

PROBLEM DRINKING :
A CONSTRUCT AND ITS MEASUREMENT

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Department of Psychology
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ABSTRACT

A problem drinking screening test for general hospital patients was developed in five experiments as a measure of the construct of problem drinking. In Experiment I, test questions were selected from a group of 59 psychological and medical items on the basis of responses from 1613 hospital patients. The resulting Problem Drinking Screening Test (PDST) has a 23 item self-report section and an optional physician's section of four items. Experiments II to V are concerned with the validity and reliability of the PDST.

Viewing problem drinking as a construct is justified theoretically, and its relationship to alcoholism, to locus of control, to labelling theory and to idiographic and nomothetic measurement is given. A method for measuring the construct is examined from the perspective of George Kelly's 1955 Personal Construct Theory, and a mathematical explanation is presented.

The experiments are introduced by a comprehensive review of the available problem drinking instruments. This review is divided into psychological measures, biomedical measures, combined psychological and biomedical measures, and others. Finally, a brief review is provided of the statistical considerations in developing a test.

To Philippa, Chloe and Sabine

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CHAPTER ONE

INTRODUCTION

During December 1980 the Alcohol Research Advisory Committee of the North Canterbury Hospital Board initiated a pilot study on alcoholism among patients in Christchurch Hospital, appointing me principal investigator. One of the aims of the study was to find the prevalence of problem drinking in patients admitted to a general hospital. While it seemed a simple matter of collecting numbers, it soon became apparent that there was no operational definition of problem drinking, regardless of the fact that the alcoholism literature and health professionals frequently referred to terms such as "alcoholic" and "problem drinker" in a way which suggested that they had very clear conceptual and operational meanings. There have been various attempts to clarify the terms, such as Keller and McCormick's Dictionary of Words about Alcohol (1968), Keller's Lexicon of Disablements Related to Alcohol Consumption (1977), and the World Health Organisation's International Classification of Diseases (1977). However, these attempts at definition were theoretically useful but clinically inadequate. Confronted with a patient with drinking problems, clinicians seem to use terms which reflect their own phraseology rather than a label derived from a standardised measure.

While problem drinking may encompass various ideas

describing patients suffering from drinking problems, there is still difficulty in deciding which patient is, and which is not a problem drinker. The fact that this problem existed intrigued me and prompted the investigation which forms the basis of this thesis.

This thesis is about the construct 'problem drinking' and its measurement. While Cahalan (1970) is able to give an authoritative and empirically based description of the types of problems which describe problem drinking, the idiosyncratic nature of the phenomenon makes it clear that further theory is needed to explain the relationship between different types of drinking problems.

In Chapter two an explanation is given of the terms 'problem drinking' and 'alcoholism', and their relationship as it applies in this thesis. In Chapter three problem drinking as a construct is discussed from the viewpoint of Kelly's 1955 theory of personal constructs. Chapter four reviews major problem drinking measures and Chapters five to nine are devoted to experiments which empirically develop a test to measure the construct of problem drinking.

Experiment I is the main experiment in which problem drinking test items were empirically selected to fit the construct parameters. This experiment was designed and carried out during 1981 and involved over 1600 patients at Christchurch Hospital. These patients are thanked for their co-operation as are the research assistants (Jan Reid, Michael Rose, Robyn Inman, Linda Garforth, Pam Alexander and Belinda Kennedy) who collected about 200 variables on each

patient. This data collection would not have been possible without the support of the Department of Labour. The research assistants had a difficult job interviewing patients under the constraints of a rigorous research design, while at the same time being sensitive to the needs of patients, nurses and doctors on the wards. To many of the staff and administration of Christchurch Hospital and the North Canterbury Hospital Board this research was a major intrusion, yet they not only allowed it but encouraged it. Special thanks are due to Dr David Andrews, Superintendent of Christchurch Hospital, and to Dr Andrew Hornblow, at that time the Acting Head of the Department of Preventive and Community Medicine. Both provided support, advice, and office accommodation throughout the study. My thanks also to Ruth Helms who typed the questionnaires and who acted as the contact for this experiment.

Thanks also go to the University of Canterbury for administering the salaries of the research assistants, and for the considerable assistance of the staff at the University's Computer Centre for their data preparation and advice on the seemingly never-ending complex computer management matters.

Mr Scott Wells assisted during the summer of 1981-82 with the data management and analysis of Experiment I. He is thanked for his contribution and his willingness to learn the complexities of the University's Prime and Burroughs computers.

In Experiments II and III the validity of the developed

test was investigated. Experiment II was a study during 1983 of convergent validity, which involved 71 patients being treated for alcoholism, from Sunnyside and Queen Mary Hospitals. Experiment III was a cross-validation study carried out during 1981 on 165 similar patients, again from the same hospitals. Thanks go to the staff and patients of Mahu Villa, Sunnyside, and Queen Mary Hospital for their time and co-operation. My particular thanks to Dr Robert Crawford, Superintendent of Queen Mary Hospital, and to the Charge Nurses and Dr Norman Walker of Mahu Clinic. Karen Baird and Yi Sheng-Yee kindly assisted with the data collection during these two experiments.

Experiments IV and V were concerned with the internal consistency and reliability of the test. Experiment IV involved 537 of the patients from Experiment I; and Experiment V was conducted during 1984, using 23 patients from Mahu Villa, and 44 patients from Queen Mary Hospital. These patients are thanked for their co-operation, and also Valerie Quinn for her assistance with data collection.

My thanks to Christine Johannis for typing the pilot questionnaires and the final questionnaires for Experiments II to V and for attending to the endless administrative details connected with these studies.

My initial interest in Kelly's construct theory came from attending Professor Ken Strongman's lectures at the University of Canterbury during 1980. It was his lectures on personality theory which stimulated me to apply construct theory to the concept of problem drinking.

Dr David Robinson from the Mathematics Department at the University of Canterbury assisted with a mathematical explanation of the construct and his help is appreciated in showing me iterative and inverse matrix solutions.

The North Canterbury Hospital Board's Alcohol Research Advisory Committee provided guidance and support over the three years during which data were collected. This committee always provided constructive criticism on the organisational aspects of the studies. The committee's membership was: Dr Elisabeth Wells, Dr William Black, Dr Robert Crawford, Dr John O'Hagan, Ms Barbara Smith, Ms Tor Wainwright and until mid-1983, Dr Laurence Malcolm as Chairman.

A major acknowledgement is given to: Dr Elizabeth Wells for her advice on statistical matters relating to the experiments; to Dr William Black who acted as my advisor, mentor and supervisor; and to Christine Johannis who patiently typed the final manuscript.

Finally, thanks to my family, Philippa, Chloe and Sabine who endured well beyond reasonable limits, my absence during the writing-up stages.

CHAPTER TWO

THE CONCEPTUALISATION AND DEFINITION OF ALCOHOLISM: AN
OVERVIEW

2.1 INTRODUCTION

Without some accepted definitions, such commonly used terms as alcoholism, problem drinking and alcohol dependence have little value. Although agreement among researchers and clinicians is on the increase, there are still many definitions to be found in the alcoholism literature. While most of these are not, strictly speaking, conflicting, neither do they have a high degree of congruence. A prevalence estimate based on one definition usually cannot be compared meaningfully with another estimate using a different frame of reference and another population. As an example, the estimate of more than nine million alcoholics in the United States was adopted by the National Institute of Alcohol Abuse and Alcoholism and accepted by the media in 1971. This estimate was based on evidence from epidemiological studies reported by Cahalan and his associates which covered numerous varieties of problem drinking, including but not restricted to alcoholism (Cahalan, 1970; Cahalan and Room, 1972, 1973). In comparison, this would have been a large increase over the official national estimate of five to six million Alcoholics used by the National Advisory Committee on Alcoholism in 1968 (National Advisory Committee on Alcoholism, 1968). While it

is possible that the prevalence did substantially increase from 1968 to 1971, the change is more likely indicative of how the use of terms can alter perceptions and give false impressions of changes in the nature of a phenomenon.

Cahalan (1970) takes the point even further:

comparing estimates of alcoholics and problem drinkers is a rather futile exercise, because the concepts of alcoholism and problem drinking are not very similar, do not necessarily apply to the same sufferers, and may have quite different implications for etiology and preventive public health measures and treatment. (p3).

The confusion and disagreement over the use and meaning of alcoholism terms are best understood from a historical perspective.

In 1946 Jellinek published a paper on the phases of alcoholism that was based on the responses of 90 white male members of Alcoholics Anonymous who happened to respond to a questionnaire prepared by some of their members. Although Jellinek pointed out that the sample was biased and the questions scientifically imperfect, Jellinek's resulting theory (Jellinek, 1952) had a significant impact. In 1960 Jellinek devised a system of alcohol abuse: alpha (no physical dependence, psychological dependence and symptoms), beta (medical symptoms but no physical dependence), gamma (symptoms and physical dependence), delta (physical dependence but few symptoms), and epsilon (binge drinking). In this system Jellinek was clearly differentiating between non-addictive alcoholism (alpha and beta) and addictive alcoholism. It provided a neat, sequential, life history of alcoholism and soon became the basis for studies on the drinking history of long-term alcoholics, dominating both assumptions and research designs well into the 1960s, and

remnants still exist today. As early as 1953, however, Straus and Bacon labelled college students who were repeatedly getting into difficulty because of drinking, as "problem drinkers", because they did not fit the prevailing disease model of alcoholism. Bacon (1973) commented that while the traditional model has been enormously productive in the past, it is now "emerging as the great new cop-out for avoiding effective response to this problem of alcoholism." (p.26).

Based on the notion that alcoholism is by nature a progressive disease (Jellinek, 1952), it has usually been assumed that minor drinking problems are probably indicative of impending alcoholism or Jellinek's "pre-alcoholic" phase. However, Pattison, Sobell and Sobell (1977) cite convincing evidence that for the great many individuals, and perhaps even the majority, the distinct progressive nature formulated by Jellinek and others is not accurate, and often unnecessary. Edwards (1974) concluded that there is little gain from dividing alcoholism behaviour into discrete and discontinuous groups, and that viewing such behaviour as a continuity of multidimensional variables producing different syndromes is considerably more plausible. This view has been supported by others (e.g. Pattison et al., 1977; Edwards and Gross, 1976; Hodgson, 1980; Chick, 1980; Skinner and Allen, 1982; Chick and Duffy, 1979).

The shift from the disease model of alcoholism to other theories attempting to explain the phenomena has generated further terms to add to the growing repertoire for the layman and professional. Several attempts have been made to standardise terminology. The National Council on Alcoholism

(1972) criteria are important for emphasising both biomedical and psychosocial factors related to excessive drinking. However, these criteria have been criticised because they lead to a unitary diagnosis (Pattison, 1981), and considerable redundancy among the criteria is evident (Ringer, Kufner, Antons and Feuerlein, 1977). The Diagnostic and Statistical Manual of Mental Disorders (DSM-III) of the American Psychiatric Association (1980) recognises two disorders: alcohol abuse and alcohol dependence, where the latter condition is evident either by alcohol tolerance or withdrawal. Previously, a World Health Organisation (WHO) task force distinguished between a core dependence syndrome and disabilities which either result from or are related to excessive drinking (International Classification of Diseases, revision 9, WHO, 1977). However, the alcohol dependence syndrome has not escaped criticism (Shaw, 1980) and Edwards, Arif and Hodgson, (1982) have attempted to define terms such as drug abuse, drug misuse, neuroadaptive state, dependence, and drug related disability, which are important in the syndrome.

Referring to the problems of definition researchers and clinicians are confronted with in the alcohol field, Bacon (1975) notes that:

The participants seemed to be talking about different things under the same label and talking about the same things under different labels; they seemed to have brought different languages, methodologies and philosophies to bear upon whatever the label might be (p.59).

Christie and Bruun (1969) have noted the emotionality which pervades the alcoholism field in its definitions as well as ideas; and the inadequacy and vagueness of the definitions

apply to words of fundamental importance, such as dependence, habituation and addiction. While adding their own contribution to the chaotic field, these authors suggest a reason for the survival of inconsistent and imprecise terminology: the terminology is socially functional. However, they argue for the removal of social functionality to achieve intellectual clarity. Keller (1977) states:

It is a comforting thought that the continuing terminological chaos in the alcohol problems field may be symptomatic of a creative stage. For surely this field is still in its budding stage of conceptualisation. (p.24).

Keller also notes that not even the combined efforts of the World Health Organisation and the National Institute on Alcohol Abuse and Alcoholism can dissuade people from adopting Humpty Dumpty's attitude: "When I use a word it means just what I choose it to mean."

Nevertheless, it is impossible to discuss alcoholism without adopting some labels, however inadequate they may be. The following discussion defines problem drinking as it is used in this thesis, and describes its relationship to alcoholism.

2.2 PROBLEM DRINKING AND ALCOHOLISM

It is difficult to determine when the term problem drinking first appears in the literature. Undoubtedly it had common usage prior to Plaut's (1967) formal definition as "...a repetitive use of beverage alcohol causing physical, psychological, or social harm to the drinker to others." (pp37-38).

Cahalan (1970) points out that one of the difficulties of this definition is in establishing causality in relation to problems, and that it is very hard to determine whether a maladjustment in interpersonal relations stemmed from someone's excessive drinking, or whether the drinking was a reaction to an intolerable situation. Cahalan suggests that the terms "problems associated with the use of alcohol" or "problem-related drinking" are precise, emphasizing that the focus is on the problems associated with drinking of certain kinds under certain circumstances, rather than implying that drinking per se necessarily constitutes the problem. Cahalan further adds that the terms problem drinking and drinking problems can be used as a form of short hand, while their meaning should be clear. Cahalan gives good reasons for adopting this system:

First, any labels need to be free of adverse side effects, such as serving as barriers to thinking on the part of clinicians and the general public. Also, the term problem drinking should encourage research and debate about the etiology of alcohol abuse, since the emphasis is on the behaviour rather than on the person, permitting inquiry into whether there may be many different types of drinking problems and problems drinkers.

Provided the label problem drinking can always be accompanied by a statement of the kind of problem, then it is much to be preferred to that of alcoholism. Again Cahalan gives good reasons for this: One is that specifying the kind of problem encourages the investigations of actual or potential problems

in which alcohol is involved. Another is that problem drinking does not have the emotional connotations of alcoholism, with alcoholism being fixed as the property of the medical profession or Alcoholics Anonymous. All too frequently alcoholism suggests a rock bottom condition which does not allow for solving problems related to excessive drinking at an early stage. Finally, the term problem drinking has the advantage that a distinction can be made between the problem and non-problem drinker, whereas alcoholism implies that alcohol is at the root of the difficulty, with little emphasis on individual and environmental factors.

For these reasons, problem drinking will be the concept used in this thesis, rather than alcoholism. The next step is to determine which problems give rise to problem drinking.

Cahalan believes that a definition of an alcohol problem should stem from the frequency or repetitiveness of problem behaviour. Bailey (1966) and Knupfer (1967) concur that an operational definition of drinking problems must take into account the type, intensity, and frequency of problems. Cahalan lists eleven broad categories of drinking problems which characterise problem drinking, based on the hypotheses of Jellinek (1960), Keller (1962), Plaut (1967) and several studies of drinking problems (Cisin, 1963; Fink, 1965; Knupfer, Fink, Clark and Goffman, 1963; Kirsch, Newcomb and Cisin, 1965; Cahalan, Cisin and Crossley, 1969). Four types of problems are concerned with the drinking behaviour itself or with reasons for drinking (frequent intoxication; binge drinking; symptomatic drinking; psychological dependence),

four are connected with interpersonal relations (problems with spouse or relatives; problems with friends or neighbours; job problems; problems with law, police, accidents) and three are miscellaneous problems which cannot conclusively be classified into prior categories (health; financial problems; belligerence). Further, Cahalan is able to give the criteria for a person to score on each of the eleven categories (pp28-32).

While Cahalan restricts the term problem drinking to these broad categories, it is not difficult to envisage that within each category there will be further alcohol related problems, having their own severity and frequency and all contributing to the broad problem category. For example, a person with job problems may have lost a job because of drinking or because of poor work performance related to drinking, or because of a number of other possibilities.

Because of the large variety of alcohol problems which can describe the problem drinker, this thesis will adopt Keller and McCormick's broad definition of a problem drinker as:

An excessive drinker whose drinking causes private or public harm and who is seen to cause problems for himself or for others. The category includes the alcoholic. Often, a euphemism for alcoholic, used especially in business and industrial programs, or to avoid the implication of a diagnosis. (1968, p. 38)

This definition is by no means perfect, and it begs the question of what constitutes excessive drinking. Other attempts at definition have been no better (e.g. Plaut, 1967; Knupfer, 1967). However, Matross and Hines (1982) were able to show that there is considerable agreement among the public, researchers and clinicians on the general content of

the signs of problem drinking. While the content of problem drinking will be covered in the later chapters, there are two other supplementary considerations to Keller and McCormick's definition which this thesis uses. First, "problems" are those behaviours which are perceived as problems by the individual himself or by significant others (such as wife, friends, employers, police or clinician). Second, recognition must be given to the duration and severity of the problem, since this not only indicates whether the problem is current, but can also be used to infer the frequency of behaviour. Both of these considerations will be explored more fully in Chapter three.

Given that the definition of problem drinking includes those who are alcoholic, and that being alcoholic is congruent with being alcohol dependent (Edwards and Gross, 1976), then in this thesis problem drinkers will be divided into two broad categories, those who are dependent (the alcoholics) and those who are non-dependent. Where possible the term alcoholic will be avoided because of the same difficulties associated with the term alcoholism. However, when citing literature which refers to alcoholics the term will remain, since it is usually not clear whether the authors mean dependent problem drinkers, or simply problem drinkers.

2.3 THE NEED FOR FURTHER THEORY ON PROBLEM DRINKING

There are a number of sound reasons for a further theory on problem drinking.

First, with the exception of Jellinek's and Cahalan's preliminary formulations there has never been any formal or salient theoretical framework for the concept of problem drinking. This does not mean that current ideas and terms should be replaced by something new. The theory to be proposed here complements these and is intended to suggest how various problem drinking terms may be related. The theory is not concerned with the intrinsic aspects such as etiology, epidemiology or treatment, but arises out of the need for a framework to tentatively describe a process to measure problem drinking.

The second need for such theory is an extension of the first. Successful communication between researchers and treatment professionals can substantially contribute to the ways in which the needs of the patients will be met. If terms are being used ambiguously or interpreted to have a different meaning from that intended, patients are likely to suffer in many ways. Some of these problems have been examined by Robinson (1976), and it seems probable that some terms are so imprecise that they only act to add to the confusion. Cartwright, Shaw and Sprately, (1975) have gathered information on the way ordinary people handle concepts of abnormal drinking, and it is clear that although there is a widespread token acceptance of alcoholism as a disease, there is confusion about what is meant by problem drinking, which is contrary to the cited evidence of Mulford (1977). It is possible that such inconsistent views stem from the researchers' different understanding of problem drinking, highlighting the need for a common denominator through which discussion can take place.

The third reason is that it would provide a research basis for investigating methods of assessment. To the author's knowledge, there is currently no instrument which claims to measure problem drinking, although various tests (summarised in Chapter Four) designed to detect alcoholics or alcoholism have been used as research tools for problem drinking. (See MacIntosh (1982) for a comprehensive review). This thesis examines the development of a screening test for problem drinking based on viewing problem drinking as a construct.

CHAPTER THREE

PROBLEM DRINKING AS A CONSTRUCT

3.1 INTRODUCTION

Worden and Rosellini (1980) point out that alcohol-related problems are much more complicated, blurred and fuzzy than the crystalline purity that professional orthodoxy implies. Yet each individual investigator uses his own mind in subtle and complex ways to interpret these problems. In other words, his cognitive processes, especially those that describe the individual's subjective view, determine for that individual the nature and extent of a particular problem. According to George Kelly (1955), all persons are primarily cognitive: they think, they learn, they interpret and organise the world around them in their minds.

Any theory which is based on a person's subjective view of the world must explain what structures and processes for knowing the world are common to all people, otherwise it is impossible to explain individual variations and differences. For Kelly, personal constructs, or categories for the interpretation of events, are the basis of subjective experience. Kelly proposed that the cognitive process consists primarily of the ways in which individuals interpret and classify things. His fundamental postulate is that "A person's processes are psychologically channelised by the ways in which he anticipates events." (p.46); that is, all

individuals develop their own category system which guides perceptions, actions, expectations and responses. Kelly refers to these categories as personal constructs.

The American Psychological Association's definition of a psychological construct, in their Standards for Educational and Psychological Tests (1974) is:

an idea developed or "constructed" as a work of informed, scientific imagination: that is, it is a theoretical idea developed to explain and to organise some aspects of existing knowledge. (p.29).

This definition differs from Kelly's in that the construct is determined by observers, while Kelly's is an individualised one. Kelly, in fact, explores precisely the meaning of a particular set of constructs, and it is this preciseness which is appealing.

In this chapter, the reasons why problem drinking can be viewed as a construct will be explained, drawing from George Kelly's personal construct theory. His theory was chosen for a number of reasons: First, while personal construct theory is a personality theory, in the writer's view it has direct application to problem drinking. Second, unlike most theorists, Kelly attempts to bridge the gap between theory and research. He suggests a means for identifying personal constructs in the Role Construct Repertory Test (1955, Chapters 5 and 6). While this test is not used here, some of its derivations are. Last, Kelly's theory emphasises the person's own view of the world. Measurement for problem drinking needs to include the individual's own perception of the problem since failing to do this is paramount to removing a person's right to determine his future.

3.2 PSYCHOLOGICAL MEASUREMENT AND THEORY

Distinctions have sometimes been made between the terms "theory" and "models" (e.g. Davidson, D., Suppes, P. and Siegel, S., 1957; Lachman, 1960). For example, a theory can refer to a set of assertions about inter-relationships among processes or constructs presumed to underlie and account for observed phenomena in some domain. On the other hand, a model can be restricted to a separate system of symbolic representation. In this thesis, both theory and model will be used in connection with measurement, and will refer to the elements, properties, and relationships represented in symbolic and mathematical systems that are co-ordinated in experiments with properties of empirical phenomena. The elements of the model are constructs which can be represented by real numbers. The theory explains how to assign numbers to the elements in such a way that the numerical operations and relations are isomorphic to certain specified empirical operations and relations.

Since the theoretical properties are difficult to determine without measurement of some kind, the problem of assigning numbers is somewhat circular and needs to be approached iteratively by successive evaluations and subsequent changes in measurement. However, the application of the measurement techniques described could provide insights into the nature of the properties of problem drinking. In discussing the application of measurement to personality theory, Messick and Ross (1962) point out that

systematic attempts should be made to relate the assumptions and requirements of the model to properties of observed behavioural consistencies. (p. 4).

Once the structural relations of problem drinking can be reflected in an empirical domain, measurement can begin. The choice of the measurement approach will depend upon the modelled relationship between the respondent and test responses. Another consideration in measurement choice is to select measures which serve the goal for which the test was intended. Since the validity of a measure is directly connected to the purpose for that measure (Bavelas, 1978) and if the measure is valid, then the means and the ends of the test match.

The remainder of this chapter is devoted to investigating a theoretical framework from which to measure the construct of problem drinking. The relationship of the construct to locus of control, idiographic and nomothetic measurement and to alcohol dependence is discussed. The involvement of labelling theory and self-efficacy to the problem drinking construct are also mentioned (Appendix A), and a simple mathematical explanation is presented (Appendix B).

3.3 DEVELOPMENT OF THE PROBLEM DRINKING CONSTRUCT

In order to understand a construct, it is necessary to understand both what it means and what it does not mean. For example, saying someone is a problem drinker has meaning only in relation to non-problem drinking. All constructs are essentially dichotomous according to Kelly (1955) and Bavelas

FIGURE 1

The Construct of 'Non-problem vs Problem'

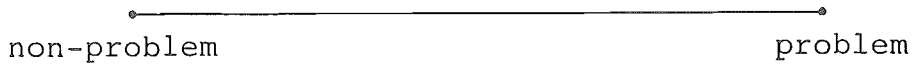
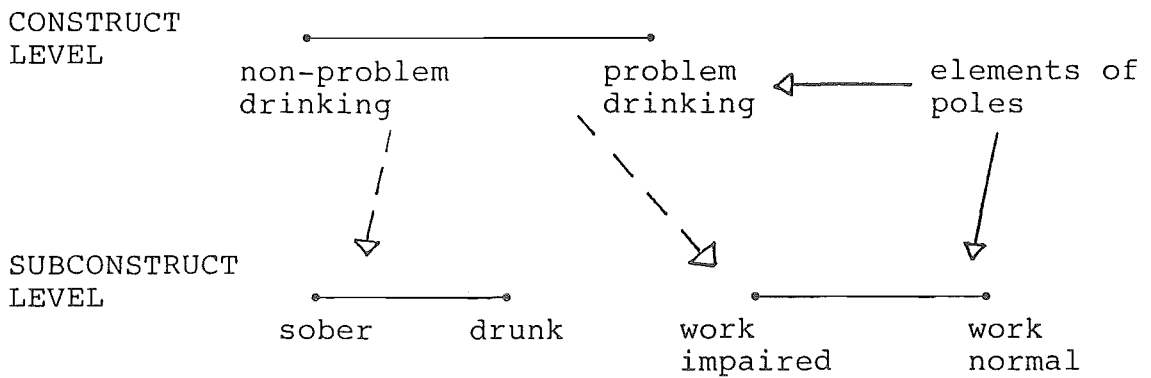


FIGURE 2

The Relationship Between Subconstructs,
Poles and Elements



(1978). However, Kelly continues to say that "... it is still possible to conceive of graduations, as Landfield (1954) did, along a dimensional line." (p.141).

A construct then, is a bipolar idea which organises some aspects of existing knowledge along a continuum which has end points representing opposite poles. For instance, consider Figure 1 which represents a non-problem versus problem construct. A person may perceive some aspect of behaviour along this dimension in terms of problem, non-problem and combinations of these. A number of comments can be made here:

First, viewing constructs in this way enables the user to predict or construe events. For example, as soon as a person is seen to have a combination of problem and non-problem, then we imply that it may happen again. According to Kelly, the very act of construing on a construct makes it impossible not to suggest prediction. This is the usual process of clinical diagnosis. That is, if problem drinking is a construct then it should enable a clear distinction to be made between what it is, and what it is not. Kelly argues that constructs are primarily personal, and that the communication of a particular construct may be misleading to the listener. Kelly further says that there is also confusion over the two-ended nature of constructs and the possibility that one person's problem may have quite a different continuum stretching away from it than does another person's problem. Another aspect of Kelly's theory, which is exemplified in problem drinking is that the constructs have

ill-defined word labels. However, Kelly believes that the alternatives and meanings derived from the action of construing are

not so vast as to be unmanageable, ... and the skilled clinician may be able to tease out the meanings and linkages ... (p.199)

Second, constructs according to Kelly can be formed into an additive type of scale. If, for example, the construct problem versus non-problem drinking is built out of the constructs hazardous versus normal drinking, employed versus unemployed, and married versus single, then a person's representation on the problem versus non-problem drinking is the sum of the representation of each of these bipolar sub-scales. It is suggested here that problem drinking is the pole of a construct incorporating the sum of many representations on subconstruct scales. Also, terms such as drunk, sober, hazardous drinking, arguments, fights, etc. frequently used in this chapter are used only as examples of constructs for the purpose of discussion and are not intended to have precise operational meanings.

It is now necessary to make three definitions: The first two are from Kelly's (1955) theory, and the third is original.

Definitions:

1. Elements:

"The things or events which are abstracted by a construct are called elements." (p.137).

2. Pole:

"Each construct involves two poles, one at each end of its dichotomy. The elements associated at each pole are like each other with respect to the construct and are unlike the elements at the other pole." (p.137)

3. Subconstruct:

A construct which subsumes a higher-order construct.

Rather than referring to a construct by the elements at both ends of the poles, such as non-problem versus problem, in the following discussion generally only one element will be named to describe the construct. The opposite element will be assumed; for example, "drunk" will represent drunk versus sober. This method of naming is in line with Kelly who says:

Any one of the like elements in the context of one's construct may give the construct its name.
(p.138).

"Like elements" defined by Kelly are those at one end of a pole.

A consideration in explaining the implicit use of constructs in problem drinking is the availability of validating data. Cronbach and Meehl (1955) describe construct validation as the study of "... predicted relations among observables" (p.300). However, in order to do this there must be enough theoretical knowledge to know what predictions to make. This problem has been anticipated by Cronbach and Meehl:

we will be able to say "what anxiety is" when we

know all of the laws involving it; meanwhile, since we are in the process of discovering these laws, we do not yet know precisely what anxiety is. (p.294).

The parallel here is that the development of a simple measure for problem drinking is impeded by the lack of detailed and sophisticated knowledge of the theory into which it might fit.

Proposition:

Problem drinking is a construct which contains a variety of subconstructs, each defined by the idiosyncratic responses of individuals to alcohol consumption.

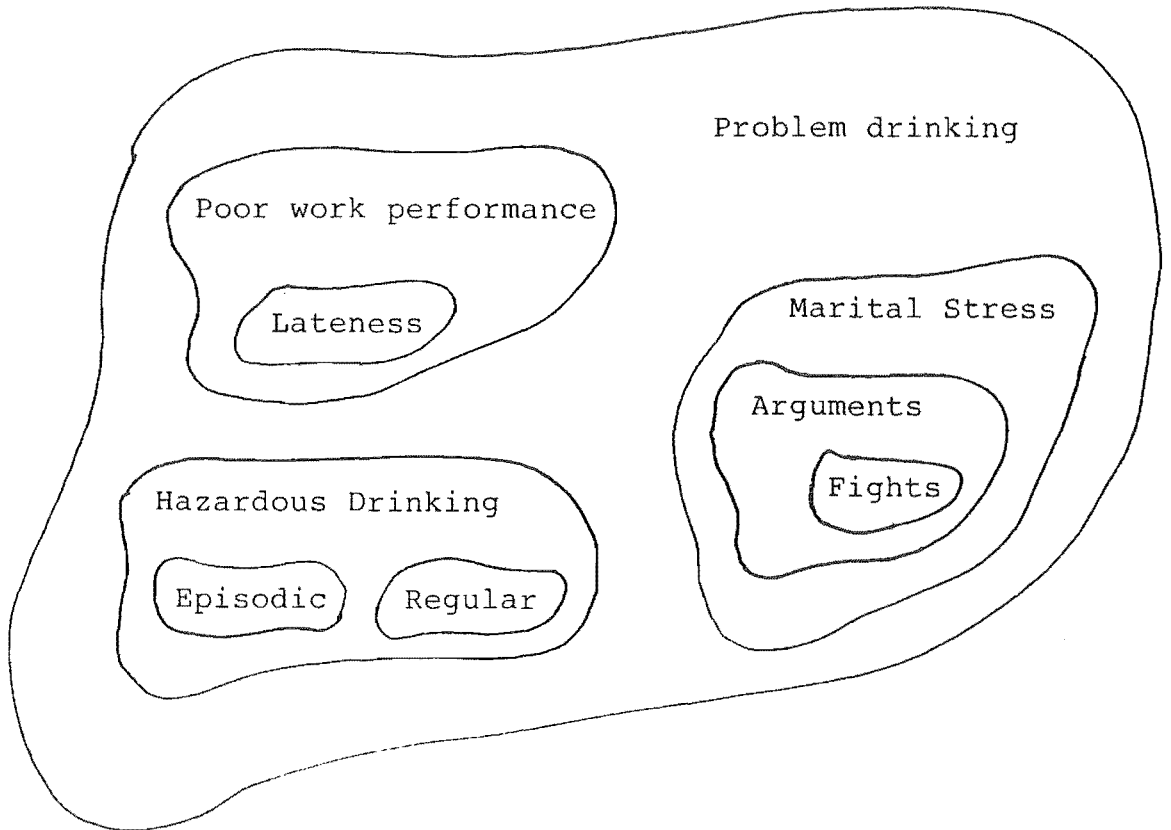
Discussion of the Proposition

There are many descriptions of which responses do, and which do not make a problem drinker. Elements of problem drinking may or may not include accidents, crime, social misdemeanours, hazardous drinking, marital stress, poor work performance etc (see Worden and Rosellini, 1980; Cahalan, 1970). It is suggested here that these elements are the poles of bipolar subconstructs of problem drinking, each operating on a continuum. Figure 2 shows diagrammatically the relationship between subconstructs, poles and elements.

Take, for example, the construct 'marital stress'. Any person who is married can be represented by combinations of the elements representing the end points of this scale. However, 'marital' is a construct itself, perhaps being subsumed by a higher-order one such as 'status'. In turn, 'status' can be subsumed by another higher-order construct.

FIGURE 3

Three Possible Subconstruct Arrangements



Whenever one construct is subsumed by another, the former, by definition, becomes a subconstruct. Kelly (1955) refers to this process as "symbolism" (p.138). In theory, this process may be extended infinitely. Another example is given in Figure 3. The outer line represents the boundary for the construct 'problem drinking'. The area outside this boundary Kelly terms a "constellatory construct",

which permits its elements to belong to other realms concurrently, but fixes their realm memberships. (p.155).

Each of the elements in Figure 3 represent one pole of a subconstruct. The choice of which pole (e.g. regular drinking or irregular drinking) is purely arbitrary. There are three possible situations in which the subconstructs can be arranged.

The first is when the subconstruct 'lateness' is a subset of 'poor work performance' which itself is a subset of 'problem drinking'. 'Lateness' is an amplification of the element at the end of the poor work performance scale (it would obviously be inappropriate to see lateness as an amplification of the good work performance end of the scale).

'Lateness' itself may have subconstructs. This is the second situation in which, for example, 'fights' is a subconstruct of 'arguments' which is a subconstruct of 'marital stress' which is a subconstruct of 'problem drinking'.

In the third situation, 'episodic' and 'regular' are disjoint subconstructs of 'hazardous drinking'. 'Episodic' and 'regular' may not be an amplification of either pole of the hazardous drinking scale, but rather an amplification of a

FIGURE 4

Near Normal Drinking Incorporating the Episodic Subconstruct

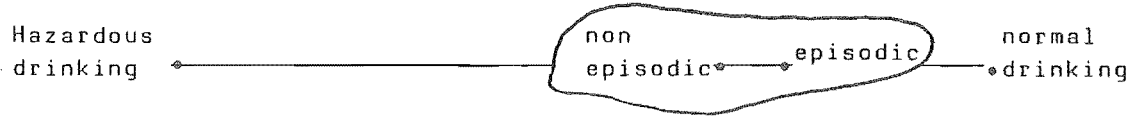
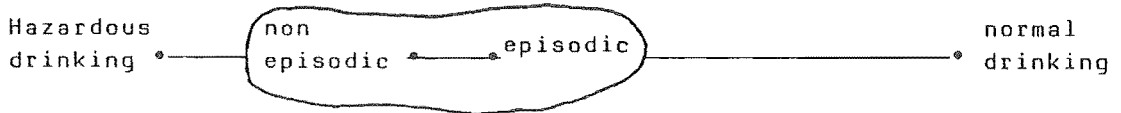


FIGURE 5

Near Hazardous Drinking Incorporating the Episodic Construct



combination of both. It is suggested here that the point at which this combination occurs on the scale is idiosyncratic. For example, some people may be episodic and near normal drinkers (Figure 4) while others may not (Figure 5). It is also suggested that 'problem drinking' is the sum of combinations of these elements from subconstruct scales. It would be possible, for example, for a problem drinker to have poor work performance although not be arriving late (Figure 3), and be a hazardous regular drinker with relative marital harmony although involved in some fights. It would also be possible for a problem drinker to have a completely different combination from the same scales. This idiosyncrasy is a possible reason for the difficulty experienced in deriving an operational definition for problem drinking.

So far, the subconstructs of problem drinking have been represented by bipolar unidimensional scales, with individuals responding idiosyncratically on these scales. However, it is necessary to examine more closely the nature of these responses.

Corollary

Responses on a problem drinking subconstruct scale are governed by internal and external perceptions.

Discussions of the Corollary:

This corollary is closely allied to the "problem of interpretation" (p.116) in Kelly's theory. That is, constructs are primarily personal, and, as mentioned earlier,

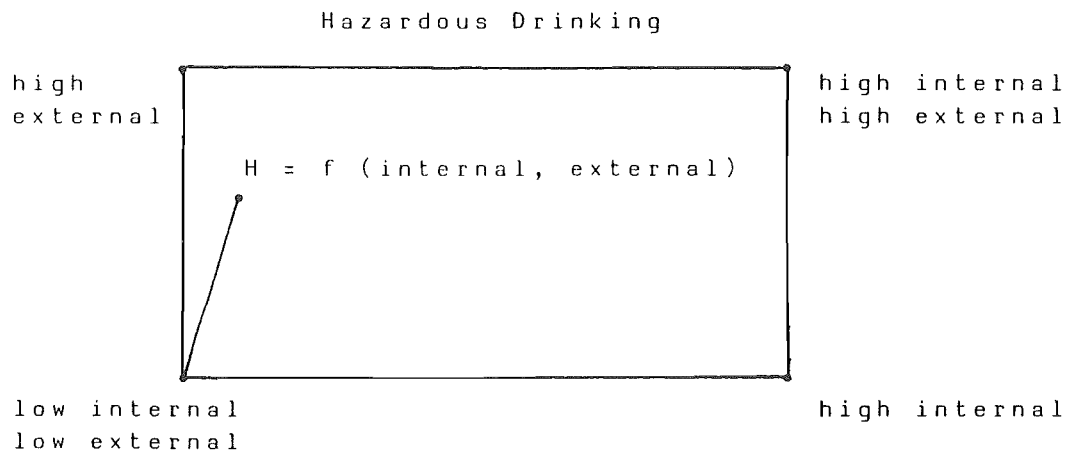
are not easily communicated. For example, take 'lateness'. An employee arriving at work one minute past the prescribed hour might consider it not late, but the employer may have very different views. In order to clarify these problems of interpretation, it is proposed to add another two dimensions to the structure of scales.

In measuring the construct of problem drinking it is necessary to account for the confounding nature of idiosyncrasy. Assessing unique, individual responses Allport (1937) calls "idiographic measurement". However, in the context of problem drinking, it would be inappropriate to rely totally on the idiographic responses of only one person. In the previous example the employee's interpretation of lateness was different from the employer's. There is not necessarily a correct or incorrect interpretation of lateness, but in fairness both interpretations need to be considered. In other words, the response on a scale for problem drinking should be made up from a combination of an internally perceived interpretation (that of the employee) and an externally perceived interpretation (that of others or the employer). Failure to account for both could result in incongruous situations. For example, an individual could interpret his drinking as normal while being observed by others to be withdrawing from alcohol dependence, in which case a diagnosis of normal drinking would not be proper.

Thus, two more dimensions of each problem drinking scale are suggested: those of high-internal versus low-internal perceptions and high-external versus low-external perceptions, henceforth referred to as internal and external

FIGURE 6

Internal and External Dimensions
of Hazardous Drinking



perceptions. 'Internal' means those cognitive processes which determine an individual's response to a stimulus designed to elicit attitudes or interpretations, such as "Do you think ...?" or "Do you feel ...?". An external perception, however, is the response to a stimulus designed to produce observable behavioural consequences. These behaviours are observable by all people and the observations are not so dependent on attitudes or interpretation. A high external stimulus could be "Have you been arrested for drunken driving?", or "Have you been admitted to hospital more than three times?". Naturally, no stimulus is likely to be purely externally or internally based, but rather will be made up of a combination of both. In the previous example 'lateness' could be fifty percent internal and fifty percent external, or thirty percent internal and seventy percent external, or numerous other combinations. The determination of these relative weightings will be discussed later. These internal and external perceptions are themselves subconstructs, and it is proposed in the corollary that it is these which determine the representation on each problem drinking subconstruct scale.

To illustrate how this process works consider the example in Figure 6 which shows how the internal and external perceptions determine a person's representation on the hazardous drinking scale. The corollary proposes that the value on the hazardous drinking scale is a combination or function of internal and external perceptions, or H on the figure. Obviously H can take a variety of perception values from low to high internal and external. Stating this differently, deciding whether or not a person is a hazardous

drinker (the value of H) depends on the perception of the individual (the internal perception) and the perceptions of others (the external perception). It is likely that this psychological process applies to any problem drinking subconstruct.

In summary, it has been proposed that the idiosyncratic responses to the scales of problem drinking are determined by a combination of representations on internal and external scales. Providing the subconstructs represent the content domain of problem drinking, it should therefore be possible to measure the construct of problem drinking by summing the scale representations of these subconstructs.

A case history

To illustrate the application of the theory consider the following hypothetical case history:

Jane was a 17 year old student who was admitted to hospital for acute abdominal pain. She had one younger brother and was the daughter of professional working parents. After passing the university bursary examination she moved into a flat with her boyfriend John, a 22 year old unemployed graduate, and intended to go to university the following year. She said she left home because her family was not a happy one, with her parents constantly arguing and Jane frequently being physically abused by her father. She said she did not begin drinking heavily until she was in the seventh form. She would drink spirits - usually vodka, in large quantities (half a bottle or more on one occasion) regularly on Friday and Saturday nights with the intention of getting drunk. She said this pattern of drinking had been going on for about a year or more. Jane reported that once she had one drink she had a craving for more and had often drunk alcohol to try to get rid

of morning trembling and nausea. She attributed the morning nausea to her drinking, felt she would like to drink less, and thought her relationship with John was deteriorating and that he had threatened to leave because of her drinking. All Jane's liver function tests were normal, indicating no liver damage due to alcohol.

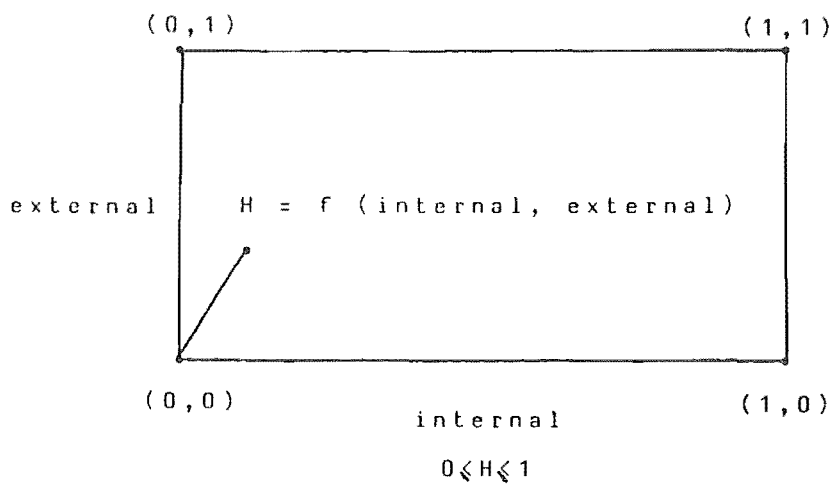
The following are examples of some of the subconstructs which can be extracted from the case history:

<u>Subconstruct</u>	<u>Governing Perception</u>
Regular drinker	Internal
Heavy drinker	Internal
Dependent on alcohol	External
Craving for more	Internal
Drinking to get rid of trembling	Internal
Deteriorating relationship	Internal/external
Morning nausea	Internal
Would like to drink less	Internal
Normal liver function	External

The governing perceptions listed above are some of those which dominate Jane's representation on each scale. Jane, for example, said that she drank regularly on Friday and Saturday nights. Anything Jane said, unless it was supported or contradicted by the perception of others, would mainly be her own perception of that subconstruct. The perception of others was largely external to Jane unless she supported or contradicted that particular interpretation. Thus, it could be said that Jane was dependent on alcohol, but since the history did not suggest this then the representation would be largely external. Her placement on the 'deteriorating relationship' scale was both internally and externally

FIGURE 7

Possible Values of External and Internal
Problem Drinking Subconstruct Scales



perceived - she said it was deteriorating and John said he would leave. If the subconstructs were a representative sample from the content domain of problem drinking, then the sum of Jane's representation on each of the scales would determine her overall score on the problem drinking scale.

Suppose, for example, each internal and external scale is arbitrarily assigned values ranging from 0 to 1. Suppose also that the result of the combination of these scales had a range from 0 to 1. This situation is represented in Figure 7.

The point H is the combination of the external and internal scales, mathematically represented as $f(\text{internal}, \text{external})$. The function f is a cognitive process which combines the external and internal scales of a particular subconstruct to give a score H. There are, of course, likely to be individual differences in the scores on these scales, the nature of the function f and, therefore, the resulting score H for any subconstruct.

One way of obtaining a total score is to find the additive sum of H's for each subconstruct. In the case of the subconstructs listed for Jane this would mean that the problem drinking score would range in values from 0 to 9, since there are nine scales each having an H ranging from 0 to 1. However, this simplistic way of summing scores does not allow for any interactive effects between the subconstructs. A full discussion of a mathematical method for representing the construct scale structures is given in

Appendix B. This discussion translates the terms and ideas of the problem drinking construct into matrix equations, giving examples of both general and simple solutions.

In practice, it may be difficult to determine the relative contribution of the internal and external dimensions towards the score for any one scale. Also, it is useful to be able to rate any subconstruct as deriving from largely external or internal perceptions, or from a reasonable balance of both. This determination has application: for example, a problem drinker with a high internally derived score is at least admitting problems and may be more likely to receive help than one who is largely diagnosed through external perceptions. Also, any test which is constructed to measure problem drinking needs a mixture of both externally and internally derived measures. This ensures that the perceptions of others and the perception of the person in question are taken into account before a diagnosis is made. This is particularly important when trying to make an early diagnosis, when more objective physical signs of alcohol dependence are not always available.

To build a number system which makes the summing of scales possible, Kelly suggests binary measures: that is, Kelly argues that because construct scales are bipolar, one end of the scale could be allocated the value 0 and the contrast pole the value 1. Suppose, for example, the subconstruct names in the case history represent the first element of each pair (e.g. regular drinker for the scale regular versus irregular drinker) and that the binary digit 1 represents the

first of each pair and 0 the second. Then a regular, light, non-dependent drinker can be written, as in the binary system, as 001. Extending this to all the scales from 'regular drinker' to 'normal liver function' means that the scale has a possible 9 steps running from 0000 to 1001. Since it has been argued that constructs operate on a continuous bipolar scale, the obvious drawback to this numbering system is that it does not allow for graduations within one scale. For instance, Jane is or is not a regular drinker (only the values 1 or 0). To alleviate this problem, it would be possible to arrange other scales to allow for more graduated representations: however, it will be shown that the binary system is preferable on utilitarian grounds.

If Jane was a problem drinker, she must have had sufficient representation on the problem drinking pole of the problem drinking versus non-problem drinking scale. That is, Jane's scores could run from 0000 to 1001, and there is some score within this range which determines problem drinking. How much representation is required raises the question of deciding on a cut-off score on the scale: this is investigated in Experiment I.

3.4 THE CONSTRUCT, IDIOGRAPHIC AND NOMETHETIC MEASUREMENT

The fact that the construct of problem drinking can be abstracted theoretically does not necessarily mean that there is some characteristic of individuals which can be measured in the context of that construct. A full explanation of the problem drinking construct is made difficult by the lack of understanding of the laws in which it operates. Is the construct common to all individuals and measured in the same way for everyone, or is it unique to each individual to be

assessed differently for each? If the former holds, then nomothetic measurement is appropriate. Alternatively, if the latter holds idiographic measurement should be used (Bavelas, 1978). So far, all problem drinking instruments have been nomothetic; that is, it is assumed that there is some measurable characteristic which is common to all individuals. If this is not true, then traditional measurement will have failed.

Bem and Allen (1974) discuss some of the characteristics of nomothetic measurement and point out three "nomothetic fallacies" (p.142) based on insufficiently acknowledged assumptions underlying nomothetic measurement. These fallacies will now be discussed in the context of the problem drinking construct:

First, there is the assumption of equivalence in the construct items. All the items in questionnaires designed to detect problem drinkers are assumed to be equivalent in the sense of measuring the same thing. Describing oneself as a heavy drinker and also dependent on alcohol are assumed to be in the same class of self-descriptions that are equivalent. While this assumption may be true in the eyes of the investigator, in the eyes of the subject, it may not. If the assumption of the shared equivalence class of items is indeed a fallacy Bem and Allen conclude:

The research will yield the conclusion that a sample of individuals is inconsistent to the degree that their behaviours do not sort into the equivalence class which the investigator imposes by his choice of behaviours and situations to sample. (p. 509).

The problem of deciding which items share the same

equivalence class for a particular construct has been referred to as the "domain definition" by Martuza (1977, p.255), or the process of deciding which elements belong to the content domain. Martuza also recognises that the process is difficult:

it must be understood that the domain definition problem has not been completely solved. (p.255).

In problem drinking the equivalence class items are the subconstructs. Naturally, even if all of the equivalence class subconstructs were known, they may be too numerous to measure. The problem is more one of determining which sample of subconstructs share the same equivalence class for problem drinking. If only one construct is being measured using a finite number of subconstructs sharing the same equivalence class, the process of determining whether the sample is representative of all the equivalence class items is referred to in traditional test construction as "content validation" (e.g. Martusa, 1977; Anastasi, 1976; Cronbach, 1970).

The second problem with traditional nomothetic measurement that Bem and Allen identify is one of scaling. Such measurement assumes that all items or behaviours are scaled, weighted, and added up in the same way for all subjects. Returning to the case history, if each of the elements at the scale poles was weighted 0 and 1, as Kelly suggests, and Jane was represented by 1 on the scales for 'regular drinker' and 'craving for more', then it is assumed that both of these items have exactly equal importance. If she scored 1 for the first three scales and 0 for the rest, then the binary representation on the problem drinking construct would be 0011. Each addition assumes equal item weighting.

The third problem Bem and Allen discuss is consistency; that is, nomothetic measures assume that different situations evoke equally consistent responses for everyone. Bem and Allen suggest that there may have been an over-generalization for some of the temporal consistencies which are present. Mischel's review (1968) has shown that an individual's behaviour is often consistent from one time to another if the situations are similar. Bem and Allen suggest that cross-situational consistency should itself be measured to determine how it affects the relationship between other variables. Consistency has been called a "moderator variable" (Kogan and Wallach, 1964) which Bavelas (1978) says should be treated as a personality trait and therefore requires appropriate validation. Bem and Allen summarise the major nomothetic measurement errors by saying that nomothetic measurement:

will yield evidence of cross-situational consistency only if the individuals in the research sample agree with the investigator's a priori claim that the sample behaviours and situations belong in a common equivalence class and only if the individuals agree among themselves on how to scale those behaviours and situations. (1974, p.510).

Idiographic measurement assumes that every individual has a different equivalence class and scaling for every characteristic. Bavelas feels that this overstates the case:

Surely we would be virtually unable to communicate, or to describe ourselves and other people, if this were true. We must have some common phenomenological experiences. (1978, p.147).

Bavelas goes on to say that there may be some constructs for which some people share the same equivalence class. That is, rather than accept the nomothetic/idiographic dichotomy, it may be possible to develop a measure in between, and outlines

a possible method based on Lewin's (1935) social and phenomenological theory of personality. That is to identify clearly the group of interest, such as problem drinkers; collect items from the group itself; and to let the group sort and label the items in their own way. However, this has not yet been done formally, although the procedure has been used to study different populations (e.g. Havighurst and Neugarten, 1955; Rice, 1965; Barthol and Bridge, 1968). The majority of attempts to use idiographic assessment has been in the field of personality research (e.g. Kelly, 1955; Mischel, 1968, 1973; Bavelas, 1978; Bem and Allen, 1974). Because idiographic assessment only permits one to predict some behaviours across some situations, a conflict arises when there is a need for the measures to have fixed parameters. Screening for problem drinking in an unselected population for instance, is not likely to involve a different set of variables for each individual. Bem and Allen's advice is simple:

Separate those individuals who are cross-situationally consistent on the trait dimension and throw the others out ... (1974, p. 512).

In summarising, the decision as to which approach to take in measurement presents a dilemma: if individual differences do exist within the construct of problem drinking then idiographic measurement is appropriate, otherwise nomothetic measurement has application. Perhaps the path, as Bavelas suggests, is somewhere between the two.

3.5 RELATIONSHIP OF THE CONSTRUCT TO LOCUS OF CONTROL

Social learning theory provides an excellent framework for the investigation of issues of personal control and researchers have attempted to use this theory to explain problem drinking. One issue has been to explore Rotter's (1966) Internal-External (I-E) Locus of Control Scale concerning the expectancy of control of reinforcements as they apply to problem drinkers. It is not the intention of the following discussion to provide a review of locus of control - this can be found elsewhere (e.g. Abbott, 1977; Rohsenow and O'Leary, 1978; Hirschman, 1976), but rather to show how locus of control relates to the construct of problem drinking.

It is important to distinguish between locus of control and the internal and external problem drinking scales. Locus of control refers to an individual's expectancies about whether or not he has control over what happens to him. It has been conceptualised by Rotter, Chance and Phares, (1972) as a continuum with one end termed "internal control" defined as:

the perception of positive and/or negative events being a consequence of one's own action and thereby under personal control. (p. 499).

and the other end termed "external control":

the perception of positive and/or negative events being unrelated to one's own behaviors in certain situations and therefore being beyond personal control. (p. 499)

In the problem drinking construct neither the internal or external scales are necessarily related to control. To use Rotter et al.'s language, the internal scale could be described as the self perception of positive and/or negative

events being a consequence of one's own action, and the external scale as the perception of others of positive and/or negative events arising from the consequences of one's own action. These perceptions are a cognitive process, and there is no suggestion of accepting responsibility for control.

In a review of the work on locus of control as it applies to alcoholics, Hinrichsen (1976) concluded that nearly all studies can be criticised on methodological grounds, and that no compelling data support the identification of alcoholics as either internally or externally orientated, which is a view supported by Abbott, (1979). It is not even clear whether Rotter's Internal-External Locus of Control Scale retains construct validity when it is applied to alcoholics. De Blij and Hinrichsen (1980) administered Rotter's I-E scale and a number of other measures including subscales of the Wechsler Adult Intelligence Scale and the Thematic Apperception Test, to 90 male inpatient alcoholics. They conclude that their data raise serious questions about the construct validity of the I-E scale when applied to alcoholics. Nevertheless, internality as well as externality has been associated with problem drinking (e.g. Barnes, 1979; Distefano, Pryer and Garrison, 1972; Goss and Morosko, 1970; Donovan and O'Leary, 1978; McClelland, Davis, Kalin and Wanner, 1972). Given that race and sex are likely to affect locus of control data (e.g. Obitz, 1978; Hurlburt, Gade and Fuqua, 1983) and that the samples used are inadequately described (Abbott, 1979), it is not surprising that the results have been inconsistent.

So far, two scales have been developed specifically for

measuring the locus of control in alcoholics.

The first is the drinking related locus of control scale (Oziel, Obitz and Keyson, 1972) which translates generalized locus of control into specific locus of control with regard to drinking behaviour. Donovan and O'Leary (1978) describe the reliability, factor structure and validity of the scale. They report on three intrapersonal, interpersonal and general control factors and that further work on its concurrent and construct validity is needed to determine its utility. However, they also consider that the scale has considerable potential as a research tool for investigating treatment and relapse.

The second scale has been designed to measure alcoholics perception of the locus of their drinking problem as internal or external. The Locus of the Drinking Problem (LODP) scale (Stafford, 1980) includes dimensions of control, responsibility, choice, blame and problem causality. Stafford developed the scale to include cognitive components which were likely to contribute to the attribution of the locus of a drinking problem, and proposed that the variables could be perceived along an internal-external continuum. Stafford hypothesised that persons subscribing to the disease model of alcoholism would perceive the locus of their drinking problem as more external than the locus perceived by persons preferring another explanation. The disease model encourages the view that alcoholics are not responsible for their condition and behaviour (e.g. Pomerleau, Pertschuk and Stinnett, 1976; Robinson, 1972; Roman and Trice, 1968). Stafford also hypothesised that when alcoholics perceived a

high external locus of drinking problem they would be more likely to want the help of others. The LODP was developed from data on 116 inpatient alcoholics who were administered the I-E scale and the 23 items of the LODP scale. The 23 items dealt with six different aspects of drinking problems - responsibility, control, blame, choice, causality and control of drinking. Non-significant correlations were found between the I-E and LODP scales. Stafford argues that the two scales are therefore measuring two different variables - the I-E measuring generalised expectancy concerning locus of control of reinforcements and the LODP measuring perception of the locus of responsibility, blame, choice and control regarding problem drinking. Both of Stafford's hypotheses were confirmed according to LODP scale scores. Wanting help from others correlated highly with the attribution of responsibility, control, blame, choice and causality to external factors. Also, persons who subscribed to the disease model were more likely to perceive the locus of their drinking problem as external.

A further finding from Stafford's LODP scores was that the more previous treatment alcoholics received, the more likely they were to perceive the locus of drinking problems as external. This result is at odds with Oziel and Obitz (1975) who found that alcoholics who had more treatment perceived themselves in greater control, both of behaviour in general as measured by the I-E scale and drinking behaviour as measured by Oziel and Obitz's own Locus of Drinking Control Scale.

One of the reasons for the conflicting and inconsistent

results of studies using the I-E scale with alcoholics is that the I-E scale examines too general an attitude to be useful for predicting in the more specific situation (Rotter, 1975). The LODP scale, however, is more specific to the situation of a drinking problem and the perception of responsibility, control, blame, choice and causality of drinking. Stafford concludes that it may be more fruitful and relevant to treatment to investigate differences between alcoholics on the dimensions tapped by the LODP rather than the I-E scale.

The LODP scale measures the subject's own internal-external perception: the perception of others, or the external perception in the problem drinking construct, is not measured. This does not mean that the LODP scale is necessarily invalid - it was not designed to measure the construct of problem drinking. It was earlier argued that the perception of others should contribute towards the measurement of problem drinking, since problem drinkers are likely to affect others in their immediate environment. To what extent the LODP items sample the content domain of problem drinking is not clear, and it is reasonable to assume that the scale cannot be used to identify problem drinkers. Nevertheless, the LODP scale is the first explicit attempt to measure the subjects own perception of their drinking problem.

Later, Stafford (1982) recognised the importance of the contribution of others' perceptions towards the locus of an individual's perceived drinking problem, not so much as a

measure of problem drinking, but as the effect internal and external views have on treatment. Earlier it was suggested that individuals with high internally derived scores were likely to be more motivated to receiving help or treatment. The implication here is obvious: if both treatment personnel and problem drinkers perceive the problem drinking subconstructs in the same way (that is, a high external and high internal representation) then the therapeutic outcome is likely to be positive. Martini and Brook (1978) suggest that similarity in attitudes and values of a therapist and his patient correlates positively with improved treatment outcome. Stafford (1982) proposes that treatment personnel and alcoholics perceive the locus of drinking problems differently. In the problem drinking construct, this is equivalent to contrasting external and internal representations.

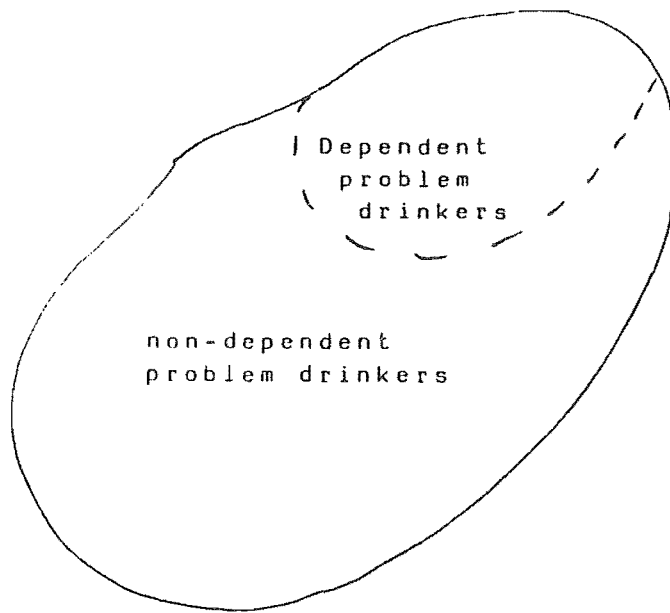
There has been very little other research on how problem drinkers or treatment personnel differ in views, and most has been related to the perception of control using the I-E scale (e.g. Marcus, 1963; Donovan and O'Leary, 1975, 1978) rather than the perception of the locus of drinking problems. However, Stafford (1982) modified the LODP scale by changing the words "I" and "me" to "alcoholics" and "the alcoholic" and gave it to 29 alcoholism counsellors. While this study did not match counsellors views with the views of alcoholics, it did nevertheless indicate how treatment personnel view the locus of alcoholics' problems. Using the results from the development of the LODP scale, Stafford was then able to compare the view of treatment personnel with the view of alcoholics. As Stafford predicted, the views differed.

Treatment personnel regarded alcoholics as more responsible, less to blame, less in control and having greater internal causation than alcoholics view themselves.

In summary, the research on how problem drinkers perceive the expectancy of internal or external reinforcement as measured by the Rotter Internal-External Locus of Control scale is restricted to dependent problem drinkers and is inconclusive because of methodological difficulties and contradictory results. Stafford's (1982) Locus of the Drinking Problem scale looks promising as a measure of problem drinkers' perceptions of the locus of their drinking problems. There is some evidence based on the LODP scale to show that treatment personnel and alcoholics view the locus of the alcoholics' drinking problems differently. Since the LODP scale includes dimensions of responsibility, choice, blame and problem causality, the use of this scale to measure treatment personnels' views and the views of alcoholics about the alcoholics' drinking problems, suggests that when the scale is used in this way it may relate closely to the internal and external scales in the problem drinking construct. However, this is only speculation, and it is likely that if there is any relationship between the LODP scale and the construct of problem drinking, it will be between the internal dimension of the LODP scale and the internal scale of the construct; that is, problem drinkers who perceive the locus of their drinking problem to be internal are likely to score highly on measures designed to identify self perceptions of drinking problems. The external dimension of the LODP scale is not likely to be contiguous with the external construct scale. The external LODP

FIGURE 8

Relationship of Dependent to Non-Dependent
Problem Drinking



dimension attributes blame to others for drinking problems, while the external scale in the problem drinking construct is intended to determine whether others perceive whether or not a drinking problem exists. It is unlikely that Rotter's I-E scales will have an obvious relationship to the construct, since Rotter's scales are related to control while the construct scales relate to perception of problems.

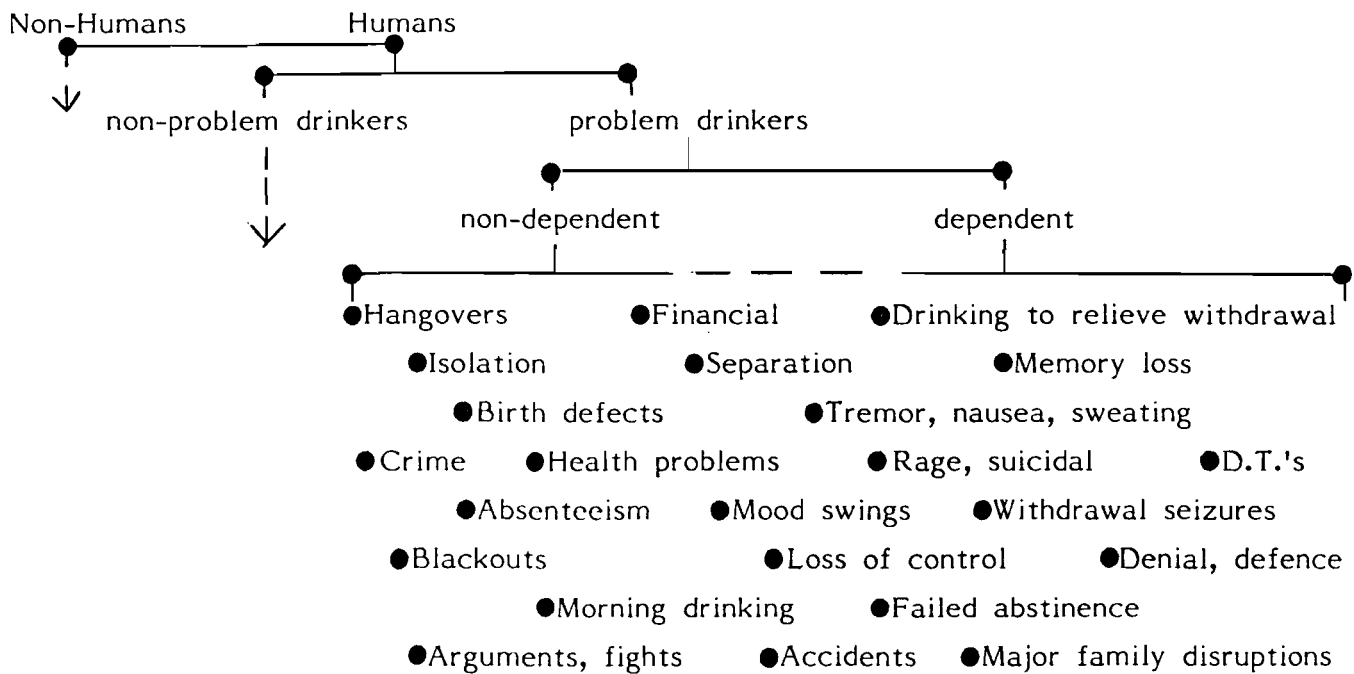
The application of labelling theory (Tannenbrum, 1938) to problem drinking was first discussed by Roman and Trice (1968), who suggested that the negative alcoholic label of others leads to the acceptance of an alcoholic's self-view. These external perceptions of others, and their effect on the problem drinker, have been viewed from a social resources perspective (Keil, Usul and Busch, 1983) and from self-efficacy theory (Rollnick and Heather, 1982). A fuller discussion of this is given in Appendix A. It is sufficient to say that the external perceptions of others may influence an individual's internal perception on subconstruct scales, leading to an acceptance of a problem drinking self-view.

3.6 ALCOHOL DEPENDENCE AND NON-DEPENDENCE AND THE PROBLEM DRINKING CONSTRUCT

In Chapter two it was proposed that there are two major types of problem drinking - those who are alcohol dependent (the alcoholics) and those who are non-dependent problem drinkers. Their relationship is represented in Figure 8.

FIGURE 9

Some Levels of Subconstructs in Problem Drinking



The relationship between dependent and non-dependent problem drinking can be expressed in construct terms. Problem drinkers represent one pole of the construct scale and encompass a variety of other subconstructs such as blackouts, memory loss, morning drinking etc. In Figure 9 the first level down from problem drinking is the dependent versus non dependent scale. Succeeding levels will have complex inter-relationship and these would be difficult to represent diagrammatically. Therefore, in Figure 9 after the non-dependent versus dependent scale only the elements at one pole of the scales are shown for a sample of possible subconstructs from the content domain of problem drinking.

The selection of which elements are likely to represent the content domain is the subject of Experiment I. However, the overlap in the dependent - non-dependent scale illustrates that many lower level scales share both poles of the construct. For example, a dependent problem drinker may be involved in arguments and fights: so too may a non-dependent one, although their representation of the arguments and fights scale may be quite different.

The natural history of the progression of non-dependent to dependent problem drinking has received little experimental study. Jellinek (1952) proposed a formal concept of an inexorable progression of problems with three major symptoms (blackouts, loss of control, prolonged intoxication) serving as markers of the prodromal, crucial, and chronic phases. However, serious problems with Jellinek's methodology have been described (e.g. Clark and Cahalan, 1977; Orford and

Hawker, 1974; Park, 1973; Trice and Wahl, 1958; Pattison et al., 1977). In recent research, there has been less focus on "disease idiology" (Taber, Quay, Mark and Nealey, 1969) and a greater emphasis on the development and correlates of particular problems related to drinking. While alcohol problems may sometimes develop as a series of increasingly serious consequences, this is not always the case (e.g. Clark and Cahalan, 1977; Fillmore, 1974; Goodwin, Davis and Robins, 1975; Vaillant, 1983; Vaillant and Milofsky, 1982). Clark and Cahalan's (1976) clinical observations over four years have indicated that individual alcohol problems are numerous, and do not always progress from the less to the more severe. They conclude that:

The apparent rapidity with which particular problems arise and subside suggest the possibility that situational factors may have a strong bearing on the problem drinker's behaviour. (Clark and Cahalan, 1977, p.183).

In the context of the construct problem drinking, the development of alcohol problems can be seen in terms of movement on the subconstruct scales. If the content domain was represented by the subconstructs in Figure 9, for example, then all problem drinkers will have a representation on each of these scales. The cited evidence that particular problems arise and subside over time can be seen in terms of changing representations on these scales. If there were only two possible outcomes on each scale (and it was earlier argued in Sec. 3.3 that there would be numerous outcomes), then in Figure 9 there would be 1012 possible combinations, which illustrates well the idiosyncratic nature of responses.

Because the World Health Organisation defined alcohol dependence as being either psychological or physical or both (sec. 303, International Classification of Diseases, 9th Revision) it is difficult to establish clearly which subconstructs are shared by non-dependent and dependent problem drinkers and which are not. Physical dependence by itself is clearly marked by withdrawal symptoms in the absence of regular alcohol intake. These subconstructs include tremor, nausea, sweating, delirium tremens and withdrawal seizures. It should therefore be possible to sample and measure the subconstructs in the content domain of physical dependence. There have been two recent attempts to do this (Raistrick, Dunbar and Davison, 1983; Stockwell, Murphy and Hodgson, 1979) although neither have clearly distinguished between physical and psychological dependence. In an excellent review on the progressive development of alcohol problems Pattison, Sobell and Sobell, (1977) conclude that:

Physical dependence does not appear to be a permanent state but may vary with subsequent patterns of drinking once established. The degree of physical dependence appears to be reversible. (p. 193).

and that:

Alcohol problems may be partially or completely reversed through either a naturalistic process or through a treatment programme. (p. 192).

The reversibility of alcohol problems, whether they relate to dependence or non-dependence, suggests that measures of the problem drinking subconstructs are likely to be time dependent. That is, an individual's score on scales will vary over time. It is possible that the subconstructs of dependent problem drinking are likely to be more stable over

time than those of non-dependent problem drinking, although this author can find no evidence to support or contradict this.

In summary, dependent and non-dependent problem drinking and any other clinical labels are simply subconstructs of the construct problem drinking. It is suggested that dependent and non-dependent problem drinking are two major types of problem drinking, each of which contains numerous other lower level scales. The unstable state of problem drinking can be observed by movement within each of these scales. Since the scores on the scales can be summed to obtain an overall problem drinking score it would be possible for a person to have the same total score at two different points in time but have a completely different set of subconstruct measures. The cited evidence suggests that this may be one distinct possibility.

3.7 SUMMARY

In this chapter the theory for problem drinking as a construct is described, based on George Kelly's definition of a personal construct. The theory describes a way in which various aspects of problem drinking, termed subconstructs, could relate to each other to determine an overall measure of the problem drinking construct.

The measure on each subconstruct is determined by the perception of the problem by the individual in question, and the perception of others. It is suggested that these external and internal perceptions are combined in some way to

produce a total problem drinking score. It is also suggested that the external component is necessary because the consequences of problem drinking usually have some impact on other people, and that there are times when a problem drinker would not agree with or notice this effect.

Kelly has stated that all constructs are bipolar and can be represented by the value 0 and 1 for each end of their scales, and that these numbers can be combined to form a total score. Since Kelly does not clearly give a method for combining scores, a mathematical explanation was developed to give a possible method for summing them as they apply to the problem drinking construct (see Appendix B); that is, an attempt is made to translate the terms and ideas presented in this chapter, into a structure which can be represented by matrix equations. While in theory these equations do have solutions, in practice these solutions will not always be possible, although there is a simple case where a problem drinking score can be derived on the basis of test results. It is this simple case which is used in the experiments.

With regard to idiographic and nomothetic measurement, it is concluded that it is difficult to decide which type of measurement is appropriate for problem drinking since the choice of measure depends on whether individual differences do exist within the construct. Since there is little or no evidence to support or contradict individual differences in problem drinking, it is suggested that the measurement of this construct should use a combination of these methods.

Rotter's Internal-External Locus of Control Scale bears

little relation to the construct of problem drinking because the construct is not concerned with control. However, the more recent Locus of Drinking Problem Scale (Stafford, 1982) may parallel very well with the internal perception dimension of the construct. Stafford's modified scale which determines the views of others on an individual's drinking problems may also relate to the external dimension.

Labelling and self-efficacy theory (summarised in Appendix A) explains a possible relationship between the external and internal dimensions on the subconstruct scales. That is, the perception of others about an individual's drinking can modify the person's own views to an extent which could lead to the acceptance of a problem drinking self-view.

It has been suggested that problem drinking incorporates non-dependent and dependent drinkers. Both of these categories and any others contained in them were described as subconstructs of the problem drinking construct, and so alcohol dependence is one such subconstruct. There is substantial evidence that problem drinking may at times be reversible. This reversibility or movement is viewed as movement on subconstruct scales and it is likely that any person will not have exactly the same representations at any two points in time, even though a measure of their score on the problem drinking construct may not change.

Before an example can be developed in Experiments I to V of an instrument to measure the construct of problem drinking, it is necessary to first review in the following chapter, the main tests which are able to measure some aspect of problem

drinking. In the context of problem drinking as it is defined in this thesis, all current instruments are only able to measure part of the construct or in other words, some of the problem drinking subconstructs. Most commonly available are tests designed to measure the dependent problem drinking subconstruct.

CHAPTER FOUR

PROBLEM DRINKING MEASURES: A REVIEW

4.1 INTRODUCTION

This review will focus on available problem drinking scales. Since the authors of nearly all instruments do not clearly state what the measure is intended to do other than to detect alcoholism or alcoholics, it is reasonable to assume that the instruments are designed to measure some aspect of dependent problem drinking. As with earlier chapters, the term "alcoholic" will be used here as it applies in the reviewed measure. Also, most of the measures developed are test instruments for classifying persons as alcoholic or non-alcoholic.

The review is divided into psychological, biomedical, combined psychological and biomedical measures, and instruments encompassing a variety of other measures.

4.2 PSYCHOLOGICAL MEASURES

Problem Drinking Scales of the Minnesota Multiphasic Personality Inventory (MMPI)

In the 1950's three scales based on the Minnesota Multiphasic Personality Inventory (MMPI) were developed (Hampton, 1953; Holmes, 1956; Hoyt and Sedlacek, 1958) to identify personality characteristics of alcoholics which distinguish

them from non-alcoholics (Hoyt and Sedlacek, 1956). However, MacAndrew and Geertsma (1964) found that these scales were primarily measures of maladjustment, and did not discriminate between alcoholics and non-alcoholics. The Hampton (1953) A1 Scale was cross-validated on 100 alcoholics and 150 non-alcoholics, producing significant mean differences. On a cross-validation study, Holmes's (1956) Am Scale discriminated significantly between alcoholics and normals.

The Ah scale of Hoyt and Sedlacek (1958) was an evaluated scale on two groups of alcoholics, three groups of normals, and four groups of psychiatric controls. Their scale successfully distinguished alcoholics from normals, but not from psychiatric patients. When MacAndrew and Geertsma (1964) administered the A1, Am, and Ah scales to 300 alcoholic and 300 psychiatric outpatients, the results produce low biserial correlations (.22, .34, and .33 for A1, Am, and Ah, respectively). Other research (Apfeldorf and Hunley, 1973; Rich and Davis, 1969; Rotman and Vestre, 1964; Uecker, Kish and Ball, 1969; Vega, 1971) has consistently shown Holmes's Am scale to differentiate inpatient alcoholics from non-alcoholic psychiatric inpatients.

In 1965 MacAndrew developed another problem drinking scale using MMPI items to differentiate outpatient alcoholics from non-alcoholic psychiatric outpatients. Using 300 alcoholic and 300 psychiatric outpatients he eventually found 49 items which discriminated the two groups. The scale correctly classified 81.5 percent. Subsequent research has shown the MacAndrew scale to differentiate alcoholics and non-alcoholic patients in a variety of settings (Apfeldorf and Hunley, 1973; DeGroot and Adamson, 1973; Kranitz, 1972; Rhodes, 1969,

Rich and Davis, 1969; Vega, 1971; Whisler and Canter, 1966; Williams, McCourt and Schneider, 1971; Apfeldorf and Hunley, 1973; Hoffman, Loper and Kammeier, 1974). However, some studies have indicated potential limitations of the MacAndrew scale. Uecker (1970) found that psychiatric controls scored much higher on the MacAndrew scale than did MacAndrew's outpatient sample, creating a high rate of false positives. Kranitz (1972) and Lachar, Berman, Grisell and Schooff (1976) both found the MacAndrew scale was unable to distinguish alcoholics from heroin addicts, suggesting the scale may measure a general addiction propensity. In another study (Ruff, Ayres and Templer, 1975) the MacAndrew scale was unable to differentiate alcoholics and criminals, although Clopton (1978) feels the authors should have used the MacAndrew scale to differentiate alcoholic and non-alcoholic criminals, not alcoholics and criminals.

Rhodes (1969) replicated the original MacAndrew (1965) study with a sample of 200 male outpatient alcoholics and 200 male psychiatric outpatients. The scale correctly classified 80 percent of the alcoholics and 71.5 percent of the psychiatric patients. Rhodes concluded that the MacAndrew scale is valid within the population for which it was designed, namely outpatients.

This view is partially supported by Schwartz and Graham (1979) who administered the scale to 161 male and 228 female psychiatric patients of which 64 were alcoholic (44 male, 20 female). For females, the MacAndrew scale differentiated alcoholics from other psychiatric patients although failed to do this significantly for males. The authors feel that the

lack of discrimination between the male alcoholic and non-alcoholic subjects may have been due to a significant number of males in the non-alcoholic group who had alcohol problems but were able to conceal them effectively from hospital personnel, as found in an earlier study by Lachar et al. (1976).

Four scales (Al, Am, Ah, and a "revised" MacAndrew scale developed by Rich and Davis, 1969) were compared in a study by Rich and Davis (1969). The Al scale failed to discriminate male alcoholics from psychiatric patients, and the Ah failed to differentiate female alcoholics and normals. The revised MacAndrew scale was the most accurate at differentiating alcoholics from other groups, although the original MacAndrew scale was better at discriminating female alcoholics from psychiatric controls. However, Miller (1976) suggests that because the base rate for problem drinking in the Rich and Davis study was much higher than normally expected, then the power of the tests to identify alcoholics was probably exaggerated compared to the normal clinical setting.

Vega (1971) tested the Al, Am, and Ah and MacAndrew scale on inpatient alcoholics, psychiatric controls, and inpatient non-psychiatric controls. The Ah failed to discriminate alcoholics from others and the MacAndrew provided the poorest discrimination mainly because of a large number of false positives (19 percent). Most of the false positives were in the normal group, which is not surprising since the MacAndrew scale was developed on a psychiatric rather than a normal control group.

Rosenberg (1972) developed an AROS scale from items common to the MacAndrew, Ah, and Am scales on the basis of their ability to discriminate inpatient alcoholics from psychiatric controls. The A1 scale was omitted because it was found to correlate highly with the Welsh Anxiety scale of the MMPI. Hoffman et al. (1974) in a longitudinal study found that the AROS and MacAndrew scale differentiated pre-alcoholic profiles from those of controls, raising the possibility of using these scales to identify high risk individuals before the development of their alcohol problems. However, Miller (1976) believes further research is needed on these scales before early identification can be undertaken with any confidence.

Atsides, Neuringer and Davis (1977) developed and validated an eight-item MMPI scale to differentiate inpatient alcoholics from inpatient neurotics. The scale correctly classified over 85% of the psychiatric inpatients in both the original and cross-validation studies. There have been no further reports on this scale.

Reviewers differ on the ability of MMPI scales to differentiate alcoholics from non-alcoholics. Barry (1974) and Williams (1976) believe some consistent findings have been reported. For example, Barry reports consistent traits centering around assertion, sociability, confidence, and social pathology. Williams reports on four studies identifying pre-alcoholics as active, aggressive, impulsive, and anti-social. In contrast, other reviewers (Sutherland, Schroeder and Todella, 1950; Syme, 1957; Franks, 1970;

Miller, 1976) question evidence that alcoholics have personality traits characteristic of alcoholics.

Franks believes that psychometric assessment of the personality of alcoholics should be abandoned. Apfeldorf (1981) says that some resolution will take place on the contrasting conclusions about the MMPI's ability to differentiate alcoholics from non-alcoholics when attention is paid to the methodological factors. Apfeldorf (1974) found that studies applying MMPI scales reported personality traits characteristic of alcoholics, while those applying other MMPI clinical scales reported contrasting conclusions. Rosen (1960) suggests that studies incorporating comparison groups sampled from the same source (rather than the usual control subjects from another source) would clarify findings of a consistent psychopathic deviance MMPI elevations in alcoholics, a belief supported Apfeldorf (1981). Apfeldorf gives examples of six studies using MMPI scales on hospital alcoholics (Button, 1956; Hoyt and Sedlacek, 1958; Hill, Haertzen and Davis, 1962; Goldstein and Linden, 1969; Whitelock, Overall and Patrick, 1971; English and Curtin, 1975) where there was no control for the source of sample.

Apfeldorf suggests that these studies make it difficult to determine whether the scores reflect sample procedures rather than personality characteristics unique to alcoholics.

Apfeldorf also suggests the same problem applies to the many studies reporting that Pd elevations characterise alcoholics (e.g. Hewitt, 1943; Manson, 1948; Hampton, 1953; Button, 1956; Hoyt and Sedlacek, 1958; Hill et al., 1962; Goldstein and Linden, 1969; Goss and Morosko, 1969; Rohan, Tatro and

Rotman, 1960; Whitelock et al., 1971; English and Curtin, 1975).

However, the study of Loper, Kammeier and Hoggman, (1973) shows that Pd elevations were already present in pre-alcoholics who were not manifesting any signs of maladjustment or deviance. Loper et al's study also incorporated comparison groups controlling for the source of sample. It is for this reason that Apfeldorf (1981) says that further work is needed on the Pd scale. Also, the Pd scale may not measure the same traits as the MacAndrew scale since correlations between the Pd and the MacAndrew scale are low (Apfeldorf and Hunley, 1973).

Summary of MMPI Scales

Attempts to derive a problem drinking scale from the MMPI have produced no fewer than seven scales: Hampton's A1 (1953), Holmes' Am (1953), Hoyt and Sedlacek's Ah (1958), MacAndrew's (1965), Rich and Davis' revised scale (1969), Rosenberg's ARos (1972), and Atsides et al's (1977).

The MacAndrew scale of the MMPI was developed in an outpatient setting but has also been shown to be useful with other treatment populations. Atsides et al's (1977) scale may be potentially valuable for differentiating alcoholics from neurotics in an inpatient setting. Hampton's (1953) A1 scale has questionable value, and evidence on Holme's (1956) Am and Hoyt and Sedlacek's (1958) Ah scales is mixed.

Miller (1976) says that if alcoholics are to be distinguished

from a generally normal population, then the revised MacAndrew scale, which contains elements from the Al, Am, and Ah, may have considerable potential value. Miller also says that the MacAndrew scale is useful for populations for which it was designed, that is, the general psychiatric population. However, the weakness of the MacAndrew scale is in the percentage of false positives it produces, especially with inpatients. Rosenberg's (1972) ARos scale may be very good at identifying alcoholics within an inpatient psychiatric population.

When the scales and the literature are reviewed, three points emerge. First, the research on the validity of the scales has not yielded consistent results. For example, two studies (Vega, 1971; Hays and Stacy, 1983) found the Hampton scale valid, while four did not (MacAndrew and Geertsma, 1964; Rotman and Vestre, 1964; Uecker, Kish and Ball, 1969; Holmes, Dungan and McLaughlin, 1982). Also, several studies were favourable towards the MacAndrew Scale (e.g., Rich and Davis, 1969; Schwartz and Graham, 1979), while others were not (e.g., Whisler and Cantor, 1966; Zager and Megargee, 1981). Second, given that all the scales should be measuring the same construct it is surprising given the validity findings, that at least five of the scales contain only three common MMPI items (Holmes et al., 1982). Last, all the scales assume that alcoholics are a homogeneous group and the scales do not differentiate between past and present problems.

For every argument supporting an MMPI scale, there is counter evidence against its use. However, one consistent fact is evident: all the scales yield false positives and false

negatives to an extent that warrants caution in their use (e.g., Cox, 1979; Holmes et al., 1982).

Other Psychological Measures

The following review does not include scales designed to identify problem drinkers on the basis of personality traits: an excellent discussion of these measures is given in Miller (1976). Instead, the focus will be on measures designed to directly assess the behavioural consequences of problem drinking.

Recently Brudger (1982) developed the Drug and Alcohol Abuse Predictor Scale by combining the MacAndrew scale with two scales of anomie (Srole, 1956; McCloskey and Schaar, 1965) and the California Psychological Inventory F Scale (Adorno, Frenkel-Brunswik, Levinson and Sanford, 1950). The scale was given to 60 psychiatric inpatients and 60 inpatient alcoholics and proved to have significantly greater classification precision with patients than did the MacAndrew scale. However, the scoring system is rather complex involving the clinical interpretation of two mathematical equations and the extensive use of a calculator.

Kalin (1972) attempted to devise a more effective scale using an inventory based on the California Psychological Inventory (Adorno et al., 1950). Williams, McCourt and Schneider, (1971) found the Anti-social Behaviour Scale of the Kalin Test was more effective than the MacAndrew Scale in discriminating heavy drinkers from light drinkers in a State

Hospital sample. However, Kalin selected items for the scale on their ability to differentiate heavy drinkers from light drinking college students. This approach has been criticised by Appfeldorf (1981) on the grounds that not all heavy drinkers are likely to become alcoholics.

The first scale which directly enquired about drinking and alcohol-related behaviours was the ALCADD Test (Manson, 1949a, 1949b). The 60-item scale was administered to 123 alcoholic and 159 non-alcoholic men and women, and only three alcoholics and seven non-alcoholics were misclassified. The ALCADD Test is frequently used in clinical settings but has rarely been reported in research. Murphy (1956) found the test discriminated 24 active and 34 abstinent alcoholics from 34 social drinkers and 28 abstaining non-alcoholics. Ross (1973) found the ALCADD significantly correlated with the Taylor (1953) Manifest Anxiety Scale and with the Psychasthenia Scale of the MMPI. Other studies have included the ALCADD Test (e.g. Carter, 1966; Gerbanowitz and Moore, 1981), but have assumed rather than tested its validity.

The CAGE questionnaire (Ewing and Rouse, 1970) was the second scale produced which directly assessed the consequences of drinking. The CAGE questionnaires derives its name from the four questions it contains: "Have you ever felt you should cut down on your drinking?" "Have people annoyed you by criticising your drinking?" "Have you ever felt bad or guilty about your drinking?" "Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover (eyeopener)?"

Mayfield, McLeod and Hall, (1974) gave the CAGE to 366 psychiatric patients (39 percent alcoholic) over a one year period and found that with two or three positive responses as the criterion for alcoholic, 81 percent of alcoholics were correctly identified and 11 percent of non-alcoholics were misclassified. Other than this study, there appears to be no further evaluation of the CAGE on different populations and in different settings. Like the ALCADD, the CAGE is nevertheless frequently used in clinical settings but has rarely been mentioned in research. Gabrynowicz and Moore (1981) have included the CAGE as one of a number of scales in a questionnaire which describes a profile for drinking drivers.

Woodruff, Clayton, Cloninger and Guze (1976) gave 1,350 psychiatric patients a "research diagnosis" of problem drinking to determine which of 18 key symptoms in the diagnosis would provide a means for the rapid screening. The subjects included 151 alcoholics and 1,199 non-alcoholics, previously classified on a clinical judgement on which of the 18 items would be used for the final test. In this context the study design appears to be introspective in that the items being evaluated were used to classify the original groups. The correlation between the diagnosis and the report of the subjects that they drink too much, or that a relative or cardinal figure in their environment is reported to be:

high enough that we could not expect any screening interview to function more efficiently. (p.435).

However, the correlation is not reported, and there is no evidence of the test elsewhere in the literature.

In 1982 Skinner developed a 28-item self-report quantitative index of problems related to drug misuse. The scale, the Drug Abuse Screening Test (DAST), was given to 223 volunteers seeking help for their drug/alcohol abuse. Fifty-nine percent had alcohol problems, 25 percent drug problems, and 16 percent had both alcohol and drug problems. The DAST, which parallels the items on Selzer's (1971) Michigan Alcoholism Screening Test (MAST), was found to have a uni-dimensional scale, which suggested that a numerical score would give an indication of the severity of drug misuse. The internal consistency reliability estimate was substantial at 0.92 and a factor analysis revealed a dimension reflecting problems related to drug abuse. A 20-item short version of the DAST correlated highly with the original 28-item version, indicating that the short version may be equally as good as the original DAST. However, Skinner points out that the DAST considers drugs as a generic group, and does not assess the consequences related to each particular class of drug use.

Given that many alcoholics are polydrug abusers, this scale should be particularly appropriate for these patients. The DAST is useful for quantifying the extent of drug involvement within a help-seeking population, and further validation work will be required in other populations and settings.

Some of the criticism directed at the Michigan Alcoholism Screening Test (MAST) has been the use of the word "ever" and the dichotomy of the responses "yes" or "no". This style of responding tends to overestimate the prevalence of problem drinking in a given population and makes it impossible to distinguish between current and former alcoholics (Favazza

and Pires, 1974; Favazza and Cannell, 1977).

Magruder-Habib, Harris and Fraker, (1982) have attempted to refine the MAST in order to distinguish between past and present alcoholism. Their test, the Veterans Alcoholism Screening Test (VAST), contains the original 24 questions from the MAST, but each of the 24 original MAST questions is followed by three questions designed to identify the specific time period to which an answer indicating problem drinking refers. The time periods are: within the last year (considered as "current"); more than a year ago but not more than five years ago; and more than five years ago.

In a comparative study Magruder-Habib et al. (1982) gave the VAST and MAST to 118 general medical and surgical outpatients and independently to their close relatives. The VAST was found to be a more valid indicator of alcoholism than the MAST. The prevalence estimates varied dramatically between the VAST (24 percent with current problem drinking) and the MAST (46 percent with problem drinking), indicating the importance between current and past assessment. However, one drawback of the VAST is its length, and the fact that it was based on a restricted population (all men, veterans, and relatively old). Like other tests, the VAST needs validation on other populations and in other settings.

In 1976 Edwards and Gross formulated the Alcohol Dependence Syndrome, comprising a cluster of psychophysiological symptoms ranged upon a continuum of severity and principally centred around a "drive" to consume alcohol. Following a widespread acceptance of this syndrome amongst clinical

practitioners and researchers (Hodgson, 1980), several psychological questionnaires have been developed to measure alcohol dependence.

The first questionnaire was the Hilton Drinking Behaviour Questionnaire (HDBQ) (Hilton and Lokare, 1978). The HDBQ was based on the proposition that although there are wide variations in the type of problems caused by alcohol abuse, there are certain symptoms which are generally considered to indicate alcohol dependence. The 34 items in the questionnaire cover stages in the development of dependence, reasons for drinking, and the physiological consequences of alcohol dependence.

The HDBQ was given to 48 non-alcoholics and 43 unmatched controls. Subjects were also given the ALCADD (Manson, 1949) and the HDBQ was found to be statistically dependent on the total and sub-scale scores of the ALCADD. Factor analysis revealed a unidimensional scale relating to dependence on alcohol. However, since the original paper on the HDBQ, there has been no reference to this questionnaire in the literature, either as a means for assessment or as a research tool.

Stockwell et al. (1979) developed the Severity of Alcohol Dependence Questionnaire (SADQ) which they deemed necessary since,

to date, no such questionnaire has been devised which both stems from a clear recognition of a core syndrome of alcohol dependence and observes the crucial distinction between the essential features of this syndrome and the diverse consequences and problems which may be associated with both dependent drinking and heavy non-dependent

drinking. (p. 79).

The SADQ is divided into five sections corresponding to: physical withdrawal symptoms; effective symptoms of withdrawal; craving and withdrawal-relief drinking; typical daily consumption; and rapidity of reinstatement of symptoms after a period of abstinence. The respondent is also instructed to focus on his or her most recent period of heavy drinking that was also typical of their heavy drinking. In all, the SADQ consists of 33 questions.

The questionnaire was completed by 104 respondents who were either outpatients or inpatients at a treatment unit. Seventy-two of the patients were independently rated for alcohol dependence on a scale from minimal alcohol dependence to severe dependence by two clinicians. The principal components and factor analysis revealed a single factor accounting for a large proportion of the total variance, and the correlation between the SADQ and the independent clinical assessment was 0.82.

It is important to note that the SADQ did not employ a control group in its development, and to date its ability to misclassify non-alcoholic patients has not been assessed. In a later paper Stockwell, Murphy and Hodgson (1983) described a revised version of the SADQ in which 13 of the original items were (unexplainably) dropped, to produce a 20 item SADQ. To measure the test-retest reliability and validity of the new form of the SADQ, the questionnaire was given to 45 inpatients at an alcohol treatment unit. To test the validity, the SADQ was compared with a drinking pattern interview, and an independent physician's assessment. While

no correlation coefficient has been reported, when the SADQ was made the dependent variable for the drinking pattern interview, 62 percent of the variance can be account for. The correlation coefficient between the physician's assessment (based on liver function testing and withdrawal symptoms) and the SADQ varies from 0.01 to 0.29. To measure reliability, the SADQ was given twice to subjects within an interval of two weeks, and the correlations for each of the five sections on the SADQ ranged from 0.76 to 0.85.

The authors report there is good evidence of construct validity and concurrent validity based on their results, which is surprising since they present no evidence of these measures. Also, two previous commentators faulted the SADQ on the basis of its reliability and validity (Shaw, Warner, Borysow, Schmitz and Lieber, 1979; Chick, 1981). Raistrick et al. (1983) have criticised the SADQ on the grounds it almost exclusively deals with withdrawal symptomatology and not with other aspects of alcohol dependence. Because of this, they state it is sensitive only to the severe end of the dependence continuum and so is of limited usefulness as a measuring instrument.

In order to overcome this problem, Raistrick et al., (1983) have developed yet another questionnaire called The Alcohol Dependence Data (ADD), based on measures of dependency as described by Edwards and Gross (1976) but designed to be sensitive across the full range of dependence. The instrument also measures changes over time and present "state dependence". The 39 item ADD was given to three contrasted groups: 41 regular drinkers; 30 psychiatric patients; and 173

alcoholic inpatients.

Using various statistical procedures on this sample, the 39 item questionnaire was reduced to 15 items. The Spearman Split Half Reliability was 0.87. Very little other statistical information on the development of this test is presented, and its validity is yet to be reported. However, the Self-administered form of the Alcohol Dependence Data (SADD) is the first attempt to provide a short screening instrument for dependent problem drinkers.

The Michigan Alcoholism Screening Test (MAST)

The Michigan Alcoholism Screening Test (MAST) is perhaps the most widely discussed screening test for problem drinking in the literature. Since its development (Selzer, 1971) there have been over 25 articles reporting on various psychometric properties of the MAST. In addition, there have been numerous reports of the MAST being used as an instrument for prevalence studies and as an aid to help professionals make a diagnosis.

The MAST is a 25-item questionnaire which uses a semi-structured interview format. The content relates to the respondent's self/appraisal of his drinking habits and to the social vocational and familial problems frequently associated with excessive drinking. The yes/no responses are summed to produce a single overall score representing the degree of alcohol involvement. A score of five or more points is regarded as alcoholic, while those scoring four are

viewed as manifesting borderline alcoholic symptomatology and those with three or less are seen as relatively well adjusted drinkers.

In its development the MAST was given to three groups: 125 hospitalized white male alcoholics; 103 white male controls; and 307 persons with drinking and/or driving arrests. The validity of the MAST was assessed by searching the records of legal, social, and medical agencies and reviewing the subjects driving and criminal records. A total of fifteen subjects who scored in the non-alcoholic range on the MAST were subsequently found to be alcoholic, although Selzer found that 11 of the 15 (73 percent) failed to score because of denial. However, the MAST, which takes about 15 minutes to administer, was recommended for use in conjunction with arrest records.

Selzer, Vanosdall and Chapman (1971) administered the MAST to 838 problem drivers undergoing improvement interviews. Ninety-five percent of the subjects were male and fifty-three percent were under the age of twenty-four years. MAST scores indicated that twenty-one percent were in the alcoholic or probably alcoholic range and twenty-five percent had at least one conviction for drunk driving or drunk and disorderly behaviour. It was concluded that the MAST was an effective instrument for screening out alcoholics in problem driver groups. Selzer and Chapman (1971) report that the converse is not true: the MAST could not predict or identify which alcoholics are likely to be problem drivers.

Pokorny, Miller and Kaplan (1972) compared the full MAST with

a shortened version of ten questions given to 60 hospitalized male alcoholics and 62 psychiatric patients. The two forms correlated highly, and the shortened test yielded a cut-off point that correctly identified all alcoholics and produced seven false positives from the control group.

Moore (1971, 1972) examined the use of the MAST in two settings. Four hundred adult psychiatric patients (270 women and 130 men) were tested with the MAST. Fifty percent of the men and 22 percent of the women scored in the alcoholic range. Of the 128 problem drinkers diagnosed by a psychiatric rating, the MAST missed only two, and the ratings and MAST were in agreement 78 percent of the time. Two hundred randomly selected patients from a general hospital population (129 females) were evaluated using the MAST and a physician's diagnosis. The MAST identified 90 percent and the physician's 50 percent of the 20 alcoholics identified with a previous history of alcohol dependence.

Miller (1976) is critical of the MAST on the grounds of diagnostic error, citing a study by Favazza and Pires (1974) who administered it to 183 active enlisted Navy men of which 75 were in medical and surgical wards. Thirty-one percent of medical and thirty-two percent of surgical patients were diagnosed as alcoholic which Miller considered an unacceptably high rate of false positives. Favazza and Pires, however, argue that the MAST may reflect an accurate diagnosis, reporting research indicating that as many as 39 of enlisted men may be problem drinkers.

McAuley, Longabaugh and Gross (1978) pose three difficulties

with the MAST: There is the possibility that the patient will deny problems thus producing false negatives; the patient may be too disturbed to complete the test with accuracy; the scale may reflect a factor of general pathology and therefore be not successful in distinguishing alcoholics from other patients. In an attempt to rectify these problems McAuley et al. (1978) developed a family form of the MAST by altering the pronoun of each question from "you" to "he" or "she". One hundred and ninety patients (112 women) in a private psychiatric hospital were given the MAST and the patients' family members completed the Family form. Also, a psychiatric diagnosis was given by a physician for each patient using the Diagnostic and Statistical Manual of Mental Disorders DSM-III (American Psychiatric Association, 1980). The Family form and the MAST total scores were the same in 57 of the 75 completed cases and the patients' scores indicated an agreement with a psychiatric diagnosis of alcohol dependence in 70 percent of cases.

These results were not as accurate as ⁱⁿ an earlier study by Morse and Swenson (1975) who gave an expanded version of the MAST to a group of 50 hospitalized alcoholics and their spouses and counsellors. Data from the spouse responses were accurate in 90 percent of cases. Given the problems of denial and that some patients are not testable for one reason or another, both Morse et al. and McAuley et al. conclude that spouse responses and the family form of the MAST may be a more reliable source of information about drinking problems than in information obtained from the alcoholic.

In an attempt to refine the MAST further, Selzer, Vinokur and

Van Rooijen (1975) gave the 25 question MAST to 501 male drivers of which 228 were known alcoholics. Using a stepwise regression procedure 12 items were selected which best discriminated the alcoholic and non-alcoholic groups. An additional question was added because of its case finding importance, to produce the final 13 items of the Short MAST (SMAST). On the basis of high correlations between the SMAST and MAST (0.90 or greater) Selzer et al. suggest that the SMAST will do as well as the MAST as a screening test for problem drinking. The authors point out an important aspect of the test which many researchers and clinicians often forget:

it is important for clinician or researcher to remember that the MAST and SMAST are screening devices rather than final diagnostic instruments. (p. 125).

Following the widespread acceptance of both the MAST and SMAST (e.g. Zung and Charalampous, 1975; Selzer et al. 1971; Yoder and Moore, 1973; Moore 1971; Favazza and Cannell, 1977; Miller, 1978; Funkhouser, 1978; Friedrich and Loftsgard, 1978; Cannell and Favazza, 1978; McAuley et al., 1978; Friedrich and Loftsgard, 1978; Zung and Ross, 1980; Zung, 1979, 1980, 1982; Skinner and Wen-Jenn, 1982; Benussi, Ballimberti, Zorzut, De Vanna and Gosparini, 1982), there has been an extensive investigation into its psychometric properties and its two briefer versions (MAST-10 and MAST-13).

In a study on 120 psychiatric in-patients (20 percent with an alcohol-related diagnosis on the DSM-III) Zung (1982) found the MAST to be 88 percent sensitive, consistent with the results of seven other studies in which valid positive rates

of 90 percent to 100 percent have been reported (Favazza and Pires, 1974; Friedrich and Loftsgard, 1978; Moore, 1971, 1972; Selzer, 1971; Zung and Ross, 1980; Siassi and Alston, 1976).

False positive rates have ranged from 12.5 percent (Moore, 1972) to 64 percent (Zung and Ross, 1980). Zung (1982) reports only a 58 percent agreement between the MAST and the DSM-III psychiatric diagnosis. However, Zung recognizes the shortcomings of a psychiatric diagnosis as a suitable criterion against which to validate the MAST and recommends the use of a problem-orientated record instead.

Various factorial studies of the MAST have identified a single broad factor defined by nearly all the test items (Zung, 1980a, 1980; Zung and Ross, 1980; Friedrich and Loftsgard, 1978; Skinner, 1979; Zung, 1978), which Zung (1980) has referred to as a general alcoholic impairment, measured along a continuum of severity.

The MAST determines the consequence of problems with alcohol without reference to a specific time period. Temporal parameters such as time of onset, duration, and the most recent occasion of the problems are omitted. Measuring problems cumulatively over a lifetime does not allow for the possibility of remissions and may limit the test's validity and utility in treatment planning. Selzer et al. (1975) favours scoring current problems, but has not explained how this should be done.

As earlier mentioned, Magruder-Habib et al. (1982) developed

a time reference system for scoring the MAST (in the last year, in the last 1 to 5 years, more than 5 years ago) and called their test the VAST. They claim the VAST is able to distinguish between patients who are currently alcoholics and those who have been alcoholics in the past. Zung (1982) has demonstrated that nearly half of all test responses on the MAST refer to problems said to have occurred most recently during the preceding six months.

Estimates of internal consistency for the MAST have been 0.80 or greater (Skinner and Wen-Jenn, 1982; Zung, 1979; Selzer et al., 1975; Skinner, 1979) and similar results have been reported for test-retest reliability (Skinner and Wen-Jenn, 1982; Zung, 1979), suggesting that the MAST can assess ongoing patterns of alcohol use with a reasonably high degree of reliability, and that patients generally provide consistent responses to items describing drinking-related problems. However, method factors such as administration, the time reference period and the statistical procedures used have varied widely across studies and may contribute differentially to the outcome.

The MAST and its derivatives were developed exclusively for male subjects (e.g. "Does your wife (or parents) ever worry or complain about your drinking?", "Has drinking ever created problems with you and your wife?", "Has your wife (or other family member) ever gone to anyone for help about your drinking?"). However, nearly all subsequent studies on the MAST have involved both male and female subjects, which assumes the test's validity on a female population, possibly contributing towards the source of sample problems outlined

by Apfeldorf (1981).

Only one study has attempted to assess sex differences in MAST score responses (Selzer, Gomberg and Nordhoff, 1979). In this study the MAST was completed by all inpatients in a treatment programme of which 123 were men and 80 were women. Men alcoholics scored significantly higher than women alcoholics on two of the MAST questions but overall the authors report that the test is equally effective for both sexes. However, these results cannot be considered as validating the MAST for women, but rather are a comparison between men's and women's responses on the MAST. It may be possible, for example, for women to have a higher rate of false positives or negatives on the MAST, which can be determined only by independent measures.

Summary of Psychological Measures

Sixteen problem drinking scales have been reviewed for which evaluation data are available. There is evidence both for and against the use of the seven MMPI scales although they perform at their best when used on the population for which they were developed. For example, the MacAndrew revised scale could be used to distinguish alcoholics from a generally normal population while the original MacAndrew scale is advisable for psychiatric outpatients; and the AROs scale may prove useful for identifying alcoholics in a psychiatric inpatient population. However, all the MMPI scales are long and are time-consuming to administer to patients, which is a major limiting factor.

The most well known direct measures generally contain broad content (e.g. ALCADD, CAGE, MAST) while more recent scales are orientated towards specific syndromes (HDBQ, SADQ, SADD), and have demonstrated a large first factor sometimes sufficient to explain the majority of individual differences on the instrument.

To date, the MAST has perhaps been the most utilised of all instruments for both research and clinical purposes.

However, the MAST has yet to be interpreted in terms of the alcohol dependence syndrome, for which specific scales have been developed.

4.3 BIOMEDICAL MEASURES

Laboratory Tests

Over the years there has been a constant search for laboratory markers to diagnose problem drinking. In a review of some of the biochemical and laboratory tests, Holt, Skinner and Israel (1981) cite about 117 attempts to use laboratory tests to diagnose alcohol abuse. There are, however, a number of problems with laboratory tests:

First, there is frequently disagreement about which markers best indicate alcohol abuse or a high alcohol consumption (e.g. blood or breath alcohol) and which markers give evidence of tolerance to alcohol or indicate alcohol dependence. Second, the relatively short half-life of the

majority of markers and the fact that their presence alone does not predict the patient's drinking habits, often detracts from their usefulness. Last, laboratory markers are only sensitive to the severe symptoms of alcohol abuse which may take five to ten years to develop through chronic heavy drinking (e.g. Lelbach, 1975).

A full review of laboratory tests will not be given here. This may be found in Holt et al. (1981) and in Clark and Kricka (1981). However, the markers which have been most widely investigated or used are serum-gamma-glutamyl transferase (GGT), aspartate transferase (AST), and Mean Cell Volume (MCV). All of these tests are commonly available and are relatively cheap to use.

Perhaps the most extensively used of tests is GGT (see Ryback, Eckardt, Felsher and Rawlings, 1982; Eckardt, Ryback, Rawlings and Grauband, 1981; Chick, Krietman and Plant, 1981; Bernadt, Mumford, Taylor and Smith, 1982). GGT values have shown to be two or three times the upper limit of the reference point for hospitalised alcoholics and outpatient alcoholics, returning to normal within a period of a few days in the absence of alcohol consumption (e.g. Rosalki, 1975; Freer and Statland, 1977; Rosalki and Rau, 1972). There is some evidence that alcoholics who drink daily will be more likely to be detected with elevated GGT than bout drinkers (Wiseman and Spencer-Peet, 1977). However, many drugs can cause an elevation in GGT (e.g. heroine, morphine, cocaine, LSD, amphetamines, barbituates, cannabis, anticonvulsants) which limit its usefulness as a test, especially in hospital populations (Penn, Worthington, Clarke and Whitfield, 1981;

Rosalki and Zilva, 1977; Whitehead, Pankov and Clarke, 1981).

Elevated GGT may also be found in cases of myocardial infarction, pancreatitis, renal failure and diabetes following radiotherapy (Clarke and Kricka, 1981). Thus the use of GGT as a diagnostic test is complicated by possible elevation due to other diseases, drug therapy and drug abuse. In addition to false positives, false negatives have been shown to occur amongst long standing alcoholics (Skude et al., 1977).

Reviewers of GGT suggest that at its best, an elevated value may suggest the possibility of an alcohol problem (e.g. Clarke and Kricka, 1981; Penn and Worthington, 1983). Nevertheless GGT has been used to provide evidence of excessive drinking when denied by the patient (Kryszewski, Bardzik, Kilkowska, Vogel-Pienkowska and Schmind, 1977), to verify abstinence when used in conjunction with AST measures (Reyes and Miller, 1980), to detect hepatic disease in suspected alcoholics (Rosalki and Rau, 1972) and to measure treatment progress by serial measurements (Horner, Kellen, Kingstone, Majaraj and Malkin, 1979; Lamy, Baglin, Aron and Weill, 1975).

It has been suggested that GGT measurement may be of greater diagnostic value when combined with other markers of alcohol intake (Whitehead, Clarke and Whitfield, 1978) and when used in discriminant function models (Ellis, Worthy and Goldberg, 1980; Eckardt et al., 1981). However, these refinements have shown only a small improvement in its diagnostic value (Penn and Worthington, 1981).

Aspartate transferase (AST) is a liver enzyme frequently raised in alcoholics, usually reflecting liver involvement, although may be raised due to muscular complaints or myocardial infarction (Hed, Hygren and Sunblad, 1972). The diagnostic sensitivity of AST is much less than that of GGT, although false positives due to drug therapy are fewer (Clark and Kricka, 1981). However, the evidence on the usefulness of AST as a laboratory marker is conflicting.

Myrhed and Bergstron (1976) found significantly higher AST enzyme levels among the higher alcohol consumers of 92 alcohol discordant male twins aged 45-65 years. Whitehead (1978) measured elevated AST levels in 2034 healthy men and found 8 percent raised, a finding which was almost identical in a subgroup of 146 whose alcohol intake was in excess of the normal value (more than four drinks per day).

Further evidence on the lack of AST to discriminate between high and low consumers is given by Bliding, Bliding, Fex and Tornquist (1982) who investigated raised enzyme levels in 150 men from the armed forces with known alcohol consumption. In contrast, Bang, Iverson, Jagt and Madsen (1958) found a rise in AST after acute alcohol intoxication in 27 of 35 alcoholic patients, and Brohult, Carlson and Reichard (1966) were able to show that a single dose of alcohol (about 3g/kg body wt) administered to apparently healthy men, produced a significant rise in AST after its intake.

In another study, Konttinen, Hartel and Louhija (1970) found AST was abnormal in alcoholics more often than other liver

enzymes. However, all the studies on the ability of AST to discriminate between alcohol abusers and normals have methodological flaws; none has measured concurrently the specificity and sensitivity and so the accuracy of AST as a marker is left in doubt.

An increase in the mean red cell corpuscular volume (MCV) has been reported in chronic alcoholics with or without liver disease (Wu, Chanarin and Levi, 1974; Morin and Porte, 1976; Carney and Sheffield, 1980), and has been associated with high alcohol consumption (Unger and Johnson, 1974; Wu et al., 1974; Whitehead et al., 1978; Whitfield, Hensley, Bryden and Gallagher, 1978; Eschwege, Papoz and Lellouch, 1978; Unger and Johnson, 1974; Chalmers and Chanarin, 1980; Bagrel, D'Houtaud and Gueguen, 1979; Papoz, Warnet, Pequignot, Eschwege, Claude and Schwartz, 1981; Chick et al., 1981). However, the interpretation of these studies is subject to a number of limitations.

In some the base population is unspecified, (e.g. Whitehead et al., 1978; Whitfield et al., 1978), the number of heavy drinkers has either been very small (e.g. Whitfield et al., 1978) or unspecified (Whitehead et al., 1978; Eschwege et al., 1978; Unger and Johnson, 1974; Chalmers et al., 1980). Usually, the reported relationship between raised MCV and smoking (Eschwege et al., 1978) and age and sex (Whitfield et al., 1978) has been ignored. The mechanism for macrocytosis is poorly understood (Mistilis and Barr, 1981) and generally all studies conclude that while positive relationships can be found between raised MCV and alcohol consumption, the lack of the sensitivity of MCV makes it a poor marker.

Recently there have been attempts to use quantitative procedures to combine laboratory tests to increase their power to differentiate normals and alcoholics. Papoz et al. (1981) report multivariate relationships between alcohol consumption, GGT levels, MCV, and tobacco use, and indicate that a combination of GGT and MCV enabled them to identify 75 percent of self-reported heavy-drinking men (more than 80g of pure alcohol daily). This approach has been supported by Eckardt et al. (1981) who used a quadratic discriminant function which included MCV, GGT, and AST. Their function correctly classified 100 percent of 130 male non-alcoholic outpatients and 98 percent of 121 medically documented male alcoholics.

Earlier attempts by other investigators to use multivariate techniques have not resulted in a useful clinical application (e.g. Burbank, 1969; Croft, 1972), possibly because of poor design and the dichotomisation of test results into normal or abnormal. The results of Eckardt et al. (1981) and cited in Ryback et al. (1982) are almost too good to be true. However, their study is well designed and replication of their methods could draw attention to the possible usefulness of a combination of laboratory markers.

Other laboratory markers which have appeared in the literature include: Plasma-amino-buteric-acid/leucine ratio (e.g. Shaw and Lieber, 1982, 1980; Herrington, Jacobson, Daley, Lipo, Biller and Weissgerber 1981; Lieber, Shaw and Van Wacs, 1978); uric, folic and lactic acids (Drum, Goldman and Janowski, 1981; Lieber, Jones, Losowski and Davidson,

1962); decreased levels of magnesium, calcium and phosphate (e.g. Stendig-Lindberg, 1974; Knochel, 1977); decreased iron and blood sugar levels (e.g. Powell, 1966; Lindenbaum and Lieber, 1969; Freinkel, Arky and Singer, 1965); raised serum concentrations of triglycerides and high density lipoprotein cholesterol (e.g. Lieber, Spritz and DeCarli, 1966; Chait, Mancini, February and Lewis, 1972; Lieber, 1973; Nikkila and Taskinen, 1978); changes in numerous hematologic tests (e.g. Jandl, 1955; Westerman, Balcerzac and Heinle, 1968; McFarland and Libre, 1963; Lindenbaum, 1968; Walls and Losowsky, 1971; Smith, Lonergan and Sterling, 1964; Wu et al., 1974); urine-alcohol, blood-alcohol, breath-alcohol, and saliva and sweat-alcohol (e.g. Hamlyn, Brown, Sherlock and Brown, 1975; Orrego, Kalant, Israel, Blake, Medine, Rankin, Armstrong and Capur, 1979; Wechsler, Kasey, Thum and Demone, 1969; McCall, Whiting, Moore, and Goldberg, 1979); and abnormal plasma transferrin and salsolinol levels (Stibler, Sydow and Borg, 1980; Collins, Nijm, Borge, Teas and Goldfarb, 1979).

Although there have been a number of reviews on the detection of alcohol abuse (Wilkins, 1974; Murray, 1977; Jacobson, 1976; Miller, 1976; Holt et al., 1981; Skinner, Holt and Israel, 1981), only one (Holt et al., 1981) has focused on physical symptoms associated with both its early and late clinical manifestations. The major areas where the symptoms occur are in the general appearance, the mouth, the gastrointestinal and genitourinary tracts, the face skin and hands, the cardiovascular and respiratory systems and the central nervous system. Like laboratory markers, most physical symptoms are not specific or sensitive enough to be useful measures. Those which are, become obvious only when

chronic alcohol dependence is well-established. Some of the symptoms which have been suggested as useful markers include: alcoholic jaundice (Sherlock, 1975), acute and chronic pancreatitis (Benjamin, Imrie and Blumgart, 1977); Dupuytren's contracture (Su and Patek, 1970); spider nevi (Bean, 1959; Brauerman, 1970); and alcoholic cirrhosis and its precursors (e.g. Bhathal, Wilkinson, Clifton, Rankin and Santamaria, 1975; Rankin, Orrego-Matte, Deschenes, Medline and Findlay, 1978).

It has been suggested that a composite index of medical signs in alcohol abuse may provide greater diagnostic accuracy than any single sign (Sher, 1977), but apart from that already outlined using laboratory markers, this suggestion has not been put into practice.

Summary of Biomedical Measures

The majority of laboratory tests used for diagnosing alcohol abuse are relatively non-specific, and the only true indicator of alcohol consumption is the detection of alcohol in a patient's body fluids. However, the relatively short half-life of these compounds and the fact that their presence alone has not been shown to predict the patient's drinking habits or the degree of tolerance, limits their use.

False positives are frequently produced by diseases not related to alcohol and even the most specific indicators are useful in a relatively small proportion of alcoholics. Given that the severity of liver disease is proportional to the

number of abnormal laboratory markers (Rankin et al., 1978; Orrego et al., 1979) many of the symptoms of liver disease will be sensitive only at the stage when other behavioural and physical signs are obvious.

However, laboratory markers may provide objective information to complement interview data and to confront patients who are denying alcohol abuse, although it must be remembered that there are nonspecific biomedical tests. Holt et al. (1981) perhaps best summarized current knowledge:

Incomplete knowledge of the sensitivity and specificity of many of the laboratory tests used in the detection of chronic excessive consumption prevents a firm recommendation for the selection of available diagnostic laboratory tests. (p.1289).

4.4 COMBINED PSYCHOLOGICAL AND BIOMEDICAL MEASURES

A World Health Organization (WHO) study group indicated that an important objective of future research on alcohol abuse is the

development of methods for screening and early detection of alcohol-related disabilities, with correlation of questionnaire and laboratory methods, (Edwards et al., 1977, p.100).

A search of the literature reveals only four attempts since 1977 to investigate combinations of psychological and biomedical measures:

In 1977 Feuerlein, Ringer, Kufner and Antons reported on the development of the Munich Alcoholism Test (MALT) which has both a medical and a psychological section. The medical section focuses on symptoms and includes several laboratory tests such as GGT. The psychological section has 24 self-report items relating to alcohol use, somatic complaints

and social drinking problems. The original report on the MALT was in German and in its translation to English (Feuerlein, Ringer, Kufer and Antons, 1980) a number of important aspects of its development were completely omitted. The following discussion is based on a corrected translation (Elvy, 1981).

A total score on the MALT is computed by summing the individual scores from the two parts to indicate suspected or definite problem drinking. There are seven items in the biomedical section and each is rated four points, although the criteria for scoring are not clearly stated. Each positive response in the psychological section is rated one point. The emphasis on the biomedical section (a possible score of 28 points for seven items compared with the psychological section where the possible score is 24 points for 24 items) is justified by the authors on the need for objectivity.

In a cross validation sample of 675 unselected patients, 201 of which were independently diagnosed by a physician as alcoholic, the MALT correctly identified 90 percent of the alcoholic patients, eight percent were judged to be suspected alcoholics, and two percent were not detected. None of the 474 non-alcoholics was incorrectly classified and the total MALT score correlated 0.85 with the independent physician's judgement. To date, there has been only one published study using the MALT, using 106 males from the armed forces reporting to the medical officer for a suspected alcohol problem (Skinner, Holt, Allen and Haakonson, 1980).

Skinner et al. were able to compare the item responses of the military sample with those of the alcoholic and control samples of Feuerlein et al. (1980) and conclude that the psychological section of the MALT forms a homogeneous scale with high internal consistency. Skinner et al. also conclude that the biomedical section of the MALT is relatively independent of the psychological section and that low scores on the biomedical section will be obtained when subjects are young and non-hospitalised.

More recently, Bernadt et al. (1982) compared the effectiveness of eight laboratory tests (mean cell volume, urate, cholesterol, high-density lipoproteins, alkaline phosphatase, AST, GGT, and glutamate dehydrogenase) and three screening tests (MAST, CAGE and the Reich) in a study to detect excessive drinking and alcohol dependence among 385 psychiatric patients. GGT, the best of the laboratory tests, detected only one third of those consuming more than 160mg of ethanol per day and of those independently diagnosed as alcoholic.

Other laboratory markers correlated highly with reported consumption but the correlations were too low to make them useful. In contrast, the MAST, the CAGE, and the Reich (Reich, Robins, Woodruff, Taibleson, Rich and Cunningham, 1975) interviews each identified nine out of ten alcoholics, and the CAGE and Reich interviews detected 93 percent and 98 percent of excessive drinkers respectively. The authors report that the interview was best at detecting those individuals defined as abnormal drinkers (more than 160mg of ethanol per day). They did not, however, combine both

biomedical and psychological data for classification purposes.

Kristenson and Trell (1982) used their own shortened version of the MAST (Mm-MAST) consisting of nine questions, in a comparison study with GGT involving 4350 middle-aged men. Using a cut-off point of two positive responses to the Mm-MAST, 66 percent of heavy drinkers, 73 percent of all registered alcoholics and 90 percent of not previously identified alcoholics were identified. GGT proved to be a poor marker for detecting the alcoholics, correctly defining only 35 percent. In combination, GGT and the Mm-MAST identified 82 percent of all registered alcoholics, and 97 percent of alcoholics who were registered in the period following the screening.

The authors conclude that the Mm-MAST in combination with biochemical tests is a useful screening instrument. However, this study is full of methodological flaws, for example: only half of the registered alcoholics answered the questionnaire; the Mm-MAST has no empirical validation or derivation; the classification for heavy drinking was not given; and GGT values were used to identify the alcoholics in the study who were not previously identified. The same flaws are even more apparent in another report (Peterson, Trell and Kristenson, 1983).

4.5 OTHER MEASURES

The advent of computers has shortened many complex and time-consuming tasks. Several authors have recently attempted to use computers to assist in the screening and diagnosis of alcohol dependence. The few reports in the literature of computer-assisted tests have employed lengthy questionnaires in their program development (e.g. Alcohol History Form of Gulliksen, 1950). Evenson, Altman, Won Cho and Montgomery (1973) developed an interactive program on data collected from 1023 alcoholics responding to the Alcohol History Form (which has 157 variables). Since the base line of the severity scale they developed used in-patient alcoholics, it is not surprising that "... far fewer items are reliably related to the severity continuum." (p.1340).

However, their severity scale has been adopted as part of a statewide data collection system (Sletten and Evenson, 1972).

Reich et al. (1975) were the first authors to use a multivariate sequential analysis strategy employing part-exit models (Sonquist and Morgan, 1970) for screening purposes. In this model 900 diagnostic items are assessed and their inter-relationships computed, with various exit-paths depending on earlier responses. The authors compared the results from the computer-based interview on 259 hospitalised patients who also had complete diagnostic interviews. The interviews agreed in 91 percent of cases, which is not surprising since there were 227 alcoholics. The authors also randomly selected 100 psychiatric in-patients and each patient was separately given a computer and a clinician's diagnosis. The overall concordance in responses was 89

percent with 27 percent detected as alcoholic. Later, Costello and Baillargeon (1978) replicated the study and found an 84 percent concordance between a clinical diagnosis and the computer interview for 57 alcoholic patients. They concluded that the screening inventory appeared to be an efficient instrument and recommended its further use, although it may lead to under-diagnosis, especially with alcoholics who are schizophrenic.

In an attempt to diagnose alcoholics using the full National Council on Alcoholism Criteria (1972), Lyons and Izadi (1980) developed a computer algorithm from the data on 120 alcoholics in treatment and 80 non-alcoholic general hospital patients. A five-category classification scheme was developed (non-alcoholics, potential problem drinkers, behaviourally-impaired drinkers, physiologically-impaired drinkers, alcoholics) which correctly diagnosed all of the 120 alcoholics and 65 percent of the 80 non-alcoholics. When the procedure was adjusted to produce a diagnosis of only alcoholic or non-alcoholic, all of the alcoholics and 85 percent of the non-alcoholics were classified correctly. So far, Lyons and Izadi are the only authors who have attempted rigorously to incorporate standard classification criteria into a computer-aided diagnosis.

More recently, Beresford, Low, Adduci and Goggans (1982) have presented a seven-item biochemical and hematologic profile which, when used as a computerised linear discriminate analysis, correctly identified 79 percent of 30 in-patient alcoholics and 80 percent of 66 in-patient non-alcoholics, where both groups were previously determined

by clinical interviews. The computer profile diagnosed 29 percent of the total sample as alcoholic, while the clinical interviews, which the authors felt were more reliable, detected correctly in 30 percent of the sample. The authors decided that the biochemical profile lacked sensitivity but did recognise patients in the early to middle stages of dependence.

All the cited computer-aided instruments have failed to report on the practical aspects of the procedures or to describe the program sufficiently well for interested others to know whether the program could be applied elsewhere. None reports how the information is gathered from respondents or whether the program is available for others to use. Another failing, that of clinical interviews to allocate patients to different experimental groups, cannot enhance the reliability of their results. Significant differences reported may in part be due to variability in the clinical interviews rather than the correct measurement of the underlying construct of interest.

There have been numerous other attempts to develop instruments which will distinguish alcoholics from normals. These include: breath and blood alcohol meters (e.g., Justin, 1979; Wilkins, 1974); dependence and tolerance instruments (e.g. Mello, 1972; Merry and Marks, 1969); galvanic skin response equipment (e.g. Coopersmith, 1964); memory dysfunction devices (e.g. Goodwin, 1971); operant analysis and unsuccessful attempts with neuropsychological tests (summarised in Miller, 1976).

4.6 SUMMARY AND CONCLUSIONS

This chapter has focused on available scales which could be used to measure the construct of problem drinking. For the purpose of the review, the measures were divided into three broad categories; psychological measures, biomedical measures, and combinations of measures.

Any clinical instrument whose results may be added to other information to decide on a patient's treatment regime, should meet various statistical and ethical criteria. Test statistical criteria are well documented (e.g. Anastasi, 1976; Cronbach, 1970; Martuza, 1977) and should include reports on measures of validity, reliability and test utility. Wilson and Jungner (1968) outline criteria for screening tests which centre around the ethical considerations on the outcome of screening, such as the availability of acceptable treatment resources. In practice, it is doubtful whether any screening instrument for problem drinking could meet all criteria. Certainly no instrument has reported on all these aspects and usually the statistical evidence is sketchy and of unclear derivation. Despite the flaws, problem drinking instruments are widely accepted and used for both clinical and research purposes.

Psychological measures include seven scales developed from the MMPI, and a variety of scales which directly measure behavioural consequences of problem drinking.

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The most cited MMPI scale is the MacAndrew and its revised

version containing items from the MMPI scales of Holmes', Hampton's, and Hoyt and Sedlacek's. However, reviewers do not agree on how well the MMPI scales differentiate alcoholics from normals. The critics (e.g. Sutherland et al., 1950; Syme, 1957; Franks, 1970; Miller, 1976; Apfeldorf, 1974, 1981) have questioned the evidence that alcoholics do have personality traits unique to alcoholics and that the MMPI scales have usually been used on samples they were not designed for, while those supporting the scales (e.g. Barry, 1974; Williams, 1976) believe consistent findings have been reported centering around clusters of traits common to alcoholics. However, it is clear that the majority of authors do not support their usefulness as clinical instruments.

The Michigan Alcoholism Screening Test (MAST) and the CAGE have been the most used direct measures. Some of the criticism directed at the MMPI scales has also been directed at other measures: they have been used widely on samples they were not designed for; for example, the MAST was developed from the responses of male drinking drivers yet is often used in inpatient and outpatient settings. The SADQ and SADD are promising recent scales which focus on the Alcohol Dependence Syndrome.

While the search for a biomedical test for problem drinking has been extensive, the results have been consistently disappointing. One study (Holt et al., 1981) cites over 100 references on laboratory tests alone to diagnose alcohol abuse. These authors discuss over 200 possible physical signs which could be used to differentiate problem and

non-problem drinkers, while others (Skinner et al., 1980; Bernadt et al., 1982; Reich et al., 1975; Eckardt et al., 1981; Feuerlein et al., 1979) have investigated combinations of psychological and biomedical measures, high-powered statistical functions of these measures, and computer models using over 900 diagnostic items. While biomedical measures have not been specific and sensitive enough to use, serum-gamma-glutamyl-transferase, asparatate-transferase and mean cell volume have received the most attention of those commonly available. The only validated instrument combining psychological and biomedical measures is the MALT (Feuerlein et al., 1980) which was developed for hospitalised problem drinkers. However, the medical section of the MALT is long and difficult to interpret, which restricts its use.

There are a number of conclusions which can be drawn from this literature review.

First, with the exception of recent alcohol dependency tests, the instruments do not have a sound theoretical framework which determines what the test is actually measuring. It seems that the majority of tests were implicitly employing Jellinek's disease model. The evidence cited suggests that this model is no longer plausible.

Second, it is difficult to decide with many of the tests whether they were designed to detect, diagnose or screen for the target group. The MAST is clearly a screening test, while the authors of other tests report on their instruments' diagnostic abilities and generally leave the reader to decide on the usage.

The third conclusion is that often instruments are used to detect or diagnose a condition on populations for which they were not designed. While these tests may have utility on other populations, the effect of clinically labelling a patient on the basis of an invalidated measure can be serious.

Fourth, many of the well used instruments often have poor statistical or psychometric documentation. If these scales were required to meet the American Psychological Associations Standards for Educational and Psychological Tests, then it is doubtful whether any would be acceptable, yet they continue to be used as clinical and research instruments.

The last conclusion is that all tests focus on the measurement of the dependent problem drinking subconstruct (the alcoholics) although this is usually assumed rather than stated. There is no instrument which claims to measure the construct of problem drinking, as problem drinking was defined in Chapter 2. The next six chapters are about developing such a measure.

CHAPTER FIVE

THE DEVELOPMENT OF A TEST TO MEASURE THE CONSTRUCT OF PROBLEM DRINKING

5.1 INTRODUCTION

The review from the previous chapter has shown that although there are many measures for detecting or diagnosing some aspects of problem drinking, few have received empirical validation and only two, the Alcohol Dependence Questionnaire (Stockwell et al., 1979) and the Alcohol Dependence Data Questionnaire (Raistrick et al., 1983), have made explicit reference to some underlying construct. Both of these tests have focussed their attention on dependent problem drinking, since alcohol dependence is the construct of interest. It is therefore unlikely that these tests will differentiate between the non-dependent problem drinker and normals.

Given that the non-dependent problem drinker has a better prognosis of recovery than those dependent (Blume, 1983), then there is good reason to develop a test on an empirical basis, which will reliably distinguish between problem drinkers and normals. However, there are several statistical considerations which must be taken into account before proceeding. It is vital to develop a test from a theoretical framework, which in this thesis, is to treat problem drinking as a construct. The choice of whether this test measures the construct of problem drinking for the purpose of diagnosis, screening or some other use, is

arbitrary. Once the decision has been made, however, then the instrument should be used solely for that purpose and applied only to the population for which it was developed.

General hospital patients have a high prevalence of dependent problem drinking (reviewed in McIntosh, 1982) and the hospital setting is excellent for the identification and treatment of this disorder (Lewis and Gordon, 1983).

Therefore, it was decided to develop a screening test to measure the construct of problem drinking specifically in general hospital inpatients. The generally low frequency with which clinicians recognise dependent and particularly non-dependent problem drinking influenced the decision to develop a screening test. Chapters six to ten and the remainder of this chapter are devoted to the development of this instrument.

5.2 STATISTICAL CONSIDERATIONS OF TEST DEVELOPMENT

Sensitivity and non-specificity

Sensitivity is the prevalence of positive responses to a problem drinking measure in the target group, and non-specificity is the prevalence in the group without the condition. Thus false positives arise when the non-specificity of a test is greater than zero, and false negatives arise when the sensitivity of a test is less than 100 percent. As Withy (1974) states:

The sensitivity of a screening test can be set at such a level that it always gives a positive result when disease is present (100 percent sensitivity, no false negatives), but this will inevitably be at the expense of loss of non-specificity due to the

selection of false positives.

This view is supported by Bernadt et al. (1982) who say that the primary requirement of a short test is that it should have a high sensitivity even at the expense of specificity. That is, it should detect a high proportion of genuine cases, even though this may result in some false positives. Alternatively, a test with a high degree of false negatives will be of little use if only a minority of the target group score on it. Murray (1977) suggests that one method of avoiding this sensitivity versus non-specificity dilemma is to use summary scores with a variety of cut-off points indicating the severity of the disability.

Reliability

The concept of test reliability has been used to cover several aspects of score consistency. In its broadest sense, Anastasi (1976) says:

test reliability indicates the extent to which individual differences in test scores are attributable to 'true' differences in the characteristics under consideration and the extent to which they are attributable to chance errors. (p. 71).

Types of reliability include test-retest, alternate-form, split-half, Kuder-Richardson and scorer reliability. Any reliability correlation coefficient can be interpreted directly in terms of the percentage of score variance attributable to different sources. For example, a reliability coefficient of 0.85 signifies that 72 percent of the variance in test scores depends on true variance in the trait measured and 28 percent depends on error variance. The reliability coefficients which are generally reported for

tests are split-half (sometimes referred to internal consistency) and test-retest estimates. Skinner et al. (1981) state that more than 180 questionnaires have been used in studies of drinking behaviour. Considering this number is likely to have more than doubled since then, there have been few reports of reliability on instruments designed to measure some aspect of problem drinking. For instance, Bailey, Haberman and Sheinberg (1966) administered a questionnaire to subjects in New York in 1960-61 and then again three years later; 25 of the 99 alcoholics identified in the first survey were not identified in the second.

Summers (1970) interviewed 15 patients admitted to a treatment unit and found that two weeks later 14 of them had changed their responses to 50 percent of the questions. Edwards, Hensman, Chandler and Peto (1973) reinterviewed 80 subjects after two to three months and reported that answers about drinking behaviour showed 70 percent reliability. Sobell, Sobell and Vanderspek (1979) found that the test-retest reliability of alcohol abusers self-reports of their daily drinking, alcohol-related incarcerations and their drinking problem history were highly reliable over a six week test interval ($R = 0.97$), although the authors are quick to point out the limits on the generalisability of the findings.

The World Health Organisation Expert Committee on Mental Health, Alcoholism Subcommittee (1952) argued that disguising the purpose of the interview would diminish the likelihood of a problem drinker denying symptoms, and therefore increase the reliability of the questionnaire. However, Edwards,

Chandler and Hensman (1972) and Plant (1977) both concluded that there was little significant difference when using disguised and undisguised questionnaires. More recently, Stockwell et al. (1983) administered the Severity of Alcohol Dependence Questionnaire (SADQ) to 45 subjects who were inpatients at alcohol treatment units. Each subject completed the SADQ twice with an interval of two weeks between tests. The test-retest correlation coefficient was 0.82 and all the individual test items had significantly similar responses.

Although apparently simple and straightforward, test-retest techniques present difficulties when applied to psychological tests for problem drinking. If the construct being measured is not stable over time, the choice of the interval between test and retest will substantially affect the correlation coefficient. Treatment effects are also likely to confound test-retest measures on self-report questionnaires; so there is a need to keep the time interval short. Anastasi (1976) suggests that for any type of instrument, the interval between test-retest should rarely exceed six months.

Validity

Test validity is concerned with what the test measures and how well it does so (Anastasi, 1976). Procedures for determining test validity focus on the relationships between test performance and other independently observed facts about the behaviour characteristics under consideration. The procedures are numerous and have been described by various names. The Standards for Educational and Psychological Test

and Manuals (1966) classifies these procedures under three main categories: content, criterion-related, and construct validity.

Criterion-related validity indicates the effectiveness of a test in predicting an individual's behaviour in a specified situation, and so has little application for problem drinking tests. However, content validity, which determines whether the test content covers a representative sample of the behaviour domain to be measured, and construct validity, which is an assessment of the extent to which the test may be said to measure a theoretical construct or trait, are both appropriate procedures to use here.

The majority of current tests rely heavily on patients' self-reports, because many aspects of problem drinking can be observed only by the person affected. The validity of self-reported data is often a neglected area in the alcohol field by researchers. In an effort to avoid the sometimes tedious and expensive procedures necessary to validate tests, they frequently choose to ignore the issue of validity or else they acknowledge an acceptable level of invalidity in their data. In a review of self-reported alcohol problems, Midanik (1982) states:

For the most part, researchers who have approached the issue of validity of self-reports in the alcohol field have concentrated their efforts on discrepancies in the direction of under-reporting (false negatives), and have thus tended to discount the possibility of over-reporting behaviours by attributing false positives to incorrect measurement of the criterion. (p. 357).

Closely aligned with validity issues is the notion that errors in reporting by patients will reflect their tendency

to deny the extent of their involvement with alcohol. Denial is seen as a defence mechanism or a conscious, deliberate manner of trying to deceive and evade specific issues (e.g. Moore and Murphy, 1961; Roizen, 1977). Gerard and Saenger (1966) suggest that because denial is an important feature in problem drinking models, patients will distort self-reported information. Hill and Blane (1967) noted that this makes evaluation based only on self-reports somewhat suspect.

Despite these widely held beliefs, numerous empirical studies indicate that most self-reports are valid (Sobell and Sobell, 1978; Sobell et al. 1975; Sobell, Sobell and Samuels, 1974; Cooper, Sobell, Masito and Sobell, 1980; Cooper, Sobell, Sobell and Maisto, 1981; Guze, Tuason, Stewart and Picken, 1963; Bailey et al. 1966; McCrady, Paolino and Longabaugh, 1978; Miller, Crawford and Taylor, 1979; Maisto, Sobell and Sobell, 1979). These studies usually show little or no bias in self-reports, but they do reveal disagreements running in both directions, and so random errors may be present which serve to reduce observed correlations. However Polich (1982) says that such random errors may not cause bias in overall means and percentages.

Some studies have compared alcoholics' reports of the amount drinking with a measure of blood-alcohol concentration (Armor, Polich and Stambul, 1978; Sobell et al. 1978, 1979; Jalazo, Steer and Fine, 1978). All of these studies found a tendency towards under-reporting. General population surveys provide other evidence that people under-report alcohol consumption by as much as 50 percent (Armor et al. 1978; Room, 1971; Casswell, 1979; Stacey and Elvy, 1981). These

studies, however, are measuring the self-report of alcohol consumption, which may contribute little useful information to a test.

While research substantiates the validity of most self-reports, Polich (1982) points out that the degree of validity depends on the type of behaviour assessed. Instruments usually report a validity coefficient between the test score and some independent measure. These construct validity correlations should not be too high, since without added advantages such as brevity or ease of administration, then the test is no better than an independent measure (Anastasi, 1976).

To the author's knowledge, measures of content validity per se have not been reported for problem drinking tests. Content validity is built into a test from the outset through the choice of appropriate items from the domain field. The fact that the content domain for problem drinking is not clearly established may partly explain the lack of such data. Generally, the reference to content validation is vague, such as:

The CAGE questions included ... (Mayfield et al. 1974, p.1121).

The MAST consists of 25 questions, many of which have also been used by other investigators in surveys of alcoholism. (Selzer, 1971, p.1653).

Items were selected to cover all stages in the development of alcoholism ... (Hilton and Lokare, 1978, p.43).

The questionnaire was designed to have the following properties ... (Raistrick et al., 1983, p.90).

Often, screening tests are assumed to be content valid (e.g.

Woodruff et al., 1976; Manson, 1949a; Selzer et al., 1975), or are based on other tests with assumed content validity (e.g. Hampton, 1953; Holmes, 1953; Hoyt and Sedlacek, 1958; Atsaiades et al., 1977; Bruder, 1982; Kalin, 1972; Skinner, 1982; Magruder-Habib et al., 1982).

Nearly all the validity coefficients reported are in fact measures of construct validity. The methods used are generally of two types: the Contrasted Groups Approach (Martuza, 1977, p151) in which the mean performance of the same measure on two contrasting groups should differ significantly; and Campbell and Fiske's (1959) multi-trait multi-method approach in which any two different measures of the same construct should have a high linear correlation and those measuring different constructs should have a low correlation.

Utility

A test which is statistically valid and reliable tells us nothing about the relative value of the test over other less costly possible procedures. Mischel (1968) points out that there is little value in developing a lengthy, expensive test or inference process to generate descriptions or predictions which are readily available from cheaper concurrent sources. Also, test derived statements are trivial if they merely correspond to routinely available information. For example, testing for problem drinking amongst inpatient alcoholics would be of little use other than to provide therapeutic feedback.

Referring to the field of personality Mischel (1968) states that:

Test-derived personality descriptions are valuable to the extent that they provide significant increments in valid information over other less readily available or less economical sources. (p.104).

Mischel refers to this as "incremental validity". Much of what can be said about incremental validity for personality tests is also true for tests of problem drinking.

First, the incremental validity of a test depends on the degree to which it adds to information available from the base rates for the appropriate population. For example, if 95 percent of inpatients at a treatment centre were diagnosed alcohol dependent, a test which predicts this label correctly 80 percent of the time is less useful than calling every patient in the hospital alcohol dependent.

Second, simple self-ratings may sometimes relate to the external criteria as well as, and often better than, more sophisticated complex tests designed to infer underlying theoretical constructs. For instance, Hase and Goldberg (1967) have shown that simple self-ratings are better predictors of how peers rate them than Gough's (1957) California Psychological Inventory. This same consideration is likely to apply to problem drinking where the majority of tests are short self-report questionnaires.

The third utility consideration relates to clinical judgement which may be shorter and cheaper than other measures.

However, there are doubts about the generality of clinical judgement across different situations (Kerch, Crutchfield and

Ballachey, 1962), about the effects of clinical training and experience (Sarbin, Taft and Bailey, 1960), and about the effects of the clinician's cognitive complexity (Bieri, Atkins, Briar, Leaman, Miller and Tripodi, 1966).

Fourth, the test should be suited to match the goal of the assessment. If a test is designed to screen for problem drinking, then it should not be used for diagnostic purposes. Labelling a patient alcohol dependent on the basis of a screening test score can have serious consequences in terms of treatment and patient self-esteem. It is likely that problem drinking tests currently being used are not serving the ends for which they were intended. Perhaps the best example of this is the Michigan Alcoholism Screening Test (Selzer, 1971) which has often been used as a diagnostic instrument (e.g. Moore, 1972; Skinner and Charalampous, 1978; Zung, 1978; Kaplan, Pokorny, Kanas and Lively, 1975).

Finally, the utility of a test depends on the time taken to complete the assessment and the confidence clinicians have in the results. Mischel (1968) says that the main purpose of tests is to supply the clinician with additional information to assist with a diagnosis. Little is gained when the administration of a test uses more time to obtain information than a skilled clinician would take to obtain the same information from a short interview.

Fortunately, the majority of problem drinking tests take less than 15 minutes to complete (e.g. Selzer, 1971; Bailey et al., 1973; Mayfield et al., 1974), although some can take up

to three half-hour interviews (e.g. Knupper, 1967). However, short tests suffer from the lack of faith in their predictive ability, although this may not be a fault of the test but rather that clinicians show great diagnostic tenacity and adherence to their initial categories, largely ignoring new information (e.g. Rubin and Shontz, 1960; Wishner, 1960; Anderson, 1965). While short tests for problem drinking are rapid, Murray (1977) believes they have not been widely accepted because of doubts about the truthfulness of responses, a view supported by Midanik (1982).

5.3 Nature of the Test

Given the enormous variety of drinking problems which are likely to be needed to cover the entire content domain of problem drinking, the logical process would be to develop a test which covers a sample of the domain. Providing measures of the sampled problems are above some predetermined criteria, then the information would alert the user to the possibility of alcohol problems. In terms of the problem drinking construct, this would be a matter of measuring a representative sample of subconstructs from the content domain. The purpose of such a test would clearly be for screening rather than for diagnostic purposes.

The procedure in the following experiments is: to select items representing the content domain of problem drinking; to write these items so that they fit Chapter three's definition of a subconstruct; to arrange the items so that collectively

they empirically measure the problem drinking construct; and finally to describe the psychometric and statistical properties of the instrument.

CHAPTER SIX

EXPERIMENT I: THE SELECTION OF PROBLEM DRINKING TEST

ITEMS

6.1 INTRODUCTION

The very process of selection means that there is some criterion which determines whether an item is included. The fact that in this experiment the test items are selected on their ability to differentiate between problem and non-problem drinkers, suggests that there is already some measure which determines problem and non-problem drinking. Unfortunately, this is not the case. Problem drinking scales summarised in Chapter four have not been validated on general hospital patients and they either measure alcohol dependence or claim to detect alcoholics. This does not mean that because there is no suitable criterion measure then the content domain of problem drinking cannot be defined. Rather, the problem of selecting items can be approached iteratively by successively evaluating the outcome, and making subsequent changes in the measurement as a result. However, any iterative process needs to begin with a measure which in some way approximates the expected result.

In the first experiment the Munich Alcoholism Screening Test (MALT) (Feuerlein et al., 1980) was used in a combination of other markers to provide a pool of possible test items representing the content domain of problem drinking, and the Short MAST (Selzer et al., 1975) was the initial criterion

FIGURE 10

General Design for Experiment I

Select a pool of test items
representing the content domain



Write items to suit the
model framework



Design and test the
questionnaire format



Empirically choose test items,
weightings and cut-off score



Describe psychometric properties
of test

FIGURE 11

Screening Out Criteria for Experiment I

Measure	Criteria
Will you take part?	No
Do you drink?	No
When did you last drink?	Never
Quantity-frequency measure (mls ethanol per day)	Average <3 for males and females
SMAST score	Score of 0

measure. The Short MAST (SMAST) was chosen because it was designed as a screening test, albeit for male alcoholic drivers, and it has received the most scrutiny and clinical application of all screening tests. The SMAST has also been used extensively for general hospital prevalence studies (summarised in McIntosh (1982)).

The test items in this study are, by definition, subconstructs of problem drinking and it is assumed that there may be interactions between these subconstructs. In this case the relationship between test items and total score reduces to the simple mathematical expression described by equation 4 in Appendix B.

6.2 METHOD

Design

In order to avoid the difficulties which generally arise when problem drinkers are compared with healthy controls (Feuerlein et al., 1980), both groups were patients in the general hospital. It was estimated that about 80 percent of patients would be non-problem drinkers, and since all patients needed to be interviewed to obtain the samples of interest, a number of special design features or phases were employed to determine which patient could be excluded from full interviews, since it was considered unethical and impractical to subject all patients to every question.

The general design for experiment I is given in Figure 10.

First, a pool of trial test items was selected which were thought to represent the content domain of problem drinking. These items included the twenty-seven MALT self-report questions and a further thirty-two psychological and biomedical markers commonly associated with alcohol abuse (see Appendix C). These markers were obtained following an extensive review of the literature. When discussing the derivation of the twenty-seven MALT items Feuerlein et al. state:

roughly 250 diagnostically relevant items were selected from the extensive literature on alcoholism and, with a total of 1335 patients were evaluated in three separate phases for their ability to differentiate. (1980, p.137).

The second step was to ensure that the test items were subconstructs and that their measurement was possible on a bipolar scale. Since there were a large number of items and the desired result was a screening test with simplicity and fast administration, the test scales were chosen as "yes" or "no" for the psychological measures, and "present" or "absent" for the biomedical measures.

The next step in the design was to construct a questionnaire format which reliably excluded non-drinking and light-drinking patients from further questioning. This problem presented some difficulty since the author was not able to find any documented method for selecting target patients from an unselected population. Obviously patients who did not drink could not be current problem drinkers, but even this assumption had to be tested. For example, asking a patient "Do you drink?" may elicit a response of "no", but by asking "When did you last drink?" the same patient may say "last week". A number of assumptions such as this were

assessed in six consecutive experimental phases during the data collection. These phases were designed to answer the following questions:

1. In order to screen out non-drinkers, is there a difference between asking "Do you drink?" and "When did you last drink?"
2. Are non-drinkers likely to score positive responses to any trial test items?
3. Are patients screened out on the basis of low quantity-frequency measures likely to score positively on trial test items?
4. How many patients scoring less than the SMAST criterion measure will score positively on trial items?
5. Will any combination of the screening out criteria affect the likelihood of positive responses on trial items?

Depending on the phase, there were five possible screening out points. These five questions and their screening out criteria are given in Figure 11.

A quantity-frequency measure was obtained by asking patients to recall how much they would drink^{on} an average drinking occasion in terms of the number and type of each drink they would have, such as one large glass of beer, three jugs of beer, two nips of spirits, etc. These measures were then converted into millilitres of ethanol to produce an average

FIGURE 12
Screening Out Questions
Used in Experiment I

Question	Phase					
	1	2	3	4	5	6
Will you take part?	**	**	**	**	**	**
Do you drink?	**	**	*	*	*	*
When did you last drink?	*	*	**	***	***	**
Quantity-frequency score	**	**	*	***	***	*
SMAST	**	*	**	**	*	*

* Measure not used
** Screening out criteria used
*** Measure taken but not used for screening out

FIGURE 13
Steps and Analyses
To Derive Test Items for Experiment I

Step	Analysis used
1. Select test items from pool of trial items	Non-specificity, sensitivity and likelihood ratios. Stepwise regression and correlation analysis
2. Check that items represent content domain, fit the definition of a subconstruct and are largely internally and externally perceived	Item analysis
3. Select problem drinking and control groups	Problem drinking group SMAST ≥ 1 . Controls SMAST = 0, drinking (but less than 35 mls and 15 mls ethanol/week males and females respec.), no physical signs.
4. Weight items to obtain maximum differentiation between problem drinking and control groups. Select cut-off scores.	Weightings from regression, trial weightings, tabulation tables
5. Describe test characteristics	Factor analysis, correlation analysis, cross tabulation with SMAST

quantity. Patients were also asked to recall the average time between drinking occasions and this and the quantity measure were then converted during the course of the interview into a measure as millilitres of ethanol per half day. It was decided that any male or female patient of any age drinking less than three millilitres of ethanol per half day (less than one nip per day) on an average drinking occasion was unlikely to experience problems with alcohol. This was the quantity-frequency screening out criteria.

The specific screening out criteria used in each phase are given in Figure 12. These criteria were incorporated into the final questionnaire (Appendix C).

The next design feature (Figure 10) was to derive the test items, weightings and test cut-off score.

It was estimated that at least 1500 patients would need to be interviewed in order to obtain useful data which would enable the statistical discrimination of the trial items. Some calculations were required in order to match resources needed for data collection with likely patient numbers, bearing in mind that all non-paediatric consecutive admissions would be interviewed (see Appendix D for these calculations).

The selection of the final test items required a number of steps and analyses, described in Figure 13.

First, items were selected from the pool of trial items. At this stage all patients were classified into two groups: problem drinkers were those whose SMAST score was one or

more; and non-problem drinkers those with a SMAST score of zero. While Selzer et al. (1975) suggest that an SMAST score of two or more is needed for a classification of possibly to definitely alcoholic, this criterion was lowered in this experiment to a score of one or more because in this author's opinion a classification of possibly alcoholic is suggestive of alcohol dependence, and since the objective in the experiment was to design a screening measure which detects both dependent and non-dependent patients, the SMAST criterion cut-off score needs to be lowered. Also, an examination of these questions (questions 10 to 22, Appendix C) shows that a positive response to any one of these items (representing a score of one) could indicate a problem with alcohol.

Data collected on patients were of three types: self-report obtained by interview (Q1 to Q44, Appendix C); data from physical examination and blood testing (blood tests, Appendix C); and biomedical data from examining the patients' ward notes (history, Appendix C). Since not all this data were able to be obtained on each patient, the sample sizes varied. For example, full self-report data which were independent on any previous selection criteria, were obtained on only 537 of the 1613 patients interviewed, while data from the ward notes were obtained from 1578 patients.

To select the items which best differentiated between the problem and non-problem drinking groups, a number of statistical procedures were used (Figure 13). First, the percentage of positive responses to a given item were determined for the problem and non-problem drinking groups to

provide measures of sensitivity (the prevalence of positive responses for a given item in the problem drinking group) and non-specificity (the prevalence in the non-problem drinking group). Second, a likelihood ratio for each item was calculated as the ratio of sensitivity to non-specificity. An item was excluded from the selection unless the sensitivity was five percent or more and the likelihood ratio was one or more. Third, each item was correlated with the SMAST groups to confirm its selection and a linear stepwise regression was used to predict the SMAST groups from the selected self-report items. The prediction equation coefficients from this regression are the t values from the mathematical equation 4 in Appendix B.

The second major step in deriving items (Figure 13) was to check that selected items were representative of the problem drinking content domain, consistent with the definition of a subconstruct, and that the total measure had items which were largely internally and externally perceived.

In the next step patients were divided into problem drinking and control groups. While problem drinkers were the same group as before, controls needed a SMAST score of 0 (the criteria for non-problem drinkers) and no evidence in their ward notes of alcohol problems. In addition, men and women in the control group had to be drinkers but to report drinking less than 35 mls and 15 mls of pure alcohol per week respectively (about the equivalent of two glasses and one glass of wine).

This additional requirement for non-problem drinkers to be classified controls was to ensure that controls did drink,

but without problems. The determination of these two groups was essential for the next step.

The fourth step was to weight the selected items to obtain the maximum differentiation between problem drinking and control groups, and to find a cut-off measure of the construct which would suggest problem drinking. While the obvious weightings were those derived from the regression analysis, these weightings would be difficult to sum in practice without an electronic calculator. Therefore, various trial weightings were used which approximated the regression coefficients. Cut-off scores were determined separately for self-report items and self-report plus physicians' items.

The final step in this experiment was to describe the factor structure of the test, how the individual items correlated with each other, and how the total test related to the SMAST.

Setting

All data were collected from admissions to 14 wards at a general hospital in Christchurch between June and November, 1981. The Hospital serves a population of about 350,000 and in the year ending 31 March 1982, the wards in which Experiment I was conducted had admitted a total of 10,048 patients (The North Canterbury Hospital Board Annual Report, 1981/1982). Patients were admitted to hospital through its Accident and Emergency Department to wards taking turns at being "on acute", and were also admitted through GP referrals and transfers from other hospitals and wards. These latter

patients were termed "arranged and waiting list admissions".

Patient interviews were conducted at the bedside in the ward. These were frequently difficult to arrange since if a patient was well enough to be interviewed, then they were usually well enough to be discharged. That is, the majority of patients were either acutely ill, recovering from or going to be operated on, connected to various apparatus which made the access to patients difficult, under medical examination by nursing or medical staff, being visited by friends and relatives, or simply being too old or sick to understand what was being said. The interviewers needed to be sensitive to all of these issues, and sometimes up to four repeated visits to patients were required before the interview was complete. Also, patients were usually in cubicles with about four other beds, making it difficult for a conversation not to be overheard by others.

There were two other aspects about the setting worth noting: First, the interview load was unpredictable. When a ward was "on acute" patients were being admitted and discharged much quicker than normal, and the interviewers had to ensure that each patient had been accounted for. Second, interviewing in such a setting was stressful for the interviewers. These stresses came from the rigorous demands from the normal ward routine, from the sometimes distressing physical appearance of patients, and from the patients' expressions of their anxiety about their condition and its associated problems to a sympathetic listener.

Subjects

All subjects were non-paediatric (over the age of 15 years) consecutive admissions to hospital. The age, sex, marital status and ward distribution of subjects are given in Appendix E (Tables I and II). Of the 2163 patients approached, full data were collected on 1613. Reasons for non-response included 50 refusals (2 percent) and 351 incomplete interviews (16 percent) resulting from early discharge or self-discharge before full data were obtained, illness or undergoing medical attention, or too old to comprehend an interview.

Procedure

Each day (excluding weekends) the admission list for the previous day was obtained from the orderlies' office. This list indicated the patient's name and the ward to which they had been admitted. From the research office in the hospital, the six interviewers then noted the names of the patients in the wards which the interviewers had been allocated. The patient list frequently contained over 100 names each day, and the interviewers were rotated on a monthly basis to each of the 14 wards, although the interviewers often had to assist each other on different wards depending on which wards were acute. The interviewers then attempted to locate the patient and arrange an interview, carefully noting whether an interview had been completed or not, since sometimes interviews were not finished until at least four days after admission. The interviewers also read the patient's ward notes to obtain other non-interview data.

Because not all patients would routinely have blood taken for

the liver function tests in this experiment, and because physical examination data would sometimes not be recorded by the medical staff in the ward notes, an attempt was made to increase the chances of obtaining this data by inserting a form, coloured pink for attention ("Attention Resident Medical Officer", Appendix C) at the front of the ward notes for the medical staff to complete. This form was inserted in every patient's notes by staff in the admitting office.

The most difficult task was collecting data from the ward notes, since there was no consistency about when the medical staff would make an entry. The interviewers therefore had to go back repeatedly until data had been recorded, or until four days had lapsed from the date of admission, in which case the data were reported as missing. Given that after four days one interviewer may have conducted 30 to 40 interviews, an accurate record system was essential. Once the interview was considered complete, a patient number was given to the interview schedule and bundles of about 200 at a time were taken for computer punching.

At 8.30 a.m. each morning, the author met with the interview staff to discuss progress and any problems arising through interviewing. Sometimes this resulted in the author visiting the patient to determine whether a referral should be made for psychiatric assessment or treatment for alcohol dependence. It was at this meeting where new experimental phases were introduced, discussed, and the interviewers practised the new schedule by interviewing each other.

The author's role in this experiment was in co-ordinating the

data collection, ensuring correct ethical procedures were being used, and in designing and checking questionnaires as the experiment progressed. Whenever an interviewer was sick or thought that an interview could be difficult, the author was the replacement. It was sometimes a major task to have the interview schedules ready at the change of each phase, since the new design depended on the outcome of earlier designs, although in practice this usually meant changing the style of data collection rather than changing the questionnaire. The co-ordination also meant that the right number of clipboards, badges, questionnaires, etc. had to be constantly updated. As the experiment progressed, the cumulative stress on the interviewers became apparent, and it was necessary to give substantial time in encouraging and supporting them.

Trials and Interviewer Training

Six workers from the Labour Department Project Employment Program assisted with the data collection. Five of the six had completed university degrees, including two at the masters level. Five were women, and all six were single. The average age was 22.7 years, with an age range of 21 to 25 years. At the beginning all six underwent a two week intensive orientation program which included visits to local treatment agencies, talks with alcohol professionals, reading and discussing relevant literature, and an introduction to hospital wards and medical staff.

In order to be familiar with interviewing techniques and the questionnaire, each completed trial interviews in the hospital wards for three days, involving 149 patients all

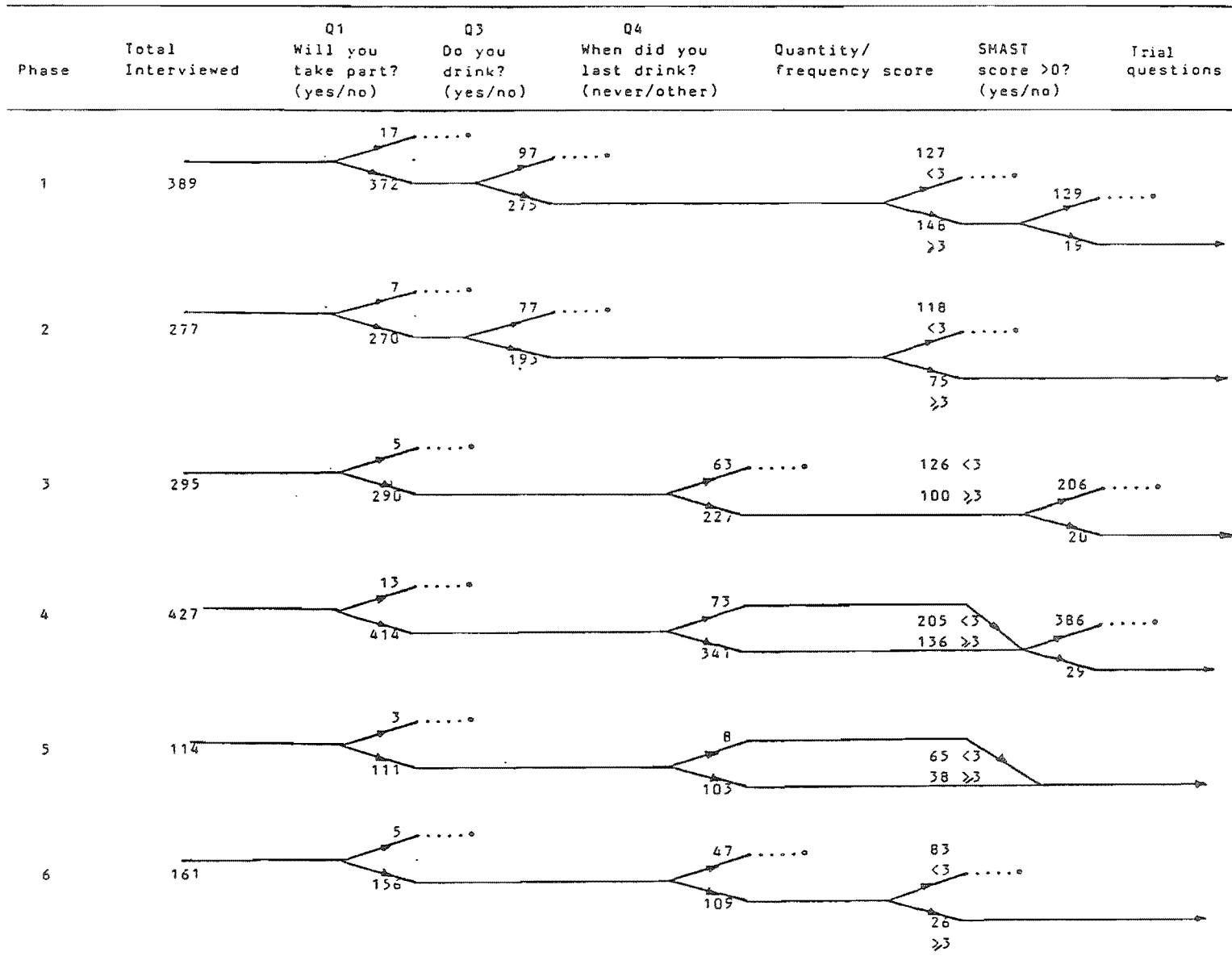
TABLE 1

Trials, Incompletes and Refusals for Experiment 1

Phase	Possible Patients	Incomplete	Refusals	Total Interviewed
1	394	5	17	372
2	284	7	7	270
3	374	79	5	290
4	590	163	13	414
5	199	85	3	111
6	173	12	5	156
Trial	149			149
Total	2163	351	50	1613

TABLE 2

Structure of Phases in Experiment I



together. At the end of each day the author and interviewers met to discuss problems and ambiguity with the questionnaire; any difficult parts were edited. (For the final questionnaire adopted see Appendix C).

Naming the Instrument

Once the final items had been selected from the pool of trial items it was decided to give the collection of items a name. Because the instrument was being designed to measure the construct of problem drinking, and because its use was to be for screening purposes only, the choice of the name for this thesis was the Problem Drinking Screening Test or PDST. (The Alcohol Research Advisory Group of the North Canterbury Hospital Board preferred for its purposes to name it the Canterbury Alcoholism Screening Test (CAST). See Elvy and Wells (1984)).

6.3 RESULTS

The raw data and SPSS computer program (Nie, Hull, Jenkins, Steinbrenner and Brent, 1957) for analysing it are given in Appendix C.

APPROACH FORMAT

The number of incomplete interviews, refusals, and patients on which full data were collected for each phase are given in Tables 1 and 2. In Table 2 the branch structure indicates the number of patients continuing with the interview, and the dotted line indicates the termination of the interview because of cut-out criteria. For example, in

TABLE 3

Tests of Phase Comparability for Experiment 1

PHASES	MEASURE	RESPONSES	χ^2	d. f.	Sig.
All	Will you take part) (Q1)	Yes, No	4.50	5	NS
1,2	Do you drink? (Q3)	Yes, No	0.47	1	NS
3 to 6	When did you last drink? (Q4)	Never, other	23.57	3	p<.001
All	Phase 1,2 with phases 3 to 6	'no' to Q3 'never' to Q4	12.19	1	p<.01
1,2	Cut-off criteria	QF>/C,QF<C	8.92	1	p<.01
3 to 6	Cut-off criteria	QF>/C,QF<C	2.74	1	NS
All	Phases 1,2 with phases 3 to 6	QF>/C,QF<C	2.74	1	NS
1,2	SMAST score	score >0 score =0	0.76	1	NS
3 to 6	SMAST score	score >0 score =0	3.34	3	NS
All	SMAST score	score >0 score =0	2.49	1	NS
2,5,6	SMAST score >0	score on trial questions			
	SMAST score =0	no score	277.60	1	p<.001

phase 1: 389 patients were interviewed (included 17 refusals); 275 said they did drink and 97 interviews were terminated because they said they did not drink; 148 patients scored higher than the quantity-frequency cut-off criteria; and 19 patients scored more than 0 on the SMAST and so continued with the trial questions. In phases 4 and 5, even when patients said "never" to the question "When did you last drink?", the interviews were still continued. Thus it can be observed that only in phases 2, 5 and 6 were the trial questions given independent of the SMAST score.

The effects of the different approaches taken between phases were tested by Chi-square significance testing (Table 3). To summarise:

(1) There were no significant differences between phases on the numbers taking part.

(2) There was a significant difference ($\chi^2 = 12.19$, $p < 0.01$) between asking "Do you drink?" and asking "When did you last drink?", with probabilities of $p = 0.73$ and $p = 0.80$ of positive responses respectively. There was also a significant difference to the "never" versus other types of responses (see questionnaire, Appendix C) to the question "When did you last drink?" between phases 3 to 6 where this question was asked.

(3) The responses in (2) did not significantly affect the quantity-frequency cut-out rates. However, these cut-out rates did vary significantly between all phases.

(4) The cut-out points taken in (1), (2) and (3) did not significantly affect the numbers scoring on the SMAST.

(5) In phases 2, 5 and 6 the trial questions were given independently of the SMAST score. While there was an obvious relationship between the trial questions and SMAST score, 125 of the 489 patients (26 percent) scoring 0 on the SMAST did score on one or more of the trial questions.

The conclusions which can be drawn from the summary are:

(1) It is better to ask "When did you last drink?" rather than "Do you drink?".

(2) Patients cut-out prior to the quantity-frequency measure and SMAST items would not score significantly above criteria on these measures.

(3) A significant number of patients scoring 0 on the SMAST did score one or more positive responses on the trial questions. For this reason, any subsequent analyses on the trial questions could include patients from only phases 2, 5 and 6 where trial questions were given independent of SMAST scores.

Thus the approach format for the instrument should include the question "When did you last drink?" and also the quantity-frequency screening out measures.

TABLE 4

Distribution of Self-Reported Quantity-Frequency Measures

	Total	0-30		31-40		41-50		Average mls ethanol/week								Above Criterion*		Below Criterion			
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%		
Men:																					
Total	856	420	49.1	126	14.7	20	2.3	61	7.1	5	0.6	85	9.9	13	1.5	126	14.7	224	26.1	632	73.9
Non-specificity	762	408	53.5	115	15.1	19	2.5	57	7.5	5	0.7	69	9.1	11	1.4	78	10.2	158	20.7	604	79.3
Sensitivity	94	12	12.8	11	11.7	1	1.1	4	4.3	0	0.0	16	17.0	2	2.1	48	51.1	66	70.2	28	29.8
Women:																					
Total	746	571	76.5	87	11.7	17	2.3	27	3.6	1	0.1	17	2.3	2	0.3	24	3.2	175	23.5	571	76.5
Non-specificity	724	567	78.3	85	11.7	16	2.2	20	2.8	1	0.1	16	2.2	2	0.3	17	2.3	148	20.4	576	79.6
Sensitivity	22	4	18.2	22	9.1	1	4.5	7	31.8	1	4.5	1	4.5	0	0.0	7	31.8	18	81.8	4	18.2

Between sexes, $\chi^2 = 1.57$, $p > 0.1$ on criterion measures

*Criterion: Men elevated >70 mls ethanol/week
 Women elevated >30 mls ethanol/week

TABLE 5

Prevalence Positive, Sensitivity, Non-Specificity and Likelihood Ratios for Trial Self-Report Questions (N=537)

Question ¹	Prevalence positive		Non-specificity(N=489)		Sensitivity (N=48)		Likelihood Ratio
	N	%	N	%	N	%	
23	37	5.0	15	3.0	12	25.0	8.33
24	42	7.8	24	5.0	18	37.5	7.50
25	14	2.6	7	1.5	7	14.6	9.73
26 *	3	0.6	2	0.2	1	2.1	10.50
27	25	4.7	17	3.5	8	16.7	4.77
28	65	12.1	37	7.6	28	58.3	7.67
29	8	1.5	4	0.9	4	8.3	9.22
30	31	5.8	17	3.2	15	31.3	9.78
31	43	8.0	24	5.0	19	39.6	7.92
32	17	3.2	9	1.7	9	18.8	11.10
33	11	2.0	7	1.3	5	10.4	8.00
34	30	5.6	15	3.0	15	31.3	10.40
35	25	4.7	13	2.6	12	25.0	9.62
36	37	6.9	24	5.0	13	27.1	5.42
37	41	7.6	23	4.8	18	37.5	7.81
38	20	3.7	10	2.0	10	20.8	10.40
39	43	8.0	23	4.7	20	41.7	8.87
40	34	6.3	18	3.7	16	33.3	9.00
41	18	3.4	9	1.9	9	18.8	9.89
42	51	9.5	30	6.1	21	43.8	7.18
43 ²	31	5.8	17	3.4	14	29.2	8.59
8 ²	217	13.5	184	12.3	33	28.4	2.31
5 ³ men	224	26.1	158	20.7	66	70.2	3.39
5 ³ women	175	23.5	148	20.4	18	81.8	4.01

1 Question numbers relate to the questionnaire, appendix C

2 N sampled = 1613, Non-specificity N = 1497, Sensitivity N = 116

3 Men N sampled = 856, Non-specificity N = 762, Sensitivity N = 94

3 Women N sampled = 746, Non-specificity N = 724, Sensitivity N = 22

* Question does not meet selection criteria of likelihood ratio >1 and sensitivity >5%

TABLE 6

Prevalence, Sensitivity, Non-Specificity and Likelihood Ratios
for Elevated Liver Function Tests

Test	Criteria for elevation	Prevalence			Non-Specificity			Sensitivity			Likelihood Ratio
		N	elevated	%	N	elevated	%	N	elevated	%	
Phos	>120 IU/l	1135	196	16.3	1064	184	16.3	71	12	16.9	0.98
AST*	>50 IU/l	1125	62	5.5	1054	54	5.1	71	8	11.3	2.19
MCV	>100 fl	1179	28	2.4	1103	26	2.4	76	2	2.6	1.12
GGT* men	>50 IU/l	567	134	23.6	515	115	22.3	52	19	36.5	1.64
GGT* women	>35 IU/l	500	117	23.4	490	114	23.3	10	3	30.0	1.29

* Indicates tests meeting selection criteria of likelihood ratio >1 and sensitivity >5%.

TABLE 7

Prevalence, Sensitivity, Non-Specificity and Likelihood Ratios for Elevated Medical Examination Tests (N=1578)

Test	Prevalence (N=1578)		Non-specificity (N=1465)		Sensitivity (N=113)		Likelihood Ratio
	elevated	%	elevated	%	elevated	%	
T.B.	27	1.7	23	1.6	4	2.7	1.69
Peptic or bleeding ulcer	20	1.3	15	1.0	5	4.4	1.10
Pancreatitis	5	0.3	4	0.3	1	0.0	0.03
High blood pressure	212	13.4	201	13.7	11	10.6	0.77
Hepatitis	19	1.2	18	1.2	1	1.8	1.50
Jaundice	28	1.8	28	1.9	0	0.0	0.00
Liver disease	7	0.4	4	0.3	3	1.8	6.00
Pneumonia	54	3.4	51	3.5	3	1.8	0.51
Chronic bronchitis	40	2.5	37	2.5	3	3.5	1.40
Epilepsy	24	1.5	22	1.4	2	3.5	2.50
Memory disorders	23	1.5	19	1.3	4	3.5	2.69
Nutrition	8	0.5	7	0.5	1	0.0	0.02
Accidents (>1)*	93	5.9	76	5.2	7	15.0	2.88
Drug abuse	8	0.5	4	0.3	4	3.5	11.67
Peripheral neuritis	1	0.1	1	0.1	0	0.0	0.00
Suicide attempt	6	0.4	3	0.2	3	2.7	13.50
Palpable liver**	75	8.5	64	7.9	11	15.7	1.99
Spider nevi*	11	1.2	8	1.0	3	4.3	4.30
Dupuytren's contractures**	33	3.7	29	3.6	4	5.7	1.58

* Indicates tests meeting selection criteria of likelihood ratio >1 and sensitivity >5%

+ N sampled = 884, non-specificity N = 814, Sensitivity N = 70

ITEM SELECTION

(I) Self-report items

Nearly all trial self-report items and those derived from the Munich Alcoholism Screening Test were administered after the SMAST, giving a total sample size for phases 2, 5 and 6 of 537. Two other questions were also added to the pool of trial question responses for analysis. The first was a self-report quantity-frequency measure and the second a question about family members with alcohol problems (questions 5, 6 and 8, Appendix C). These questions were asked before the SMAST was given and samples of 1602 and 1613 responded respectively.

The self-reported quantity-frequency measures were treated separately for men and women. Since the author could find no cited evidence about which levels of alcohol intake could lead to alcohol problems, it was accepted that if men drank on the average more than 70 millitres of ethanol per week and women more than 30 per week (about 36 nips and 15 nips of spirits each) then in the long term alcohol problems may result. These levels were therefore used as a trial marker for the quantity-frequency item.

The distribution of the quantity-frequency measures for both sexes, their non-specificity and sensitivity, and the numbers scoring above and below the criterion are given in Table 4. Twenty-six percent of males and 24 percent of females scored above the quantity-frequency criteria. In view of the likely prevalence of problem drinking in this sample to be in the range of 10 to 20 percent (McIntosh, 1982) then a prevalence

of around 25 percent scoring above quantity-frequency criteria was considered acceptable. These results, with their accompanying non-specificities and sensitivities were added to the pool of trial item results. Between the sexes, there were no significant differences for those scoring above or below the criterion ($\chi^2=1.57$, 1 d.f., $p>0.1$).

The prevalence of positive responses to all trial self-report items (including the previous quantity-frequency question, scored as above or below criterion) and their sensitivity, non-specificity and likelihood ratios are given in Table 5. In order to be selected the questions were required to have a likelihood ratio of more than one and a sensitivity less than five percent. Only one item in Table 5 (question 26 "At the moment do you feel miserable because of any problems or difficulties related to your drinking?") did not meet the selection criteria, because its sensitivity was less than five percent. In fact, only three patients (0.6 percent) scored positively to this item.

Thus 22 of the 23 re-written Munich Alcoholism Screening Test items were included and two additional items, one relating to family members with alcohol problems and the other to quantity-frequency measures, were finally selected as self-report questions.

(II) Medical examination and blood tests

Blood samples for liver function testing were routinely taken in 73 percent of cases for which full self-report data were obtained. Alkaline Phosphotase (Phos), Aspartate Transaminase (AST) and Gamma-glutamyl-transpeptidase (GGT)

were three of twenty-seven liver function tests calculated whenever a SMAC was ordered for a patient. The SMAC is a computerised analytical processor which automatically calculates liver function scores from about five millilitres of blood. A further five mls of blood were required for the Pathology Department to determine mean cell volume (MCV).

The prevalence, sensitivity, non-specificity and likelihood ratios for elevated tests are given in Table 6. GGT is sex specific and so must be evaluated separately for men and women. Alkaline Phosphatase and MCV were excluded because they did not meet selection criteria. It was important to note that elevated GGT occurred in nearly a quarter of non-problem drinkers (i.e., non-specificity), indicating that caution would be needed in its interpretation, and stressing the importance of interpreting elevated values in combination with other markers.

The requested medical examination for a palpable liver, spider nevi and Dupuytren's contractures was completed in 884 cases (55 percent) in which full self-report data were obtained, and the results from other medical examinations written in the ward notes were obtained in 1578 (98 percent) of cases. After discussions with senior medical staff, it was assumed that if a marker was not elevated, then its normality is not recorded in patient's notes. That is, medical staff record what is abnormal and rarely record normal results.

The prevalence, sensitivity, non-specificity and likelihood ratios for elevated medical examination tests are given in

Table 7. Of the twenty tests investigated, only three met selection criteria (accidents, all types and more than one; a palpable liver; Dupuytren's contractures).

In summary, of the twenty-four medical examination and blood tests investigated, only five were finally selected. These were: elevated AST, elevated GGT, a palpable liver, Dupuytren's contractures, and accidents (all types, more than one). It was the opinion of the author that the item relating to accidents should be rewritten to a self-report item as "Have you been in hospital more than once because of accidents? (by accidents, we mean all types)".

These resulting twenty-four self-report items and four medical items will be referred to as the "PDST Self-report" and "PDST Physicians" sections for subsequent analyses (see Appendix F).

(III) Stepwise regression and correlation analyses

Stepwise regression and correlation analysis were calculated for the selected items as a further check for their inclusion. Problem versus non-problem drinking was the dependent variable (SMAST scores of more than 1 and of 0 respectively) and only data from phases 2, 5 and 6 were used. The frequency of responses for the selected items are given in Table 3, Appendix E. The PDST physician's section (questions 25 to 28, Appendix F) was initially excluded from the regression analysis because only 214 patients had all four physician's items checked in phases 2, 5 and 6 (39 percent of patients) and of these, only about 10 percent had elevated scores. Also, regressing the physician's items

TABLE 8

Stepwise Regression Analysis of Selected Items
With Problem and Non-Problem Drinking Dependent

(N = 537)

Question item ¹	B	Beta	Std. Error B	R Square ²	Simple R	F Ratio	Sig.
6	0.304	0.28	0.041	0.369	0.607	54.587	a
20	0.158	0.12	0.050	0.490	0.550	10.078	a
9	0.171	0.13	0.046	0.540	0.507	13.731	a
23	0.169	0.14	0.046	0.569	0.500	13.436	a
13	0.159	0.07	0.083	0.585	0.417	3.682	a
10	0.177	0.13	0.046	0.595	0.477	14.827	a
2	0.150	0.15	0.034	0.603	0.467	19.511	a
17	-0.100	-0.08	0.046	0.609	0.316	4.739	a
22	0.361	0.16	0.089	0.613	0.417	16.615	a
4	0.053	0.06	0.023	0.618	0.186	5.232	a
11	0.051	0.03	0.062	0.622	0.406	0.677	c
16	-0.168	-0.09	0.066	0.624	0.440	6.382	a
5	-0.100	-0.07	0.049	0.627	0.223	4.260	a
8	0.132	0.08	0.059	0.630	0.486	5.058	a
15	0.147	0.09	0.064	0.631	0.470	5.262	a
7	-0.291	-0.11	0.105	0.635	0.215	7.610	a
18	0.083	0.06	0.056	0.636	0.477	2.240	a
21	-0.085	-0.06	0.068	0.637	0.490	1.540	b
24	0.066	0.04	0.060	0.638	0.449	1.214	c
12	0.098	0.04	0.084	0.638	0.315	1.374	c
3	0.036	0.03	0.036	0.639	0.156	1.011	c
14	-0.040	-0.02	0.090	0.639	0.252	0.193	c
19	-0.016	-0.01	0.080	0.639	0.416	0.039	c
(constant 0.0023)							

a significant at 1 percent or less

b significant at 5 percent or less

c not significant at 10 percent or less

1 order of entry (see Appendix F for questions)

2 cumulative

TABLE 9

Stepwise Regression of Selected Physician's Items
for 214 Problem and Non-Problem Drinkers

Item ¹	B	Beta	Std. Error B	R Square ²	Simple R	F Ratio	Sig.
AST	0.171	0.15	0.077	0.037	0.192	4.912	a
GGT	0.048	0.14	0.024	0.058	0.187	4.025	a
Duptyrens							
Contractures	0.114	0.10	0.084	0.073	0.134	1.845	b
Palpable liver	0.058	0.06	0.067	0.076	0.126	0.741	b

1 order of entry

2 cumulative

a significant at 1 percent level or less

b not significant at 10 percent level or less

AST = Aspartate transaminase

GGT = Gamma-glutamyl-transpeptidase

responses of these 214 patients with the SMAST criterion measure accounted for only eight percent of the total explained variance (Table 9). The author felt, however, that the test should include some objective externally perceived measures to give the resulting test face validity. The physician's section was therefore analysed separately.

Self-report items

The linear stepwise regression analysis results for the selected self-report items are given in Table 8. All questions were entered into the analysis, although several were not significant at 10 percent or less, but were still entered because at least 0.1 percent of the proportion of the variance not explained by other independent variables could be explained by the addition of these questions. Taken together, the 23 self-report questions explained 64 percent of the total variance and correlate 0.80 with the criterion score. The Pearson product-moment correlation coefficients for each item with the criterion measure ranged from 0.16 to 0.61.

Questions which correlated 0.5 or more with the criterion were: "After the first glass or two of alcohol do you ever feel a craving for more?"; "When you are upset do you drink alcohol to calm down?"; "When you drink a lot of alcohol, do you tend to eat less?"; and "Have you ever deliberately tried to do without any alcohol at all?". These four questions were also the first four entered into the regression analysis and all are indicative of dependent problem drinking. These first four questions accounted for 89 percent of the explained variance. Question 6, "After the first glass or

two of alcohol do you ever feel a craving for more?", is responsible for more than half of the total explained variance. The overall regression equation was highly significant ($F=39.49$; $d.f.=23.513$; $p<0.001$).

The beta values in Table 8 allow a comparison to be made of the effects of the independent variables on the outcome variables. When the beta values are positive, the question helps to explain problem drinking, while negative beta coefficients are associated with non-problem drinking. It is difficult to explain the negative coefficients in Table 8 although it may in part be due to the interpretation of the question. For example, question 17 which has a negative beta coefficient is "In order to cut down your drinking, have you ever felt it necessary to limit it to certain occasions or certain times of the day?". Some non-problem drinkers may respond positively to this because they feel it is inappropriate to drink at certain times of the day (e.g. while at work) and may not be relating their response to "In order to cut down". Another example, question 7 "Do you find you are thinking a lot about alcohol?", could be scored positively by non-problem drinkers who are highly aware of the effects and consequences of alcohol abuse, but who drink very little or not at all.

An examination of the item intercorrelation matrix (Table 4, Appendix E) reveals that the two items "Have you been in hospital more than once because of accidents? (by accidents we mean all types)." and "Have any close family members such as a parent, spouse, brother or sister, had drinking problems?" (questions 3 and 4, Appendix VI) have very low

correlations with other self-report items. The question "Have you been in hospital more than once because of accidents?" correlates best with "Do you find you are thinking a lot about alcohol?" (question 7), which confirms the author's subjective view that patients hospitalised from a recent alcohol-related accident are frequently concerned about the role alcohol had in the accident.

Several items correlate 0.5 or higher with other items. These are question 24 ("Have you often been told that your breath smells of alcohol") with questions 6, 21 and 22 ("After the first glass or two of alcohol do you ever feel a craving for more?", "Are there times when you would like to stop drinking?", "Would you get along better with your spouse/partner/the people you are closest to if you didn't drink?") which could be interpreted as patient awareness of the effect of their alcohol use on others, combined with an inability to stop drinking.

The next highest intercorrelations are between question 14 ("Do you prefer to drink alone?") and questions 12 and 13 ("Have you ever used alcohol to get rid of trembling or the feeling that you might be sick?", "Have you ever been criticised at work because of your drinking?") which could be seen as indicative of alcohol dependence. Finally, there is a high correlation between question 18 ("Do you feel you should drink less?") and questions 16 and 17 ("Do you ever have a guilty conscience about drinking?", "In order to cut down your drinking, have you ever felt it necessary to limit it to certain occasions or to certain times of the day?"), suggesting an awareness that their drinking has been

excessive and they have a genuine desire to drink less.

Physician Items

The regression analysis results for the SMAST criterion measure against the selected physician items for the 214 patients who had all four items checked in phases 2, 5 and 6, are given in Table 9. All items were entered although two (presence of Dupuytren's contractures, presence of a palpable liver) were not significant at the 10 percent level or less. The four physician's items together explain only eight percent of the variance and correlate 0.28 with the criterion measure. All items have positive beta values and all have similar correlations with the criterion measure, ranging from 0.13 to 0.19.

The intercorrelation matrix (Table 5, Appendix E) indicates a very weak relationship between the physician's examination items (the presence of a palpable liver, the presence of Dupuytren's contractures) and the liver function blood tests (AST, GGT) for the 570 patients on which full data on each item were collected. However, the correlations were much higher between individual blood tests and also between the physician's examination items.

Summary of Item Selection

On the basis of data from a maximum of 1613 patients, 25 self-report trial questions and 24 trial medical markers were reduced to 24 self-report and four medical items on the basis of sensitivity, non-specificity, and likelihood ratios.

These resulting items, named "PDST self-report" and "PDST physicians" were then subjected to a stepwise linear regression analysis using the SMAST as a criterion measure to confirm their selection. All selected items were entered into the analysis.

ITEM ANALYSIS

An item analysis was conducted to check that the selected items represent the content domain of problem drinking, fit the definition of a subconstruct, and are largely internally and externally perceived. The definition of a problem drinker as someone whose drinking causes harm to themselves or others is so broad that any items which measured the construct represented by this definition were likely to be sampling that content domain.

First, it can be argued that because the initial pool of items was selected by various means to sample the content domain of problem drinking, then any items selected empirically from that pool will therefore also represent the content domain.

Second, an examination of the final 24 self-report and four physicians items reveals that each item is consistent with the definition of a subconstruct. Each item measures only one idea and represents one pole of a subconstruct scale. In fact, a positive response to any item contributes positively to the problem drinking condition. That is, all items represent elements at "like" ends of the subconstruct scales. Also, as previously mentioned, each item was chosen to give "yes" or "no" responses rather than a number of discrete

TABLE 10

Raw Data on the Responses of Six Raters
On the Internal-External Dimensions of the PDST Self-Report Questions

PDST Question*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total	
Internal	6	0	2	2	6	6	2	5	4	4	3	2	5	6	6	6	6	6	6	6	6	6	6	6	6	107
External	0	6	4	4	0	0	4	1	2	2	3	4	1	0	0	0	0	0	0	0	0	0	0	0	0	31
Ratio E/I	0.0	>1	2.0	2.0	0.0	0.0	2.0	0.2	0.5	0.5	1.0	2.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3

* see Appendix F for questions

TABLE 11

Percentage* of Inter-Rater Agreement on the
Number of Self-Report PDST Internal - External Questions

Rater	1	2	3	4	5	6
1	100	78	78	83	78	83
2		100	83	83	78	78
3			100	83	61	87
4				100	65	100
5					100	65
6						100

$$* \text{ Percentage} = \frac{\text{No. in agreement}}{\text{Total no. of questions}}$$

Average = 79 percent

measures along the subconstruct scale. This is consistent with Kelly's allocation of 0 or 1 for each scale pole, and also with the mathematical explanation in Appendix B.

Last, in order to assess the presence of external and internal dimensions for each item, two experienced practice nurses, three psychologists (each having masters degrees in psychology, and with clinical experience) and one secondary school teacher (with a masters degree in English) independently rated each PDST self-report question as being largely externally or largely internally perceived. The physician's section was omitted from this analysis because each item is an objective external measure. The raw data and ratio of external to internal scores are given in Table 10. Any item which had a ratio of external score to internal score less than one was therefore more internally than externally perceived. Of the 23 items, only six (26 percent) were rated as largely external. These were PDST self-report questions 3, 4, 5, 8 and 13 (see Appendix F for questions). Question 11 ("Have you found that your hands have been trembling a lot?") was rated as being equally external and internal. The percentage of inter-rater agreement was calculated for each pair of raters as:

percentage = number in agreement / (total number of questions).

These percentages for the total number of inter-rater agreements are given in Table 11. Overall, the raters agreed in 79 percent of cases.

TABLE 12

Age and Sex Characteristics for Problem Drinkers and Controls

	Age			Sex			
	N	mean	s.d.	N	Male %	N	Female %
Problem drinkers	116	39.51	18.88	89	80.2	22	19.8
Controls	242	53.21	19.63	106	43.8	136	56.2
Significance	t= 25.85 351 d.f. p<0.001			X ² = 7.92 1 d.f. p<0.005			

TABLE 13

Consumption Data for Problem Drinkers and Controls
Consumption in average mls ethanol/day

Drink	Problem drinkers (N=116)			Controls (N=242)			Significance (351 d.f.)
	mean	s.d.	range	mean	s.d.	range	
Beer	97.2	134.8	0-999*	10.4	18.8	0-120	t=7.50 p<0.001
Spirits	24.5	52.2	0-300	8.7	15.9	0-100	t=4.03 p<0.001
Fortified Wine	4.4	29.2	0-300	3.2	9.3	0-60	t=0.56 NS
Table Wine	8.7	32.5	0-200	5.4	12.9	0-80	t=1.47 p<0.1
Other	0	0	0	0.1	10.3	0-20	-
Total	131.5	129.7	0-804	27.7	18.1	0-120	t=9.31 p<0.001

* Consumption exceeded 1000 mls ethanol/day

TABLE 14

Age Factors in Selected Physician's Items
for Problem Drinkers and Controls

	AST(>50 IU/l)		Sig.		GGT (>50 IU/l [♂]) (>35 IU/l [♀])		Sig.		Palpable liver		Sig.		Dupuytren's Contractures		Sig.	
	elevated	normal	X ²	P	elevated	normal	X ²	P	elevated	normal	X ²	P	elevated	normal	X ²	P
Problem drinkers: (SMAST >2)																
≥ 30 yrs	3	33	0.01	NS*	10	10	2.31	NS	7	18	2.48	NS*	3	22	2.70	NS*
< 30 yrs	2	17			5	14			2	19			0	21		
Controls: (SMAST = 0)																
≥ 30 yrs	35	611	0.48	NS*	164	494	10.21	<0.001	37	469	5.94	<0.025*	15	491	2.31	NS*
< 30 yrs	3	80			7	72			0	76			0	76		

* Fishers exact test used

TABLE 15

PDST Self-Report Score Distributions for Trial Weightings

Trial	Groups	PDST Score							Total
		0	1	2	3	4	5	6+	
B weights	Controls	234	1	1	3	2	1	0	242
	Problem drinkers	5	3	8	3	2	2	93	116
B weights scaled	Controls	184	52	2	1	0	1	2	242
	Problem drinkers	11*	5	3	4	2	3	88	116
Equal weightings of 1	Controls	184	52	2	1	3	0	0	242
	Problem drinkers	6	7	12	9	14	14	54	116

* One patient scored -3, one patient -2, and two -1.

TABLE 16

Cut-Off Score Effects on PDST Self-Report Score Distribution
for Different Item Weightings

Weightings	Cut-off score											
	2			3			4			5		
	A	B	C	A	B	C	A	B	C	A	B	C
B weights	2.89	93.10	0.031	2.47	86.21	0.029	1.24	83.62	0.015	0.41	81.90	0.005
B weights scaled	2.47	86.21	0.029	1.65	83.62	0.020	1.24	80.17	0.015	1.24	78.45	0.016
Equal weightings of 1	2.47	80.17	0.031	1.65	69.82	0.024	1.24	62.07	0.020	1.24	58.62	0.021

A = Percent of controls over cut-off score

B = Percent of problem drinkers over cut-off score

C = Ratio of A/B

TABLE 17

Linear Regression for 353 Problem and Control Drinkers
to Determine PDST Self-Report Cut-off Score

$$\text{Self-report PDST} = 1.425 \times \text{SMAST} + 0.752$$

F = 404.95, d.f. = 1.351, p < 0.01

Pearson's correlation = 0.82

	SMAST Categories		
	Not Alcoholic	Possibly Alcoholic	Definitely Alcoholic
SMAST Score	0-1.49	1.50-2.49	>2.50
PDST Score	0-2.88	2.89-4.30	>4.32

TABLE 18

PDST Self-Report Distribution in Relation to Short MAST Scores

Groups	N	PDST Self-report score (%)					CAST >3
		0	1-2	3-5	6-8	9+	
Control	242	76.0	22.3	1.7	0.0	0.0	1.7
Problem drinking SMAST groups:							
Non-alcoholics (SMAST=1)	39	12.8	28.2	33.3	17.9	7.7	58.9
Possibly alcoholic (SMAST=2)	36	2.8	16.9	38.9	33.3	8.3	80.5
Definitely alcoholic (SMAST=3+)	41	0.0	4.9	24.4	34.1	36.6	95.1
Total	116	5.2	16.4	31.8	28.5	18.1	78.5

TABLE 19

PDST Physician's Score Distribution for Trial Weightings

Trial	Groups	CAST Score							Total
		0	1	2	3	4	5	6	
B weights	Controls	196	0	0	0	0	0	0	196
	Problem Drinkers	18	0	0	0	0	0	0	18
B Weights scaled	Controls	143	32	10	8	2	0	1	196
	Problem Drinkers	5	6	1	6	0	0	0	18
Equal weightings of 1	Controls	143	40	10	2	1	0	0	196
	Problem Drinkers	5	7	6	0	0	0	0	18

TABLE 20

PDST Score Distribution (Physician's plus Self-Report)
for 214 Problem Drinkers and Controls

Groups		PDST Score							Total
		0	1	2	3	4	5	6+	
Control	N	106	65	13	5	5	0	2	196
	%	54.0	33.2	6.6	2.6	2.6	0.0	1.0	100.0
Problem drinkers	N	1	0	3	0	2	2	10	18
	%	5.6	0.0	16.7	0.0	11.1	11.1	55.3	100.0

TABLE 21

Principal Factor Matrix for PDST Questions

(N = 111 problem drinkers)

Questions	Factor 1	Factor 2	Factor 3	Factor 4	Communality
2	.083	<u>.466</u>	<u>.429</u>	-.185	.442
3	.118	.027	-.056	-.197	.057
4	.124	-.257	.107	.156	.117
5	.320	.261	-.270	-.339	.359
6	.299	-.138	.139	.281	.207
7	.378	-.221	-.087	.189	.235
8	.204	.117	-.091	.129	.080
9	-.025	<u>.490</u>	-.091	-.173	.278
10	.347	-.117	-.073	.123	.154
11	.329	.261	-.057	.310	.275
12	.310	.364	-.376	.284	.451
13	<u>.422</u>	.298	-.168	.100	.305
14	.333	.018	-.324	-.104	.227
15	.318	.167	.148	.189	.187
16	<u>.540</u>	-.102	.096	-.011	.311
17	.384	.108	.321	.193	.299
18	<u>.431</u>	.198	.218	-.085	.280
19	<u>.718</u>	-.017	.084	-.203	.552
20	.345	.021	.072	.062	.129
21	<u>.512</u>	-.100	.178	-.200	.344
22	<u>.560</u>	-.377	-.188	-.266	.561
23	.268	-.209	.035	-.041	.118
24	.331	-.220	-.056	-.013	.161
Total % of variance	51.1	21.4	14.1	13.5	
Eigen value	3.13	1.31	0.86	0.83	

Counting in the physician's section, a total of 17 of the 27 scoring items (63 percent) were rated as largely internally perceived.

It can be concluded from the item analysis that each of the selected questions which form the PDST are consistent with the definition of a subconstruct. Also they do sample the content domain of problem drinking and do have largely internally and externally perceived items.

SELECTION OF PROBLEM DRINKING AND CONTROL GROUPS

The major purpose of selecting problem drinking and control groups (Step 3, Figure 13) was to provide criterion measures in order to experimentally determine cut-off scores and item weightings.

Only data from patients in phases 2, 5 and 6 were used to select for the problem drinking and control groups, because only these patients were given the PDST self-report questions independently of the SMAST results, remembering that the SMAST results in other phases significantly affected the PDST self-report responses. Of the 537 patients taking part in these phases, only 358 were used for the problem drinking and control groups, with the remaining patients being omitted because they did not meet either group's criterion.

There were 116 problem drinkers and 242 controls, and both groups were significantly different on age and sex factors ($\chi^2 = 7.92$, $p < 0.005$, 1 d.f., Table 12). Problem drinkers were also drinking significantly more alcohol than controls ($t = 9.31$, $p < 0.001$, 351 = d.f.), with the difference being most apparent in the consumption of beer and spirits (see Table 13)

In order to determine whether age factors were likely to affect the outcome on the physician's items, both problem drinkers and controls were divided into patients over 30 years of age and under 30. A significant difference was found between these ages for GGT ($X^2=10.21$, 1 d.f., $p<0.001$) and the presence of a palpable liver ($X^2=5.94$, 1 d.f., $p<0.025$) for controls, but not for problem drinkers (Table 14). However, a comparison between problem drinkers and controls on age factors in the physician's items cannot really be made because of the significant difference between the mean ages for these two groups ($t=25.85$, 351 d.f., $p<0.001$, Table 9). An examination of table 14 does nevertheless, show that patients under the age of 30 years selected as problem drinkers would not be likely to score significantly differently on the physician's items from those over the age of 30 years.

ITEM WEIGHTINGS AND CUT-OFF SCORES

Since it was likely that the PDST would be used in settings where a physician's assessment was not always possible, experimental weightings and cut-off scores were considered separately for the self-report PDST and when the physician's section was added in.

PDST Self-report weightings

There were three trial methods used for determining item weightings: First, the B weights (item coefficients) from the stepwise regression analysis (Table 8) were used. Second, because it was likely in practice that these B weights could not be calculated without the assistance of an electronic device, equal interval scales were employed to

convert the B weights into whole numbers (see Table 6, Appendix E). Last, items were given weightings according to the author's judgement on their relative importance, resulting in equal weightings of one.

The PDST self-report score distributions for controls and problem drinkers for these three different trial weightings are given in Table 15. When the B scaled weights were used, four problem drinkers scored negatively, and so these patients were recorded as scoring 0 for the purposes of the distribution. An examination of these distributions shows that the problem drinkers and controls are separated around PDST scores of either 2, 3, 4 or 5. In order to find which set of item weightings best separated the two groups two criteria were used:

1. The problem drinking and control patients PDST score distribution means should be separated maximally on either side of the cut-off score (shortly to be determined).
2. The item weightings should in practice, enable the items to be summed without an electronic calculator.

Given hypothetical cut-off scores of 2, 3, 4 or 5, the percentage of controls and problem drinkers scoring over these cut-off scores and the ratio of these percentages are given in Table 16. The maximal separation on either side of these cut-off scores occurs when the ratio of the percentages (column C) is the smallest. Table 16 reveals that there is little difference between the scaled B weights and equal weightings of one. Given that in practice the use of

unscaled or scaled B weights would be difficult, and that the ratio of percentages of problem drinkers and controls scoring over the hypothetical cut-off scores are very similar, the author decided to use equal item weightings of one. Also, equal weightings of one are consistent, as previously mentioned, with Kelly's method of summing construct scores and with the suggested mathematical method for measuring the construct (Appendix B). In this method equal item weightings of one can be easily summed from each item (subconstruct scale) response to give a total problem drinking score. The next section deals with how much measure of the construct, or the cut-off score, is needed to indicate drinking problems.

PDST self-report cut-off scores

Regressing the SMAST scores from the problem-drinking group with their PDST self-report scores, indicated that a score of three or four points on the PDST corresponds to a score of two on the SMAST which is the lower cut-off for possibly alcoholic. The regression equation and predicted scores are given in Table 17. On the basis of this relationship and the score distributions obtained in Table 15, a score of three or more on the PDST self-report section was chosen to indicate alcohol problems sufficiently severe to warrant further assessment.

The distribution of PDST self-report scores for the control group and problem drinking Short MAST groups is given in Table 18. The PDST misclassified only 1.7 percent of control group patients as problem drinkers. Of those classified definitely alcoholic by the Short MAST, the PDST identified 95.1 percent as problem drinkers. However, the PDST also

identified as problem drinkers 12.3 percent and 58.9 percent of the two groups defined as non-alcoholic by the Short MAST (Short MAST scores of 0 and 1 respectively). These problem drinkers detected by the PDST but not by the Short MAST tended to respond positively to the question on craving (Q.6 Appendix F) and to questions indicating their concern about their level of drinking (Questions 9, 17, 18, 23, Appendix F) rather than questions relating to the physical or social consequences of drinking. Conversely, the PDST score did not reach the SMAST criterion measure for 19.5 percent of possible alcoholics and 4.9 percent of definite alcoholics. These patients missed by the PDST scored mainly on the Short MAST questions relating to external perceptions (arrests and others complaining) and not their internal personal concerns about their own drinking.

PDST Physician's Section

Item weightings

Using the data from phases 2, 5 and 6, there were 214 patients who had all four clinical items checked. Three methods of weighting items were investigated. These were: the B weights from Table 9; the B weights scaled to the nearest whole number (see Table 7, Appendix E); and equal weightings of 1. The PDST physician's score distribution using these trial weightings is given in Table 19. An examination of this table reveals that when B weights are used, the sum of these weights for any patient is always less than one. A more usable distribution can be obtained by either scaling the B weights into positive whole numbers, or

allocating equal weightings of 1 for each item.

Because there was generally a low likelihood of all four physician's items being available ($p=0.182$) it was decided to count the total physician's section as 0 for no positive item responses and 1 for any one or more of the physician's items elevated. The rationale for this scoring system was:

1. The distributions of the B weights scaled uniformly to positive whole numbers and equal weightings of one (Table 19) both have equal numbers of patients scoring one or more on the physician's section (27 percent of controls and 72 percent of problem drinkers) and so it is simpler to allocate equal weightings of one.

2. An investigation of the effect of different weightings and scoring systems on the total PDST's scores (self-report plus physician's) relation to the criterion measure revealed that treating the physician's section as a whole and scoring it as zero or one for any one or more items scoring positively, maximised the correlation with the criterion measure and accounted for the greatest amount of change in the explained variance.

Scoring the physician's section in this way increased the explained variance from 64 percent (without the physician's section) to 65 percent (when the physician's section was added to the PDST self-report section). The correlation co-efficient for the physician's section with the criterion measure was 0.27.

PDST Physician's plus self-report cut-off score

The total PDST score distribution for 214 problem drinkers and controls is given in Table 20. This was the distribution obtained when the physician's section was scored as one for any one or more items scored positively and zero otherwise. An examination of this table suggests that a cut-off score of four or more would be desirable on the basis of false positives (3.6 percent) and that only 22.3 percent of problem drinkers would be missed by the PDST, which is similar to the 21.6 percent missed when only the self-report section is used. Selecting any other cut-off score results in either an unacceptable number of false positives, or an unacceptable number of problem drinkers misclassified as normals.

On the basis of these cut-off score characteristics, it was decided that when the physician's section is included in the assessment and scored as zero or one, the cut-off score for the PDST should be raised to four or more to indicate problems with alcohol.

PDST FACTOR STRUCTURE, CORRELATION MATRIX AND RELATION TO
SMAST

Introduction

These properties of the PDST are described only for the self-report section, since as earlier emphasised, it is expected that this section is likely to have the major usage. The factor structure and inter-correlation matrix are described for 111 patients from phases 2, 5 and 6. Also, the distribution of the self-report PDST and the SMAST is given

for 537 patients (111 problem drinkers and 426 controls) from phases 2, 5 and 6. Descriptions of the reliability and validity of the PDST will not be presented here: they are the subject of experiments II to V.

Factor Structure

The item scores for 111 problem drinkers were subjected to a principal factor analysis (Nie et al, 1975). The principal factor matrix and item weightings are given in Table 21. Item loadings of more than +0.4 are underlined. The analysis yielded two factors with an eigenvalue greater than or equal to one, and a further two factors with eigenvalues of 0.86 and 0.83 respectively. The first two factors accounted for 72.5 percent of the total variance, and no item loaded on more than two factors.

The first factor consists of six items (questions 13, 16, 18, 19, 21 and 22, Appendix F) and relate to the respondent's feelings of guilt. None of these questions is indicative of alcohol dependence and all indicate early symptomatology of problem drinking, such as concern about the spouse/partner's attitude and a desire to drink less or to stop drinking altogether. The highest loading on question 19 suggests an awareness that alcohol is causing problems which in combination with other items (guilty conscience; desire to drink less; would like to stop drinking) implies that persons scoring highly on this factor are likely to be well-motivated to receiving help: they are aware of their problems and would like to stop drinking or drink less. All of these six items from factor one were rated as being largely internally perceived (Table 10).

The second factor has only two items, questions 2 and 9. Patients scoring highly on this factor may be substituting alcohol for food, since they are scoring on the drinking question and when they do drink, are eating less. Such patients often have long-standing drinking problems.

Correlation matrix

The self-report inter-correlations were typically very low ranging from 0.0 to 0.42 (Table 8, Appendix E). Only seven items correlated 0.35 or more. Of the seven items, question 19 ("Do you think that without alcohol you would have fewer problems?") correlated with four others: question 5 ("Do you drink before lunch fairly often?"), question 16 ("Do you ever have a guilty conscience about drinking?"), question 21 ("Are there times when you would like to stop drinking?"), and question 22 ("Would you get along better with your spouse/partner/the people you are closest to if you didn't drink?"). With the exception of question 5, all of these questions have a heavy loading on factor one, and suggest that those with a self-awareness that there would be fewer problems without alcohol also have feelings of guilt, a desire to stop drinking, and a need for a better spouse/partner relationship.

Relationship of the PDST self-report to the SMAST

The distributions of SMAST scores and PDST self-report scores and various aspects relating to these distributions are given in Table 3, Appendix E. The probability of being a problem drinker on the SMAST is 0.09, while on the self-report PDST the probability was 0.11. Thus, the self-report PDST was an

improvement over the SMAST in the detection rate. In fact, the self-report PDST detected 12.3 percent of patients with a score of zero on the SMAST. Other aspects relating to this table have already been discussed. The conclusion which can be drawn, however, is that the overall prevalence of possible problem drinking in the sample during the surveyed period was about 11 percent, as measured by the self-report PDST.

6.4 DISCUSSION

The aim of this experiment was to select questions from a pool of trial items to provide a measurement instrument for the problem drinking construct. The result, the PDST (Appendix F) was a 24 self-report item instrument of which 23 items score, with an optional physician's section of four items. The first two self-report items ("When did you last drink?", "How much do you normally drink each week?") serve to screen out patients who are not likely to be problem drinkers.

The majority of the 24 trial medical markers which were investigated were much too insensitive to use, and even the four included in the physician's assessment section of the PDST did not discriminate well, either singly or together. However, if this section is available, it would be useful to add to the self-report section to provide a more comprehensive view of the patient's functioning. It is expected that in practice the main function of the physician's section will be to provide evidence with which to confront patients who deny that their alcohol consumption is

causing problems.

When the Short MAST criterion measure of two or more is used to indicate "possible or definite alcoholism", the Short MAST misses 47 percent of those detected by the PDST (a score of three or more on the self-report section) as problem drinkers. The self-report PDST has 75 percent of items rated as being largely internally perceived, whereas the Short MAST questions relate mainly to external perceptions such as drinking/driving charges, hospital admissions and Alcoholics Anonymous attendances.

By investigating different item weightings empirically, it was decided to give each self-report item a weighting of one point and to sum the result for a total PDST score. When the physician's section is included, if any one or more item scores positively, a further point is added to the total PDST score and the cut-off raised by one to four.

From a construct measurement viewpoint, the justification for this simple addition of unitary positive response scores is given in Chapter three and in the mathematical explanation (Appendix B); that is, each PDST item is a subconstruct of the problem drinking construct. Each item has a scale which any patient can be represented on as a score of zero or one, corresponding to "no" or "yes". The overall representation on the problem drinking construct scale (the score on the PDST) can be described by the sum of the weighted representations on the subconstruct scales (the PDST item scores). Referring to equation 4 in Appendix B, all the b 's are one, and the test results, t , are either zero or one.

While the methods used to select the test items and to devise a scoring system are simplistic, the empirical evidence does nevertheless suggest that the PDST is an improvement over the Short MAST in measuring the problem drinking construct and has a higher percentage of internally perceived events, which if scored positively, do indicate that the patients are at least saying that they are having alcohol problems and may be motivated to accept help. The PDST has a strong first factor relating to a self-identified awareness of alcohol problems, guilt, and a desire to stop drinking or drink less. While the Short MAST has not yet been subjected to factor analysis, Zung (1978) has factor analysed the longer MAST and identified four dimensions of alcohol dependence symptomatology; Help-Seeking, Discord, Alienation and Denial. The factor structures of the PDST and MAST suggest that the MAST is orientated towards dependent problem drinking, while the PDST could be better for use as an early detection instrument for non-dependent patients.

In Chapters 7 to 10, a series of smaller experiments designed to study the validity and reliability of the PDST are described. These experiments are an important part of the total test development. Because it would have been difficult to collect data on the PDST physician's section, the experiments apply only to the PDST self-report section.

CHAPTER SEVEN

EXPERIMENT II: TEST CONSTRUCT VALIDITY

7.1 INTRODUCTION

The aim of Experiment I was to select test items from a pool of trial items in order to devise a measurement instrument for the problem drinking construct. While some of the psychometric properties of the PDST items have been presented, the next logical step is to investigate test validity. In this experiment the construct validity is explored using the principle of convergent validity (Martuza, 1977, p.153). Divergent validity asserts that any two instruments intended to measure different constructs, should have a low linear correlation. This principle was not explored in this experiment, because a suitable similar length screening test designed to measure some other construct could not be found.

With convergent validity any two different measures of the same construct should have a relatively high linear correlation. That is, tests designed to measure the same characteristics should rank a group of respondents in approximately the same order. Since the PDST was the only measure developed specifically for non-dependent and dependent problem drinking, it was not possible to obtain another instrument which measures exactly the same construct. Again, the nearest approximation was the Michigan Alcoholism

Screening Test (MAST) (Selzer, 1974). The longer 25 question MAST was chosen for this experiment instead of the 13 item Short MAST because the longer version approximated the same length as the PDST, which is an important consideration in testing construct validity in this way (Martuza, 1977).

7.2 METHOD

Settings and Subjects

All 71 subjects were inpatients during the first week of a program designed to treat alcohol dependence.

There were 40 male and 12 female patients from Queen Mary Hospital, Hanmer Springs, and 15 males and four females from Mahu Villa, Sunnyside Hospital. Both groups of patients were diagnosed as alcohol dependent by the admitting physicians and were involved in a treatment program of 12 weeks.

The average age of patients was 35 years (range 18 to 68 years) and none was drinking at the time of the study.

Design and procedure

When patients were admitted for treatment, they were first placed in a welcome group, in which they were introduced to the hospital routine and the treatment program. In their welcome group sessions (usually the Friday of the first week) patients were asked by the group leader if they would take part in some research about drinking patterns. They were asked to remember when they were last drinking and to respond for that time period. They were then given a

TABLE 22

Self-Report PDST and MAST Score Distributions
for 71 Alcohol Dependent Patients

PDST Score	0-2	3-8	9-14	15-20	21-33	>3 ¹	Total
N	1	2	13	48	7	70	71
Percent	1.4	2.8	18.3	67.6	9.9	98.9	100
Cumulative Percent	1.4	4.2	22.5	90.1	100.0		100

1 Problem drinkers

MAST Score	0-4	5-6 ²	7-25	26-44	45+	>7 ³	Total
N	0	2	11	46	12	69	71
Percent	0.0	2.8	15.5	64.8	16.9	97.2	100
Cumulative Percent	0.0	2.8	18.3	83.1	100.0		100

2 Possibly Alcoholic

3 Definitely Alcoholic

TABLE 23

Relation Between PDST Self-Report and MAST Score Distributions

Groups		PDST Score				
		0-2	3-10	11-20	21+	≥3
Possibly alcoholic (score 5-6)	N	0	2	0	0	2
	%	0.0	100.0	0.0	0.0	100.0
Definitely alcoholic (score 7+)	N	1	3	58	7	68
	%	1.3	4.3	84.1	10.2	98.6
Total		1	5	58	7	70

self-administered questionnaire which had the PDST self-report section one one side and the MAST self-administered form on the other side (Appendix G). On completion all questionnaires were checked by the group leader to ensure that all items were answered.

7.3 RESULTS

The raw data and the SPSS Source program for analysing it are given in Appendix G.

The PDST screened 70 of the 71 patients (99 percent) as problem drinkers, of which 91.5 percent scored 10 or more (maximum 23), with the average score 17. The one patient screened as a non-problem drinker was a 28 year old male whose major dependence was not alcohol. The MAST, on the other hand, screened all patients as dependent, 69 as definitely alcoholic and two as possibly alcoholic. The PDST and MAST score distributions are given in Table 22.

Table 23 shows the relationship between the PDST self-report and MAST scores. Only two of the patients screened as problem drinkers by the PDST were classified as possibly alcoholic by the MAST. The remaining 69 patients were classified definitely alcoholic by the MAST including the one patient screened as a non-problem drinker by the PDST. An examination of this patient's responses reveals that he scored seven points on the MAST, five points for a positive response to the question "Have you ever attended a meeting of Alcoholics Anonymous?", and two points for the question "Have

you ever been arrested for drunk driving, driving while intoxicated, or driving under the influence of alcoholic beverages?".

The responses to the quantity-frequency question of the PDST (question 23, Appendix F) gave the total mean consumption per week for each patient as the equivalent of 91 nips of spirits, or about three large 750 millitre bottles of gin.

The Pearsons product-moment correlation between the MAST and the PDST was 0.70.

7.4 DISCUSSION

The main purpose of this experiment was to provide a measure of the convergence of two tests measuring the same construct. The measure of 0.70 is acceptably high, accounting for 49 percent of the explained variance.

A weakness in this study is that the MAST was designed to detect alcoholics, which presumably are those dependent on alcohol. The PDST on the other hand, was designed to screen for problem drinking, which includes non-dependent and dependent patients. There is, therefore, a slight conceptual difference in the construct which both tests were designed to measure. That is, the correlation between the PDST and the MAST could be higher if the MAST was also designed to detect non-dependent problem drinking.

Another weakness in this study is that the 71 patients were

diagnosed as alcohol dependent. While this sample's age and sex characteristics are similar to the data the PDST were developed on (age: $t=2.09$, $p<0.01$, d.f.=185; sex: $\chi^2=0.193$, $p<0.10$, 1 d.f.), the number of alcohol dependent patients in Experiment I and this experiment were clearly different, since, according to the MAST, 96 percent of patients in this sample were screened definitely alcoholic while only 35 percent in Experiment I were.

In summary, a correlation of 0.70 between the PDST and the MAST does indicate a reasonable agreement on the convergent validity of these two tests.

CHAPTER EIGHT

EXPERIMENT III: TEST CROSS-VALIDITY

8.1 INTRODUCTION

According to Cronbach (1970) the purpose of cross-validating an instrument is to ensure that the test performs in the same way for different random samples from the same population. Martuza (1977) gives the following procedure for determining a cross-validation co-efficient:

- (a) Derive a prediction equation using data generated by the first sample,
- (b) Administer the predicted test to the second sample drawn from the same population,
- (c) Use the prediction equation obtained from the first sample (called the validity sample) to estimate criterion performance for each of the individuals in the second sample (called the cross-validation sample),
- (d) Measure the actual criterion performance for each individual in the cross-validation sample, and
- (e) Calculate the linear correlation between the predicted and actual criterion scores for this cross-validation sample. (p.164).

8.2 METHOD

The prediction equation for the PDST is simply the numerical sum of item responses and the criterion performance is problem or non-problem drinking. The preceding principles of Martuza are used in this experiment to provide a measure of the cross-validation for the PDST.

Subjects and Setting

The samples were obtained during 1981 from 187 patients, of which 84 were from Queen Mary Hospital, Hanmer, and 83 were from Mahu Villa, Sunnyside Hospital. Other aspects about the setting and subjects are the same as those described in Experiment II.

Design and procedure

Data were collected by interview from patients during the first week of their treatment program using the questionnaire in Appendix H. The research assistants who conducted the interviews were three of those who assisted with the data collection for Experiment I. The questionnaire included the Short MAST, PDST and numerous other demographic and medical items relating to alcohol abuse. All patients approached agreed to take part in the interviews and each patient was asked to think back to the period in which they were last drinking.

Because at the time of the study patients were being treated for alcohol dependence, the author believed that the PDST would predict each patient in the cross-validation sample to be a problem drinker. Using Martuza's (1977) terminology, the criterion performance for each patient would be problem or non-problem drinking. The main point of this study was, therefore, to determine how many patients were screened as problem drinkers.

TABLE 24

Self-Report PDST score Distribution for 165 Alcohol Dependent Patients

PDST Score	0 - 2	3 - 8	9 - 14	15 - 20	21 - 23	Total
N	0	12	59	92	2	165
Percent	0.0	7.2	35.8	55.8	1.2	100
Cumulative Percent	0.0	7.2	43.0	98.8	100	

8.3 RESULTS

Of the 187 patients approached, full data were obtained on 165. The SPSS Source program and raw data are given in Appendix H. The main reason for non-response (12 percent of patients) was that interviews were interrupted by the requirements of the treatment program. The mean age of the sample was 39 years (range 16 to 76), and there were 127 males (77 percent) and 26 females. There was no significant difference in age between the PDST development data on 116 problem drinkers and the age of patients in this study ($t=0.23$, $p<0.1$, $d.f.=279$), neither was there a significant difference in the numbers of males and females ($X^2=0.40$, $p<0.10$, $d.f.=1$).

The PDST score distribution for the sample is given in Table 24. All patients scored three or more on the PDST self-report and 98 percent scored five and over.

8.4 DISCUSSION

The purpose of this experiment was to determine whether or not the PDST performs in the same way on two different samples drawn from the same population. Because all alcohol dependent patients would be classified as problem drinkers by the PDST, and because all patients in this experiment had received a diagnosis of alcohol dependence, the hypothesis was that the PDST would predict each patient in the cross-validation sample to be screened as a problem drinker. The results confirmed this hypothesis.

As with Experiment II, the weakness of this study was that the sample did not include non-dependent problem drinkers while the validity sample had 34 percent (39 patients) in this category according to the Short MAST. A further validation study involving both dependent and non-dependent problem drinkers is therefore needed.

CHAPTER NINE

EXPERIMENT IV: TEST INTERNAL CONSISTENCY

9.1 INTRODUCTION

A test is said to be internally consistent if all of its items measure the same thing. The factor analysis results from Experiment I suggest that the PDST is uni-dimensional, with the first factor accounting for more than half the total explained variance. Given this, and that the PDST was designed to measure the construct of problem drinking, it is important to determine whether the test items are a relatively homogeneous sample from the content domain. The two most frequently used techniques for measuring internal consistency are the split-half procedure and a calculation of co-efficient alpha. Given the choice between the split-half and alpha co-efficients for measuring the internal consistency, alpha is preferable because its application to any particular set of test data results in a unique value (Martuza, 1977, p.128).

The aim of this experiment was to provide a measure of co-efficient alpha for the PDST self-report.

9.2 METHOD

The data for this experiment were the same as that for

Experiment I for phases 2, 5 and 6. The subjects, setting and procedure for the data collection have been described in Sec. 6.2.

Co-efficient alpha was calculated for the self-report PDST responses for the 537 problem and non-problem drinkers. Because the data were in dichotomous form, the equivalent Kuder-Richardson-20 equation was used.

9.3 RESULTS

Co-efficient alpha was 0.89.

9.4 DISCUSSION

The Kuder-Richardson-20 co-efficient alpha calculation provides a useful lower bound estimate of reliability (Martuza, 1977, p.131), which suggests that the PDST self-report has a true reliability greater than 0.89.

CHAPTER TEN

EXPERIMENT V: TEST RELIABILITY

10.1 INTRODUCTION

In Experiment I PDST items were empirically selected and in Experiments II and III measures of test validity were obtained. However, no test would be authentic without some indication of its reliability. Reliability studies give information about the consistency of a person's score on a series of measurements. There are many ways of measuring test reliability, such as test-retest, parallel forms approach, the split-half procedure, a measurement of the alpha co-efficient and inter-rater reliability.

Another important consideration is the relationship between test length and reliability. According to Cronbach (1970) the importance of test length is that with every question added, the sample of performance becomes a more adequate index of performance on all possible questions. Extreme increases in test length, however, can introduce boredom and may reduce reliability.

The most obvious method for finding the reliability of test scores is by repeating the identical test on a second occasion with the same sample. The longer the time between tests, the lower the co-efficient of reliability (sometimes called the co-efficient of stability or temporal stability).

The reliability co-efficient is the correlation between the scores obtained by the same person on two administrations of the test. Error variance corresponds to the fluctuations of performance from one test session to the other. Since retest correlations decrease progressively as the interval between testing lengthens, the error variance increases and there is an infinite number of retest reliability co-efficients for any test (Anastasi, 1976). The time interval between testing should therefore be appropriately chosen and any relevant intervening experiences of the subjects being tested need to be well-documented.

In the Standards for Educational and Psychological Tests (American Psychological Association, 1974) it is suggested that in some situations where test scores are obtained for changing characteristics of individuals, the test-retest reliability co-efficients may need to be calculated on the basis of successive days or weeks. Given the likelihood of treatment effects in the sample used in this experiment, the time interval needed to be as small as possible, yet not too small for the subjects to remember some of their former answers, which would give an over-estimation of reliability.

If the problem drinking construct is relatively stable over time for an individual then the obvious answer is to choose a long-time interval to minimise memory effects. However, there was no cited evidence of the likely stability of dependent or non-dependent problem drinking over intervals appropriate for a test-retest study. In one study of problem drinking test-retest reliability a time interval between testing of two weeks was used (Stockwell et al., 1983). It

was decided here that to minimise treatment effects the time interval between testing should be one week.

10.2 METHOD

Subjects and Setting

This study involved 23 patients from Mahu Villa, Sunnyside Hospital, and 44 patients from Queen Mary Hospital, Hanmer, at the beginning of 1984. All were inpatients undergoing treatment for alcohol dependence. Other details regarding the treatment programs in hospitals have been described previously in Experiment III.

Design and Procedure

All patients were given the self-report PDST (Appendix F) during the first week of their treatment, usually on a Friday. They were told to think back to the last time they were drinking before giving their responses. The patients' names were recorded at the top of the form to allow matching on retest. Approximately 60 patients from Queen Mary Hospital and 25 patients from Mahu completed the test on the first occasion, but a number of these were absent on retest because they had been discharged. Any patient who was unable to read or was having difficulty with the questions was able to be assisted by the author and a research assistant.

After exactly one week had elapsed, the patients completed the same questionnaire and were given the same instructions as on the previous occasion. A number of new patients had

TABLE 25

Test-Retest Correlation Coefficients for PDST Self-Report
(N = 67, all significant at $p < 0.005$)

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	TOTAL
Correlation	.70	.85	.88	.60	.72	.68	.67	.74	.71	.63	.61	.62	.63	.57	.58	.60	.32	.49	.60	.40	.52	.50	.65	.90

entered the program and they also completed the questionnaire. The final sample included all those patients who had completed the questionnaire on both test and retest measures.

10.3 RESULTS

A total of 67 patients completed the PDST on both occasions. Raw data and SPSS source programs are in Appendix I. There were 53 males, 14 females, and the average age was 37.1 years (range 16 to 73 years). There was no significant difference in sex between the original PDST development data (Experiment I) on 116 problem drinkers and this sample ($\chi^2=0.03$, $p<0.10$, d.f.=1), nor was there a significant difference in the age characteristics ($t=0.97$, $p<0.10$, d.f.=181).

Pearson correlation co-efficients were calculated for each of the 23 self-report scoring items and for the total score. These correlations are given in Table 25. Sixteen of the individual items yielded correlation co-efficients greater than 0.60, and six of these were greater than 0.70. The range was 0.32 to 0.88. All items were significant at the $p<0.001$ level. The total score correlation was 0.90.

10.4 DISCUSSION

With the exception of question 17, the PDST self-report items and the PDST total score were all found to yield consistently high and significant test-retest reliability co-efficients. The low reliability co-efficient for question 17 ("Do you

think that without alcohol you would have fewer problems?") may be explained in part by treatment effects. Seven patients (10 percent) who responded "no" to this question on the first test, responded "yes" on retest. It is possible that alcohol-dependent patients undergoing treatment, frequently initially deny their alcohol problems. The effect of treatment is to erode this denial, and if this is the case, a change in response patterns to question 17 would be likely.

CHAPTER ELEVEN

DISCUSSION AND CONCLUSIONS

While there is a large amount of literature on alcoholism as a disease, very little has been written on problem drinking as a concept, although problem drinking as a term is frequently referred to. Most notably, Cahalan (1970) presented a strong argument for adopting the term problem drinking to replace the term alcoholism. Cahalan also empirically derived clusters of drinking problems which could be summed and called problem drinking. However, Cahalan gives no conceptual argument as to why it is possible to do this. If we continue to approach problem drinking theory in an ad-hoc way, then there is a danger of the term becoming as confused and as emotionally charged as the term alcoholism.

It is only recently that two questionnaires, the Self-Administered Dependency Questionnaire (Stockell, 1979) and the Self-Administered Alcohol Dependence Data (Raistrick, 1983), have used a more accurate concept than alcoholism, namely the now ten-year old alcohol dependence syndrome (Edwards and Gross, 1976).

Undoubtedly Cahalan's attempt to produce clusters of drinking problems based on the definitions from Plaut (1967), Knuffer (1967) and Keller and McCormick (1968) is to be admired. Yet the major difficulty is that because drinking problems are so idiosyncratic, any empirically derived definition needs

to be broad enough to include most possibilities: and it is likely to be imprecise. There is an urgent need, therefore, to reconsider how we interpret and communicate theory on problem drinking.

Interpreting problem drinking as a construct as defined in the Standards for Educational and Psychological Tests (1974) and more precisely as a personal construct by George Kelly (1955) makes it possible to view a drinking problem as a concise, numerical and theoretically measurable concept. Both Kelly and later Bavelas (1978) agree that constructs are ideas which organise some aspect of existing knowledge along a scale with end points. The theory developed in this thesis suggests that it is possible to allocate numbers to these ideas, as Kelly did, and to sum them to form an overall numerical representation of a cluster of ideas. The ideas are alcohol problem constructs, or subconstructs, and the sum of subconstructs forms the construct problem drinking. The strength of this theory is that it allows for all possible drinking problems to be measured similarly, and for problem drinking to be represented on a continuum.

Every person can be represented on the problem drinking construct scale and two or more people at the same point on the scale may have completely different clusters of problems, which vary over time and across situations. In this sense the construct of problem drinking is common to all individuals and can be measured in the same way for everyone, while at the same time it allows for the individual responses of each. Although the operational problem of deciding exactly which subconstructs form the content domain of

problem drinking may be difficult, this thesis does give a consistent way of both interpreting and scoring any drinking problem.

Kelly's personal construct theory was the stimulus for viewing problem drinking as a construct in this thesis. This does not mean that problem drinking should be viewed as primarily personal. In fact, the views of others, or the external perceptions, are an important part of the problem drinking construct. However, Kelly's theory does help explain the personal interpretations of drinking problems, and that these interpretations can be broken down into measurable subconstruct scales, with each scale representing a particular problem from the domain of problem drinking. This process also applies to the view of others, and it is important to combine both views when measuring the construct.

If a diagnosis of problem drinking is required, then a very large sample of drinking problems from the content domain would be necessary to ensure that all problem drinkers were sharing the same equivalence classes. A much easier approach, which the experiments in this thesis use, is to select a representative sample of items from the content domain to provide a measure of the construct. If all shared equivalence classes are not included, then such a measure of the construct can only hint on the possibility of problem drinking, and as such, the measure becomes a screening rather than a diagnostic instrument.

Because the choice in the experiments was to devise a

screening instrument for an unselected general hospital population to measure the construct of problem drinking, it was necessary to find statistically and ethically safe ways to select the target group. Also, because the construct being measured was on a continuous scale from non-problem to problem drinking, an effort was made to ensure that only a small number of problems was needed before a patient scored positively, while at the same time trying to keep false positives to a minimum. The focus thus became one of measuring the construct in such a way that early detection for problem drinking was possible. There is increasing evidence that early detection for problem drinking is worthwhile (e.g.: Blume, 1983; Lewis and Gordon, 1983; Margolis, Krystal and Siegel, 1964; Smart, 1974; Vogler, Compton and Weissbach, 1966; Fagan and Fagan, 1966), and there is little point in screening only for dependent problem drinking when this is already apparent to medical staff.

The result of the experiments was the construction and refinement of the Problem Drinking Screening Test (PDST). Each item in the PDST was a subconstruct with a bipolar scale, scored as zero or one. The summing of these scores was justifiable mathematically and the total score provided a measure of the problem drinking construct, alerting the user to the possibility of drinking problems.

The PDST has been designed primarily as a self-report measure, although a physician's section is included. Because a large number of items (74 percent) from the self-report PDST are rated as internally perceived, then there is a high likelihood that a patient scoring on this section is at least

admitting to some alcohol problems, and so may be more motivated to receiving help than patients scoring on most other instruments, where the majority of items are usually externally perceived.

For dependent problem drinkers the PDST has construct validity ($r=0.70$); it was 100 percent correct in a cross-validation study; the internal reliability was greater than 0.89 (co-efficient alpha 0.89); and the total score test-retest correlation was 0.90. Although other questions such as test utility and the validity of self-report have already been raised in Chapter five, one further consideration was needed before the PDST could be completed.

There is now substantial evidence that people move into and out of drinking problems (Cahalan, 1970; Vaillant, 1980, 1983) and that temporal markers such as the duration of the problem, need to be considered. For this reason a time frame, arbitrarily chosen as three months, was placed on all self-report responses. Failure to include this could result in gross over-reporting (Magruder-Habib et al., 1983) or false positives. While the need to focus on recent events may conflict with the disease concept of alcoholism, the focus fits perfectly well when viewing problem drinking as a construct.

Several conclusions can be drawn from this work: First, it is not only possible, but it is highly desirable to view problem drinking as a construct. Second, the construct can be measured in a way which enables the scientific development

of a problem drinking instrument. Third, with the exception of the PDST, there are no instruments which claim to detect or measure problem drinking. Fourth, there is an urgent need to present problem drinking theory scientifically so that it is not criticised for vagueness in the way the term alcoholism has been. Finally, as always, more research is needed.

APPENDIX A

LABELLING THEORY, SELF-EFFICACY AND THE PROBLEM DRINKING
CONSTRUCT

The relevance of labelling theory in its application to the internal and external dimensions of the subconstruct scales is discussed below:

Tannenbaum (1938) was the first to point out the consequences of labelling for the self-concept and behavioural patterns of the labelled. The basis of labelling theory is that one's self-concept is influenced by the response of others. Most labelling theory is discussed in the framework of deviant behaviour patterns and has excluded problem drinking (e.g. Lemert, 1951; Becker, 1963; Brookover, Erickson and Joiner, 1967; Ziller and Golding, 1969; Ziller, 1973). The first mention of the function of labelling to drinking problems was by Roman and Trice (1968) who contended that the disease concept of alcoholism placed alcoholics and deviant drinkers in "sick roles" with expectations that served to develop, legitimize, and in some cases even perpetuate the abnormal use of alcohol. The general model was that the negative alcoholic labels of others lead to the acceptance of an alcoholic's self-view.

Ward (1979) has shown that perceived labelling and self-concepts account for differential drinking patterns. Other studies have shown that social-psychological variables play an important role in accounting for problem drinking (e.g. Cahalan, 1970; Jessor, Graves, Hansen and Jessor, 1968), although they have not incorporated perceived

alcoholic labels of others into self-concept. Ward concludes:

significant others in the problem drinker's life are often those who impute the personally devastating negative alcoholic labels whose consequences are often further drinking. (p.1044).

Further support for the notion that problem drinking labels by others affect self-concepts comes from several different sources.

Skinner et. al. (1982) compared individuals who identified themselves as alcoholic versus non-alcoholic in a clinical sample of 255 referred for alcohol-related problems. The self-identified alcoholics were more likely to have attended Alcoholics Anonymous and agree with its philosophy that abstinence is necessary for improvement. These authors conclude that the perception that a drinking problem exists is complemented by an exposure to an ideology such as Alcoholics Anonymous.

The second source of support comes from Keil et. al. (1983) who studied the effects of labelling from a social resources perspective. Their findings indicated that once a person was judged to have an alcohol problem, the likelihood of a repeated admission for treatment is enhanced.

The third source of evidence comes from Kaplan, Kanas, Pokorny and Lively (1974) who examined the MAST responses from 66 alcoholics from treatment wards (the self-identified alcoholics) and a matched group of alcoholics from general psychiatric wards (non-self-identified alcoholics). They found that the self-identified alcoholics scored

significantly higher on the MAST, and they also responded positively with a significantly greater frequency to the specific MAST items that were independently judged to reflect alcoholic self-identification. Unfortunately the authors do not report on which MAST items reflect alcoholic self-identification, other than ^{that} 43 percent of the 25 question MAST items did so. Since a conservative estimate by the author of the 25 question MAST is that 18 (or 61 percent) of the items reflect the perception of others rather than self-perception (that is, external perceptions in construct scales), then it is likely that a large number of the alcoholic self-identification items reported by Kaplan et. al. also reflected external perceptions.

Last, self-efficacy theory accounts specifically for the role of cognitive expectations in treatment and their effect upon behaviour (Bandura, 1977, 1978, 1980; Bandura and Adams, 1977; Bandura, Adams, Hardy and Howells, 1980). Bandura argues that a distinction can be made between outcome expectations, and efficacy expectations, which refer to the conviction that a person can successfully produce the behaviour required to achieve the outcomes. He points out that:

Individuals can believe that a particular course of action will produce certain outcomes, but if they entertain serious doubts about whether they can perform the necessary activities such information does not influence their behaviour. (1977, p193).

If Bandura's theory is correct, then abstinence treatment will be successful only to the extent that the alcoholic develops a sense of mastery over maintaining life-long abstinence in the community. Since this is the most common therapeutic goal of most abstinence treatments some authors

(Sterne and Pittman, 1965; Davies, 1981) have expressed concern about the effect of moralistic judgements of motivation towards this goal on patient self-esteem. Rollnick and Heather (1982) suggest that some patients may not believe that life-long abstinence is the solution, or that one drink will necessarily lead to relapse. They believe that if labelling such patients as unmotivated causes initial, specific problem to become generalised and insurmountable, then alternatives such as controlled drinking should be explored. Wilson (1978) on the other hand, argues that the alcoholics' belief that they will not be able to cope with a return to drinking is deliberately reinforced in traditional approaches to abstinence treatment. Since some studies have shown that hospitalised alcoholics are concerned with the issue of respectability and returning to normality (Heather, Edwards and More, 1975; Rollnick and Heather, 1980), such an expectation may contribute to a general sense of hopelessness and low self-esteem and a feeling of being abnormal and different from most people (Rollnick and Heather, 1982).

Both outcome and efficacy expectations appear to contain positive and negative aspects (Rollnick and Heather, 1982). Expectation is created that life-long abstinence will lead to the resolution of the drinking problem (the outcome), while it is also emphasised that if the alcoholic returns to drinking, this will lead to relapse. Similarly, the alcoholic's feelings of personal mastery are developed remaining abstinent, yet an expectation is also created which stresses the personal weakness and inability to cope with further drinking. Rollnick and Heather (1982) predict that

if a person endorses the negative counterparts of these expectations, then they are likely to relapse if they return to drinking after a period of abstinence. Other authors have pointed out the belief that a single drink leads to relapse could create a self-fulfilling prophecy (Marlatt, 1978; Wilson, 1978; Sobell, Sobell and Christelman, 1972; Schaeffer, 1971).

Labelling theory explains an aspect of the relationship between the external and internal scales of the problem drinking construct: that is, the external perceptions of others, whether they are derived from a social resources perspective or individualised, subtly influence the individual's internal perception on a subconstruct scale. As an example, consider a patient waking up in the morning after an alcohol-related accident the night before, and suppose they are questioned about how much they had to drink, or the perception on the "very little vs very much to drink" scale. Without reference to any other information, they may feel they had "very little to drink" (the internal representation). However, when told that their blood alcohol was over the limit (the external perception of others on the scale) they may very well change their responses. In labelling theory, the label "over the limit" may have led to the acceptance of an "over the limit" self-view. It is possible that the cumulative effect of labelling on other subconstruct scales could lead to the acceptance of a problem drinking self-view which, in turn, may lead to higher patterns of drinking and associated problems.

A MATHEMATICAL EXPRESSION FOR THE
PROBLEM DRINKING CONSTRUCT

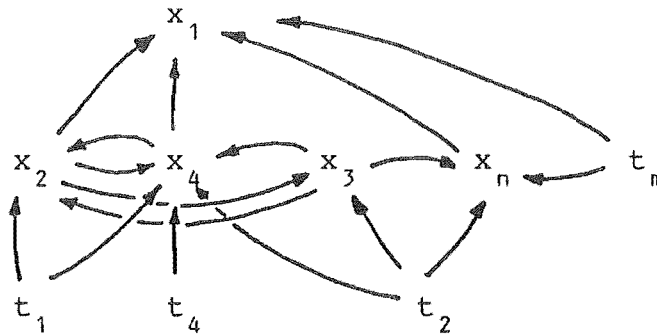
One of the problems in the clinical measurement of problem drinking is that instruments have been derived on an ad hoc empirical basis without thought on how the scales relate to some underlying construct or trait of interest. The test development procedure has usually been to empirically derive a scale, determine its psychometric properties, and only then decide on what the test is measuring. However, there have been recent attempts (summarised in chapter 4) to derive alcohol dependency tests based on the alcohol dependence syndrome.

The mathematical explanation attempts to translate the problem drinking construct into a series of equations which can be incorporated into research. The mathematics has many assumptions and is simplistic and tentative. Its function is to explain in an exact way the psychological process of obtaining a problem drinking score from a variety of problem drinking subconstructs.

Suppose that S_1 is the problem drinking construct scale in which an individual may be represented by a score x_1 , and that S_2, \dots, S_n are subconstruct scales of S_1 on which the individual can score x_i for S_i with possible values lying between and including 0 and 1. Suppose also that each x_i is dependent on the results of tests T_1, T_2, \dots, T_m and that each T_i has a measured t_i , also lying between and including 0 and 1. Thus each t_i is the stimulus at the end points of a tree structure which ultimately determine the score x_1 on the

problem drinking construct scale S_1 . The branches of the tree are connected by the values of x_i for each S_i . One possible structure is represented in Figure 1.

Figure 1. A tree structure of subconstruct scores



Since each x_i is dependent on a combination of x_1, \dots, x_n and ultimately t_1, \dots, t_m , then there must be coefficients a_i for x_i and b_i for t_i which determine this relationship. If the relationship between the scales is linear, then

$$\begin{aligned}
 x_i &= a_{i1} x_1 + a_{i2} x_2 + \dots + a_{in} x_n + b_{i1} t_1 + b_{i2} t_2 + \\
 &\quad \dots + b_{im} t_m \\
 &= \sum_{j=1}^p a_{ij} x_j + \sum_{k=1}^m b_{ik} t_k
 \end{aligned}$$

It would be normal for $a_{ii} = 0$, so that x_i does not depend on itself, although this condition does not affect the following algebra.

Consider the simple tree structure in Figure 2. which represents the scores from six scales,

$$X = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \qquad T = \begin{bmatrix} t_1 \\ t_2 \\ t_3 \end{bmatrix}$$

and we may combine all the equations into one matrix equation

$$X = AX + BT$$

In Figure 12, $a_{11}, a_{21}, a_{22}, a_{31}, a_{32}, a_{33}, b_{31}$ and $b_{32} = 0$.

And so

$$X = \begin{bmatrix} 0 & a_{12} & a_{13} & x_1 \\ 0 & 0 & a_{23} & x_2 \\ 0 & 0 & 0 & x_3 \end{bmatrix} + \begin{bmatrix} b_{11} & b_{12} & b_{13} & t_1 \\ b_{21} & b_{22} & b_{23} & t_2 \\ 0 & 0 & b_{33} & t_3 \end{bmatrix}$$

And so

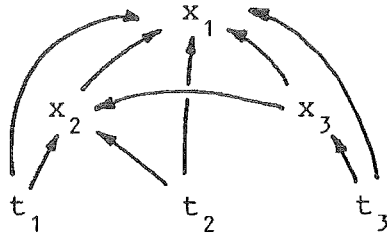
$$x_1 = a_{12}x_2 + a_{13}x_3 + b_{11}t_1 + b_{12}t_2 + b_{13}t_3$$

$$x_2 = a_{23}x_3 + b_{21}t_1 + b_{22}t_2 + b_{23}t_3$$

$$x_3 = b_{33}t_3$$

S_1, S_2, S_3 and $T_1, T_2,$ and T_3 .

Figure 2. A tree structure with six scores



Other than S_1 , each scale contributes a score which in some way affects the final score x_1 on S_1 . The following equations can be written:

$$x_1 = a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + b_{11}t_1 + b_{12}t_2 + b_{13}t_3$$

$$x_2 = a_{21}x_1 + a_{22}x_2 + a_{23}x_3 + b_{21}t_1 + b_{22}t_2 + b_{23}t_3$$

$$x_3 = a_{31}x_1 + a_{32}x_2 + a_{33}x_3 + b_{31}t_1 + b_{32}t_2 + b_{33}t_3$$

The coefficients a_{ij} form a 3×3 matrix, A , and the coefficients b_{ik} form a 3×3 matrix B . If the scores x_i and t_i similarly form vectors X and T , then:

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \quad B = \begin{bmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{bmatrix}$$

In practice, the matrices A and B are not known, although the conceptual model suggests that they do exist, because the subconstruct scales sometimes relate to each other in some way and always determine the final score x_1 for the construct of problem drinking. If the subconstructs represent the content domain of problem drinking, then the number of subconstructs will be (columns in A + columns in B)-1.

Generalising from the example in Figure 2, the coefficients a_{ij} form an $n \times n$ matrix A and the coefficients b_{ik} form an $n \times m$ matrix B. Then,

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdot & \cdot & a_{1n} \\ a_{21} & a_{22} & \cdot & \cdot & a_{2n} \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ a_{n1} & a_{n2} & \cdot & \cdot & a_{nn} \end{bmatrix} \quad B = \begin{bmatrix} b_{11} & b_{12} & \cdot & \cdot & b_{1m} \\ b_{21} & b_{22} & \cdot & \cdot & b_{2m} \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ b_{n1} & b_{n2} & \cdot & \cdot & b_{nm} \end{bmatrix}$$

$$X = \begin{bmatrix} x_1 \\ x_2 \\ \cdot \\ \cdot \\ x_n \end{bmatrix}$$

$$T = \begin{bmatrix} t_1 \\ t_2 \\ \cdot \\ \cdot \\ t_m \end{bmatrix}$$

Combining these as before gives the matrix equation

$$X = AX + BT \quad [1]$$

If I is the $n \times n$ identity matrix, then

$$IX - AX = BT$$

so

$$(I-A)X = BT$$

and

$$X = (I-A)^{-1}BT \quad [2]$$

That is, the scores x_i for scales S_i can be derived from the result t_i from scale T_i , providing A and B are known and providing $(I-A)^{-1}$ exists. Generally $(I-A)$ will be invertible, although counter examples can be found.

Since the calculation by this method requires the inversion of the matrix $(I-A)$, an alternative is to calculate X by the convergence of successive approximations. Suppose there is an initial vector X_0 for which each $(x_i)_0$ is conveniently known. Setting

$$X_r = AX_{r-1} + BT \quad [3]$$

for each $r = 1, 2, \dots$, enables $(x_i)_r$ of X_r to be calculated. Continuing this calculation until X_r approximates X_{r-1}

yields the solutions for x_i .

By definition, each subconstruct scale S_i has $0 \leq x_i \leq 1$. It should therefore not be difficult to choose X_0 and it would be convenient and reasonable to set each $(X_i)_0 = \frac{1}{2}$.

To illustrate the two methods of solving for X , suppose in Figure 12

$$x_1 = \frac{1}{2}x_2 + \frac{1}{2}x_3 + \frac{1}{4}t_1 + \frac{1}{2}t_2 + \frac{1}{4}t_3$$

$$x_2 = \frac{1}{4}x_3 + \frac{1}{2}t_1 + \frac{1}{4}t_2 + \frac{1}{2}t_3$$

$$x_3 = \frac{1}{2}t_3$$

then

$$A = \begin{matrix} & \begin{matrix} x_1 & x_2 & x_3 \end{matrix} \\ \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{2} \\ 0 & 0 & \frac{1}{4} \\ 0 & 0 & 0 \end{bmatrix} & \end{matrix} \quad B = \begin{matrix} & \begin{matrix} t_1 & t_2 & t_3 \end{matrix} \\ \begin{bmatrix} \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ \frac{1}{2} & \frac{1}{4} & \frac{1}{2} \\ 0 & 0 & \frac{1}{2} \end{bmatrix} & \end{matrix}$$

Since $X = AX + BT$ (from equation [1])

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{2} \\ 0 & 0 & \frac{1}{4} \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ \frac{1}{2} & \frac{1}{4} & \frac{1}{2} \\ 0 & 0 & \frac{1}{2} \end{bmatrix} \begin{bmatrix} t_1 \\ t_2 \\ t_3 \end{bmatrix}$$

Using the inversion method,

$$X = (I-A)^{-1} BT \quad (\text{from equation [2]})$$

$$= \begin{bmatrix} \frac{1}{2} & \frac{3}{8} & \frac{11}{16} \\ \frac{1}{2} & \frac{1}{4} & \frac{5}{8} \\ 0 & 0 & \frac{1}{2} \end{bmatrix} \begin{bmatrix} t_1 \\ t_2 \\ t_3 \end{bmatrix} \quad (\text{see proof, page 222.})$$

Suppose the test scores on the scales T_1, T_2, T_3 were 1, 0, 1

$$\text{then } \begin{bmatrix} t_1 \\ t_2 \\ t_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

$$\text{and } \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} \frac{1}{2} & \frac{3}{4} & \frac{11}{8} \\ \frac{1}{2} & \frac{1}{4} & \frac{5}{8} \\ 0 & 0 & \frac{1}{2} \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{19}{16} \\ \frac{9}{8} \\ \frac{1}{2} \end{bmatrix}$$

thus $x_1 = \frac{19}{16}$, $x_2 = \frac{9}{8}$, $x_3 = \frac{1}{2}$

Using the iterative method,

$$x_r = AX_{r-1} + BT \quad (\text{from equation [3]})$$

Supposing $(x_i)_0 = \frac{1}{2}$, and substituting the values for A, B and T,

$$x_0 = \begin{bmatrix} \frac{1}{2} \\ \frac{1}{2} \\ \frac{1}{2} \end{bmatrix} \quad x_1 = \begin{bmatrix} 1 \\ \frac{9}{8} \\ \frac{1}{2} \end{bmatrix} \quad x_2 = \begin{bmatrix} \frac{19}{16} \\ \frac{9}{8} \\ \frac{1}{2} \end{bmatrix}$$

$$x_3 = \begin{bmatrix} \frac{19}{16} \\ \frac{9}{8} \\ \frac{1}{2} \end{bmatrix} \quad (\text{see page 226 for proof})$$

Since $x_2 = x_3$, this is the solution,

or

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} \frac{19}{16} \\ \frac{9}{8} \\ \frac{1}{2} \end{bmatrix}$$

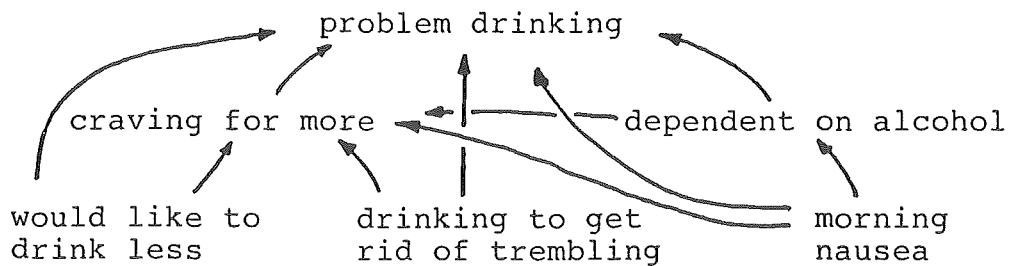
and as before $x_1 = \frac{19}{16}$, $x_2 = \frac{9}{8}$, $x_3 = \frac{1}{2}$.

The solution for X using the inversion and iterative methods is not unique to this example (see page for another example). While algebraic characters have been used to represent the terms from the theoretical model, it is a simple matter to translate these characters into the theoretical terms. For example, in Figure 2, suppose $x_1, x_2, x_3, t_1, t_2, t_3$ are scores on scales $S_1, S_2, S_3, T_1, T_2, T_3$ and that

- S_1 = 'problem drinking'
- S_2 = 'craving for more'
- S_3 = 'dependent on alcohol'
- T_1 = 'would like to drink less'
- T_2 = 'drinking to get rid of trembling'
- T_3 = 'morning nausea'

then one possible combination of these scales is shown in Figure (S₂ - T₃ have been drawn from chapter three.

Figure 3. Possible relationships between scales



In the mathematics of this example, t_1 , t_2 , t_3 were set at 1, 0, 1 respectively. If the test scales T_1 , T_2 , T_3 had possible t_i values of only 0 and 1 (in the mathematical model, t_i can be continuous), then in Figure 13 the person would like to drink less ($t_1 = 1$), is not drinking to get rid of trembling ($t_2 = 0$), and does have morning nausea ($t_3 = 1$). These results are related by the coefficients in matrix B to x_1 , x_2 and x_3 scores for construct scale S_1 and subconstruct scales S_2 , S_3 respectively. The scores x_2 and x_3 are similarly related to x_1 in S_1 by the coefficients in matrix A. If the subconstruct scales S_2 , S_3 , T_1 , T_2 and T_3 were in fact related to the problem drinking construct scale S_1 in this way, then test scores of 1, 0 and 1 would result in a problem drinking score of $\frac{19}{16}$. The maximum score would be $\frac{25}{16}$ (T scores of 1, 1, 1) and the minimum 0 (T scores of 0, 0, 0) (see page 228 for the derivation of the maximum and minimum values).

In practice the relationship between the subconstruct scales and the derivation of a final problem drinking score will be much more complex than the simplistic example in Figure 3. However, it is expected that generally the process for computing a problem drinking score would be similar, given that the coefficients in the linear relationships between the scales are known. It is not the purpose of the mathematics to explain a method for deriving a problem drinking score on the basis of actual test results on subconstruct scales. This cannot be done, since the coefficients relating the scales are not known, although their existence is assumed. The purpose of the mathematics to translate the construct idea into a plausible structure which can be used as a basis for research. It would be reasonable,

for example, to derive a test with items measuring single subconstructs with scores which may be summed according to empirically derived weightings, to produce a total score.

There is, however, a simple case when all a_{ij} of A are 0.

Since $X = AX + BT$ from [1]

When a_{ij} from A = 0

$$X = BT$$

or x_i of X are dependent on the test results t_j of T and the coefficients b_{ij} of B, or

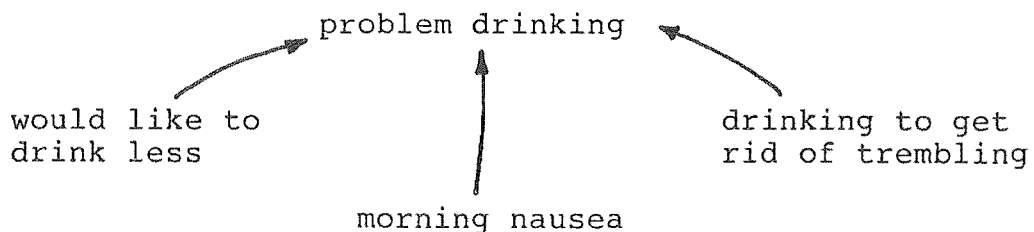
$$x_i = b_{i1}t_1 + b_{i2}t_2 + \dots + b_{im}t_m$$

when $a_{ij} = 0$

$$= \sum_{j=1}^m b_{ij}t_j \quad [4]$$

That is, the score x_i is the sum of the test results weighted by coefficients b_{ij} .

Figure 4. A tree structure with only one level of subconstructs



In Figure 4 for example, the problem drinking score depends only on one level of subconstructs. Setting these subconstruct scale scores to be t_i of T enables a total score to be derived, assuming the b_{ij} for each t_i are known. Empirically the b_{ij} are the test item weightings. Thus, the simple case represented by equation [4] has direct experimental application.

The mathematical model does have limitations which are built into the following assumptions:

1. The relationship between the subconstruct scales is linear.
2. The coefficients connecting the scales in the linear equations exist.
3. All subconstruct scale scores lay between and including 0 and 1. This restriction does not hold for the final score on the construct scale.
4. The subconstructs represent the content domain of the problem drinking construct.

In summary, the purpose of the mathematics model is to translate the terms from the theoretical construct into a structure which describes in a simple way, how these terms could be related to each other. This structure describes a means for determining a problem drinking score from the results of tests which are at the end points of a variety of interrelated subconstruct scales. The tests are subconstructs of problem drinking whose scale scores interact with other subconstructs. It is assumed that these interactions are known and can be represented by linear equations which determine a

final score on the problem drinking construct scale. It is also assumed that the subconstructs in the structure represent the content domain of the problem drinking construct. Given that the structure relating subconstruct scales to the construct scale is known, then the mathematical model gives two matrix methods for determining the score on any of these scales from test results.

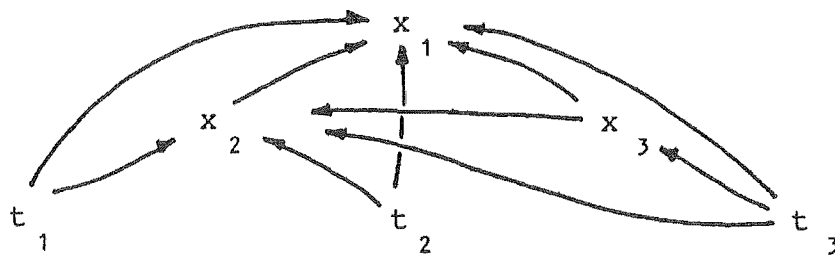
When there is only one level of subconstructs, these become the tests whose results are summed according to their weightings to give the final score.

MATHEMATICAL PROOFS AND EXAMPLES

(1) Proof that with the inversion method,

$$X = \begin{bmatrix} \frac{1}{2} & \frac{3}{8} & \frac{11}{16} \\ \frac{1}{2} & \frac{1}{4} & \frac{5}{8} \\ 0 & 0 & \frac{1}{2} \end{bmatrix} \begin{bmatrix} t_1 \\ t_2 \\ t_3 \end{bmatrix}$$

Fig. 12



Equations

$$x_1 = \frac{1}{2}x_2 + \frac{1}{2}x_3 + \frac{1}{4}t_1 + \frac{1}{2}t_2 + \frac{1}{4}t_3$$

$$x_2 = \frac{1}{4}x_3 + \frac{1}{2}t_1 + \frac{1}{4}t_2 + \frac{1}{2}t_3$$

$$x_3 = \frac{1}{2}t_3$$

Since

$$X = AX + BT \quad [1]$$

and

$$A = \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{2} \\ 0 & 0 & \frac{1}{4} \\ 0 & 0 & 0 \end{bmatrix} \quad B = \begin{bmatrix} \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ \frac{1}{2} & \frac{1}{4} & \frac{1}{2} \\ 0 & 0 & \frac{1}{2} \end{bmatrix}$$

$$X = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \quad T = \begin{bmatrix} t_1 \\ t_2 \\ t_3 \end{bmatrix}$$

then substituting X, A, B and T into [1]

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{2} \\ 0 & 0 & \frac{1}{4} \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ \frac{1}{2} & \frac{1}{4} & \frac{1}{2} \\ 0 & 0 & \frac{1}{2} \end{bmatrix} \begin{bmatrix} t_1 \\ t_2 \\ t_3 \end{bmatrix}$$

Transforming (1)

$$X - AX = BT \quad \text{from [1]}$$

$$X(I-A) = BT$$

$$X = (I-A)^{-1} BT \quad [2]$$

Now

$$\begin{aligned} (I-A) &= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} - \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{2} \\ 0 & 0 & \frac{1}{4} \\ 0 & 0 & 0 \end{bmatrix} \\ &= \begin{bmatrix} 1 & -\frac{1}{2} & -\frac{1}{2} \\ 0 & 1 & -\frac{1}{4} \\ 0 & 0 & 1 \end{bmatrix} \end{aligned}$$

Calculating $(I-A)^{-1}$ by row operators

$$\begin{bmatrix} 1 & -\frac{1}{2} & -\frac{1}{2} & 1 & 0 & 0 \\ 0 & 1 & -\frac{1}{4} & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 \end{bmatrix}$$



$$R_1 = R_1 + \frac{1}{2}R_2$$

$$\begin{bmatrix} 1 & 0 & -\frac{3}{8} & 1 & \frac{1}{2} & 0 \\ 0 & 1 & -\frac{1}{4} & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{array}{c}
 \downarrow \\
 \begin{array}{ccc}
 R_1 & R_1 & \frac{3}{8} R_3 \\
 R_2 & R_2 & \frac{1}{4} R_3
 \end{array} \\
 \left[\begin{array}{cccccc}
 1 & 0 & 0 & 1 & \frac{1}{2} & \frac{3}{8} \\
 0 & 1 & 0 & 0 & 1 & \frac{1}{4} \\
 0 & 0 & 1 & 0 & 0 & 1
 \end{array} \right]
 \end{array}$$

Hence

$$(I-A)^{-1} = \begin{bmatrix} 1 & \frac{1}{2} & \frac{3}{8} \\ 0 & 1 & \frac{1}{4} \\ 0 & 0 & 1 \end{bmatrix}$$

Substituting the values for $(I-A)^{-1}$, B, T and X in [2]

$$\begin{aligned}
 \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} &= \begin{bmatrix} 1 & \frac{1}{2} & \frac{3}{8} & \frac{1}{4} & \frac{1}{2} & \frac{1}{4} & t_1 \\ 0 & 1 & \frac{1}{4} & \frac{1}{2} & \frac{1}{4} & \frac{1}{2} & t_2 \\ 0 & 0 & 1 & 0 & 0 & \frac{1}{2} & t_3 \end{bmatrix} \\
 &= \begin{bmatrix} \frac{1}{2} & \frac{3}{8} & \frac{11}{16} \\ \frac{1}{2} & \frac{1}{4} & \frac{5}{8} \\ 0 & 0 & \frac{1}{2} \end{bmatrix} \begin{bmatrix} t_1 \\ t_2 \\ t_3 \end{bmatrix}
 \end{aligned}$$

When
$$\begin{bmatrix} t_1 \\ t_2 \\ t_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

then
$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} \frac{19}{16} \\ \frac{9}{8} \\ \frac{1}{2} \end{bmatrix}$$

(2) Proof that using the iterative method with the example in (1),

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} \frac{19}{16} \\ \frac{9}{8} \\ \frac{1}{2} \end{bmatrix}$$

Given

$$X_r = AX_{r-1} + BT$$

and that

$$X_0 = \begin{bmatrix} 1 \\ \frac{1}{2} \\ \frac{1}{2} \end{bmatrix}$$

then substituting the values for A, B and T,

$$X_1 = \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{2} \\ 0 & 0 & \frac{1}{4} \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} \frac{1}{2} \\ \frac{1}{2} \\ \frac{1}{2} \end{bmatrix} + \begin{bmatrix} \frac{1}{4} & \frac{1}{2} & \frac{1}{4} \\ \frac{1}{2} & \frac{1}{4} & \frac{1}{2} \\ 0 & 0 & \frac{1}{2} \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{1}{2} \\ \frac{1}{8} \\ 0 \end{bmatrix} + \begin{bmatrix} \frac{1}{2} \\ 1 \\ \frac{1}{2} \end{bmatrix} = \begin{bmatrix} 1 \\ \frac{9}{8} \\ \frac{1}{2} \end{bmatrix}$$

$$X_2 = \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{2} \\ 0 & 0 & \frac{1}{4} \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 \\ \frac{9}{8} \\ \frac{1}{2} \end{bmatrix} + \begin{bmatrix} \frac{1}{2} \\ 1 \\ \frac{1}{2} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{11}{16} \\ \frac{1}{8} \\ 0 \end{bmatrix} + \begin{bmatrix} \frac{1}{2} \\ 1 \\ \frac{1}{2} \end{bmatrix} = \begin{bmatrix} \frac{19}{16} \\ \frac{9}{8} \\ \frac{1}{2} \end{bmatrix}$$

$$X_3 = \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{2} \\ 0 & 0 & \frac{1}{4} \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} \frac{19}{16} \\ \frac{9}{8} \\ \frac{1}{2} \end{bmatrix} + \begin{bmatrix} \frac{1}{2} \\ 1 \\ \frac{1}{2} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{11}{16} \\ \frac{1}{8} \\ 0 \end{bmatrix} + \begin{bmatrix} \frac{1}{2} \\ 1 \\ \frac{1}{2} \end{bmatrix} = \begin{bmatrix} \frac{19}{16} \\ \frac{9}{8} \\ \frac{1}{2} \end{bmatrix}$$

$x_2 = x_3$ and so a solution has been reached, and

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} \frac{19}{16} \\ \frac{9}{8} \\ \frac{1}{2} \end{bmatrix}$$

(3) Calculating the maximum value for the example in (1).

The maximum scores are

$$\begin{bmatrix} t_1 \\ t_2 \\ t_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

From (1)

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} \frac{1}{2} & \frac{3}{8} & \frac{11}{16} \\ \frac{1}{2} & \frac{1}{4} & \frac{5}{8} \\ 0 & 0 & \frac{1}{2} \end{bmatrix} \begin{bmatrix} t_1 \\ t_2 \\ t_3 \end{bmatrix}$$

Substituting the values $t_1 = t_2 = t_3 = 1$ gives

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} \frac{25}{16} \\ \frac{11}{8} \\ \frac{1}{2} \end{bmatrix}$$

Since x_1 is the final score on S_1 , the maximum score is $\frac{25}{16}$.

(4) Calculating the minimum value for the example in (1).

The minimum scores are

$$\begin{bmatrix} t_1 \\ t_2 \\ t_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

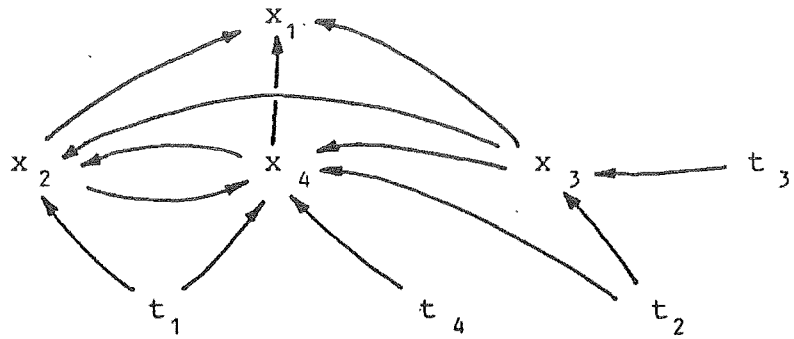
Since this vector contains all zeros, so does any product with it, and so from (1),

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

and the minimum score x_1 on S_1 is 0.

(5) A further example, involving 8 scales, $S_1, \dots, S_4, T_1, \dots, T_4$ with respective x_i for S_i and t_i for T_i .

The hypothetical score tree is shown in the following figure.



From the figure it can be observed that

$$x_1 = f(x_2, x_3, x_4)$$

$$x_2 = f(x_3, x_4, t_1)$$

$$x_3 = f(t_2, t_3)$$

$$x_4 = f(x_2, x_3, t_1, t_2, t_4)$$

Suppose these functions can be represented by the equations

$$x_1 = \frac{1}{2}x_2 + \frac{1}{2}x_3 + \frac{1}{4}x_4$$

$$x_2 = \frac{1}{4}x_3 + \frac{1}{2}x_4 + \frac{1}{2}t_1$$

$$x_3 = \frac{1}{4}t_2 + \frac{1}{4}t_3$$

$$x_4 = \frac{1}{4}x_2 + \frac{1}{2}x_3 + \frac{1}{2}t_1 + \frac{1}{2}t_2 + \frac{1}{4}t_4$$

Since

$$X = (I-A)^{-1} BT \quad \text{from [2]}$$

and

$$A = \begin{array}{c} x_1 \quad x_2 \quad x_3 \quad x_4 \\ \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{2} & \frac{1}{4} \\ 0 & 0 & \frac{1}{4} & \frac{1}{2} \\ 0 & 0 & 0 & 0 \\ 0 & \frac{1}{4} & \frac{1}{2} & 0 \end{bmatrix} \end{array} \quad B = \begin{array}{c} t_1 \quad t_2 \quad t_3 \quad t_4 \\ \begin{bmatrix} 0 & 0 & 0 & 0 \\ \frac{1}{2} & 0 & 0 & 0 \\ 0 & \frac{1}{4} & \frac{1}{4} & 0 \\ \frac{1}{2} & \frac{1}{2} & 0 & \frac{1}{4} \end{bmatrix} \end{array}$$

then

$$(I-A) = \begin{array}{c} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} - \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{2} & \frac{1}{4} \\ 0 & 0 & \frac{1}{4} & \frac{1}{2} \\ 0 & 0 & 0 & 0 \\ 0 & \frac{1}{4} & \frac{1}{2} & 0 \end{bmatrix} \\ \\ = \begin{bmatrix} 1 & -\frac{1}{2} & -\frac{1}{2} & -\frac{1}{4} \\ 0 & 1 & -\frac{1}{4} & -\frac{1}{2} \\ 0 & 0 & 1 & 0 \\ 0 & -\frac{1}{4} & -\frac{1}{2} & 1 \end{bmatrix} \end{array}$$

Calculating $(I-A)^{-1}$ by row operators and converting to decimals

$$\begin{bmatrix} 1 & -.500 & -.500 & -.250 & 1 & 0 & 0 & 0 \\ 0 & 1 & -.250 & -.500 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & -.250 & -.500 & 1 & 0 & 0 & 0 & 1 \end{bmatrix}$$

$$\begin{array}{l} \downarrow \\ R_1 = R_1 + 0.500 R_2 \\ R_4 = R_4 + 0.25 R_2 \end{array}$$

$$\begin{bmatrix} 1 & 0 & -.625 & -.500 & 1 & .500 & 0 & 0 \\ 0 & 1 & -.250 & -.500 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & -.563 & .875 & 0 & .250 & 0 & 1 \end{bmatrix}$$

$$\begin{array}{l} \downarrow \\ R_1 = R_1 + .625 R_3 \\ R_2 = R_2 + .250 R_3 \\ R_4 = R_4 + .563 R_3 \end{array}$$

$$\begin{bmatrix} 1 & 0 & 0 & -.500 & 1 & .500 & .625 & 0 \\ 0 & 1 & 0 & -.500 & 0 & 1 & .250 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & .875 & 0 & .250 & .563 & 1 \end{bmatrix}$$

$$\downarrow R_4 = R_4 / .875$$

$$\begin{bmatrix} 1 & 0 & 0 & -.500 & 1 & .500 & .625 & 0 \\ 0 & 1 & 0 & -.500 & 0 & 1 & .250 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & .286 & .643 & 1.143 \end{bmatrix}$$

$$\downarrow R_1 = R_1 + .500 R_4$$
$$\downarrow R_2 = R_2 + .500 R_4$$

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 1 & .643 & .947 & .572 \\ 0 & 1 & 0 & 0 & 0 & 1.143 & .573 & .572 \\ 0 & 0 & 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & .286 & .643 & 1.143 \end{bmatrix}$$

Hence

$$(I-A)^{-1} \begin{bmatrix} 1 & .643 & .947 & .572 \\ 0 & 1.143 & .573 & .572 \\ 0 & 0 & 1 & 0 \\ 0 & .286 & .643 & 1.143 \end{bmatrix}$$

$$\text{and } (I-A)^{-1} \cdot (I-A) = I$$

Suppose
$$\begin{bmatrix} t_1 \\ t_2 \\ t_3 \\ t_4 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \\ 1 \\ 0 \end{bmatrix}$$

Since
$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = (I-A)^{-1} \cdot BT \quad \text{from [2]}$$

Substituting the values into this equation gives

$$\begin{aligned} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} &= \begin{bmatrix} 1 & .643 & .947 & .572 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1.143 & .573 & .572 & .500 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & .250 & .250 & 0 & 1 \\ 0 & .286 & .643 & 1.143 & .500 & .500 & 0 & .250 & 0 \end{bmatrix} \\ &= \begin{bmatrix} .608 & .523 & .237 & .143 & 1 \\ .858 & .429 & .143 & .143 & 0 \\ 0 & .250 & .250 & 0 & 1 \\ .715 & .732 & .161 & .286 & 0 \end{bmatrix} \\ &= \begin{bmatrix} .845 \\ 1.001 \\ .250 \\ .873 \end{bmatrix} \end{aligned}$$

and so the final score x_1 on scale S_1 is 0.845.

Iteratively, the calculation is simpler.

Given

$$X_r = AX_{r-1} + BT$$

and

$$X_0 = \begin{bmatrix} .500 \\ .500 \\ .500 \\ .500 \end{bmatrix}$$

Then

$$X_1 = \begin{bmatrix} 0 & .500 & .500 & .250 & .500 \\ 0 & 0 & .250 & .500 & .500 \\ 0 & 0 & 0 & 0 & .500 \\ 0 & .250 & .500 & 0 & .500 \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 & 0 & 1 \\ .500 & 0 & 0 & 0 & 0 \\ 0 & .250 & .250 & 0 & 1 \\ .500 & .500 & 0 & .250 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} .625 \\ .375 \\ 0 \\ .375 \end{bmatrix} + \begin{bmatrix} 0 \\ .500 \\ .250 \\ .500 \end{bmatrix} = \begin{bmatrix} .625 \\ .875 \\ .250 \\ .875 \end{bmatrix}$$

$$X_2 = \begin{bmatrix} 0 & .500 & .500 & .250 & .625 \\ 0 & 0 & .250 & .500 & .875 \\ 0 & 0 & 0 & 0 & .250 \\ 0 & .250 & .500 & 0 & .875 \end{bmatrix} + \begin{bmatrix} 0 \\ .500 \\ .250 \\ .500 \end{bmatrix}$$

$$= \begin{bmatrix} .781 \\ .500 \\ 0 \\ .344 \end{bmatrix} + \begin{bmatrix} 0 \\ .500 \\ .250 \\ .500 \end{bmatrix} = \begin{bmatrix} .781 \\ 1.000 \\ .250 \\ .844 \end{bmatrix}$$

Similarly,

$$X_3 = A \begin{bmatrix} .781 \\ 1.000 \\ .250 \\ .844 \end{bmatrix} + BT$$

$$= \begin{bmatrix} .836 \\ .485 \\ 0 \\ .375 \end{bmatrix} + \begin{bmatrix} 0 \\ .500 \\ .250 \\ .500 \end{bmatrix} = \begin{bmatrix} .836 \\ .985 \\ .250 \\ .875 \end{bmatrix}$$

$$X_4 = A \begin{bmatrix} .836 \\ .985 \\ .250 \\ .875 \end{bmatrix} + BT$$

$$= \begin{bmatrix} .836 \\ .563 \\ 0 \\ .371 \end{bmatrix} + \begin{bmatrix} 0 \\ .500 \\ .250 \\ .500 \end{bmatrix} = \begin{bmatrix} .836 \\ 1.063 \\ .250 \\ .871 \end{bmatrix}$$

$$X_5 = A \begin{bmatrix} .836 \\ 1.063 \\ .250 \\ .871 \end{bmatrix} + BT$$

$$= \begin{bmatrix} .874 \\ .561 \\ 0 \\ .391 \end{bmatrix} + \begin{bmatrix} 0 \\ .500 \\ .250 \\ .500 \end{bmatrix} = \begin{bmatrix} .874 \\ 1.061 \\ .250 \\ .891 \end{bmatrix}$$

Similarly,

$$X_6 = \begin{bmatrix} .878 \\ .508 \\ 0 \\ .390 \end{bmatrix} + \begin{bmatrix} 0 \\ .500 \\ .250 \\ .500 \end{bmatrix} = \begin{bmatrix} .878 \\ 1.008 \\ .250 \\ .890 \end{bmatrix}$$

$$X_7 = \begin{bmatrix} .852 \\ .508 \\ 0 \\ .377 \end{bmatrix} + \begin{bmatrix} 0 \\ .500 \\ .250 \\ .500 \end{bmatrix} = \begin{bmatrix} .852 \\ 1.008 \\ .250 \\ .877 \end{bmatrix}$$

$$X_8 = \begin{bmatrix} .848 \\ .501 \\ 0 \\ .377 \end{bmatrix} + \begin{bmatrix} 0 \\ .500 \\ .250 \\ .500 \end{bmatrix} = \begin{bmatrix} .848 \\ 1.001 \\ .250 \\ .877 \end{bmatrix}$$

$$X_9 = \begin{bmatrix} .845 \\ .501 \\ 0 \\ .375 \end{bmatrix} + \begin{bmatrix} 0 \\ .500 \\ .250 \\ .500 \end{bmatrix} = \begin{bmatrix} .845 \\ 1.001 \\ .250 \\ .875 \end{bmatrix}$$

$$X_{10} = \begin{bmatrix} .844 \\ .500 \\ 0 \\ .375 \end{bmatrix} + \begin{bmatrix} 0 \\ .500 \\ .250 \\ .500 \end{bmatrix} = \begin{bmatrix} .844 \\ 1.000 \\ .250 \\ .875 \end{bmatrix}$$

Since $X_9 \approx X_{10}$, this is the solution, which is also that obtained by the inverse method.

The minimum values of x_i in X occurs when all t_i in T equal 0.

Given $X = (I-A)^{-1} BT$ from [2]

if all $t_i = 0$ then all $x_i = 0$. That is, when the test results are all zero, so too are all the derived scores.

In the example the minimum scores are therefore

$$x_1 = x_2 = x_3 = x_4 = 0.$$

The maximum values of x_i in X are when all t_i in T equal 1.

In the example, substituting these values in equation [2] gives

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 1 & .643 & .947 & .572 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1.143 & .573 & .572 & .500 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 & .250 & .250 & 0 & 1 \\ 0 & .286 & .643 & 1.143 & .500 & .500 & 0 & .250 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1.511 \\ 1.573 \\ .500 \\ 1.894 \end{bmatrix}$$

The maximum score in this example on the final scale is 1.511, although lower level scales may at times have higher scores.

APPENDIX C

QUESTIONNAIRES, SPSS COURSE PROGRAMME AND
RAW DATA FOR EXPERIMENTS I AND IV

PATIENT ALCOHOL RELATED ILLNESS SURVEY

Name: _____

Code No.
1-7

1						
---	--	--	--	--	--	--

"My name is and I am from the Department of Preventive and Community Medicine. I am doing a survey on behalf of the Alcoholic Liquor Advisory Council, and I'm interviewing patients at Christchurch Hospital.

This survey is intended to provide information on the drinking patterns of patients admitted to Christchurch Hospital. The questions I'd like to ask you should only take about 20 minutes."

Q 1. Do you mind participating in the survey? [1=Yes, 2=No] 8 []

Q 2. Have you taken part in this survey before? [1=Yes, 2=No, 3=Not sure] 9 []

"WE HAVE A FEW QUESTIONS ON WHEN PEOPLE DRINK BEER, WINES AND SPIRITS. WE ARE ASKING THESE QUESTIONS OF EVERYBODY, SO WE CAN GET AN AVERAGE PICTURE FOR ALL PATIENTS."

Q 3. Do you drink alcohol at all? (IF NO, GO TO Q.44) 10 []

Q 4. Can you tell me when you last drank alcohol? 11 []

[1] Less than 12 hours ago
[2] 13-23 hours ago
[3] One to four days before
[4] Five to thirteen days before
[5] Two to three weeks before
[6] Over three weeks but less than six months
[7] Six months or more

Q 5. On an average drinking occasion, can you tell me the number and type of each drink you would have?

[Examples of measures, 1 large glass of beer, 3 jugs of beer, 2 nips of spirits, half a bottle of wine etc.]

Number and type of measure

1. Beer _____ 12-14

--	--	--

2. Spirits _____ 15-17

--	--	--

3. Fortified Wine _____ 18-20

--	--	--

(Sherry, Port, Vermouth)

4. Table wine _____ 21-23

--	--	--

5. Other beverages _____ 24-26

--	--	--

TOTAL

--	--	--	--

27-30

Q 6. How long is it on the average between drinking occasions?

	<u>Days</u>	
[1] Less than 12 hours	1	
[2] One day	2	
[3] Two to four days	3	
[4] Five to thirteen days	20	
[5] Two to three weeks	30	
[6] Over three weeks but less than six months	200	
[7] Six months or more	-	
		31 []

Calculate $\frac{\text{Total}}{\text{Days}}$

Score =

Q 7. Approximately how much would you spend on yourself on an average drinking occasion?	32 []
Q 8. Have any close family members such as a parent, brother or sister had drinking problems? [1] Yes [2] No [3] Not sure	33 []
Q 9. [If yes] What was the relationship? [1] Parent [2] Brother/sister [3] Children [4] Spouse or partner [5] Combination of above [6] Other	34 []

IF SCORE IS LESS THAN 3 GO TO Q.44

"NOW I'M GOING TO READ OUT SOME QUESTIONS AND I'D LIKE YOU TO ANSWER YES OR NO TO EACH ONE."

Q 10. Do you feel you are a normal drinker? (By normal we mean you drink less than or as much as most other people?) (NO)	35 []
Q 11. Does your wife, husband, a parent, or other near relative ever worry or complain about your drinking? (YES)	36 []
Q 12. Do you ever feel guilty about your drinking? (YES)	37 []
Q 13. Do friends or relatives think you are a normal drinker? (NO)	38 []
Q 14. Are you able to stop drinking when you want to? (NO)	39 []
Q 15. Have you ever attended a meeting of Alcoholics Anonymous? (YES)	40 []
Q 16. Has drinking ever created problems between you and your wife, husband, a parent, or other near relative? (YES)	41 []
Q 17. Have you ever been in trouble at work because of drinking? (YES)	42 []
Q 18. Have you ever neglected your obligations, your family or your work for two or more days in a row because you were drinking? (YES)	43 []
Q 19. Have you ever gone to anyone for help about your drinking? (YES)	44 []
Q 20. Have you ever been in a hospital because of drinking? (YES)	45 []
Q 21. Have you ever been arrested for drunken driving, driving while intoxicated, or driving under the influence of alcoholic beverages? (YES)	46 []
Q 22. Have you ever been arrested, even for a few hours, because of other drunken behaviour? (YES)	47 []

[QUESTIONS 23-43, YES=1, NO=2]

- Q 23. Have you found that your hands have been trembling a lot recently? 48 []
- Q 24. Do you sometimes have feelings of nausea in the morning? 49 []
- Q 25. Have you ever tried to get rid of trembling and nausea with alcohol? 50 []
- Q 26. At the moment do you feel miserable because of any problems or difficulties related to your drinking? 51 []
- Q 27. Do you drink before lunch fairly often? 52 []
- Q 28. After the first glass or two of alcohol do you ever feel a craving for more? 53 []
- Q 29. Are you preoccupied with thoughts about alcohol? 54 []
- Q 30. Do you sometimes drink alcohol even against your doctor's advice? 55 []
- Q 31. When you drink a lot of alcohol, do you tend to eat less? 56 []
- Q 32. Have you ever been criticized at work because of your drinking? 57 []
- Q 33. Do you prefer to drink alone? 58 []
- Q 34. Do you think you've been in worse shape since you started drinking? 59 []
- Q 35. Do you ever have a guilty conscience about drinking? 60 []
- Q 36. Have you ever felt it necessary to limit your drinking to certain occasions or to certain times of the day? 61 []
- Q 37. Do you feel you should drink less? 62 []
- Q 38. Do you think that without alcohol you would have fewer problems? 63 []
- Q 39. When you're upset do you drink alcohol to calm down? 64 []
- Q 40. Are there times when you'd like to stop drinking? 65 []
- Q 41. Would you get along better with your spouse/partner/the people you're closest to if you didn't drink? 66 []
- Q 42. Have you ever deliberately tried to do without any alcohol at all? 67 []
- Q 43. Have you often been told that your breath smells of alcohol? 68 []

- Q 44. Finally, I'd like to ask a few questions about yourself. Firstly, can you tell me in which year you were born?
- Q 45. And what is your present marital status?
 - [1] married
 - [2] separated
 - [3] divorced
 - [4] de facto
 - [5] single
 - [6] widowed
- Q 46. Lastly, are you presently in employment?
 - Sex (M=1, F=2)
 - Ward
 - Date (day/month)

Code 1-7

2						
---	--	--	--	--	--	--

8 [] []

10 []

11 []

12 []

13-16

--	--	--	--

17-20

--	--	--	--

BLOOD TESTS

1. SMAC 56-72

DATE	TIME	PHOS	GGT	AST

Code No. 1-7

3						
---	--	--	--	--	--	--

2. MCV 8-18

DATE	TIME	MCV

SUMMARY

Form 1. Complete	19 []
2. Missing MCV	20 []
3. Missing SMAC	21 []
4. Missing clinical exam	22 []
5. Patient refused	23 []
6. Patient incapable	24 []
7. Patient died	25 []
8. Incomplete for other reason	26 []

PATIENT ALCOHOL RELATED ILLNESS SURVEY

Attention Resident Medical Officer

Could you please complete this form if any one or more of the symptoms listed are present.

In addition it would be useful if both a SMAC and MCV test are requested as part of the routine admission of all adult patients during this study.

This form is to remain in the chart notes.

PLEASE AFFIX PATIENT IDENTIFICATION LABEL HERE

Please acknowledge you have seen this form

Tick if present

PALPABLE LIVER

JAUNDICE

SPIDER ANGIOMATA

DUPUYTRENS CONTRACTURES

OTHER ALCOHOL RELATED PHYSICAL SYMPTOMS

(Please specify)

RUN NAME
VARIABLE LIST

INPUT MEDIUM
INPUT FORMAT

RECODE
RECODE
RECODE
MISSING VALUES
MISSING VALUES

COMPUTE
IF
ASSIGN MISSING
RECODE
RECODE
RECODE
RECODE
VAR LABELS

PHREQVAN
N, INT, PHS, Q1 TO Q4, BEER, SPRT, FRTW, TABW, OTHR, TOT, Q6 TO Q43,
AG, Q45, Q46, SEX, WARD, DATE, F21 TO F48, PLET, PNUM, SMTD, SMTM,
PHOS, GGT, AST, HOT, MTH, MCV, S1 TO S8
[GMT]
FIXED (IX, F4.0, 6F1.0, 5F3.0, F4.0, 38F1.0/7X, F2.0, 3F1.0,
2F4.0, 28F1.0, A3, A4, 2F4.0, 3F3.0 /7X, 2F4.0, F3.0, 8F1.0)
INT TO Q2, AG TO S8 (BLANK=9999)
Q1 TO Q9 (BLANK=0)
Q10 TO Q43 (9=0)
Q4 TO TOT, AG, WARD, DATE, PNUM TO MCV (9999)
INT, Q1 TO Q1, Q6 TO Q43, Q45 TO SEX, F21 TO F48,
S1 TO S8 (9, 9999)
AGE=81-AG
(AGE LT 1) AGE=AGE+100
AGE (9999)
PHOS (LO THRU 29=1) (30 THRU 120=2) (121 THRU 9000=3)
GGT (LO THRU 34=1) (35 THRU 49=2) (50 THRU 9000=3)
MCV (LO THRU 79=1) (80 THRU 100=2) (101 THRU 9000=3)
AST (LO THRU 49=1) (50 THRU 9000=2)
N PATIENT NUMBER/
INT INTERVIEWER/
PHS SURVEY PHASE/
Q1 SURVEY PARTICIPATION?
Q2 PREVIOUSLY SURVEYED?
Q3 DRINK ALCOHOL AT ALL?
Q4 LAST DRANK ALCOHOL?
BEER BEER/
SPRT SPIRITS/
FRTW FORTIFIED WINE/
TABW TABLE WINE/
OTHR OTHER BEVERAGES/
TOT TOTAL CONSUMED : MLS OF PURE ALCOHOL/
Q6 HOW OFTEN DO YOU DRINK?
Q7 HOW MUCH DO YOU SPEND?
Q8 FAMILY ALCOHOL PROBLEMS?
Q9 WHICH FAMILY MEMBERS?
Q10 MALT 01/
Q11 MALT 02/
Q12 MALT 03/
Q13 MALT 04/
Q14 MALT 05/
Q15 MALT 06/
Q16 MALT 07/
Q17 MALT 08/
Q18 MALT 09/
Q19 MALT 10/
Q20 MALT 11/
Q21 MALT 12/
Q22 MALT 13/
Q23 MALT 01/
Q24 MALT 02/
Q25 MALT 03/
Q26 MALT 04/
Q27 MALT 05/
Q28 MALT 06/
Q29 MALT 07/
Q30 MALT 08/
Q31 MALT 09/
Q32 MALT 10/
Q33 MALT 11/
Q34 MALT 12/
Q35 MALT 13/
Q36 MALT 14/
Q37 MALT 15/
Q38 MALT 16/
Q39 MALT 17/
Q40 MALT 18/
Q41 MALT 19/
Q42 MALT 20/
Q43 MALT 21/
AGE AGE/
Q45 MARITAL STATUS/
Q46 PRESENTLY EMPLOYED?
SEX SEX/
WARD WARD/
DATE DATE/
F21 FILE PRESENT?
F22 SURGICAL ADMISSIONS/
F23 MEDICAL ADMISSIONS/
F24 PSYCHIATRIC ADMISSIONS/
F25 MATERNITY ADMISSIONS/
F26 TUBERCULOSIS/
F27 PEPTIC OR BLEEDING ULCER/
F28 PANCREATITIS/
F29 HIGH BLOOD PRESSURE/
F30 HEPATITIS/
F31 JAUNDICE/
F32 LIVER DISEASE : CIRRHOSIS/
F33 PNEUMONIA/
F34 CHRONIC BRONCHITIS/
F35 EPILEPSY/
F36 MEMORY DISORDER/
F37 NUTRITION/
F38 ACCIDENTS : ALL TYPES/
F39 DRUG ABUSE/
F40 PERIPHERAL NEURITIS/
F41 SUICIDE ATTEMPT/
F42 PALPABLE LIVER/
F43 JAUNDICE/
F44 SPIDER ANGIOMATA/
F45 DUPUYTREN'S CONTRACTURES/
F46 OTHER/
F47 CLINICAL EXAM CHECKED?
F48 ENTRY POINT/
PLET PATIENT/
PNUM NUMBER/
SMTD SMAC DATE/
SMTM SMAC TIME/
PHOS ALKALINE PHOSPHATE : IU PER LITRE/
GGT GAMMA GT : IU PER LITRE/
AST AST : IU PER LITRE/
MUT MCV DATE/
MTH MCV TIME/
MCV MEAN CELL VOLUME/
S1 COMPLETE/
S2 MISSING MCV/
S3 MISSING SMAC/
S4 MISSING CLINICAL EXAM/
S5 PATIENT REFUSED/
S6 PATIENT INCAPABLE/
S7 PATIENT DIED/
S8 INCOMPLETE FOR OTHER REASON/
INT (2) Jan
(3) Belinda
(4) Mick
(5) Linda
(6) Pam
(7) Robyn
(8) Gail
(9) Missing Data

(9999) Blank/
Q1 (1) Yes
(2) No
(9) Missing Data
(9999) Blank/
Q2 (1) Yes
(2) No
(3) Not Sure
(9) Missing Data
(9999) Blank/
Q3 (1) Yes
(2) No
(6) Special
(9) Missing Data
(9999) Blank/
Q4 (1) <12hrs
(2) 13-23hrs
(3) 1-4 days ago
(4) 5-13days before
(5) 2-3weeks before
(6) >3weeks <6months
(7) >6months
(8) Special
(9) Special
(9999) Blank/
BEER TO OTHR (1) 10 - 50 mls
(2) 51 - 100 mls
(3) 101 - 200 mls
(4) 201 - 300 mls
(5) 301 - 400 mls
(6) 401 - 500 mls
(7) 501 - 999 mls
(9999) Blank/
TOT (1) 10 - 50 mls
(2) 51 - 100 mls
(3) 101 - 200 mls
(4) 201 - 300 mls
(5) 301 - 400 mls
(6) 401 - 500 mls
(7) 501 - 1000 mls
(8) 1001 - 2000 mls
(9) 2001 - 3000 mls
(10) 3001 - 4000 mls
(11) 4001 - 5000 mls
(9999) Blank/
Q6 (1) <12hrs
(2) one day
(3) 2-4 days
(4) 5-13days
(5) 2-3weeks
(6) >3weeks <6months
(7) >6months
(9) Missing Data
(9999) Blank/
Q7 (1) <\$1.00
(2) \$1.01 - \$3.00
(3) \$3.01 - \$5.00
(4) \$5.01 - \$8.00
(5) >\$8.00
(6) Don't Know
(7) Others Paid
(9) Missing Data
(9999) Blank/
Q8 (1) Yes
(2) No
(3) Not Sure
(9) Missing Data
(9999) Blank/
Q9 (1) Parent
(2) Sibling
(3) Children
(4) Partner
(5) Combintn Of Above
(6) Other
(9) Missing Data
(9999) Blank/
Q10 TO Q22 (1) Score
(9) Missing Data
(9999) Blank/
Q23 TO Q43 (1) Yes
(2) No
(9) Missing Data
(9999) Blank/
AGE (1) 15-20
(2) 21-30
(3) 31-40
(4) 41-50
(5) 51-60
(6) 61-70
(7) 71-80
(8) 81-90
(9) 90+
(9999) Blank/
Q45 (1) Married
(2) Seperatd
(3) Divorced
(4) De Facto
(5) Single
(6) Widowed
(9) Missing Data
(9999) Blank/
Q46 (1) Yes
(2) No
(9) Missing Data
(9999) Blank/
SEX (1) Male
(2) Female
(9) Missing Data
(9999) Blank/
WARD (7) Orthpdc
(8) Orthpdc
(10) Orthpdc
(11) Genito-Urinary
(12) General Surgery
(13) General Surgery
(25) Gastro
(26) General Surgery
(27) Rheumato
(28) Neurology
(29) Haemato-Immuno
(30) Radiology
(31) Ophthalm
(32) Ear Nose & Throat
(9999) Blank/
DATE (9999) Blank/
F21 (1) Yes
(2) No
(9) Missing Data
(9999) Blank/
F22 TO F25 (9) Missing Data
(9999) Blank/

VALUE LABELS

Table with multiple columns containing alphanumeric codes, numbers, and identifiers. The table is organized into several vertical columns, with the first column on the left and the last column on the right. It contains a dense grid of data points, likely representing a list of records or transactions.

3035061150600J0 92			3040512	1A1	
10359622217	106 2	21ARW6549	10406322214	40	40412
203596229122001170612			204063229611001322061000		32AQL5740
3035962			30406321906	091 11	
10361622216 50	506 2		10407322215	30	30772
203616217121001117061		22ARW020616061215110 10 19	204073224911200132206131 0		21ARB3171
303616216061100 89			30407322216	40	
1036262222			10408312213120		120342
2036262036220011170612	1	22ARW0840816061570 80 10 12	204083163511001322061000		31ARL7192
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2215875236120012020912001			31ASY467303091532 54 10 20					
321587501091340 86 61								
121597522 7 10		106 14		22222222222222222222				
2215975151120012020912001			31ALP944302091843104 87 19					
321597507090830 89 1								
121607522 4 10		106 14		32222222222222222222				
2216075986120012020913101			1 11ASY173902091640 81 39 26					
321607502091510 95								
121617522 7 20		207 14		22222222222222222222				
2216175051120025020912201			31AJE915802090930 77 71 9					
321617502092056 87 ... 1								
121627522 6 60		605 2		22222222222222222222				
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3216275094091010 78 1								
1216375								
2216375966120026030910104			31ASY720603092101116 10 26					
321637503092039 77 1 1								
1216475								
2216475605110026030910000			31ASY774503072045 50 10 24					
321647503091640 79 1 1								
1216575								
2216575655120026030910000			31ASY837704091435 88 15 32					
3216575	1	1						
1216675								
2216675625110026030910000			31ASY8130					
32166750309 86 11 1								
121677522 2 80		00552		22222222222222222222				
2216775405120026030911000			31ACH680803091651 54 10 13					
321677503091550 85 1								
121687522 1 60		606 2		22222222222222222222				
2216875491120026030912002			31ARF622903092101 49 12 15					
321687503092036 79 1								
1216975								
2216975006120027010911203			31APV502501092043 74 58 95					
321697501091838 90 1 1								
121707522 2 10 20		302 2		22222222222222222222				
2217075985120025010915100			31AKX460001092042114 90 16					
321707501091839 88 1								
1217175								
2217175261120026010910001			31ASA3626					
3217175	111	1						
1217275								
2217275191120026010911000			31ASX513502091048 93 10 18					
321727502090840 90 1 1								
1217375								
2217375541120026010910000			31ASB7996					
3217375	111	1						
1217475								
2217475541 10026010911000		1	31AMC8537					
3217475	111	1						
121757522 3 100		100352 1111		11222121212111212212				
2217575605110026010910000			32ASX200402091047 78 10 26					
321757502090850 87 1								
121767522 3 30		30222 11		22222222222222222121				
221767521110026010910200			32AEX369301091543 54 10 14					
321767501091315 84 1								
121777522 4 5		93 2		22222222222222222222				
2217775161120025310810100			31ASG068931081328 75 10 14					
321777531082200 86 1								
121787522 3 60		60332		22222222222222222222				
2217875295110026310810000			11ASX651401091146 92 33 28					
321787531081700 811								
1217975								
2217975471120026010913000			31AQX624801092304 73 10 13					
321797501092017 74 1 1								
1218075								
2218075006120012020910000			1 31ASY251402091641 76 12 16					
321807502091530 86 1 1								
1218175								
2218175401120012030915005			32AMV9900					
321817501091335 91 11 1								
121827522 7 10		107 2		22222222222222222222				
2218275156120026010913200			31AKW279302091048 80 59 18					
321827502090830 98 1								
1218375								
2218375421120011300815500			31ACP022530081055 74 10 13					
32183753064 85 1 1								
1218475								
2218475665120026320810000			31ASV326326081039116 14 26					

APPENDIX D

CALCULATION OF LABOUR NEEDED FOR EXPERIMENT I

1. Expected number of patients able to be interviewed

(a) From medical records, the typical age distribution for patients in Christchurch Hospital is: (31.1.80 at 2400 hours).

Table 1

	Age (years)												N= 405
	0-1	2-5	6-10	11-15	16-20	21-30	31-40	41-50	51-60	61-70	71-80	>80	
N	10	15	13	12	27	49	26	27	42	84	70	30	
%	2	4	3	3	7	12	6	7	10	21	17	7	
cum%	2	6	9	12	19	31	37	44	54	75	92	99	

(b) The average number of new admissions per day can be calculated from the monthly new admissions:

Table 2

<u>Month</u>	<u>N</u>
August 1980	1429
September	1416
October	1471
November	1336
December	1333
January 1981	1161
TOTAL	8146

Mean N = 1358 / month
 = 340 / week

(c) On the basis of an unpublished report by fifth year medical students on the prevalence of alcoholism in Christchurch Hospital during the summer of 1973 - 74, 11% of patients were discharged before interview, 7% were not able to be interviewed, 3% died, 2% were too young (< 15 years). However, table 1 suggests 13% <15 years. Mean % <15 yrs = 8. Thus 11 + 7 + 3 + 8 = 29% not able to be interviewed.

(d) From (b) and (c), the mean number of patients able to be interviewed per week = $(100-29) \times 340$
= 241 / week.

2. To allow for the statistical investigation of the effects of age and sex on the problem drinking groups scores, about 100 problem drinkers are needed. Considering the likely prevalence of problem drinking (a conservative estimate is 7%), and the numbers not able to be interviewed (29%), then if x is the number of patients required to survey,

$$\begin{aligned} 0.07x(1 - 0.29) &= 100 \\ x &= 2012 \end{aligned}$$

As there are about 241 patients per week available, it will take 2012/241 or 8 weeks to obtain the sample.

3. Assuming one person could interview about 8 patients per day, then about 6 interviewers would be needed to cover the 241 patients per week for 8 weeks. Given the likely delays, trials, fluctuations and training, allow at least 12 weeks for the data collection.

APPENDIX E

TABLES 1 TO 8 FOR EXPERIMENTS I, II AND III

EXPERIMENT I TABLE 1

AGE, SEX AND MARITAL CHARACTERISTICS FOR 1,613 PROBLEM AND
NON-PROBLEM DRINKERS USED FOR SELECTING ITEMS

		Percent	Cumulative percent
Sex:			
male	856	53.1	53.1
female	746	46.2	46.6
missing data	11	0.7	100.0
Age: (years)			
15-20	105	6.5	6.5
21-30	142	8.8	15.4
31-40	73	4.5	19.9
41-50	90	5.6	25.5
51-60	161	10.0	35.5
61-70	175	10.8	46.4
71-80	487	30.2	76.7
81-100	380	23.3	99.6
missing data	6	0.4	100.0
Marital status:			
married	897	55.6	55.6
single	351	21.8	77.4
widowed	261	16.2	93.6
separated	53	3.3	96.9
divorced	42	2.6	99.5
de facto	3	0.2	99.7
missing data	6	0.4	100.0

Mean age = 52.6; range 15-100; s.d. 20.7

EXPERIMENT I TABLE 2
TYPE OF WARD FOR 1613 PROBLEM AND NON-PROBLEM
DRINKERS USED FOR SELECTING ITEMS

Ward	N	Percent	Cumulative percent
Orthopaedic	274	17.0	17.0
General Surgery	380	22.3	39.3
Genito-Urinary	359	22.3	61.6
Gastroenterology	100	6.2	67.8
Rheumatology	63	3.9	71.7
Neurology	77	4.8	76.5
Haematology- Immunology	61	3.8	80.3
Radiology	115	7.1	87.3
Ophthalmology	106	6.6	93.9
Ear Nose & Throat	96	6.0	99.9
Missing data	2	0.1	100.0

EXPERIMENT I TABLE 4
PEARSON'S INTER-CORRELATIONS FOR SELECTED SELF-REPORT ITEMS
FOR 537 PROBLEM AND NON-PROBLEM DRINKERS

Question	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
2	100	15	05	25	38	09	26	38	23	25	16	26	08	29	35	28	47	27	39	42	11	33	23
3		100	10	09	12	21	00	14	14	01	03	03	05	12	17	13	14	20	14	13	16	11	19
4			100	-05	16	06	08	04	17	03	-01	08	05	07	07	-01	04	06	10	10	08	04	11
5				100	14	17	30	32	19	14	29	21	16	18	16	09	19	40	25	28	29	25	19
6					100	24	38	37	33	28	24	35	22	45	49	42	47	36	38	51	29	38	50
7						100	18	14	31	19	40	26	30	56	32	38	39	36	23	26	40	20	28
8							100	44	30	45	38	30	25	30	36	15	34	34	40	29	22	48	25
9								100	35	37	31	24	13	38	34	23	39	33	36	32	24	31	25
10									100	31	24	38	20	38	40	31	31	40	40	46	38	35	25
11										100	49	40	27	44	32	27	22	21	38	14	15	28	21
12											100	43	50	37	25	24	31	39	25	20	21	21	22
13												100	50	47	43	30	38	39	32	28	32	21	30
14													100	25	29	12	28	33	13	24	37	18	34
15														100	48	42	47	33	34	33	29	42	24
16															100	34	51	47	35	46	43	40	36
17																100	50	33	27	36	24	41	29
18																	100	46	40	60	31	47	34
19																		100	41	60	49	46	41
20																			100	42	45	39	45
21																				100	51	53	51
22																					100	34	54
23																						100	35
24																							100

EXPERIMENT I TABLE 5
PEARSON'S CORRELATIONS FOR SELECTED PHYSICIANS ITEMS
FOR 570 PROBLEM AND NON-PROBLEM DRINKERS

Item	AST	GGT	Palpable liver	Duputyrens Contractures
AST	100	27	14	04
GGT		100	16	04
Palpable liver			100	22
Duputyrens Contractures				100

AST = Aspartate transaminase

GGT = Gamma-glutamyl-transpeptidase

EXPERIMENT I TABLE 6

ITEM WEIGHTINGS FOR PDST SELF-REPORT QUESTIONS: SCALED WEIGHTS

Question	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Weighting*	3	1	1	-2	6	-6	3	4	4	1	2	3	-1	3	-4	-2	2	-1	3	-2	8	4	2

Scaling factors: (see EXPERIMENT I TABLE 8 :, B values)

B interval	0.01 - 0.05	0.06 - 0.10	0.11 - 0.15	0.16 - 0.20	0.21 - 0.25	0.26 - 0.30	0.31 - 0.35	0.36 - 0.40
Weighting	1	2	3	4	5	6	7	8

EXPERIMENT I TABLE 7

ITEM WEIGHTINGS FOR PDST PHYSICIANS ITEMS: SCALED WEIGHTS

Item	GGT	AST	Duputyrens Contractures	Palpable Liver
Weighting*	1	2	2	1

* Scaling factors (See EXPERIMENT I TABLE 9 :, B values)

B interval	0.01 - 0.09	0.10 - 0.17
Weighting	1	2

EXPERIMENT I : TABLE 8

ZERO-ORDER CORRELATION MATRIX FOR PDST QUESTIONS
(N=111)

Question	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
2	100	-04	12	08	-06	-17	03	21	-05	12	-04	08	-02	15	07	15	21	09	06	17	-18	-07	-17
3		100	05	07	-08	07	-12	05	02	-10	04	05	03	04	08	06	11	13	02	05	13	-06	07
4			100	-15	12	12	-02	-17	23	12	-08	-01	-06	03	08	-06	-07	10	06	16	05	04	14
5				100	-03	01	13	25	05	11	13	27	20	01	05	-05	11	35	16	14	17	13	11
6					100	05	18	-21	13	16	04	12	02	02	23	25	08	18	20	19	04	-01	25
7						100	04	-15	23	13	14	07	12	03	21	18	09	19	11	09	33	16	15
8							100	11	13	16	18	09	-01	06	16	-04	03	14	17	06	04	02	03
9								100	-02	16	13	10	-08	02	00	-03	04	-01	-02	-04	-10	-18	-09
10									100	08	15	17	10	13	24	07	00	20	13	22	25	12	-03
11										100	31	21	08	21	16	15	16	16	18	-04	05	14	09
12											100	35	30	13	06	13	13	12	05	08	00	-08	00
13												100	24	20	19	20	16	25	17	15	07	-01	12
14													100	05	14	-01	16	20	-01	13	33	03	15
15														100	16	25	23	19	09	11	04	06	-05
16															100	21	24	40	11	26	40	23	14
17																100	33	27	15	15	09	11	09
18																	100	31	16	31	18	-04	15
19																		100	25	42	38	34	22
20																			100	18	15	04	22
21																				100	37	16	20
22																					100	16	27
23																						100	11
24																							100

APPENDIX F

THE PROBLEM DRINKING SCREENING TEST (PDST);
A MEASURE FOR THE CONSTRUCT OF PROBLEM DRINKING

A. PDST Self-Report Items

1. When did you last drink?
(Discontinue if response is 'never')
2. How much do you normally drink each week?
(Discontinue if men score less than five 'drinks' and women less than 3. Score 1 point for men drinking 36 or more 'drinks', women 16 or more)

For questions 3 to 28, all positive responses score 1 point.

3. Have you been in hospital more than once because of accidents?
(By accidents, we mean all types)
4. Have any close family members such as a parent, spouse, brother, or sister, had drinking problems?

Thinking over the last three months -

5. Do you drink before lunch fairly often?
6. After the first glass or two of alcohol do you ever feel a craving for more?
7. Do you find you are thinking a lot about alcohol?
8. Do you sometimes drink alcohol even against your doctor's advice?
9. When you drink a lot of alcohol do you tend to eat less?
10. In the morning do you sometimes feel that you might be sick (vomit)?
11. Have you found that your hands have been trembling a lot?
12. Have you ever used alcohol to get rid of trembling or the feeling that you might be sick?

13. Have you ever been criticized at work because of your drinking?
14. Do you prefer to drink alone?
15. Do you think you're in worse shape because of your drinking?
16. Do you ever have a guilty conscience about drinking?
17. In order to cut down your drinking, have you ever felt it necessary to limit it to certain occasions or to certain times of the day?
18. Do you feel you should drink less?
19. Do you think that without alcohol you would have fewer problems?
20. When you're upset do you drink alcohol to calm down?
21. Are there times when you'd like to stop drinking?
22. Would you get along better with your spouse/partner/the people you're closest to if you didn't drink?
23. Have you ever deliberately tried to do without any alcohol at all?
24. Have you often been told that your breath smells of alcohol?

B. PDST Physician's Assessment

25. Palpable liver
26. Dupuytren's Contractures
27. Elevated Serum-gamma-glutamyl-transpeptidase
28. Elevated aspartate transaminase.

Conversion of Reported Quantities to 'Drinks'

<u>Beer</u>	<u>No.</u>	<u>Spirits/Liqueurs</u>	<u>No.</u>	<u>Fortified Wine</u>	<u>No.</u>
Glass/can	1	Nip	1	glass	1
Large can	2	bottle (sm)	16	bottle	14
Handle	2	bottle (large)	30		
Bottle	4	<u>Table wine</u>		<u>Cocktails</u>	
Jugs	6	glass	1	glass	2
Flagon	8	bottle	8		

QUESTIONS, SPSS SOURCE PROGRAMME AND RAW DATA FOR EXPERIMENT II

Data 1-6 Sex (M/F) 7 Age 8-9 Code 10

- | | | TICK | | |
|---------------------------------------|--|--------------------------|--------------------------|----|
| | | YES | NO | |
| Q 1. | Have you been admitted to hospital more than once because of accidents? (By accidents, we mean all types) | <input type="checkbox"/> | <input type="checkbox"/> | 1 |
| Q 2. | Have any close family members such as a parent, brother, spouse, or sister, had drinking problems? | <input type="checkbox"/> | <input type="checkbox"/> | 1 |
| Thinking over the LAST THREE MONTHS - | | | | |
| Q 3. | Do you drink before lunch fairly often? | <input type="checkbox"/> | <input type="checkbox"/> | 1 |
| Q 4. | After the first glass or two of alcohol do you ever feel a craving for more? | <input type="checkbox"/> | <input type="checkbox"/> | 1 |
| Q 5. | Do you find you are thinking a lot about alcohol? | <input type="checkbox"/> | <input type="checkbox"/> | 1 |
| Q 6. | Do you sometimes drink alcohol even against your doctor's advice? | <input type="checkbox"/> | <input type="checkbox"/> | 1 |
| Q 7. | When you drink a lot of alcohol, do you tend to eat less? | <input type="checkbox"/> | <input type="checkbox"/> | 1 |
| Q 8. | In the morning do you sometimes feel that you might be sick (vomit)? .. | <input type="checkbox"/> | <input type="checkbox"/> | 1 |
| Q 9. | Have you found that your hands have been trembling a lot? | <input type="checkbox"/> | <input type="checkbox"/> | 1 |
| Q10. | Have you ever used alcohol to get rid of trembling or the feeling that you might be sick? | <input type="checkbox"/> | <input type="checkbox"/> | 20 |
| Q11. | Have you ever been criticized at work because of your drinking? | <input type="checkbox"/> | <input type="checkbox"/> | 21 |
| Q12. | Do you prefer to drink alone? | <input type="checkbox"/> | <input type="checkbox"/> | 22 |
| Q13. | Do you think you're in worse shape because of your drinking? | <input type="checkbox"/> | <input type="checkbox"/> | 23 |
| Q14. | Do you ever have a guilty conscience about drinking? | <input type="checkbox"/> | <input type="checkbox"/> | 24 |
| Q15. | In order to cut down your drinking, have you ever felt it necessary to limit it to certain occasions or to certain times of the day? | <input type="checkbox"/> | <input type="checkbox"/> | 25 |
| Q16. | Do you feel you should drink less? | <input type="checkbox"/> | <input type="checkbox"/> | 26 |
| Q17. | Do you think that without alcohol you would have fewer problems? | <input type="checkbox"/> | <input type="checkbox"/> | 27 |
| Q18. | When you're upset do you drink alcohol to calm down? | <input type="checkbox"/> | <input type="checkbox"/> | 28 |
| Q19. | Are there times when you'd like to stop drinking? | <input type="checkbox"/> | <input type="checkbox"/> | 29 |
| Q20. | Would you get along better with your spouse/partner/the people you're closest to if you didn't drink? | <input type="checkbox"/> | <input type="checkbox"/> | 30 |
| Q21. | Have you ever deliberately tried to do without any alcohol at all? | <input type="checkbox"/> | <input type="checkbox"/> | 31 |
| Q22. | Have you often been told that your breath smells of alcohol? | <input type="checkbox"/> | <input type="checkbox"/> | 32 |
| Q23. | On the average, write in the number you would normally drink in a week | <input type="checkbox"/> | <input type="checkbox"/> | 33 |

<u>Beer</u>	<u>No.</u>	<u>Spirits/ Liqueurs</u>	<u>No.</u>	<u>Sherry</u>	<u>No.</u>
glass/can	<input type="text"/>	nip	<input type="text"/>	glass ...	<input type="text"/>
large can	<input type="text"/>	bottle (sm)	<input type="text"/>	bottle ..	<input type="text"/>
handle ..	<input type="text"/>	bottle (lge)	<input type="text"/>	<u>Cocktails</u>	
bottle ..	<input type="text"/>	<u>Wine</u>		glass ...	<input type="text"/>
jugs	<input type="text"/>	glass	<input type="text"/>		
flagon ..	<input type="text"/>	bottle	<input type="text"/>		

M.A.S.T.

TICK

Questions

YES NO

- 1. Do you feel you are a normal drinker? 37
- 2. Have you ever awakened the morning after some drinking the night before and found that you could not remember a part of the evening? 38
- 3. Does your spouse (or parents) ever worry or complain about your drinking? 39
- 4. Can you stop drinking without a struggle after one or two drinks? 40
- 5. Do you ever feel bad about your drinking? 41
- 6. Do friends or relatives think you are a normal drinker? 42
- 7. Do you ever try to limit your drinking to certain times of the day or to certain places? 43
- 8. Are you always able to stop drinking when you want to? .. 44
- 9. Have you ever attended a meeting of Alcoholics Anonymous (AA)? 45
- 10. Have you ever been in fights when drinking? 46
- 11. Has drinking ever created problems with you and your spouse? 47
- 12. Has your spouse (or other family member) ever gone to anyone for help about your drinking? 48
- 13. Have you ever lost friends or girlfriends/boyfriends because of drinking? 49
- 14. Have you ever been in trouble at work because of drinking? 50
- 15. Have you ever lost a job because of drinking? 51
- 16. Have you ever neglected your obligations, your family, or your work for two or more days in a row because you were drinking? 52
- 17. Do you ever drink before noon? 53
- 18. Have you ever been told you have liver trouble? Cirrhosis? 54
- 19. Have you ever had delirium tremens (DTs), severe shaking, heard voices, or seen things that weren't there after heavy drinking? 55
- 20. Have you ever gone to anyone for help about your drinking? 56
- 21. Have you ever been in a hospital because of drinking? 57
- 22. Have you ever been a patient in a psychiatric hospital or on a psychiatric ward of a general hospital where drinking was part of the problem? 58
- 23. Have you ever been seen at a psychiatric or mental health clinic, or gone to a doctor, social worker, or clergyman for help with an emotional problem in which drinking had played a part? 59
- 24. Have you ever been arrested, even for a few hours, because of drunk behaviour? 60
- 25. Have you ever been arrested for drunk driving after drinking? 61


```

RUN NAME      QMH.P
PRINT BACK    CONTROL
VARIABLE LIST DATE,SEX,AGE,CODE,Q1 TO Q23,BQ,BC,SQ,SC,WQ,WC,SHQ,SHC,CQ,CC,M1
              TO M25
INPUT MEDIUM [QMH.D]
INPUT FORMAT FIXED(F6.0,F1.0,F2.0,F1.0,23F1.0,5(F3.0,F1.0),25F1.0)
VAR LABELS   Q1 ADM. TO HOSP. BEFORE BECAUSE OF AN ACC./
              Q2 FAMILY MEMBER WITH DRINKING PROBLEM/
              Q3 DRINK BEFORE LUNCH/
              Q4 CRAVE FOR MORE/
              Q5 THINK ABOUT ALCOHOL ALOT/
              Q6 DRINK AGAINST DOCTOR'S ADVICE/
              Q7 EAT LESS/
              Q8 SICK IN MORNING/
              Q9 TREMBLING HANDS/
              Q10 USE ALCOHOL TO REDUCE TREMBLING/
              Q11 CRITICISED AT WORK/
              Q12 PREFER TO DRINK ALONE/
              Q13 IN WORSE SHAPE BECAUSE OF DRINKING/
              Q14 GUILTY CONSCIENCE/
              Q15 LIMIT DRINKING/
              Q16 DRINK LESS/
              Q17 FEWER PROBLEMS WITHOUT ALCOHOL/
              Q18 DRINK TO CALM DOWN/
              Q19 LIKE TO STOP DRINKING/
              Q20 GET ALONG BETTER WITH PEOPLE/
              Q21 DELIBERATELY TRIED TO DO WITHOUT/
              Q22 BREATH SMELLS/
              Q23 DRINK SCORE/
              BQ QUANTITY OF BEER/
              BC CONTAINER BEER DRUNK FROM/
              SQ QUANTITY OF SPIRITS/
              SC CONTAINER SPIRITS DRUNK FROM/
              WQ QUANTITY OF WINE/
              WC CONTAINER WINE DRUNK FROM/
              SHQ QUANTITY OF SHERRY/
              SHC CONTAINER SHERRY DRUNK FROM/
              CQ QUANTITY OF COCKTAILS/
              CC CONTAINER COCKTAILS DRUNK FROM/
              M1 NORMAL DRINKER/
              M2 BLACKOUT/
              M3 SPOUSE COMPLAINING/
              M4 STOP DRINKING AFTER 1 OR 2 DRINKS/
              M5 FEEL BAD ABOUT DRINKING/
              M6 FRIENDS THINK YOU A NORMAL DRINKER/
              M7 LIMIT DRINKING/
              M8 STOP DRINKING WHEN YOU WANT TO/
              M9 A.A.MEETING/
              M10 FIGHT WHEN DRINKING/
              M11 DRINKING CREATED PROB.WITH SPOUSE/
              M12 SPOUSE GONE FOR HELP/
              M13 LOST FRIENDS/
              M14 TROUBLE AT WORK/
              M15 LOST A JOB/
              M16 NEGLECTED OBLIGATIONS FAMILY WORK/
              M17 DRINK BEFORE NOON/
              M18 LIVER TROUBLE/
              M19 DELIRIUM TREMENS/
              M20 GONE FOR HELP/
              M21 HOSPITAL/
              M22 PATIENT IN PSYCHIATRIC WARD/
              M23 EMOTIONAL PROBLEMS/
              M24 ARRESTED/
              M25 DRUNK DRIVING/
VALUE LABELS SEX (1)MALE (2)FEMALE/

```

```

CODE (1)QUEEN MARY HOSPITAL (2)MAHU/
Q1 TO Q22 (0)NO (1)YES/
BC,SC,WC,SHC,CC (0)DOESN'T DRINK THIS BEVERAGE
(1)GLASS OR CAN (2)LARGE CAN (3)HANDLE (4)BOTTLE (5)JUG
(6)FLAGON (7)MIP (8)SMALL BOTTLE (9)LARGE BOTTLE/
M2,M3,M5,M7,M9 TO M25 (0)NO (1)YES/
M1,M4,M6,M8 (0)YES (1)NO/
DATE TO M25(BLANK=9999)
RECODE       Q1 TO Q23,M1 TO M25(9999=0)(9=0)
RECODE       DATE TO M25(9999)
MISSING VALUES
COMPUTE      CAST=0
DO REPEAT   Q=Q1 TO Q23
COMPUTE      CAST=Q+CAST
END REPEAT
COMPUTE      SMAST=M1+M3+M5+M6+M8+M9+M11+M14+M16+M20+M21+M24+M25
COMPUTE      MO=M3+M5+M10+M17
COMPUTE      MT=M1+M2+M4+M6+M7+M8+M11+M12+M13+M14+M15+M16+M18+M19+M22+M23+
              M24+M25
COMPUTE      MF=M9+M20+M21
COMPUTE      MAST=MO+(2*MT)+(5*MF)

```


APPENDIX H
QUESTIONS, SPSS SOURCE PROGRAMME AND
RAW DATA FOR EXPERIMENT III

PATIENT ALCOHOL RELATED ILLNESS SURVEY

Name: _____

Code No.
1-7

	Pat no.	Hos	Int
1			

"My name is and I am from the Department of Preventive and Community Medicine. I am doing a survey financed by the Alcoholic Liquor Advisory Council, and I'm interviewing patients to provide information on the drinking patterns of people admitted to this hospital. The questions I'd like to ask you should only take about 20 minutes."

Q 1. Do you mind participating in the survey? [1=Yes, 2=No] 8 []

Q 2. Have you taken part in this survey before [1=Yes, 2=No, 3=Not sure] 9 []

"WE HAVE A FEW QUESTIONS ON WHEN PEOPLE DRINK BEER, WINES AND SPIRITS. WE ARE ASKING THESE QUESTIONS OF EVERYBODY, SO WE CAN GET AN AVERAGE PICTURE FOR ALL PATIENTS."

Q 3. Can you tell me when you last drank alcohol? 10 []

[1] Less than 12 hours ago
 [2] 13-23 hours ago
 [3] One to four days before
 [4] Five to thirteen days before
 [5] Two to three weeks before
 [6] Over three weeks but less than six months
 [7] Over six months but less than one year
 [8] More than one year ago
 [9] Never (GO TO Q.42)

Patients in treatment agencies: "THE REMAINING QUESTIONS APPLY TO THE LAST PERIOD IN WHICH YOU WERE DRINKING."

Patients in Christchurch Hospital: "HAVE THERE BEEN ANY PERIODS IN WHICH YOU'VE BEEN A HEAVY DRINKER?" EXPAND IF NECESSARY. IF YES, GO TO Q.42. 11 []

Q 4. On an average drinking occasion, can you tell me the number and type of each drink you would have?
 [Examples of measures, 1 large glass of beer, 3 jugs of beer, 2 nips of spirits, half a bottle of wine etc.]

Number and type of measure

1. Beer _____	12-14	<input type="text"/>	<input type="text"/>	<input type="text"/>
2. Spirits _____	15-17	<input type="text"/>	<input type="text"/>	<input type="text"/>
3. Fortified Wine _____ (Sherry, Port, Vermouth)	18-20	<input type="text"/>	<input type="text"/>	<input type="text"/>
4. Table wine _____	21-23	<input type="text"/>	<input type="text"/>	<input type="text"/>
5. Other beverages _____	24-26	<input type="text"/>	<input type="text"/>	<input type="text"/>
TOTAL	27-30	<input type="text"/>	<input type="text"/>	<input type="text"/>

Q 5. How long is/was it on the average between drinking occasions?

	Days	
[1] Less than 12 hours	1	
[2] One day	2	
[3] Two to four days	3	
[4] Five to thirteen, days	20	31 []
[5] Two to three weeks	30	
[6] Over three weeks but less than six months	200	
[7] Six months or more	-	

Calculate $\frac{\text{Total}}{\text{Days}}$ (enter score if more than 3)	32-34 <input type="text"/>
<p>Q 6. Have any close family members such as a parent, brother or sister had drinking problems?</p> <p>[1] Yes [2] No [3] Not sure</p> <p>Q 7. [If yes] What was the relationship?</p> <p>[1] Parent [2] Brother/sister [3] Children [4] Spouse or partner [5] Combination of above [6] Other</p>	<p>35 [</p> <p>36 [</p>
<p>CHRISTCHURCH HOSPITAL PATIENTS: IF SCORE IS MORE THAN 3 GO TO Q.42. CONTINUE FOR ALL OTHER PATIENTS.</p>	
<p>"NOW I'M GOING TO READ OUT SOME QUESTIONS AND I'D LIKE YOU TO ANSWER YES OR NO TO EACH ONE."</p>	
<p>Q 8. Do you feel you are a normal drinker? (By normal we mean you drink less than or as much as most other people?) (NO)</p> <p>Q 9. Does your wife, husband, a parent, or other near relative ever worry or complain about your drinking? (YES)</p> <p>Q 10. Do you ever feel guilty about your drinking? (YES)</p> <p>Q 11. Do friends or relatives think you are a normal drinker? (NO)</p> <p>Q 12. Are you able to stop drinking when you want to? (NO)</p> <p>Q 13. Have you ever attended a meeting of Alcoholics Anonymous? (YES)</p> <p>Q 14. Has drinking ever created problems between you and your wife, husband, a parent or other near relative? (YES)</p> <p>Q 15. Have you ever been in trouble at work because of drinking? (YES)</p> <p>Q 16. Have you ever neglected your obligations, your family or your work for two or more days in a row because you were drinking? (YES)</p> <p>Q 17. Have you ever gone to anyone for help about your drinking? (YES)</p> <p>Q 18. Have you ever been in a hospital because of drinking? (YES)</p> <p>Q 19. Have you ever been arrested for drunken driving, driving while intoxicated, or driving under the influence of alcoholic beverages? (YES)</p> <p>Q 20. Have you ever been arrested, even for a few hours, because of other drunken behaviour? (YES)</p>	<p>37 [</p> <p>38 [</p> <p>39 [</p> <p>40 [</p> <p>41 [</p> <p>42 [</p> <p>43 [</p> <p>44 [</p> <p>45 [</p> <p>46 [</p> <p>47 [</p> <p>48 [</p> <p>49 [</p>

[QUESTIONS 21-41, YES=1, NO=2]

Q 21. Have you found that your hands have been trembling a lot recently?	50 []
Q 22. Do you sometimes have feelings of nausea in the morning?	51 []
Q 23. Have you ever tried to get rid of trembling and nausea with alcohol?	52 []
Q 24. At the moment do you feel miserable because of any problems or difficulties related to your drinking?	53 []
Q 25. Do you drink before lunch fairly often?	54 []
Q 26. After the first glass or two of alcohol do you ever feel a craving for more?	55 []
Q 27. Are you preoccupied with thoughts about alcohol?	56 []
Q 28. Do you sometimes drink alcohol even against your doctor's advice?	57 []
Q 29. When you drink a lot of alcohol, do you tend to eat less?	58 []
Q 30. Have you ever been criticized at work because of your drinking?	59 []
Q 31. Do you prefer to drink alone?	60 []
Q 32. Do you think you've been in worse shape since you started drinking?	61 []
Q 33. Do you ever have a guilty conscience about drinking?	62 []
Q 34. Have you ever felt it necessary to limit your drinking to certain occasions or to certain times of the day?	63 []
Q 35. Do you feel you should drink less?	64 []
Q 36. Do you think that without alcohol you would have fewer problems?	65 []
Q 37. When you're upset do you drink alcohol to calm down?	66 []
Q 38. Are there times when you'd like to stop drinking?	67 []
Q 39. Would you get along better with your spouse/partner/the people you're closest to if you didn't drink?	68 []
Q 40. Have you ever deliberately tried to do without any alcohol at all?	69 []
Q 41. Have you often been told that your breath smells of alcohol?	70 []

Q 42. Finally, I'd like to ask a few questions about yourself. Firstly, can you tell me how long you've been in hospital?

Q 43. In which year were you born?

Q 44. Lastly, what is your present marital status?

[1] married
 [2] separated
 [3] divorced
 [4] de facto
 [5] single
 [6] widowed

Sex (M=1, F=2)

Ward

Date (day/month)

Code 1-7

2						
---	--	--	--	--	--	--

wks	days	hour

 8-13

--	--	--	--	--	--

 14-15 [] []

16 []

17 []

18-21

--	--	--	--

22-25

--	--	--	--

FILE HISTORY

1. File present	26 [
2. Number of previous admissions (Ch.Ch. and other hospitals) [0,1,2,3, 5=greater than 3]	
Surgical bed	27 [
Medical bed	28 [
Psychiatric bed	29 [
Maternity bed	30 [
3. 1=Yes, 2=Not clear	
T.B. _____	31 [
Peptic or bleeding ulcer _____	32 [
Pancreatitis _____	33 [
High blood pressure _____	34 [
Hepatitis _____	35 [
Jaundice _____	36 [
Liver disease (cirrhosis) _____	37 [
Pneumonia _____	38 [
Chronic bronchitis _____	39 [
Epilepsy _____	40 [
Memory disorders _____	41 [
Nutrition _____	42 [
Accidents (all types, more than one) _____	43 [
Other drug abuse _____	44 [
Peripheral Neuritis _____	45 [
Suicide attempt _____	46 [
ALCOHOLISM DIAGNOSED? _____	47 [
Palpable liver _____	48 [
Jaundice _____	49 [
Spider angiomata _____	50 [
Dupuytren's contractures _____	51 [
Other _____	52 [
Clinical exam checked? (Christchurch Hospital Only)	53 [
Patient Identification	54-60

--	--	--	--	--	--	--	--

RUN NAME FREQVAR
VARIABLE LIST N, HOS, INT, Q1 TO Q4, BEER, SPRT, FRTM, TABW, OTHR, TOT, Q5, SC,
Q6 TO Q41, Q42M, Q42D, Q42H, AG, MAR, SEX, WRD, DATE, F26 TO F53, PHUM,
SHDT, SMTH, PHOS, GGT, AST, MDT, MTH, MCV, S1 TO S8
INPUT MEDIUM [TREAT]
INPUT FORMAT FIXED(I, F, 0, 2P1, 0, 1X, 4P1, 0, 5P3, 0, F4, 0, P1, 0, F3, 0, 36P1, 0/
7X, 3P1, 0, F2, 0, 2P1, 0, 2F4, 0, 28P1, 0, F7, 0, 7X, 2P4, 0, 3P3, 0,
2F4, 0, F1, 0, RFL, 0)
RECODE N TO Q7, Q21 TO Q41, AG TO S8 (BLANK=9999)
MISSING VALUES HOS, INT, Q1 TO Q4, Q5, Q6, Q7, Q21 TO Q41, MAR, SEX, , S1
TO S8 (9, 9999)
MISSING VALUES BEER TO TOT, SC, , AG, WRD, DATE, PHUM TO MCV (9999)
COMPUTE AGE=61-AG
ASSIGN MISSING IF AGE(9999)
IF (AGE LT 1) AGE=AGE+100
RECODE BEER TO OTHR (10 THRU 50=1) (51 THRU 100=2) (101 THRU 200=3)
(201 THRU 300=4) (301 THRU 400=5)
(401 THRU 500=6) (501 THRU 999=7)
RECODE PHOS (10 THRU 29=1) (30 THRU 120=2) (121 THRU 999=3)
RECODE GGT (0 THRU 35=1) (36 THRU 50=2) (51 THRU 999=3)
RECODE AST (10 THRU 45=1) (50 THRU 999=2)
RECODE MCV (10 THRU 79=1) (80 THRU 100=2) (101 THRU 999 =3)
COMPUTE Q21 TO Q41 (2, 9=0)
IF DH=Q42M+14
COMPUTE DO=Q42D+2
IF (Q42H LT 12 AND GT 0) DH=1
IF (Q42H GE 12) DH=2
COMPUTE STY=DM+DO*DM
IF (STY(9999))
RECODE SC (0 THRU 100=1) (101 THRU 200=2) (201 THRU 300=3)
(301 THRU 400=4) (401 THRU 500=5) (501 THRU 999=6)
RECODE STY (0 THRU 20 =1) (21 THRU 50 =2) (51 THRU 100=3)
(101 THRU 200=4) (201 THRU 999=5)
VAR LABELS N PATIENT NUMBER/HOS HOSPITAL
INT INTERVIEWER/
Q1 SURVEY PARTICIPATION?/
Q2 PREVIOUSLY SURVEYED?/
Q3 LAST DRANK ALCOHOL/
Q4 PERIODS OF HEAVY DRINKING?/
BEER BEER/
SPRT SPIRITS/
FRTM FORTIFIED WINE/
TABW TABLE WINE/
OTHR OTHER BEVERAGES/
TOT TOTAL CONSUMED, NLS OF PURE ALCOHOL/
Q5 HOW OFTEN DO YOU DRINK?/
SC CALCULATED SCORE/
Q6 FAMILY ALCOHOL PROBLEMS?/
Q7 WHICH FAMILY MEMBERS?/
Q8 MAST 01/
Q9 MAST 02/
Q10 MAST 03/
Q11 MAST 04/
Q12 MAST 05/
Q13 MAST 06/
Q14 MAST 07/
Q15 MAST 08/
Q16 MAST 09/
Q17 MAST 10/
Q18 MAST 11/
Q19 MAST 12/
Q20 MAST 13/
Q21 MAST 01/
Q22 MAST 02/
Q23 MAST 03/
Q24 MAST 04/
Q25 MAST 05/
Q26 MAST 06/
Q27 MAST 07/
Q28 MAST 08/
Q29 MAST 09/
Q30 MAST 10/
Q31 MAST 11/
Q32 MAST 12/
Q33 MAST 13/
Q34 MAST 14/
Q35 MAST 15/
Q36 MAST 16/
Q37 MAST 17/
Q38 MAST 18/
Q39 MAST 19/
Q40 MAST 20/
Q41 MAST 21/STY TIME IN HOSPITAL/
AGE AGE/
MAR MARITAL STATUS/
SEX SEX/
WRD WRD/
DATE DATE/
F26 FILE PRESENT?/
F27 SURGICAL ADMISSIONS/
F28 MEDICAL ADMISSIONS/
F29 PSYCHIATRIC ADMISSIONS/
F30 MATERNITY ADMISSIONS/
F31 TUBERCULOSIS/
F32 PEPTIC OR BLEEDING ULCER/
F33 PANCREATITIS/
F34 HIGH BLOOD PRESSURE/
F35 HEPATITIS/
F36 JAUNDICE/
F37 LIVER DISEASE + CIRRHOSIS/
F38 PNEUMONIA/
F39 CHRONIC BRONCHITIS/
F40 EPILEPSY/
F41 MEMORY DISORDER/
F42 NUTRITION/
F43 ACCIDENTS + ALL TYPES/
F44 DRUG ABUSE/
F45 PERIPHERAL NEURITIS/
F46 SUICIDE ATTEMPT/
F47 ALCOHOLISM DIAGNOSED/
F48 PALPABLE LIVER/
F49 JAUNDICE/
F50 SPIDER ANGIOMATA/
F51 DUPUYTREN'S CONTRACTURES/
F53 CLINICAL EXAM CHECKED?/
PHUM PATIENT IDENTIFICATION/
SHDT SHAC DATE/
SMTH SHAC TIME/
PHOS ALKALINE PHOSPHATE + IU PER LITRE/
GGT GAMMA GT + IU PER LITRE/
AST AST + IU PER LITRE/
MDT MCV DATE/
MTH MCV TIME/
MCV REAN CELL VOLUME/
S1 COMPLETE/
S2 MISSING MCV/
S3 MISSING SHAC/
S4 MISSING CLINICAL EXAM/
S5 PATIENT REFUSED/
S6 PATIENT INCAPABLE/
S7 PATIENT DIED/

VALUE LABELS

S8 INCOMPLETE FOR OTHER REASON/
INT (2) Jan
(3) Belinda
(4) Mick
(5) Linda
(6) Pam
(7) Robyn
(8) Geoff
(9) Missing Data
(9999) Blank/
Q3 (1) <12 hrs
(2) 13-23 hrs
(3) 1-4 days
(4) 5-13 days
(5) 1-3 wks
(6) 3 wks-6 months
(7) 6-12 months
(8) >1 yr
(9) never
(9999) Blank/
BEER TO OTHR (1) 10 - 50 mls
(2) 51 - 100 mls
(3) 101 - 200 mls
(4) 201 - 300 mls
(5) 301 - 400 mls
(6) 401 - 500 mls
(7) 501 - 999 mls
(9999) Blank/
TOT (1) 10 - 50 mls
(2) 51 - 100 mls
(3) 101 - 200 mls
(4) 201 - 300 mls
(5) 301 - 400 mls
(6) 401 - 500 mls
(7) 501 - 1000 mls
(8) 1001 - 2000 mls
(9) 2001 - 3000 mls
(10) 3001 - 4000 mls
(11) 4001 - 5000 mls
(9999) Blank/
Q5 (1) <12hrs
(2) one day
(3) 2-4 days
(4) 5-13days
(5) 2-3weeks
(6) >3weeks <6months
(7) >6months
(9) Missing Data
(9999) Blank/
SC (1) 0-100
(2) 101-200
(3) 201-300
(4) 301-400
(5) 401-500
(6) >500
(9999) Blank/
Q6 (1) Yes
(2) No
(3) Not Sure
(9) Missing Data
(9999) Blank/
Q7 (1) Parent
(2) Sibling
(3) Children
(4) Partner
(5) Cohabitant Q(Above)
(6) Other
(9) Missing Data
(9999) Blank/
Q8 TO Q10 (1) Score
(9) Missing Data
(9999) Blank/
Q21 TO Q41 (1) Yes
(2) No
(9) Missing Data
(9999) Blank/
STY (1) 0-20 half days
(2) 21-50 "
(3) 51-100 "
(4) 101-200 "
(5) 201-999 "
(9999) Blank/
AGE (1) 15-20
(2) 21-30
(3) 31-40
(4) 41-50
(5) 51-60
(6) 61-70
(7) 71-80
(8) 81-90
(9) 90+
(9999) Blank/
MAR (1) Married
(2) Separated
(3) Divorced
(4) De Facto
(5) Single
(6) Widowed
(9) Missing Data
(9999) Blank/
SEX (1) Male
(2) Female
(9) Missing Data
(9999) Blank/
WRD (1) Orthpdic
(2) Orthpdic
(10) Orthpdic
(11) Genito-Urinary
(12) General Surgery
(13) General Surgery
(25) Gastro
(26) General Surgery
(27) Rheumato
(28) Neurology
(29) Haemato-Immuno
(30) Radiology
(31) Ophthal
(32) Ear Nose & Throat
(9999) Blank/
DATE (9999) Blank/
F26 (1) Yes
(2) No
(9) Missing Data
(9999) Blank/
F27 TO F30 (9) Missing Data
(9999) Blank/
F31 TO F52 (1) Yes
(2) No
(9) Missing Data
(9999) Blank/
F53 (1) Alpha
(2) Beta


```
(3) Gamma
(4) Delta
(5) Epsilon
(9) Missing Data
(9999) Blank/
PNUM (9999) Blank/
SMDT (9999) Blank/
SMTH (9999) Blank/
PHOS (1) <30
      (2) 30-120
      (3) >120
      (9999) Blank/
GGT   (1) 0-35
      (2) 36-50
      (3) 51-999
      (9999) Blank/
AST   (1) <50
      (2) >50
      (9999) Blank/
MDT   (9999) Blank/
MTH   (9999) Blank/
MCV   (1) <80
      (2) 80-100
      (3) >100
      (9999) Blank/
S1 TO S8 (1) Yes
          (9999) Blank/
Q8 TO Q20 (BLANK,9=0)
MAST =0
M=Q8 TO Q20
MAST=MAST*M
Q21 TO Q41 (9999=0)
HALT=0
MA=Q21 TO Q41
HALT=HALT*MA

RECODE
COMPUTE
DO REPEAT
COMPUTE
END REPEAT
RECODE
COMPUTE
DO REPEAT
COMPUTE
END REPEAT
```

103677 226 210 21030702 11 111 11 222221122222112111112
 203677 4000004622 1310
 303677 111
 103777 227 200 20021001111 111 1 21121112121211111122
 203777 4100005212 1310
 303777 111
 103877 226 140 14020701511111 1 212221222212111211122
 203877 0400004612 1310
 303877 111
 103977 226 240 24030802 11111 1 1 212221121221111111112
 203977 0000024312 1310
 303977 111
 104077 224 300 100 4002200161111111111 11111111111111111111
 204077 3900006052 1310
 304077 111
 104177 228 510100 61023051111111111111 112222121212111111212
 204177 4241 3009
 304177 111
 104277 227 320300 140 7602380151111111111 212221121221121111112
 204277 2500005041 3009
 304277 111
 104377 226 280 28021402 11111111111 121211121111111111111
 204377 2800004112 0710
 304377 111
 104477 226 150 150207512111 111 11 112221121212111211112
 204477 1600004611 2110
 304477 111
 104577 227 120100 220307316 1 1 1 11111 111121211221222111111
 204577 5200004631 2110
 304577 111
 104677 224 120 30 150400715 11111 1111221222221222122112
 204677 0000016041 2110
 304677 111
 104777 227 200120 32021602 1111111 111 111221112221111111111
 204777 1400003431 0610
 304777 111
 104867 226 240 80 320310611 111111111 111211121111111111111
 204867 0900005951 280915000 1 1 1 1 81060
 304867 28071219 70 21 252807 441
 104967 226 240 60 3002150121111111111111112111112121111111
 204967 1400004311 280913500 1 1 1 1 78038
 304967 19051233 44 39 241906 761
 105067 226 80140 22021102 1 1 11 111 1 11121112121111121112
 205067 1000003821 280911200 1 81059
 305067 28071218 58 52 232807 911
 105167 226 680 6802340151111111 11111111111211121111212
 205167 0700004721 280910500 1 1 1 81062
 305167 18081201 58 42 22 1
 105267 225 280 2806 2 1 111111111 2222111111111111111
 205267 0204003632 280912202 1 1 1 81067
 305267 18091221 56 9 91809 881
 105367 226 600 60023002 111111111111111211111111111111111
 205367 0500004321 280910100 1 81066
 305367 3108 174 2708 991
 105467 226 180600 78021902 1 11111111 111111111121121211111
 205467 0400005811 280913500 1 1 80040
 305467 2212 87 26 382212 761
 105567 225 520 80 600230011111111111 111122111122111111112
 205567 0100005651 280910300 1 1 11 1 80042
 305567 23091215 75 76 212309 861
 105667 223 800240 104025201511111111121111111212111
 205667 0003004621 280910300 1 11 1 1 81031
 305667 29041204 94167 400405 801
 105767 226 160250 41022052 1 1 11 1112111221121111111
 205767 0400002731 011013300 1 1 1 11 78054

305767 11
 105867 223 240300 54022702 1 1 11 1111 2111121112211211211
 205867 2500003451 011010500 1 1 1 1 78037
 305867 2204 78 33 1310041048 981
 105967 216 10 20 306 2 111 11 11 2222221122111111112
 205967 1600002411 280911300 1 1 81034
 305967 15051216122 35 231505 951
 106067 223 600 60023002 1 1111111111 1111111111111111111
 206067 0002002421 05102 1
 306067 11 1
 106167 224 210 40 70 32031062 11 111 11112122211212211211112
 206267 0304005121 051012200 1 1 81070
 306167 18091220 67 16 71809 951
 106267 222 80 120 20021001611 1 111 1 22122122112122111211
 206267 0000233951 01102 1
 306267 11 1
 106367 224 300 30021502 11 1111 11 112121221122122112112
 206367 0100005221 051010200 1 1 1 81073
 306367 11
 106467 225 600 60023002 1111111 111111111211111122121111
 206467 0300004321 051012500 1 1 81072
 306467 18091220 68 50 281809 911
 106567 226 300 30021502 11 1111 2111121112121121221
 206567 02 2731 20101 1
 306567 07701501013010 0921
 106667 224 150 1502075111111 11111 1111122111111111111
 206667 05 1621 20101 1
 306667 13010 095 1
 106767 225 999 999929992 1 1 11 11111 12111112121112112221
 206767 01 3851 20101
 306767 11
 106867 225 999929992 11111111 1111121122122111111122
 206867 02 4951 20101 1
 306867 13 047024019 0911
 100152 225 180 180209015 1111111111111211221111121111111
 200152 1 3011000206101 1
 300152 111
 100252 226 300 300310016 1 11 111 222221221222212111111
 200252 1 5721 213101 19999
 300252 11
 100353 225 300150 100 05506003121111111111121112111111121111111
 200353 1 4331 130101 1
 300353 111
 100453 226 180 1802 90131 1 1 222221122212212212121
 200453 4 2511 123091 1 199999
 300453 25091030 64 2525091659 941
 100552 226 250 250508012111 1 111 11121122121111111112
 200552 1 3311000223091 119999
 300552 11
 100652 224 360 3602180121111111111 111111111111111112
 200652 1 4441000123091 1 1 1 99999
 300652 11
 100752 224 420 42014202 11 1111 11 1111212221111212111122
 200752 1 2 21000223091 119199
 300752 11
 100852 226 40120 16020802 11 11 11 121211222211111111111
 200852 4 2811000123091 11 199999
 300852 11
 100952 227 180 1803060121111 11 11 2 1121122121111111122
 200952 1 1 4011000224091 1 1 1 1999992
 300952 11
 101052 222 200100 300215015 11111 111112112211111221111111111
 201052 7 4711 222091 1 199999
 301052 11
 101152 225 180 40 22021102 111 1 11 2122222222211211122
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301152 11
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QUESTIONS, SPSS SOURCE PROGRAM AND RAW DATA FOR EXPERIMENT III

Ward _____ Age _____ Sex _____

Name _____

Hospital No. _____

SELF-ADMINISTERED QUESTIONNAIRE ON ALCOHOL

TICK
YES NO

- Q 1. Have you been admitted to hospital more than once because of accidents? (By accidents, we mean all types)
- Q 2. Have any close family members such as a parent, brother, spouse, or sister, had drinking problems?
- THINKING OVER THE LAST THREE MONTHS -
- Q 3. Do you drink before lunch fairly often?
- Q 4. After the first glass or two of alcohol do you ever feel a craving for more?
- Q 5. Do you find you are thinking a lot about alcohol?
- Q 6. Do you sometimes drink alcohol against your doctor's advice?
- Q 7. When you drink a lot of alcohol, do you tend to eat less?
- Q 8. In the morning do you sometimes feel that you might be sick (vomit)? ..
- Q 9. Have you found that your hands have been trembling a lot?
- Q10. Have you ever used alcohol to get rid of trembling or the feeling that you might be sick?
- Q11. Have you ever been criticized at work because of your drinking?
- Q12. Do you prefer to drink alone?
- Q13. Do you think you're in worse shape because of your drinking?
- Q14. Do you ever have a guilty conscience about drinking?
- Q15. In order to cut down your drinking, have you ever felt it necessary to limit it to certain occasions or to certain times of the day?
- Q16. Do you feel you should drink less?
- Q17. Do you think that without alcohol you would have fewer problems?
- Q18. When you're upset do you drink alcohol to calm down?
- Q19. Are there times when you'd like to stop drinking?
- Q20. Would you get along better with your spouse/partner/the people you're closest to if you didn't drink?
- Q21. Have you ever deliberately tried to do without any alcohol at all?
- Q22. Have you often been told that your breath smells of alcohol?
- Q23. On the average, write in the number you would normally drink in a week:

<u>Beer</u>	<u>No.</u>	<u>Spirits/ Liqueurs</u>	<u>No.</u>	<u>Sherry</u>	<u>No.</u>
glass/can	<input type="text"/>	nip	<input type="text"/>	glass ..	<input type="text"/>
large can	<input type="text"/>	bottle (sm)	<input type="text"/>	bottle..	<input type="text"/>
handle	<input type="text"/>	bottle (lge)	<input type="text"/>	<u>Cocktails</u>	
bottle ..	<input type="text"/>	<u>Wine</u>		glass ..	<input type="text"/>
jugs	<input type="text"/>	glass	<input type="text"/>		
flagon ..	<input type="text"/>	bottle	<input type="text"/>		

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RUN NAME
PRINT BACK CONTROL
VARIABLE LIST AGE,SEX,Q1 TO Q23,DRINK1,C1 TO C23,DRINK2
INPUT MEDIUM [TEST.D]
INPUT FORMAT FIXED(F2.0,24F1.0,F3.0,23F1.0,F3.0)
MISSING VALUES AGE(99)/SEX,Q1 TO Q23,C1 TO C23(9)/DRINK1,DRINK2(999)/
VALUE LABELS SEX(1)MALE (2)FEMALE/
Q1 TO Q23,C1 TO C23 (0)NO (1)YES/
COMPUTE TOT1=Q1+Q2+Q3+Q4+Q5+Q6+Q7+Q8+Q9+Q10+Q11+Q12+Q13+Q14+Q15+Q16+Q17
+Q18+Q19+Q20+Q21+Q22+Q23
COMPUTE TOT2=C1+C2+C3+C4+C5+C6+C7+C8+C9+C10+C11+C12+C13+C14+C15+C16+C17
+C18+C19+C20+C21+C22+C23

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