Development and validation of a novel approach to work sampling: a study of nurse practitioner work patterns

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KEY WORDS

Advanced practice nursing; health service research; nurse practitioner; work sampling

ABSTRACT

Objectives
This methodological paper reports on the development and validation of a work sampling instrument and data collection processes to conduct a national study of nurse practitioners' work patterns.

Design
Published work sampling instruments provided the basis for development and validation of a tool for use in a national study of nurse practitioner work activities across diverse contextual and clinical service models. Steps taken in the approach included design of a nurse practitioner-specific data collection tool and development of an innovative web-based program to train and establish inter rater reliability of a team of data collectors who were geographically dispersed across metropolitan, rural and remote health care settings.

Setting
The study is part of a large funded study into nurse practitioner service. The Australian Nurse Practitioner Study is a national study phased over three years and was designed to provide essential information for Australian health service planners, regulators and consumer groups on the profile, process and outcome of nurse practitioner service.

Results
The outcome if this phase of the study is empirically tested instruments, process and training materials for use in an international context by investigators interested in conducting a national study of nurse practitioner work practices.

Conclusion
Development and preparation of a new approach to describing nurse practitioner practices using work sampling methods provides the groundwork for international collaboration in evaluation of nurse practitioner service.

INTRODUCTION

There is a growing body of research on nurse practitioner service models and education (LeCuyer et al 2009; Nicolson et al 2005) and a sound evidence base on the effectiveness and safety of nurse practitioner service when compared with other health care professionals (Pirret 2008; Wilson and Shifaza 2008; Borgmeyer et al 2008; Donald and McCurdy 2002; Dierick-van Daele et al 2009). Research on acceptability of the service by consumers and other health care professionals supports the role (Donald and McCurdy 2002) and there is an emerging body of knowledge on differentiating the nurse practitioner from other advanced practice nursing roles (Gardner et al 2006, Rosenfeld et al 2003).

Notwithstanding the expanding research-based knowledge on the benefits of the nurse practitioner role, the global community of nurse practitioners practise from different regulatory and educational bases. For example the title 'nurse practitioner' is legally protected in Australia, but not in the United Kingdom (Gardner et al 2006, Currie 2007; Eve 2005). An important landmark has been reached in the USA recently with a national consensus model for regulation of advanced practice nurses, which includes the nurse practitioner (Stanley 2009). Consensus on regulation already exists in Australia (ANMC 2006), Alaska (Giessel 2006) and most parts of Canada (CNPI 2006). Educational requirements for the nurse practitioner vary across international borders with some, but not all jurisdictions having mandatory master's level training for authorisation to practice (Currie 2007). A consequence of this variance in regulation of the role is that the generalisability of knowledge from international research on nurse practitioner service is limited and must be qualified by attention to cross border legal, educational and practice standards. Considering the contribution of the nurse practitioner role to health service reform internationally there is clearly a need to begin a process of cross border information sharing to improve understanding of nurse practitioner service.

A key area of nurse practitioner research that has to date been neglected is development of knowledge on the patterns of clinical practice of nurse practitioners and the aspect of practice that may influence associated patient outcomes across different models (Hoffman et al 2003; Rosenfeld et al 2003; Laurant et al 2004). This information may contribute to building an international understanding of the parameters of nurse practitioner practice, the potential variability in the effectiveness of the role and the relative practice focus in diverse nurse practitioner models.

Work sampling methods

Research into work activity is well established in nursing and other health care professions (Pelletier and Duffield 2003) and work sampling methodology is frequently used in this field. This research approach has been developed to generate a clear picture of workflow and work practices by providing information on the amount of time that clinicians or groups of clinicians spend on particular activities (Pelletier and Duffield 2003). The method traditionally involves taking intermittent, random, instantaneous observations of work activities of multiple workers by independent observers who record the actual activity on a data collection instrument (Urden and Roode 1997). Activities are mutually exclusive and organised into categories.

A number of methods have been employed for data collection in work sampling including self reporting using an observation tool or clinical activity log (Pelletier and Duffield 2003) and self-completing survey (Rosenfeld 2003). A different approach to self reporting used in one study was intermittent recording of activity by nurses in response to a PDA alarm programmed to vibrate a set number of times over the shift (Hendrich et al 2008). Alternatively, data are collected by independent trained observers (Herdman et al 2009; Hurst 2004). Overall there is agreement in the literature that the most reliable method of data collection for work sampling is use of independent trained observers (Urden and Roode 1997; Burke et al 2000; Pelletier and Duffield 2003; Hoffman et al

2003). For the study in this report initial consultation with nurse practitioner clinicians confirmed that the independent trained observers approach would be more reliable than self-reporting.

Work sampling as a method has been used by nurse researchers for over 50 years (Walker et al 2007) but its application exclusive to studying nurse practitioner work is scant. One study used work sampling methods to effectively compare the management of ICU patients by nurse practitioners with student physicians (Hoffman 2003). Rosenfeld et al (2003) developed and validated a work sampling tool to examine acute care nurse practitioner work activities using a self-completing survey. Most other work sampling research in nursing related to nursing in roles and settings other than nurse practitioner service.

The study reported here is part of a large funded study into nurse practitioner service. The Australian Nurse Practitioner Study (AUSPRAC) is a national study phased over three years. The nurse practitioner role is less than ten years old in Australia and the study was designed to provide essential information for Australian health service planners, regulators and consumer groups. Phase two of this study reported here was conducted in 2008 and involved in-depth investigation into the process and pattern of nurse practitioner work drawing upon work sampling methodology. This paper reports on development and validation of an instrument and processes to conduct a valid and reliable national study of nurse practitioner work activities across diverse contextual and clinical service models.

The Study

Findings from Phase One of AUSPRAC revealed that nurse practitioners in Australia provided healthcare across diverse services from community centres to hospitals, nursing homes, and rural and remote settings; and to individuals from all ages, families, communities and groups (Gardner et al 2009). Nurse practitioner service is based upon health care needs of specific populations and contexts and the authors have scant information that enables comparison between model specific and generic patterns of this practice. The approach to work sampling adopted in this study was necessarily a departure from the traditional approaches in that the study aimed to focus on work patterns of:

- individual clinicians rather than teams;
- clinicians dispersed across a broad geographical area;
- clinicians practicing in diverse service models; and
- who practice according to generic competencies regulated at national level.

This research aim called for innovation in instrument development, data collection and recruitment and training of research staff.

Instrument development

The nature of the nurse practitioner role and the approach to work sampling adopted in this study required development of a work sampling instrument that would capture nurse practitioner-specific patterns of work. This instrument development involved reference to the literature, working from the basis of validated tools (Pelletier and Duffield 2003; Rosenfeld et al 2003; Urden and Roode 1997), and informed by the Australian Nurse Practitioner Competency Standards (ANMC 2006).

The work category labels published in this literature were *direct care, indirect care, unit related* and *personal*. the authors replaced the *unit related* category with *service related*. The focus on service addressed clinical leadership competencies and enabled us to capture the health service, rather than ward or unit, context of nurse practitioners' work. Within each of these categories is grouped a number of activities. The activities were drawn from the previously cited instruments and adapted to conform to the nurse practitioner level of clinical practice with reference to the ANMC Competency Standards (2006). Each activity has a numerical code and a clear, evidence based definition. The definition of each activity identifies the extended and autonomous nature of nurse practitioner service. See table 1 for the organisation of categories, activities and codes that directed data collection.

Table 1: Work Sampling Instrument – Nurse Practitioner Categorised Activities

Direct Care	Indirect Care	Service Related	Personal
1. Physical assessment	14. Handover	23. Travel†	30. Personal
2. History taking	15. Fills out standardised forms	24. Computer data retrieval: service	
3. Communicates diagnosis	16. Documents in progress notes and charts	25. Research and audit	
4. Requests diagnostic investigations/procedures	17. Computer data entry: patient	26. Meetings and Administration	
5. Performs diagnostic investigations/procedures	18. Computer data retrieval: patient	27. Preceptoring	
6. Analyses/interprets diagnostic investigations	19. Coordinates care	28. Continuing professional development: self	
7. Performs/manages therapeutic procedures	20. Discharge planning	29. Provision of professional development: others	
8. Prescribes medication	21. Used references for patient care (text/electronic)		
9. Administers medication	22. Sets up and prepares room/ equipment		
10. Interacts with patient/ family/caregiver			
11. Teaching			
12. Initiates patient transfers/ discharge			
13. Telemedicine			

Direct Care includes all nurse practitioner activities performed in the presence of the patient/ family/ caregiver and there are 13 activities in this category. The category of *Indirect Care* includes all activities performed away from the patient but on a specific patient's behalf and there are nine activities in this category. The *Service Related* category comprises seven activities that are not patient specific and include clinical leadership responsibilities that are part of the nurse practitioner role and competency standards. Finally, consistent with other work sampling instruments, the category of *Personal* was included to account for all personal activities not related to patient care, service or professional development (Fontaine et al 2000; Pelletier and Duffield 2003; Urden and Roode 1997). Activities included in this category relate to meals, breaks, adjusting personal schedules, personal phone calls and socialising with co-workers.

Pelletier and Duffield (2003) argued that a successfully designed tool incorporates easily labelled and marked timeframe boxes or grids. However, there is no consensus in the literature on time frames for work sampling data collection and the time interval between each observation varies in reported work sampling studies. Observations are recorded at various intervals ranging from 5 to 20 minutes, different shift times across morning, evening or night shifts and overall data collection period vary between seven days (Hendrich et al 2008), one month (Hurst 2005) to six weeks (Pelletier and Duffield 2003). There is no justification in published studied for the period of data collection or the requisite number of observations that are required to produce an accurate picture of work activities or patterns (Ampt et al 2007; NHMRC 1998; Pelletier and Duffield 2003). For this study our data collection patterns followed the schedule used by Urden and Roode (1997); data were collected at ten minute intervals in forty, two hour time blocks randomly allocated over a six week period, seven days a week, across all shifts.

The layout design of the data collection instrument was adapted from tools used by Pelletier and Duffield

(2003) and Rosenfeld et al (2003). The instrument has a section to record the participant nurse practitioner unique identifier code and a series of six boxes to record observations by date, day of the week and twelve observations points. For example, for time period 0700 – 0900 hours, the study tool included twelve data collection points occurring every ten minutes starting at time zero and finishing at time 110 (see table 2). The number corresponding to the activity observed is entered against that ten minute time point. Because the activity of travel is non-specific and highly variable across models there is an area on the instrument to record the amount of time spent in transit/travel from patient-to-patient.

Table 2: work sampling instrument – data collection

Work Sampling Instrument

Date:		**Date:**		**Date:**		**Date:**		**Date:**		**Date:**	
Day:		**Day:**		**Day:**		**Day:**		**Day:**		**Day:**	
Time Period: *		**Time Period:**		**Time Period:**		**Time Period:**		**Time Period:**		**Time Period:**	
Time	**Activity Code**	**Time**	**Activity Code**	**Time**	**Activity Code**	**Time**	**Activity Code**	**Time**	**Activity Code**	**Time**	**Activity Code**
0		0		0		0		0		0	
10		10		10		10		10		10	
20		20		20		20		20		20	
30		30		30		30		30		30	
40		40		40		40		40		40	
50		50		50		50		50		50	
60		60		60		60		60		60	
70		70		70		70		70		70	
80		80		80		80		80		80	
90		90		90		90		90		90	
100		100		100		100		100		100	
110		110		110		110		110		110	

* Time period: enter data collection period here. For example, 0900 – 1100hours.

Validation of work sampling instrument

Face and content validity of the instrument was established through several measures. Content validity of the work sampling instrument was addressed by undertaking a thorough review of the literature followed by a review of the instrument by an international panel of experts. The panel assembled consisted of five members; clinical experts, nurse practitioner and a pyschometrician experienced in work sampling methods. Only items that reached 100% consensual validation by the panel were retained. The instrument was then subjected to a pilot study to test the consensus decision on the activity items. The pilot was conducted with nurse practitioners over three sites; one from a metropolitan emergency department and one from an outer metropolitan emergency department and the third from a renal service in a large metropolitan tertiary referral hospital. A two hour observation session was conducted at each site collecting a total of 36 observations. Following this trial of the instrument, the expert panel and the researchers reviewed the data and clarified the accuracy and appropriateness of the activities. The final instrument is illustrated in tables 1 and 2

Whilst standard approaches were used to establish validity of the instrument, establishing reliability for work sampling measurement does not have a standardised approach and consequently has received little attention in the literature. For example, item-correlation approaches, such as Cronbach's alpha, are an inappropriate method of quantifying reliability in the work sampling context in that the instrument is formative in nature. The activity

frequencies cause or form the nurse practitioner's distribution of time across the four work categories. There is no reason to expect items to be correlated with each other in general, in fact they are mutually exclusive, and the same total score in each work category may be derived from different frequencies of the same activities. Inter-rater reliability of data collectors however is essential in work sampling research and is addressed in the next section.

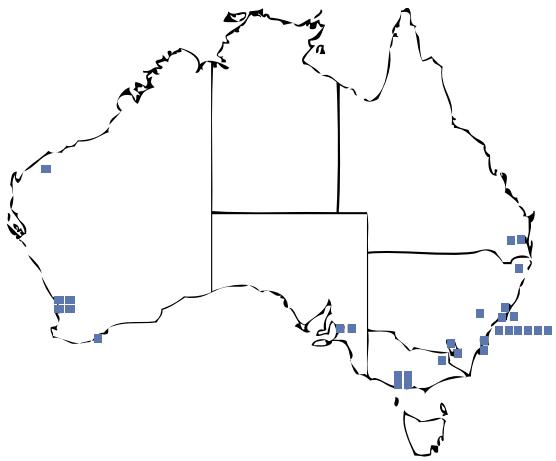
Data collection processes

Australia is the sixth largest country in the world in terms of overall land area but has the lowest population density per square kilometre (Pink 2008). The country has a surface area of more than 7.7 million square kilometres and a population of just over 21 million people who live in widely separated cities primarily along its 36,000 kilometres of coastline (Pink 2008). Access to health services in Australia is influenced by the number and distribution of health professionals and the challenges of providing service for populations dispersed over diverse geographical areas.

A weighted, stratified sample of 30 participants was randomly selected from 144 nurse practitioners who registered their interest in participating in this work sampling study. Stratification was weighted according to the population number of nurse practitioners per state/territory and across metropolitan or non-metropolitan region (see figure 1). According to the Australian Institute of Health and Welfare (2004), metropolitan zones include capital cities and other metropolitan centres with a population of more than 100,000 people and non-metropolitan zones include those with a population of less than 100,000 people. At the time of the study Tasmania and Northern Territory had not formalised the nurse practitioner role and so were not included in the study.

As already discussed the approach to work sampling in this study was to observe individual clinicians for a total of eighty hours with times and days for data collection randomly selected from a six week period. One data collector (or equivalent) was needed to observe one individual nurse practitioner for the duration of the data collection period. Ethics approval to conduct the study was granted through application to 23 Human Research Ethics Committees and Research Governance bodies.

Figure 1: distribution of data collection sites



Recruitment, training and reliability of data collectors

Thirty five data collectors were recruited throughout Australia from metropolitan, rural and remote locations where participating nurse practitioners worked (figure 1). Recruitment was conducted at the local level and organised through state/territory based AUSPRAC project centres. The literature on work sampling methods asserts the importance of establishing reliability across data collectors (Pelletier and Duffield 2003; Urden and Roode 1997; Herdman et al 2009) however information on processes used is scant. One study reported using the preparatory training session to ensure consistency and conducted inter-rater reliability testing with scenarios (Herdman et al 2009). Pelletier and Duffield (2003) cautioned that nurses frequently perform more than one activity at a time, making it essential that data collectors are trained to accurately identify and record the primary activity being performed. For our study random check for rater reliability in the field was not possible due to the geographical spread and in some cases remoteness of the research sites, it was therefore important that inter-rater reliability was established before data collection commenced. The authors achieved this through a sophisticated

training program which incorporated inter-rater reliability testing. Additionally a two day practice period was built in to the data collection schedule for each site.

A self-directed, competency based training package using a computer assisted instruction modality was designed to ensure standardised and competent data collection. A researcher experienced in work sampling methods, a nurse practitioner and a multimedia designer collaborated in the development of the training program to maximise the organisation, navigation, readability and appropriateness of the content, consistent with best practice in this field (Green et al 2007). Use of this electronic medium for the training program enabled data collectors to complete their training regardless of their geographical location. The training program was self-paced and interactive. Each data collector was provided with a customised training package that included the CD-ROM, documents including literature on work sampling research, work sampling categories and activities with detailed definitions, the data collection instrument and an on-line registration code. Registration enabled the researchers in the centralised Research Coordinating Centre, to monitor the progress of each data collector, provide individualised helpdesk service and to validate level of accuracy and competency before the data collector could commence data collection.

The training program comprised three modules based on five hours of live video material obtained by filming a nurse practitioner's working day. The Modules were i) an introduction to work sampling, ii) skill-based tutorials and iii) an inter-rater reliability testing module. In Module One, using interactive coaching activities, the data collector learnt about work categories and work activities and how to use the work sampling instrument. Module Two contained nine tutorials in which the data collector was required to apply their knowledge of coding work activities. Each tutorial had to be successfully completed before progressing to the next. In each tutorial data collectors watched a short video of a nurse practitioner in action. Visual cues were used to prompt recording the nurse practitioner's work activity at a set point in time. If an incorrect category or activity was selected the user was provided with instant feedback on why the activity selected may have been incorrect and given the opportunity to try again before proceeding to the next tutorial.

Module Three was the final assessment and inter-rater reliability measurement which could only be attempted on successful completion of Modules One and Two. In Module Three each data collector completed a final two hour episode of work sampling data collection. This final data collection activity was based on a two hour video of a nurse practitioner working, providing real life conditions of actual data collection. The data collector was required to watch the video and record observations at ten minute intervals signalled in the video by discrete cues; a total of twelve observations were recorded. The use of a cue (i.e. flashing green light at the bottom of the screen), ensured that each user was observing the exact same activity; an important consideration when comparing the accuracy of an individual's response with the gold standard. On completion of this full simulated work sampling activity the data collector submitted their data sheet online to the Research Coordinating Centre where it was compared for reliability with the gold standard – a master data sheet coded by a researcher experienced in work sampling.

Hence, each data collector was tested for inter-rater reliability through a mastery learning approach. At least 90% accuracy was required to successfully pass the assessment. Mastery learning is a technique similar to competency-based education whereby the learner has to acquire essential knowledge and skill, measured rigorously against fixed achievement standards without regard to the time needed to reach the outcome (Wayne et al 2006). Achievement of mastery indicates a much higher level of performance than competence alone (Wayne et al 2006). Practice, feedback and remediation in a supportive environment were key components of this training package and throughout the training program, regular telephone support was provided

to each of the data collectors in order to provide feedback and opportunity for questions, discussions and problem-solving.

CONCLUSION

The findings from work sampling research provide important information for health service managers but there are methodological limitations that need to be considered by researchers considering this approach. Data collection is expensive; observers need to be trained and engaged in sufficient numbers to cover a range of research sites. Furthermore this is descriptive research related to work patterns of a group, it does not allow for evaluation of an individual's practice or the quality of practice. Not-withstanding these limitations, the preparation and development of a new approach to investigating the patterns of nurse practitioner work activity with work sampling methods provides the groundwork for evaluation of nurse practitioner service nationally and lays the foundations for international collaboration in nurse practitioner research.

Work sampling has been used by researchers to describe clinicians' work activities and compare work patterns across discipline groups and roles within disciplines. However extant methods and instruments were considered not sensitive enough to capture the extended practice activities of nurse practitioner work or patterns of service. In this national study the authors adapted and validated an innovative nurse practitioner-specific work sampling instrument that is designed to capture generic work activities and is thus relevant across different nurse practitioner service models. The authors have also described the development and successful application of a sophisticated on-line training program that achieved nationally consistent data collection across diverse geographical settings.

There is scant information in the literature on monitoring or evaluating implementation of workforce reform models. This methodological paper makes an important contribution to health services research in that it provides a detailed report on the development and validation of materials and processes to conduct a nation-wide study into nurse practitioner service. As such, the paper provides a template, resources and comprehensive description that can be used by other researchers seeking to replicate this study or adopt our tools and methods to evaluate the service of nurse practitioners or other emerging health care providers.

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