# Understanding research

## Part two: terminology

Research literature is awash with terminology which at first glance can be off-putting. By becoming familiar with a few core terms and concepts the novice can read the majority of research articles with some degree of confidence. This article explores some of the more common terms that are found in research articles so that those who are new to research will be better armed to unpick the meaning and reliability of both quantitative and qualitative studies.

## Variables

Variables are qualities, properties, or characteristics of persons, things, or situations that change or vary and are manipulated, measured, or controlled in research (Burns and Grove, 2001). Variables can differ between groups and even within groups e.g. age, gender, smoking, quality of life scores, wound duration or wound size. There are two main categories of variables: independent and dependent. Let's consider a study to determine the ability of agents Manuka honey or IntraSite Gel (Smith & Nephew, Hull) to deslough venous leg ulcers (Gethin and Cowman, 2008). The variable that the research study is manipulating is the independent variable (desloughing agents). The variable that is being observed for any consequent changes is called the dependent variable (slough). In research, variables are characterised by degrees, amounts, and differences. In the latter study, slough was measured in percentages and wound size was measured in $cm^2$.

In qualitative studies and in some quantitative studies the focus is on abstract concepts, such as grieving, caring and health promotion (Burns and Grove, 2001). Researchers identify the elements of the study as concepts, rather than variables.

## Validity and reliability

Validity refers to whether a measurement instrument accurately measures what it is supposed to measure (Parahoo, 1997). Validity also measures the truth or accuracy of a claim and provides the base for making decisions about which findings are useful for patient care (Burns and Grove, 2001). If the measuring tools used in research are not valid, the study findings will be negated. For example, using a hand-held doppler probe is a valid method of assessing the ankle brachial pressure index, but simply palpating pulses is not.

Reliability refers to whether a test, measurement or method of data collection will produce similar results if used either more than once by the same researcher, or by different researchers (Leiba and Notter, 1996). For example, when recording the blood pressure of a patient the instrument should give the same results each time regardless of who uses the instrument. However, a measuring device that is unreliable cannot be valid but a reliable item is not necessarily valid (Polit and Hungler, 1995). A simple means of understanding this is by example: say we set our watches five minutes fast so that we are always early for appointments the watch will do what we want each time (i.e. it will give us the correct time plus five minutes) and thus can be said to be reliable. However, it is not valid as the time displayed is not the actual time.

There is a paucity of validated and reliable tools available to practitioners for assessment of wound management outcomes. Fletcher (2003) recommends that tools which have been previously validated should be used in research as they add to the robustness of the data collected. An example of such a tool is the Wong-Baker FACES pain scale (Stuppy, 1998). This scale has been demonstrated to have high reliability and concurrent validity for use with adults (Stuppy, 1998).

## Understanding data

Without valid, accurate, accessible, and verifiable data from a research study one cannot obtain a reliable result in which people will have faith (McKenzie-McHaig and Ayers, 1999). Pocock (1983) highlights the difficulty in obtaining reliable data as he considers four types of information: factual; measurement; clinical assessment; and patient opinion. A potentially complex picture must be constrained into a series of specific requests for factual information so that consistent data recording takes place in a manner suitable for statistical analysis (Pocock, 1983). This is most relevant to quantitative studies in which one presents the findings in numerical form. In qualitative research, data is presented in quotes, opinions, comments, or themes that arise from discussion, observation and interviews.

There are simple types of data that are particularly important to quantitative studies. These are:

- Categorical:
  a) Two categories: male/female; smoker non-smoker; venous ulcer/non venous ulcer
  b) More than two categories: marital status; number of comorbidities; source of referral.
- Numerical:
  a) Discrete: counts or numbers e.g. number of children, number of episodes of ulceration, number of treatments
  b) Continuous: measurement of blood pressure; age; wound duration.
- Other types include ranks, ratios, rates and scores.

## Population and sample

The population in a research study is the entire group of people that the researcher is seeking information about. This could be the population of people with pilonidal sinus. However, it would not be possible to study an entire population unless a condition is extremely rare. Therefore, a study will try to obtain a 'sample' of that population.

Parahoo (1997) defines a sample as 'a proportion or subset of the population'. By stipulating the inclusion criteria such as those with open venous leg ulcers and the exclusion criteria such as patients taking steroids, the researcher sets the target

population, that is the population to be studied or the study population (Parahoo, 1997).

The purpose of sampling in quantitative research is to draw a representative subset of the population and collect data from them with the aim of generalising the findings to a wider population (Parahoo, 1997). The essential feature is to make patients in the trial representative of all future patients who are liable to benefit from the trial's findings (Pocock, 1983). There are two main types of sampling: random (also called probability) or non-random (also called non-probability).

The word random suggests a lack of order or planning but this is not the case. Random sampling means using a technique that is precise and systematic. It is a powerful method of sampling and is used in the randomised controlled trial. The strength of this method is that the researcher cannot decide which treatment group a person goes into and they are chosen 'at random'.

In non-random sampling, subjects are selected but are less likely than in random sampling to produce representative and, therefore, accurate samples (Polit and Hungler, 1995). This method may be chosen for reasons such as time, availability and opportunity, or when random sampling is not possible.

The number of participants in the study will depend on the study aims and objectives, what is known about this topic, the size of the population, and the magnitude of a difference that is desirable between treatments. The size of a sample in quantitative research is instrumental in achieving statistical representativeness and to infer generalisability of the findings (Polit and Hungler, 1995). Wound care trials have been criticised as giving little consideration to sample size, often using samples that are too small to show a difference in treatments (Fletcher et al, 1997; O'Meara et al, 2001). A trial should be big enough to have a high chance of detecting as statistically significant a worthwhile effect — if it exists — and thus to be reasonably sure that no benefit exists if it is not found in the trial (Venkatraman et al, 2002). This is crucial when trying to avoid type I and type II errors.

Type I errors occur when the researcher concludes there is a significant difference between groups when in fact none exists (Burns and Grove, 2001). Type II errors occur when it is concluded that no significant difference exists, when in fact there is one (Burns and Grove, 2001). In small studies the chance of an imbalance in characteristics or risk factors occurring accidentally is high and the less power the study has to detect the difference between treatment groups (Venkatraman et al, 2002). The trial's power is defined as the probability of finding a difference if it exists.

In qualitative studies the number of participants is quite small as one aims to gain an understanding of a particular phenomena e.g. the lived experience of having a pressure ulcer. However, a study to compare healing outcomes when two different treatments are applied may be much larger. The deciding factor in determining an adequate sample size for some studies is power. Power is the capacity of the study to detect differences or relationships that actually exist in the population (Burns and Grove, 2001). If a research study does not have sufficient power to detect differences or relationships that exist in the population, one might question the advisability of conducting the study. Indeed it could be argued that if a trial is too small to detect clinically relevant differences then one should refrain from inconveniencing patients and wasting time, money and effort on an experiment which is scientifically inadequate. The advice of a statistician should therefore be sought to help determine the sample size.

## Conclusion

When reviewing a research article it is important for the authors to have stated who the study population is how a sample was chosen, and how the size of the study was determined. Different methods of measuring outcomes may be employed within research studies. This is important to consider whether the study has addressed the validity and reliability of the methods used. Finally, you should be able to determine if the findings of the study are applicable to your area of practice. WUK

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