Introduction

Drug abuse in South Africa poses immense challenges to organisations involved in education, health care, law enforcement and industrial safety as far as prevention and reliable detection is concerned. This manuscript discusses the critical issues related to drugs-of-abuse testing in schools and the workplace. It is the experience of the author that most of the South African public as well as workforce (employers/employees) are unaware of the pitfalls in drugs-of-abuse testing practices and it is therefore essential to convey the correct information to this extent. A false positive drug test result can not only cause devastation to the individual, but may also impact tremendously on their family life.

The consumption of illicit substances are prohibited by South African Law and can be detected by either clinical behavioural or biochemical analytical laboratory testing. The latter is more reliable and the responsibility of drugs-of-abuse detection in humans currently resides mainly with medical practitioners and health workers in private practice and industry. Concerned parents also perform this task sometimes in the privacy of their homes to test their children for drug abuse. Detection of illicit compounds in humans has, like the proverbial coin, two sides to it. The one side being the protection of the learner/worker/organisation against the detrimental effects of illicit substance use, through the prevention of false negative results; the other side relates to the protection of the individual’s integrity in the case of a false positive result. The minimisation of the number of false positive or negative results therefore requires a constant and conscious effort. Ignorance as far as the testing strategy is concerned will render the drugs-of-abuse detection procedure not only worthless but also has the potential to harm all parties involved, especially children. The following factors are of prime importance in detection of drugs-of-abuse in humans: choice of bio-sample matrix, sampling protocol and bio-analytical procedure.

Choice of bio-sample

Various matrices such as plasma, serum, urine, saliva, hair, nails, etc. can be utilised for biochemical laboratory analysis. Saliva, hair and nail sampling is obviously the least invasive, however, the latter two will only reflect long-term use and care should be taken to eliminate environmental contamination. Plasma and serum samples are typically used for emergency testing and therapeutic monitoring, since assays in these matrices will reflect the patient's current status.

Urine samples are normally used for the detection of illicit compound use in schools and workplaces. Urinary detection is also regarded as sufficient proof that the compound has been part of the body's internal environment, whereby it could exert an effect on the central nervous system. Urine samples can also be taken relatively non-invasively as compared to blood sampling.

Sampling protocol

The sampling protocol should be based on principles that have been established internationally and should be designed to ensure that the entire drug testing process undertaken is capable of legal scrutiny. It should also provide safeguards to protect specimen donors and to provide accurate and reliable information about a donor’s legal/illegal drug use. Some guidelines on the collection of urine are given below.

The sampling protocol should ensure that the specimen is:
• Freshly voided.
• Not subjected to contamination during the sampling procedure.
• Protected against tampering and adulteration.
• Traceable back to the donor.

The donor’s written informed consent and permission that the results are allowed to be communicated to a third party is a prerequisite. Photographic identification by the donor is an absolute necessity before the sampling procedure commences and the chain-of-custody must be guaranteed.

The collection officer should adopt procedures to minimise the risk of adulteration of the specimen during the collection procedure. Both the donor and the collection officer must keep the specimen container/bottles in view at all times prior to the urine specimen being sealed and labelled. The specimen should be split into a minimum of two specimen bottles. One bottle will be used for the drug test while the second bottle will remain sealed at the analytical laboratory in case of a positive result being challenged. When the specimen is transferred from the specimen container to the specimen bottles, it must be poured and the collection officer should request the donor...
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to observe the transfer of the specimen and the attachment of the that any tampering with the specimen will be evident to laboratory personnel during the laboratory receipt.

The specimen bottle should have an identification label that contains at a minimum: the date, the donor’s specimen number and the donor’s signature initials. The collection officer should enter all information on the chain of custody form to identify the origin of the specimen. Both specimen bottles and all pages of the chain of custody will be labelled at the time of collection with a unique identifier. The donor should be asked to read and sign a statement on the chain of custody form certifying that the specimen identified on the form, was in fact the specimen provided by the donor. Disclosure of recent use of medication, or evidence that the donor was advised of the significance of recent medication should be indicated. The collection officer and the donor should be present throughout the procedures outlined in the paragraphs of this section.

Direct contact tests, like temperature measurement or on-site screening tests, should only be carried out on the residue of the specimen after the sample has been split and sealed into specimen bottles, i.e. to prevent contamination.

Bio-analytical analysis

The analytical strategy often includes a screening test (performed in private homes and laboratories) as well as a confirmatory test (performed by a competent laboratory). Immunoassay immunochromatographic testing kits (available from pharmacies and supermarkets) can be used only for preliminary screening to differentiate between negative and presumptive positive samples. It should, however, be kept in mind that this technology is subjected to:

- “In-vivo adulteration”, i.e. the person may consume specific formulations/chemicals that can mask a positive result, causing a false negative result. These formulations are freely available and can be purchased over the Internet. Large volumes of water and solutions of household vinegar and baking soda can also be employed for this purpose.
- “Cross reactions”, caused by other compounds, which may trigger a false positive result.

Screening assays

Immunoassay and enzymatic screening analyses are based on the interaction between an antibody and an antigen (drug). Cross-reactivity of related compounds is common to all assays which are widely available at pharmacies and supermarkets. Explicit claims of extreme selectivity and sensitivity for these testing kits are sometimes made by the suppliers; however, extreme care should be exercised when testing your loved ones since the active constituents in legal over-the-counter pain formulations, can be purchased over the Internet. Large volumes of water and solutions of household vinegar and baking soda can also be used of the specimen. It has been shown not to be subjected to in-vivo adulteration and is also highly specific for the individual drugs (and their metabolites), as opposed to compound class detection of immunoassay analysis. The MS-MS screening test includes all of the major compounds currently performed by immunoassay technology, alongside extra metabolites which may be clinically/forensically relevant.

Confirmation assay

Gas Chromatography-Mass Spectrometry (GC-MS) is without a doubt the “gold standard” for confirmation of presumptive positive screening tests and provides the highest level of confidence. Employed in a scientifically correct manner, it provides a result that can be regarded as a “fingerprint” of an illicit compound in urine.

Conclusions and recommendations

One of the major pitfalls in drugs-of-abuse testing in South Africa currently is the decisive and irresponsible use of screening test kits and corresponding results. Screening/preliminary tests results are employed incorrectly as decisive in decision-making processes where school children are involved. Disciplinary hearings, pre-employment screening and random drugs-of-abuse testing are also subjected to this malpractice.

Confirmatory testing by a competent pathology laboratory is essential for a drug test result, since it is well-known that an overwhelmed child/human cannot defend themselves sufficiently, or under extreme psychological pressure can even falsely admit the use of drugs.

The drugs-of-abuse testing kits, supplied by chain stores in South Africa, are usually based on the immunoenzyme colour strip detection technology and the public is mostly completely ignorant regarding the inaccuracies of these tests. The well-known “urine dip-sticks” and immunochromatography colour strip testing all reside within this class of testing methods and are therefore all subjected to non-specificity due to cross-reactivity. This has the potential of resulting in relative high rate of false positive and false negative results; i.e. a learner may be accused falsely of illicit compound use or the drug abuser may go undetected.

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