in a laboratory compared to the analysis methods used by POCT devices

Laboratory analysis is likely to be more accurate and reliable than field analysis with a POCT device

- contamination risks may be lower in a laboratory due to more control over environmental conditions compared to field testing
- the equipment utilised in a laboratory is more likely to be subjected to regular monitoring and calibration
- laboratory staff are likely to have higher level skills and qualifications in sample analyses and the interpretation of test results, compared to staff who conduct field tests with POCT devices.

While laboratory analysis is likely to be more accurate and reliable than field analysis using a POCT device, laboratory analysis can also be subject to error. No studies were located that had evaluated the effectiveness of Australian laboratory drug testing services. However, several international studies have raised concerns regarding the accuracy and reliability of laboratory testing. For example, in one U.S. study (Riley, Lu, & Taylor, 2000) the same 931 urine samples were submitted to two independent laboratories for analysis. Of these samples, a total of 52 resulted in a different analysis outcome from the two laboratories. Thirty eight were found to be positive at the first laboratory and negative at the second. Fourteen were found to be negative at the first laboratory and positive at the second (Riley et al., 2000). The researchers concluded that differential results between the two laboratories may have been largely due to differences in procedural and operational factors. Such findings raise serious concerns about the veracity of testing even when undertaken by laboratories.

A more recent U.S. study also found that a significant proportion of tests within the same laboratory can be susceptible to misinterpretation (Levy, Sherritt, Vaughan, Germak, & Knight, 2007). Levy et al. (2007) examined 710 urinalysis results obtained from 110 adolescent patients in a hospital substance abuse program and found re-analysis indicated 40 samples originally classified as negative were too dilute to accurately interpret (i.e., they may have been adulterated) and 45 tests originally classified as positive for illicit drug use were due to the licit use of prescribed medication (Levy et al., 2007). This is an error rate of 12%.

Like most workplaces, laboratories that test for drugs can be subject to human or equipment error and mistakes can be made. In addition, the collection, storage, transportation and analysis of samples require a large amount of manual handling. Different procedures involved in this handling may result in sample deterioration or contamination, or test results being misinterpreted. There is also evidence to indicate that the reliability and accuracy of laboratory analysis can vary between laboratories (Lu & Taylor, 2006; Montagna, Poletini, Stramesi, Groppi, & Vignali, 2002; Riley et al., 2000) and according to the methods of analysis utilised by individual laboratories (Baptista et al., 2002; Eichhorst, Etter, Lepage, & Lehotay, 2004).

4.2.3 Summary

Research indicates that in the majority of cases, POCT devices and laboratory analysis can detect drug use. However, for POCT devices the risk of false positives can be relatively high depending on the type of device used, the target drug, and the expertise of the person conducting the test. This risk is reduced, but not eliminated, by laboratory confirmation of positive POCT tests.

False positives can result from the test detecting a legal substance that is chemically similar to the target drug (e.g., over-the-counter or prescribed medications). For example codeine, like other opioids, metabolises to morphine and most drug tests cannot distinguish between codeine and other opioids (such as heroin) that also metabolise to morphine.

Other factors that can contribute to false positives include:

- environmental contamination at the time of the test
- passive drug exposure ⁵
- poor interpretation of test results
- poor quality testing
- test device/method error or malfunction.

False negatives can result from:

- sample adulteration or substitution
- poor interpretation of test results
- poor quality testing
- test device/method error or malfunction.

While sensitivity, specificity, and accuracy are indicators of a test's efficacy in detecting drug use, there is a range of other factors that can influence the efficacy, usefulness, and appropriateness of drug tests. A positive test merely indicates that a drug, or drug metabolite,⁶ is present at or above a designated cut off level.⁷ While a positive test may indicate that a drug / drug metabolite is present at a designated cut off level, it cannot determine:

- dose level
- time of use
- frequency of use
- degree of impairment.

In contrast, a negative test does not necessarily mean that the person tested has not used drugs. For example, a drug / drug metabolite may be detected that is below the cut off level. Alternatively, use may have occurred at a time outside the test's window of detection.

4.3 Workplace drug testing technologies⁸

There are three types of tests that are commonly used for workplace drug testing:

- breath analysis
- urinalysis
- saliva testing.

These three technologies are described below, together with their associated advantages and disadvantages.

⁵ Passive exposure can occur when a non-drug user comes into contact with or is in close proximity to drugs or a person using drugs. Hair tests, for example, have been shown to be particularly sensitive to passive exposure from cannabis smoke (Uhl & Sachs, 2004).

⁶ Metabolites are chemical compounds created as a drug is activated or deactivated by internal chemical processes after ingestion. In some cases, very little of the actual (parent) drug is evident in biological samples, however recent use can be determined by the presence of drug metabolites.

⁷ In general, cut off levels are set at a point likely to maximise the detection of true positives, while at the same time minimising the likelihood of false negatives. Australian standards have set cut off levels for POCT and laboratory urinalysis (Standards Australia, 2001), and while target drug/drug metabolite concentrations in saliva have been set (Standards Australia, 2006), there are currently no Australian standards on cut off levels for hair, or sweat testing.

⁸ Blood testing is considered the 'gold standard' for accuracy and reliability in detecting drug use, but for a variety of reasons it is not suitable for workplace drug testing. In particular, blood testing is an invasive medical procedure than can pose a health and safety risk to both donor and collector. Blood testing is not discussed further in this report.

4.3.1 Breath analysis

Breath analysis involves determining the level of blood alcohol content by analysing mass of alcohol per volume of exhaled breath. Breath analysis has a long research history and there is a strong evidence base to support the relationship between alcohol detected by breath analysis and intoxication. Specimen donors are required to exhale air from deep within the lungs into a (usually) hand held device.

Breathalysers are relatively reliable and accurate. However, they require on-going calibration and can give false readings as a result of mouth contamination (e.g., alcohol-based mouth wash). To control for mouth contamination, donors are usually observed for 15 minutes prior to providing a breath sample, with donors that test positive usually re-tested 20-30 minutes after the first positive test result.

Breathalysers are also subject to false readings as a result of environmental contamination. This is a particularly important point for workplaces that store or use solvent based paint products, celluloid, petrol, cleaning fluids, other volatile compounds. The presence of these chemicals can result in a false positive on some breathalysers.

Advantages:	Disadvantages:
<ul style="list-style-type: none"> • Onsite tests that can indicate alcohol intoxication/impairment • Un-intrusive, breath sample only • Window of detection is narrow and produces a result similar to blood tests (current/recent use) Australian standards for breath alcohol testing devices exist (Standards Australia, 1997). 	<ul style="list-style-type: none"> • Can only detect alcohol use • Testing equipment relatively expensive and requires ongoing maintenance and calibration • Cannot detect impairment due to “hangover effects” of heavy alcohol use <ul style="list-style-type: none"> ◦ Hangover effects (e.g., fatigue and poor concentration) can continue to negatively impact on workplace safety and productivity after blood alcohol content levels have returned to zero • Unable to store sample for confirmation.

4.3.2 Urinalysis

Urinalysis is also one of the most researched drug test technologies currently conducted in workplace settings. Specimen donors are usually required to produce a urine sample, delivered directly into a sterile tamper-proof container. While Australian standards (Standards Australia, 2001) allow for the physical observation of the urine being passed into the collection device, donors can produce the specimen in a private toilet cubicle. In these cases, donors are supervised entering and leaving the cubicle and water in the toilet cistern and bowl is dyed to prevent sample dilution.

Urinalysis is the least expensive of all drug test types, whether conducted using a POCT device or in the laboratory. For most drug types, it can detect use that has occurred up to three days prior to the test. One exception to this is for cannabis use, where occasional use can be detected up to 6 days or more prior to the test, and for regular use the window of detection can increase to several weeks.

Advantages:	Disadvantages:
<ul style="list-style-type: none"> • Least expensive of all tests • Sufficient quantities of specimen sample can be obtained for confirmatory analysis and retesting • A substantial number of Australian laboratories have expertise in urinalysis • Higher concentrations of drug metabolites⁹ are present in urine compared to other types of specimen samples, making detection of past drug use more likely in urinalysis compared to some other test types • Australian standards for specimen collection, detection and quantification of drugs in urine exist (Standards Australia, 2001). 	<ul style="list-style-type: none"> • Relatively intrusive <ul style="list-style-type: none"> ◦ Effective collection can involve the collector physically observing the specimen passing from the donor into the specimen container • Wide window of detection (days/weeks) • Cannot detect current/recent use or intoxication/impairment levels <ul style="list-style-type: none"> ◦ Does not test for presence of drug, rather tests for presence of drug metabolites that result from previous use • Collection facilities that maintain donor privacy and comfort need to be provided • Good quality POCT devices can be more expensive than laboratory urinalysis • Can be time consuming <ul style="list-style-type: none"> ◦ Donor may not be able to readily provide a sample specimen • Dilution, adulteration, or substitution of urine samples is more easily achieved compared to other specimen samples.

4.3.3 Saliva testing

Saliva testing is a relatively new technology that is increasingly popular as a less invasive form of testing compared to urinalysis. Saliva samples are usually collected from inside the donor's mouth by use of a swab or pipette. However, while less invasive than urinalysis, the collection of saliva is not without problems. Given the relatively small amounts of saliva present in the mouth, the collection of sufficient quantities for confirmatory analysis or retesting can be problematic.

While more saliva can be generated by stimulation (e.g., the chewing of gum), this alters the pH level of the saliva collected, which in turn can influence the test result. In addition, the ability of saliva POCT devices to detect cannabis use has been questioned (Crouch et al., 2005; Verstraete & Raes, 2006; Walsh et al., 2003). This is an important issue given that cannabis is the drug most likely to be used by Australian workers (Pidd et al., 2008b).

⁹ Metabolites are chemical compounds created as a drug is activated or deactivated by internal chemical processes after ingestion. In some cases, very little of the actual (parent) drug is evident in biological samples, however recent use can be determined by the presence of drug metabolites.

Advantages:	Disadvantages:
<ul style="list-style-type: none"> • Specimen collection process is relatively un-intrusive <ul style="list-style-type: none"> ◦ requires swab wipe only • Window of detection is narrow (can detect current/recent use) • Specimen is available immediately • Collection of sample is more easily supervised which reduces the opportunity for specimen substitution, dilution, or adulteration • Higher concentrations of the parent drug in saliva compared to urine allow for more reliable identification of drug type and recent use • Australian standards for specimen collection, detection and quantification of drugs in saliva exist (Standards Australia, 2006). 	<ul style="list-style-type: none"> • Can be difficult to collect sufficient sample quantities for subsequent confirmatory analysis or retesting • Oral contamination (e.g., eating or drinking) can adulterate or dilute the sample • Can be time consuming <ul style="list-style-type: none"> ◦ due to the risk of oral contamination, donors need to be supervised for up to 30 minutes prior to sample collection • Cannot detect intoxication/impairment <ul style="list-style-type: none"> ◦ Relationship between presence of drug in saliva and intoxication or impairment is unclear • At present there is doubt about the ability of oral fluid/saliva testing to reliably detect cannabis use.

Table 7. A summary of specific issues related to urinalysis and saliva testing

Issue	Breath	Urine	Saliva
Level of invasiveness	Low	High	Low
Window of detection	Up to 12 hrs ¹	Up to 3 days ²	Up to 48 hrs
Environmental contamination risk	Low	Low	Low
Sample adulteration / dilution risk	Low	Medium	Medium
Sample substitution risk	Low	Medium	Low
Collection difficulty	Low	High	Low
Sample storage/transportation difficulty	High	Medium	Medium
Availability of POCT devices	High	High	High
Availability of Australian laboratories	N/A	High	Medium
Applicable Australian standards	Yes	Yes	Yes

¹ Depending on the amount of alcohol consumed.

² Window of detection for cannabis use can be up to several weeks depending on frequency of use.

4.3.4 Summary

Due to potential limitations in the reliability and accuracy of POCT screening for drugs, Australian standards require positive screens to be confirmed by laboratory analysis. The most common types of testing technologies used in the workplace are breath analysis, urinalysis, and saliva testing. All three test technologies have limitations. Apart from breath analysis, which can detect alcohol intoxication, no other workplace drug test can detect intoxication or impairment. Urinalysis is particularly problematic due to its inability to distinguish between recent and past drug use.

4.4 Workplace drug testing programs

There are different types of drug testing programs within which different testing technologies can be applied. The different types of testing programs currently used in the workplace context include:

- pre-employment screening
- random testing
- for-cause testing
- post-accident testing.

Pre-employment testing involves screening job applicants for drug use as part of the application process. Pre-employment drug testing is purportedly one of the most common types of testing program utilised, not because of its effectiveness but because it is more acceptable to employees and labour organisations (Levine & Rennie, 2004). One of the key limitations of pre-employment screening is that it is only a point in time test. In recognising this, Levine and Rennie (2004) argue that it is likely to detect only the uninformed, forgetful or severely addicted applicants.

Random testing involves the screening of a pre-determined proportion of the total workforce and is usually conducted without notice with all employees having an equal chance of being tested. While random testing can be perceived by workers to be procedurally fair, in that it involves all workers, it is often disliked by workers as it assumes all workers are drug users, and places the onus on workers to prove that they do not use drugs.

Moreover, random testing may result in industrial issues if workers in non-safety-sensitive work roles are targeted equally with workers employed in safety-sensitive roles. A recent review of Australian legal decisions concerning workplace testing (Roche et al., 2007) indicated that random zero tolerance testing without strong justification (i.e., for safety or integrity reasons) may be judged as unreasonable.

For-cause testing involves screening individual workers where there is physical or other evidence of drug use, or it is reasonable to suspect the worker may be using drugs.

Post-accident testing involves screening workers involved in accidents or near-miss incidents in the workplace. Post-accident and for-cause testing receive most support from workers (Elmuti, 1994; Howland, Mangione, Lee, Bell, & Levine, 1996). However, post-accident testing can result in the under-reporting of minor accidents and near misses (Morantz & Mas, 2008).



5 Workplace drug testing efficacy

5.1 Drug testing rationale, cost and effectiveness

There is no publicly available data on either the number of Australian workplaces that use each type of test technology, the number of tests conducted, or the proportion of samples that test positive.

In comparison, drug testing in U.S. workplaces is commonplace, with an estimated 30-40 million U.S. workers and job applicants tested for illicit drug use each year (Walsh, 2007). In the U.S., drug testing is more common than alcohol testing and the main testing technology used is urinalysis (Macdonald et al., 2010).

There are several explanations for workplace drug testing being more prevalent in U.S., compared to Australian workplaces, and why urinalysis is the main technology utilised. In the U.S., drug testing is carried out under the *Drug Free Workplace Act* (1988; 1991) which mandates that workplaces be 'drug free' and thereby implicitly authorises drug testing.¹⁰ The Act allows employers to develop policies that prohibit the use of alcohol at work and prohibits the use of illicit drugs at any time (Walsh, 2007).

In general, U.S. Federal and State courts have upheld U.S. employers' rights to test and enforce a zero tolerance policy in regard to illicit drug use (Caplan et al., 2007). The main objective of workplace drug testing programs in the U.S. is to deter drug use, rather than detect impairment/intoxication (Macdonald et al., 2010). Urinalysis is a relatively reliable and accurate method for detecting past drug use (i.e., use in the last few days/weeks), but it is less reliable as an indicator of recent use and cannot detect intoxication or impairment.

In contrast to the United States, Australia has no generic Federal or State legislation that covers workplace alcohol or drug testing. The only exception to this is industry specific legislation (e.g., rail and civil aviation) that mandates testing. In addition, rather than focusing on detecting drug use, the main objective of workplace testing in Australia is to improve workplace safety by preventing alcohol or drug related impairment in the workplace.

Most Australian workplaces deal with workplace alcohol or drug issues under Occupational Health and Safety Acts and Regulations which require employers and employees to take all reasonable steps to ensure a safe workplace. Some generic state occupational health and safety legislation explicitly refers to alcohol and drug use as a potential safety risk, but no state or federal generic workplace safety legislation mandates or recommends testing as a response.

The main objective of workplace drug testing programs in the U.S. is to deter drug use, rather than detect impairment/intoxication.

Australia has no generic Federal or State legislation that covers workplace alcohol or drug testing.

¹⁰ The Drug Free Workplace Act is Federal U.S. Government legislation and applies to individuals and organisations receiving Federal government funding/contracts. That is, you cannot receive federal funding or tender for a Federal contract unless you have a drug free workplace program that includes testing. However, the extent of workplace drug testing in the U.S. varies from state to state. Some U.S. states have legislation that specifically mandates workplace testing, while other U.S. states and local governments have statutes that limit or prohibit workplace testing unless specifically required by state or Federal regulations for certain jobs. Thus, in some US states drug testing is more prevalent than in others.

In contrast to U.S. legal decisions, Australian legal determinations concerning workplace testing indicate that zero tolerance testing, in the absence of a strong justification, may be judged as unreasonable (Roche et al., 2007). In addition, given the inability of urinalysis to detect impairment and its poor reliability in detecting recent use, the Australian Industrial Relations Commission has ruled the use of urinalysis to address workplace safety concerns as unjust and unreasonable (*Shell Vs CFMEU Shell Refining (Australia) Pty Ltd V Construction, Forestry, Mining and Energy Union*, 2009).

Workplace drug testing has, in some cases, led to industrial disputation.

In the Australian context, the introduction of workplace drug testing has, in some cases, led to industrial disputation (e.g. Holland, Pyman, & Teicher, 2005). A recent New Zealand study indicated that this was an important issue for employers considering the implementation of drug testing (Haar & Spell, 2007). Employers who perceived testing to be associated with negative outcomes, such as union pressure or industrial action, were less likely to adopt workplace testing compared to employers who perceived testing to be associated with positive outcomes (Haar & Spell, 2007).

5.2 Testing as a deterrence strategy

One of the purported benefits of drug testing programs is their ability to improve or contribute to safety and productivity by deterring drug use among the workforce. A number of studies have examined this issue, but they have produced mainly inconclusive results. In addition, much of the research concerning testing as a deterrent also suffers from methodological and conceptual weaknesses. For example, Dupont and colleagues (Dupont, Griffin, Siskin, Shiraki, & Katze, 1995) reported that following the introduction of workplace random testing regimes in several U.S. work organisations in the early 1990's, positive test results declined in subsequent years.

Such data is often posited as evidence of the effectiveness of workplace testing regimes as a deterrent to drug use. However, these findings do not provide confirmatory evidence of a reduction in drug use. A myriad of other factors may contribute to reductions in positive test results including:

- evasion
- specimen substitution or adulteration
- changes in patterns of use or types of drug used that are less likely to be detected
- general declines in drug use across the population in general.

French, Roebuck and Kébreau (2004) examined nationally representative data on the U.S. workforce and found that those employed in workplaces with an drug testing program were significantly less likely to use drugs compared to workers employed in workplaces with no drug testing program. However, as identified by Carpenter (2007), such simple comparisons fail to control for other workplace programs that may also impact on a workers' drug use.

To address this issue, Carpenter examined nationally representative U.S. workforce data and found that workers employed in workplaces with testing had significantly lower drug use prevalence rates compared to those in non-testing workplaces. The effect was strongest in workplaces where a positive test resulted in instant dismissal. However, a similar deterrent effect was also evident in workplaces that did not test, but provided alcohol and drug related training and education.

In a review of research concerning the efficacy of testing, Macdonald and colleagues (2010) examined the issue of deterrence and concluded that even though the number of positive test results declined following the implementation of workplace drug testing, the effect could be explained by other factors. As illustrated in another study, Walsh (2007) compared data on the incidence of positive workplace tests and self-report measures of drug use among the U.S. workforce. Walsh reported that data provided by

Quest Diagnostics, the largest provider of workplace drug testing in the U.S., indicated that positive test rates had declined from nearly 14% of all tests conducted in 1988 to just over 4% conducted in 2004 (a decline of 66%).

This type of finding is often used as evidence of the deterrent effect of drug testing. However, during the same time period, Walsh identified that the number of U.S. workers self-reporting drug use rose by 30% (Figure 1). During the same time period, the U.S. population rose by only 13% (U.S. Census Bureau). Therefore, it is implausible that testing alone was responsible for the reduction in positive drug test results. Other factors are clearly operating.

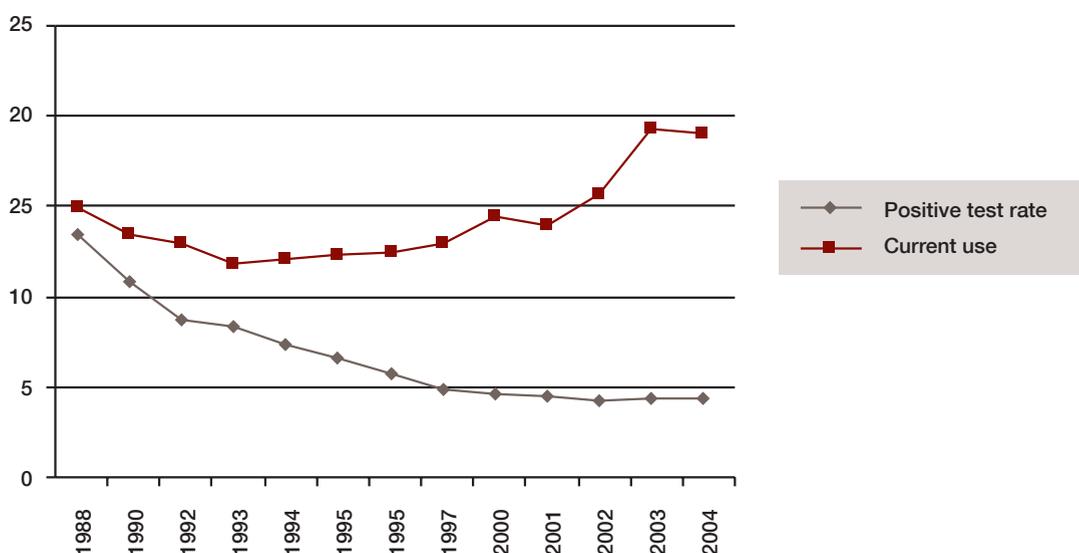


Figure 1. Positive test rates (%) versus number of U.S. workers self-reporting illicit drug use (millions) from 1988 to 2004 [adapted from Walsh (2007)]

According to Walsh (2007), a range of factors explain the discrepancy between the proportion of positive tests and apparent drug use including:

- not testing for the right drugs
 - the types of drug used by U.S. workers has changed substantially over the past 20 years
- using screening assays that have become too specific
 - many on site drug tests are drug specific and will not react to other compounds. For example, some amphetamine tests will not detect methamphetamine while most standard opiate tests will not detect newer forms of opiates such as oxycontin
- test evasion and specimen adulteration or substitution
 - the past 20 years has seen an exponential growth in the availability of substances and methods designed to beat or evade drug tests.

The inconclusive findings of research assessing the deterrent effect of workplace testing may also be due to invalid assumptions. Deterrence theories generally assume that individuals weigh up the rewards versus the costs of engaging or not engaging in risky activities before making a rational choice. The guiding principle for including sanctions or punishment in response to infringements is that offenders will be discouraged from repeating the infraction. However, it is also possible that offenders will succumb to the “gambler’s fallacy”, believing that they would be very unlikely, or unlucky, to be caught more than once. Moreover, according to deterrence theory, sanctions are seen as a necessary component when determining whether a testing program has a deterrent effect (Schaub, 2004), yet approximately 25%

of workers surveyed in Carpenter's (2007) study reported no official penalties or actions associated with a positive drug test.

Whether drug testing is likely to influence an individual's decision to use drugs or not largely depends on the individual's personal attitudes toward drug use and the significance they place on any sanctions associated with a positive test. In a study of drug testing in elite sports, Strelan and Boeckman (2006) identified that despite sanctions that included being banned from their sport, drug testing had little influence on athletes' decisions to use drugs. Rather, the strongest influence on athletes' decisions to use drugs was their personal moral beliefs and health concerns relevant to sport related drug use (Strelan & Boeckmann, 2006).

5.2.1 Summary

As with evidence for the effectiveness of testing in reducing workplace accidents and injuries, evidence concerning the effectiveness of testing to deter workers' alcohol or drug use is inconclusive. In general, the few studies that have utilised a rigorous methodology indicate that workplace testing has either no deterrent effect, or only a very small effect.

5.3 Testing as a strategy to reduce workplace accidents and injuries

A number of U.S. studies have been undertaken over the past two decades that have examined the effectiveness of drug testing to improve workplace safety (Table 8).

Overall, the evidence provided by these studies is inconclusive and a number of the studies suffer from conceptual and methodological weaknesses that limit the usefulness of research findings. For example, Normand et al. (1990) examined the utility of pre-employment drug testing for the U.S. Postal Service and found that 10% of eligible job applicants returned a positive pre-employment drug test.

While they found no relationship between a positive pre-employment drug test and subsequent workplace accidents and injuries, workers who tested positive were significantly more likely to take sick leave, be heavy users of leave and be more likely to be fired. However, Normand, et al.'s study (1990) may have suffered from selection bias and failed to control for other workplace factors that contribute to drug use, accidents, turnover, and absenteeism. In addition, the authors report that other factors such as race and age were more salient predictors of turnover and absenteeism.

Table 8. Studies of workplace drug testing effectiveness to improve safety

Test program	Workplace	No. workers	Outcome	Reference	Study quality
Pre-employment	U.S. postal service	5,465 job applicants	+ test associated with higher absenteeism and turnover rates	Normand et al. (1990)	Fair
Not reported	34 U.S. construction companies	Not reported	Testing reduced accident rates, increased productivity, worker morale & profits	Minchin et al. (2006)	Poor
Pre-employment & post-accident	U.S. metal foundry	610	Testing had no affect on accident rates	Dell & Berkhout (1998)	Fair
Pre-employment random, for-cause & post-accident	U.S. manufacturing (15 worksites)	1,719	Testing had no affect on injury rates but did result in decreased employer medical expenditure	Ozminkowski et al. (2003)	Good

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Test program	Workplace	No. workers	Outcome	Reference	Study quality
Pre-employment, for-cause & post-accident	48 U.S. businesses	Not reported	Post-accident, but not pre-employment or for-cause testing, reduced accident and illness rates	Feinauer & Havlovic (1993)	Good
Not reported	All workplaces in 29 U.S. states	Not reported	No difference in injury rates between U.S. states that did or did not mandate workplace testing	Kesselring & Pittman (2002)	Good
Not reported	49 U.S. construction companies	Not reported	Testing reduced accident rates	Gerber & Yacoubian (2001)	Fair
Random	U.S. transport industry	Not reported	Testing reduced number of road accidents	Jacobson (2003)	Poor
Random	U.S. transport industry	Not reported	Testing reduced number of road accidents	Swena & Gaines (1999)	Poor
Post-accident testing	U.S. retail company	> 100,000	Testing reduced number of workers' compensation claims & reports of minor injuries	Morantz & Mas (2008)	Fair

Minchin and colleagues (2006) surveyed 34 U.S. construction companies and concluded that companies that used workplace drug testing experienced increased work quality and productivity and reduced numbers of accidents, compared to companies that did not test. However, these conclusions were based on a small number of case studies of companies with testing programs. Moreover, the evidence presented by Minchin and colleagues to support these conclusions was largely anecdotal, based on managers' opinions, rather than actual pre- and post-testing program data.

Some studies have found that workplace drug testing was associated with either no reductions, or very small reductions, in workplace injuries. In general, these studies utilised more rigorous methodologies to control for other confounding factors. Dell and Berkhout (1998) examined work injuries in a U.S. metal foundry between 1980 and 1995 where pre-employment and post-accident drug testing was introduced in the last two years of the study period. They concluded that testing had no effect on subsequent accident rates. Ozminowski and colleagues (2003) examined the relationship between drug testing and occupational injury rates in a large U.S. manufacturing company. Drug testing was significantly associated with lower employer medical expenditures, but not injury rates. Moreover, they found the monthly injury rate per employee was low (0.6%) and that doubling the drug testing rate for employees would reduce this already low rate by only 0.01%.

In a five year longitudinal study, Feinauer and Havlovic (1993) examined the relationship between different types of drug testing programs and workplace accident and injury rates in 48 U.S. businesses. While they found some support that post-accident testing reduced accident and illness rates, for-cause testing and pre-employment testing was not associated with any reduction. The authors suggested that it is unrealistic to expect a one-off test to lead to a reduction in workplace accidents as an employee may commence using drugs at any point. They argue, like Levine and Rennie (2004), that pre-employment testing is only likely to detect the most problematic of drug users and suggest that this type of testing is more akin to an IQ test than an indication of drug use.

Kesselring and Pittman (2002) undertook a comparison of national U.S. occupational injury rates with a number of variables that could potentially influence injury rates, including whether the workplace was located in a U.S. state that did or did not mandate workplace drug testing. They found that the most significant predictor of occupational injury was the industry in which workers were employed – no other variable (including the legal status of drug testing) was significantly related to occupational injury rates.

By contrast, some studies report large reductions in workplace injury that are associated with workplace drug testing. For example, Gerber and Yacoubian's (2001) evaluation of drug testing in the construction industry reported that injury rates fell by 51% within two years of the implementation of a drug testing program. However, the data provided by Gerber and Yacoubian also indicate that during the study period, injury rates were declining in the U.S. construction industry in general (regardless of whether workplaces tested or not). This is important, given that Gerber and Yacoubian's study failed to report or control for factors that were contributing to this overall reduction in injury rates.

Jacobson (2003) examined the effects of workplace drug testing legislation on fatal truck crashes in the United States and reported a 9-10% reduction in fatalities following the introduction of legislation mandating testing programs. However, the author also noted that further research was required to ascertain the mechanisms contributing to the decrease in fatalities, suggesting an unclear association between drug testing per se and the reduction in fatalities. Swena and Gaines (1999) also examined the impact of random drug testing on fatal truck crashes in the United States and reported that while there was a statistically significant reduction in fatalities in the two years following the implementation of drug testing, the rate of fatalities had been decreasing for the seven years prior to its introduction. Fatal accident rates began to increase again in later years (Swena & Gaines, 1999).

More recently, Morantz and Mas (2008) examined whether post-accident drug testing reduced workplace injuries in a study of a large U.S. retail chain employing more than 100,000 employees. Their study covered a five year period (2002-2007) with post-accident drug testing implemented halfway through the study period. This post-accident drug testing program required any worker involved in an accident resulting in an illness or injury that needed medical attention, caused death or injury to a third party, or caused more than \$250 of property damage, to undertake an oral fluid (saliva) drug test. During the study period, a total of 12,000 injuries were reported with 108 employees terminated for returning a post-accident positive drug test. Assuming that all employees testing positive were terminated, the positive result rate was 0.9%.

Morantz and Mas (2008) found the introduction of the post-accident drug testing program resulted in a significant reduction in workers' compensation claims. However, the largest reduction was for claims involving medical treatment, but not lost time. There were even greater reductions in the frequency of first aid reports (minor injuries requiring only simple short-term first aid treatment). The authors concluded that post-accident testing reduced workers' compensation claims. However, a substantial proportion of this reduction was due to workers under-reporting minor injuries and accidents (Morantz & Mas, 2008). Thus, Morantz and Mas also concluded that while the reduction in claims may reduce workers' compensation costs in the short-term, the under-reporting of injuries and accidents could impose even greater costs over the long-term (Morantz & Mas, 2008).

5.3.1 Summary

Research evidence for the efficacy of drug testing in reducing workplace accidents and injuries is inconclusive. In general, studies that support the efficacy of testing suffer from methodological limitations. Evidence provided by more rigorous studies indicates that drug testing has only a small effect or no effect in reducing workplace accidents and injuries. These findings are consistent with

Research evidence for the efficacy of drug testing in reducing workplace accidents and injuries is inconclusive.

other systematic reviews of research that have found insufficient evidence to conclude that workplace drug testing improves workplace safety (Cashman, Ruotsalainen, Greiner, Beirne, & Verbeek, 2009; Kraus, 2001; Macdonald et al., 2010).

One reason for the lack of evidence for the effectiveness of testing may be the invalid assumptions underlying the relationship between workers' alcohol or drug use and workplace safety. As argued elsewhere (e.g., Feinauer & Havlovic, 1993), the proposition that workplace drug testing reduces accident or injury rates is predicated on two assumptions:

- 1) alcohol or drug use is a substantial cause of workplace accidents and
- 2) testing can reduce accidents and injuries by detecting and/or deterring use.

However, as indicated above, the incidence of alcohol or drug related accidents is likely to be low, and the mere detection of alcohol or other drug use does not mean that alcohol or other drugs were causally implicated in an accident or injury (Frone, 2004).

5.4 The cost effectiveness of drug testing as a workplace safety strategy

Drug testing that complies with Australian standards can be expensive. It is therefore important to consider the cost effectiveness of drug testing as a workplace safety strategy. Strategies that are not cost effective may limit resources that can be directed toward other potentially more effective strategies. Despite the millions of dollars spent on workplace drug testing programs internationally each year, information concerning their cost effectiveness is scarce. Of the few studies that have examined this issue, most indicate that workplace drug testing is not cost-effective.

A study of U.S. postal workers, cited above (Normand et al., 1990) found that positive pre-employment tests were associated with absenteeism and staff turnover. The authors speculated that using pre-employment tests to screen out drug users could potentially result in millions of dollars in savings each year. However, a subsequent study of U.S. postal workers (Zwerling, Ryan, & Orav, 1992) estimated the average cost saving associated with pre-employment testing to be only \$162 per applicant hired. Zwerling and colleagues also acknowledged that this saving was dependent on the initial prevalence of drug use and that in the case of low prevalence, pre-employment drug testing was unlikely to be cost-effective.

More recently, Halperin, Andolsek, Jackson and Weinerth (2008) examined the cost effectiveness of pre-employment drug testing of U.S. trainee medical practitioners. Their examination found only one positive test out of 2,329 tests conducted over an eight year period. The authors report that the cost of this pre-employment testing program during this period was approximately \$93,160.

Mehay and Webb (2007) examined the economic costs and benefits of random drug testing in the U.S. Navy. The U.S. Navy requires frequent random drug testing and the dismissal of those who return a positive result for illicit drugs. After assessing the impact of deterrence and detection and balancing this with the testing program costs (actual drug testing costs, lost time while personnel are doing the tests, costs associated with replacing dismissed staff, etc.), Mehay and Webb estimated that the program generated a net economic loss. As a result, they suggested that a workplace program focusing on the rehabilitation of workers with a substance abuse problem was more cost-effective than a drug testing program based on zero tolerance.

In addition to the direct financial and resource costs of workplace drug testing, workplace testing may also result in an indirect cost to the employers. In a study of 63 U.S. communications and computer companies, Shepard and Clifton (1998) found that those with drug testing programs were on average 29% less productive than their non-testing counterparts. While this lower productivity rate may have been due to the costs of the testing program itself, the researchers concluded that it was more likely to do with

the attitudes of workers toward their employer. According to Shepard and Clifton, drug testing without cause implied a lack of trust, negatively affecting employee morale, which in turn affected employee effort and loyalty.

An alternative explanation for the poor cost effectiveness of workplace drug testing may be the relatively low prevalence of drug use among the workforce in general. While Australian data is not available, data provided by Quest Diagnostics (2010) indicate that the proportion of positive tests resulting from U.S. workplace testing is relatively low. Quest Diagnostics (the largest provider of workplace tests in the U.S.) conducted more than 5.5 million urinalyses in 2009. Table 9 outlines the proportion of positive tests for each test type for safety-sensitive employees (where testing is mandated) and the general workforce.

Table 9. Percentage of positive tests by testing type*

Testing Reason	% positive	
	Safety-sensitive**	General Workforce#
For-Cause	11.10%	26.80%
Post-Accident	2.20%	5.30%
Pre-Employment	1.50%	3.40%
Random	1.40%	5.40%

*Adapted from the Quest Diagnostic Index (Quest Diagnostics, 2010)

**There were over 1.3 million tests for safety-sensitive personnel in 2009

There were over 4.2 million tests in the general workforce in 2009

While a higher proportion of positive tests were evident among the general workforce, the portion of positive tests for both workforce groups is relatively low for all types of testing programs except for-cause testing. However, the high positive prevalence rate for for-cause testing is to be expected as for-cause testing only applies in cases where there is pre-existing evidence that a worker may be using drugs. Given this rationale for conducting a for-cause test, it could also be argued that positive results of only one in nine (safety-sensitive workforce) and one in four (general workforce) tests are also relatively low.

5.4.1 Summary

Of the few studies that have examined the cost effectiveness of drug testing, most have concluded that workplace testing is not cost effective. This may be due to the relatively low number of positives that are detected compared to the number of tests conducted, or it may be due to the costs associated with lost time, replacing dismissed staff, or the reduction in employee morale.

Of the few studies that have examined the cost effectiveness of drug testing, most have concluded that workplace testing is not cost effective.

6 Best practice workplace drug testing

Best practice workplace testing programs are those based on the principles of quality practice. Such programs are more likely to be accepted and endorsed by employees.

6.1 Employee acceptability of workplace testing

The acceptability of workplace testing to employees is crucial. Whether employees hold positive or negative attitudes toward a workplace safety intervention can play a pivotal role in the ultimate success or failure of that intervention. Employee attitudes to testing are important because employee's attitudes influence job satisfaction, organisational commitment, turnover intention and performance (Konovsky & Cropanzano, 1991). Thus, the negative impact of testing on employee attitudes can adversely affect productivity (e.g., Shepard & Clifton, 1998) and can result in industrial disputation (e.g., Holland et al., 2005).

Employees can be particularly critical of testing programs (Sweeny & Penner, 1997) and a number of factors can influence employees' attitudes towards, and endorsement of, workplace drug testing. According to Kravitz and Brock (1997), these factors include:

- false positive and false negative rates
- punitive consequences of a positive drug test
- the inability of testing to differentiate between recent drug use and impairment.

All these issues affect employee attitudes towards workplace drug testing. Even if employees generally see testing as relatively non-invasive, they may also hold the view that testing does not enhance safety and this may negatively influence their preparedness to take a drug test (Comer, 2000).

Drug testing was found in one study to be more acceptable when administered in the pre-employment context rather than during the course of an individual's employment (Ambrose, 2000). Ambrose suggested that this is because the applicant has more choice in a pre-employment situation. This is supported by the findings of Rosse, Miller and Ringer (1996) which identified that pre-employment testing was likely to deter drug users from applying for a job. It is also consistent with research that identified a greater likelihood of drug using workers to be critical of workplace testing compared to non-drug users (Moore, Grunberg, & Greenberg, 1998).

Ambrose (2000) noted that testing programs that resulted in dismissal on the basis of a positive test were viewed less favourably than those based on rehabilitation. Similarly, Elmuti (1994) found that employees favoured the provision of treatment and counselling for those who tested positive.

Employees in safety-sensitive positions are more likely to perceive alcohol testing as fair compared to employees in non-safety-sensitive positions (Truxillo, Bauer, & Paronto, 2002). Moore, Grunberg and Greenberg (1998) reported that trust, participation and communication are essential factors which contribute to workers viewing drug testing programs more favourably.

In a study that compared the acceptability of workplace drug testing programs with the acceptability of an alternative impairment detection program (fitness for duty), Seijts and O'Farrell (2005) found that neither program was viewed particularly favourably by employees. However, compared to the drug testing program, employees regarded the impairment detection program as fairer, more effective in detecting impairment, and having more potential to facilitate a safe workplace.

A factor consistently identified in the research in regard to employee acceptability of drug testing is the issue of procedural fairness. According to the Australian Public Service Commission (2007), the principles of procedural fairness require people whose interests will be adversely affected by a decision to be given an opportunity to be heard, and decision-makers to act without bias or self-interest, and to base their decisions on compelling or 'logically probative' evidence.

Konovsky and Cropanzano (1991) reported that employees' perception of the procedural fairness of a drug testing program affected the acceptability of drug testing. Procedural fairness in this case included advanced notice of testing, employees having a voice in the program and having the right of appeal. The authors suggested that where the program is seen as procedurally unfair there may be higher employee turnover, fewer job applicants and lower performance. Similarly, Ambrose (2000) noted that a program viewed as unfair may reduce employee loyalty and undermine the workplace culture, resulting in negative outcomes which need to be weighed against any potential benefits of the program. However, if the testing program is perceived to be justified and procedurally fair, employees are less likely to hold negative attitudes toward it (Seijts, Skarlicki, & Gilliland, 2003).

Ensuring that workplace testing is procedurally fair raises a potential dilemma for Australian workplaces. To be considered fair, drug testing must be directed towards all employees rather than targeted at sections of the workforce (Wagner & Moriarty, 2002). Nonetheless, as noted in the review of Australian legal decisions above, zero tolerance testing that targets all employees, even with a strong justification on safety or integrity grounds, may be judged as unreasonable (Roche et al., 2007).

If the testing program is perceived to be justified and procedurally fair, employees are less likely to hold negative attitudes toward it.

6.2 Best practice approach to testing

Australian industrial relations and occupational safety legislation encourages a collaborative and cooperative approach between employers and employees. This approach minimises industrial disputation and maximises employee commitment to industrial and safety agreements by involving employees in the decision making process. For such an approach to assist the introduction of workplace testing, employees need to be convinced that workplace testing would enhance occupational health, safety and welfare. To achieve this, evidence concerning the effectiveness of testing and the procedural details of testing programs need to be identified and disseminated to employers and employees.

An industrial relations dispute between BHP and a union in 1998 in relation to the implementation of random drug testing at the company's mine sites was examined by Holland and colleagues (2005). In analysing this dispute, Holland and colleagues identified several legal, ethical and industrial issues that need to be considered in relation to the introduction of workplace drug testing, including:

- the obligation of an employer to provide and maintain a safe working environment
- the relationship (or otherwise) between alcohol and other drugs and accidents and costs, and the interrelationship with work factors
- the inaccuracy of testing
- employee contractual obligations regarding fitness for duty and performance
- employee rights to privacy.

Holland et al. (2005) concluded that despite the contentious and complex issues surrounding workplace drug testing, the development and implementation of testing programs must be part of a holistic approach to OH&S that necessitates a consultative process between employers and unions in the development of appropriate programs involving education and rehabilitation.

Such an approach is supported by Brown, Bain and Freeman (2008) who found that perceptions of the effectiveness of a workplace alcohol and drug policy was more positive when employees felt that the employer was taking a holistic approach rather than just focusing on drug testing programs. Policies were also considered to be more effective if the employer attended to issues such as job design and employee health and wellbeing.

Factors identified for an effective workplace strategy to address alcohol and drugs were:

- information about the policy
- information about alcohol and drugs
- training of supervisors to deal with potential problems
- fair administration
- focusing on rehabilitation.

Positive attitudes toward drug testing were found in relation to:

- transparency
- upholding employee rights
- having a clear rationale for the testing program.

Evidence in support of such a holistic approach is provided by Wickizer, Kopjar, Franklin and Joesch (2004) who assessed the effectiveness of a United States' 'Drug-Free Workplace Program' in preventing occupational injuries. The program consisted of a workplace substance abuse policy, employee assistance program, workplace drug testing, annual education for employees on substance abuse, and training for supervisors and managers regarding substance abuse. They found that the program contributed to a reduction in occupational injury equivalent to 3.33 in 100 and a statistically significant reduction in lost time injuries. The reductions in injury were most evident in the construction, manufacturing and service industries, whilst lost time injury reductions were higher in the construction and service industries.

The authors concluded that the drug-free workplace program had a selective effect in reducing occupational injury and the effects were dependent on the level of injury risk and prevalence of substance abuse in the workplace. They also noted that the program may have contributed to a workplace culture shift that could also impact positively on safety.

Others recommend that the issue of alcohol and other drugs in the workplace needs to be addressed in the same manner as other occupational safety issues (Calogero, 1996) and should:

- assess the current situation
- formulate objectives and policy
- develop strategies which are consistent with the objectives and policy
- monitor and evaluate the impact of the strategies
- adjust/modify the approach based on the monitoring and evaluation information.

Businesses may opt to collect baseline data regarding accident and incident rates to ascertain if alcohol and drugs are a problem in their workplace (Calogero, 1996). Moreover, workplace alcohol and drug policies should:

- be developed through a consultative approach
- be comprehensive and universal in application
- effectively disseminated and implemented
- tailored to the individual workplace.

In terms of implementing suitable workplace interventions other than drug testing Webb, Shakeshaft, Sanson-Fisher and Havard (2009) recently undertook a systematic review of workplace interventions for alcohol related problems and suggest that the interventions with potential include:

- brief interventions
- interventions in health and lifestyle programs
- psychosocial skills training
- peer referral.

6.3 Summary

To be effective, any strategy for improving workplace safety needs to be:

- 1) based on principles of quality practice
- 2) be accepted by employees.

For drug testing to be accepted by employees the available research literature indicates that such testing should be justified as being required to address an identified risk and the associated policy and procedures need to be adequately disseminated and applied in a procedurally fair manner.

To be consistent with principles of quality practice and be accepted and endorsed by employees, testing programs need to:

- result in counselling, treatment, and rehabilitation rather than punitive outcomes
- target safety-sensitive rather than non-safety-sensitive work roles
- allow for employee input into the development and implementation of the program
- allow for a right of appeal
- incorporate appropriate education and training.

7 Summary and recommendations

This document examined the efficacy of workplace drug testing for improving workplace safety and identified best practice workplace testing programs. Key findings are discussed below, together with recommendations for evidence based practice.

7.1 Workers' alcohol and drug use

A review of workforce alcohol and drug prevalence data revealed that most Australian workers (90.7%) are current drinkers, with 21.3% regularly drinking at levels that placed them at elevated risk of injury or chronic illness. A smaller proportion (10.2%) had recently used (in the last month) some type of drug for non-medical purposes.

While nearly 9% of the workforce used alcohol at work and nearly 6% had attended work under the influence of alcohol, much smaller proportions used drugs at work (0.9%) or attended work under the influence of drugs (2.0%). Prevalence data revealed that consumption patterns varied significantly across the workforce, with much larger prevalence rates evident in particular industry and occupational groups. Consumption patterns also vary according to demographic factors with higher prevalence rates among males, single, and younger workers.

The findings have important implications for interventions, such as drug testing, that are designed to address alcohol and drug related risk to workplace safety. First, due to the greater prevalence of alcohol use compared to drug use, alcohol is more likely to be a threat to workplace safety than the use of other drugs. Testing should therefore not just focus on drug use, but should also target alcohol use as a priority. Second, while the proportions of workers who use alcohol or drugs at work or come to work under the influence are relatively low across the total workforce, some industry and occupational groups have a much higher prevalence of these behaviours.

Hence, testing programs should be targeted toward, and tailored to suit the specific needs of, these high risk groups. Finally, as the prevalence of use at work or attending work under the influence is relatively low across the total workforce, the extent of alcohol or drug risk to safety is also likely to be low for most workplaces. Thus, while alcohol or drug related risk to workplace safety is an important issue, there are likely to be more prevalent risk factors that also warrant attention.

It is recommended that data concerning the prevalence of alcohol and drug use among the Australian workforce is regularly updated and made publicly available. Categorized according to occupational and demographic variables, such data will allow for the identification of high risk workforce groups and aid the development of targeted and tailored interventions.

7.2 The extent of alcohol or drug related injuries in Australian workplaces

Few Australian studies that had examined the extent of alcohol or drug related workplace injuries were identified in the literature review. Those that examined non-fatal injuries indicated that between 4% and 15% may be associated with alcohol. The extent to which other drugs are associated with non-fatal injury in Australian workplaces is largely unknown. The most recent Australian research concerning workplace

fatalities indicated that 3.7% of cases were associated with alcohol or drugs. While this research indicates the prevalence of alcohol or drug related workplace injury is relatively low, few definitive conclusions can be drawn.

Research concerning this issue is scarce and much of what is available suffers from conceptual and methodological limitations. For example, much of the research concerning non-fatal injuries involved studies that were conducted on weekends at hospital Emergency Departments, focused on alcohol, and only examined workplace injuries as a subset of all injury presentations. In the case of fatal workplace injury, most research reviewed was limited by lack of toxicology data for a substantial proportion of workplace fatalities.

It is recommended that methods for providing reliable and accurate Australian data on the extent of alcohol or drug related workplace fatal and non-fatal injuries are identified and implemented.

7.3 The relationship between workers' alcohol or drug use and workplace safety

Much of what is known about the relationship between workers' alcohol and drug use and workplace safety comes from U.S. research. Most of this research contains conceptual and methodological limitations that restrict the conclusions that can be drawn from it. For example, much of the research focuses on alcohol and drug use by the workforce in general (i.e. consumption that largely occurs outside working hours) rather than workplace use (consumption that occurs during work hours and/or at the workplace). Workplace use is likely to have a direct relationship with workplace safety, while the relationship between workforce use and workplace safety is likely to be indirect and confounded by other factors.

In general, the research in this area concludes that there is an association between alcohol and drug use and workplace accidents and injuries. The association is likely to be stronger for younger workers, males, and certain industries and occupations. However, the research also indicates that the proportion of injuries caused by alcohol or drug use is relatively small and that there is strong evidence that other factors, such as unsafe work practices and conditions, fatigue, and poor training can play a more important role.

Without a clear understanding of the nature of the relationship between workers' alcohol and drug consumption patterns, evidence based intervention strategies to reduce or eliminate alcohol and drug related risk to safety cannot be developed. To-date, few Australian studies have examined the nature of the relationship between workers' alcohol use and workplace safety. There is a need for more Australian research in this area to inform evidence based interventions and policies.

It is recommended that research is undertaken to examine the nature of the relationship between Australian workers' alcohol and drug consumption patterns and workplace safety.

7.4 Drug testing to detect alcohol or drug related risk to workplace safety

Workplace drug testing is a two stage process that involves an initial on-site screen using a point of collection test (POCT) device followed by confirmation of positive screens with laboratory analysis. For POCT devices, the risk of false positives and false negatives is relatively high depending on the type of device used, the target drug, and the expertise of the person conducting the test. This risk is reduced, but not eliminated, by laboratory confirmation of positive POCT tests. False positives can result from the detection of legally prescribed drugs, environmental contamination, poor interpretation of test results, poor quality testing, or errors or malfunction in the test device/method. False negatives can result from sample adulteration or substitution, poor interpretation of test results, poor quality testing, or test

device/method error or malfunction. To some degree, the potential risk of false positives is dealt with by subsequent laboratory analysis. Of more concern for the assessment of safety risk however are false negatives which are likely to go undetected.

The most common types of testing technologies used in the workplace are breath analysis, urinalysis, and saliva testing. All three test technologies have limitations. Apart from breath analysis, which can detect alcohol intoxication, no other workplace drug test can detect intoxication or impairment. Urinalysis is particularly problematic due to its inability to distinguish between recent and past drug use.

It is recommended that employers and employees are made aware of the potential limitations of workplace testing as a strategy for detecting alcohol or drug related risk to safety. These limitations are likely to be particularly evident when testing is used as a standalone strategy.

It is recommended that employers and employees are informed of alternative strategies that can be used in conjunction with testing to minimise these limitations.

7.5 Drug testing as a strategy to reduce workplace accidents and injuries

Despite the extent of workplace drug testing, both in Australia and the wider international context, the research literature contains only a relatively small number of evaluation studies. In general, these studies provided inconclusive results with some studies finding that testing had a significant effect in reducing workplace injuries and accidents, while others have found either a very small reduction effect or no effect at all. Moreover, there was evidence that in some cases, testing may negatively impact workplace safety by reducing workers' willingness to report minor injuries and accidents or near misses.

Of the studies that found workplace testing to significantly reduce accidents and injuries, most were methodologically flawed in that they did not control for other factors that may have also contributed to observed reductions in injuries and accidents. The inconclusive nature of evidence for the efficacy of testing is also reported in systematic reviews of relevant research. These reviews consistently report insufficient evidence to conclude that workplace drug testing reduces workplace accidents or injuries.

One reason for the discrepancy between inconclusive evidence concerning the efficacy of testing and the growing prevalence of testing may be potentially invalid assumptions underlying the relationship between workers' alcohol or drug use and workplace safety. The proposition that workplace drug testing reduces accident rates is based on several assumptions, including:

1. alcohol and drug use results in impairment which in turn contributes to workplace accidents
2. drug testing can detect use and impairment
3. the detection of use or impairment by conducting workplace tests, will result in fewer alcohol or drug related accidents and injuries.

However, as indicated by the evidence reviewed above:

1. alcohol or drug use does not necessarily result in impairment, and the incidence of alcohol or drug related accidents is likely to be low
2. breath analysis aside, drug testing cannot detect impairment
3. the detection of alcohol or other drug use following a workplace accident or injury does not automatically indicate causality.

To-date, evidence to support drug testing as an effective method for improving workplace safety is inconclusive. Support for workplace testing appears to be largely based on perceptions of effectiveness, rather than hard data or empirical evidence. Without such data or evidence both employers and employees may be reluctant to endorse workplace testing and the implementation of testing may draw resources and attention away from more effective strategies.

It is recommended that evaluation studies that examine the effectiveness of testing, using rigorous research methodologies such as randomised controlled trials and controlling for potential confounders, are undertaken.

7.6 Drug testing as a strategy to deter use

Only four studies were identified that have examined the efficacy of testing in deterring use. As with research concerning the efficacy of testing in improving workplace safety, the results of these studies were inconclusive. The two studies that found drug testing did deter use failed to control for other factors that may have also played a role, while a more rigorous study found only a small effect that was similar to other non-testing strategies.

Data that shows a decline in positive test rates after the introduction of workplace testing are often posited as evidence that testing can deter use. However, one study reviewed in this report found the prevalence of workforce drug use rose during the same period that positive test results declined. A number of different reasons were cited to explain why this may have occurred including, 1) changes in the types of drugs used, 2) only testing for specific types of drugs, and 3) test evasion and specimen adulteration or substitution.

The evidence reviewed also indicated that whether drug testing influences an individual's decision to use drugs largely depends on the individual's personal attitudes toward drug use and the significance they place on any sanctions associated with a positive test.

As evidence concerning the effectiveness of workplace drug testing in deterring use is extremely scarce, it is recommended that research is undertaken to determine if testing deters use, and to assess how any observed deterrent effect operates.

7.7 Best practice workplace drug testing programs

To be effective, any strategy to improve workplace safety needs to be:

- 1) based on principles of quality practice, and
- 2) be accepted by employees.

Whether employees hold negative or positive attitudes toward a workplace safety intervention can play a crucial role in the ultimate success or failure of that intervention. The research literature indicates that for drug testing to be accepted by employees, it should be justified as being necessary to address an identified risk and the associated policy and procedures need to be adequately disseminated and applied in a procedurally fair manner.

Testing programs identified as likely to be accepted and endorsed by employees were those that:

- involved counselling, treatment, and rehabilitation rather than punitive outcomes
- were targeted toward safety-sensitive rather than non-safety-sensitive work roles
- allowed for employee input into the development and implementation of the program
- allowed for a right of appeal.

Research evidence highlights that the development and implementation of testing should adopt a holistic approach to OH&S, and involve consultation between employers and employees. Such an approach is consistent with Australian industrial relations and occupational safety legislation and is likely to enhance employee acceptance of testing.

Adopting a holistic approach involves the identification and implementation of additional strategies to support the testing program that are based on the needs and resources of individual workplaces. These could include strategies with demonstrated effectiveness such as brief interventions, health and lifestyle programs, psychosocial skills training and peer referral.

The inclusion of education and training within the testing program is important as it not only crucial for the effective dissemination of the testing policy, but has demonstrated efficacy in influencing workers' alcohol and drug related behaviours and attitudes. However, for education and training programs to change attitudes and behaviours, they need to go beyond a focus on how the testing program operates to include content on identifying and responding to health and safety risks associated with alcohol and drug use.

The lack of clear guidelines that employers can access and utilise may be a significant factor in workplaces not implementing best practice strategies in this area. With the exception of some industry-specific legislation (e.g., rail and civil aviation), Australia has no generic legislation, regulatory framework, codes of practice, or guidelines that address workplace drug testing. Thus, many employers and employees are unaware of their rights and responsibilities regarding this issue, and unclear about which strategies constitute best practice.

It is recommended that guidelines for the design and implementation of best practice workplace testing programs are developed and disseminated. It is also recommended that the potential for introducing legislation, regulatory framework, or codes of practice concerning workplace testing is assessed.



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Appendix A:

Methodology

A comprehensive literature search was undertaken to obtain and appraise information related to:

- The prevalence of workers' alcohol and drug use and the extent to which this use is associated with negative workplace consequences in terms of accidents, injuries and productivity
- The effectiveness of alcohol and drug testing to reduce occupational accidents, injuries and deterring alcohol and drug use
- The features of drug testing programs that make them more (or less) acceptable to employees.

The CINAHL, Medline, PsycLit, ProQuest and Web of Knowledge citation databases were searched for relevant research articles published post-1990 using combinations of the following terms:

work*	alcohol	drug	substance
occupation*	employ*	test*	screen*
reduc*	impair*	injur*	detect*
deter*	death	fatal*	

Results of these searches were assessed and articles relevant to the topic retrieved. A total of 189 research articles were identified as a result of this review.





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