
Role Definition, Skill Mix, Multi-Skilling and “New” Workers[‡]

James MD Buchan and Mario R Dal Poz

INTRODUCTION

This paper examines the human resource management issues related to skill mix in health care. The World Health Report 2000 has noted that determining and achieving the ‘right’ mix of health personnel is a major challenge for most healthcare organisations and health systems (1). Healthcare is labour intensive, and in many units labour costs will account for two thirds, or three quarters or more of total running costs. With the cost of labour accounting for such a high proportion of total costs, it is important that managers and professionals in any healthcare provider unit strive to identify the most effective mix of staff achievable within available unit resources and priorities.

This paper summarises the main findings from a review of available literature, and highlights the implications for health system managers, health professionals and other stakeholders. The review focuses primarily on the period since 1996, building on a previous review completed in that year. Key findings of the previous review are integrated in this report. The next section of this report highlights the reasons why skill mix is a growing issue in many health systems, and examines some of the main drivers for skill mix change. The report then summarises the findings of recent meta-analysis, other literature reviews and single papers examining skill mix and related issues; these issues include reports on defining and changing the role of health workers.

The annex to the report examines and assesses different methods of determining skill mix, and evaluates the effects of skill mix change, including reported evaluation of different “tools”.

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SKILL MIX IN THEORY

In practice, health care providing organisations can respond to the need to decide on the best mix of staff by using one or more of a range of methodologies. Why does the same challenge of determining skill mix produce different approaches? One reason is that there is a great deal of variation in what is meant by 'skill mix'. It can refer to the mix of posts in the establishment; the mix of employees in a post; the combination of skills available at a specific time; or alternatively, it may refer to the combinations of activities that comprise each role, rather than the combination of different job titles (3).

The reason for the existence of different skill-mix methodologies is thus partly due to the various understandings of skill mix and to the different types of problems that prompt service employers to review skill mix. Developing an approach to skill mix requires a broader vision of resource planning, in order to help map out the issues and the methods that can be used to tackle them. The danger is that a 'skill-mix review' can become a stand-alone exercise, not linked to other initiatives and organisational developments. This can lead to duplication of data collection, or results can be made redundant if other far-reaching initiatives, (such as reorganisation) have staffing implications of their own.

APPROACHES TO SKILL MIX

Methods used to examine staff mix can focus within occupational groups, or across different groups, such as nurses and doctors (51, 52). These approaches can be categorised as adopting a mainly quantitative or qualitative approach. Eight approaches used in reviewing and determining skill mix were identified in the analysis of research on the subject. The table 1 shows the key characteristics, strengths and limitations of each approach (8).

Table 1. Approaches of Skill Mix

<i>Approach</i>	<i>Methods</i>	<i>Strengths/Weaknesses</i>
Task Analysis	Frequency and cost of 'task' elements of jobs identified. Skills and knowledge required for agreed 'tasks'; used to profile staff and identify gaps.	Reliance on trained observers (costly; problematic if no agreement of skills/knowledge required). Task-based approach criticised because it focuses on the "measurable".
Activity Analysis/ Activity Sampling	Activity performed by each staff member recorded by observers at predetermined intervals, for agreed time period. Frequency of different activities/time required identified. Data analysed, used as basis for reallocation of activities/tasks to staff.	Quantitative approach can be used as basis for discussion and debate. Observers can be expensive; difficult approach if workplace is not a 'fixed' ward or unit; danger that if staff are not involved they will not accept results.
"Daily Diary"/ Self-Recording	As above, but staff record activities.	Can overcome cost implications of using observers (<u>but</u> has an opportunity cost) . Staff may not provide accurate details. Strength is direct involvement of staff.
Case Mix/ Patient Dependency	Patients/clients classified in groupings according to diagnosis or dependency. Formula is used to relate "scores" to staff hours required.	Uses mix of qualitative and quantitative methods. Benefits can include determining variations in staffing over time to match changing workload. Gives only overall numbers of staff; further work required to determine mix.

<i>Approach</i>	<i>Methods</i>	<i>Strengths/Weaknesses</i>
Reprofiling/ "Re-engineering" ("zero-based")	Detailed analysis of current mix, activity, skills and costs. Working group considers alternatives within available resources; aim is to achieve 'ideal' mix.	Often radical and fundamental. Rarely applied in full, because of organisational/political constraints. Danger of becoming a "wish list", with less focus on "how to get there".
Professional Judgment	Staff/management in work area assess current activity and staffing, review data available, apply collective judgment to reallocation of work.	"Low tech" approach; involves staff, can be quick. Constraints are possible lack of transparency/objectivity; possibility of little change.
Job Analysis Interviews/Role Reviews	Detailed individual or group interviews; can include critical incident technique; repertory grid.	Structured approach, if interviewers are skilled, can reveal much relevant information. Involves staff. Main problems are potential for bias and lack of objectivity.
Group Discussion/"Brainstorming"	Facilitates workshop/discussion group of staff to identify issues requiring change. Use of available data as basis for discussion.	Can be quick—often used as 'diagnostic' phase of other approaches. Involves staff. Requires skilled facilitation; raises expectations and can generate mass of contradictory information.

THE LIMITATIONS OF CURRENT RESEARCH ON SKILL MIX

The eight approaches outlined in Table 1 above represent the main methods used by health care organisations to review the mix and level of

personnel. Each approach has its pros and cons, and often more than one method will be used in combination.

It is notable that whilst published research on skill mix and associated issues in developing countries was relatively scarce in this review, much of which was identified focused primarily on testing or reporting the application of a methodology, sometimes as a “pilot” or exploratory study. These reports included: the comparison of results of different approaches to task analysis, staff in reproductive health clinics in Ecuador (53); the self reported activities of pharmacists in Northern Ireland (54); the activity analysis (staff and workflow), of child health services in the USA (55); patient dependency and staffing; child psychiatry in the UK (56); task analysis of surgical workload, urology in Ceylon (57); the validation of two health status measures and outcomes of home care nursing in Canada (58); the workload and cost analysis, using computer simulation, to determine “ideal” mix of orthodontists and assistants in the USA (59); and the activity analysis of physics’ staffing in radiotherapy in Germany (60).

Whilst these studies assist in contributing to our understanding about aspects of skill mix in certain defined contexts and situations, and can also help test valid models, they are primarily a contribution to improving the methodological evidence base. A distinction must be drawn between the pragmatic and practical approach, necessarily adopted by many employing organisations, because of resource limitations and time constraints, and the “ideal” approach, dictated by a research study, where “objectivity” is required.

In an ideal study, the effectiveness of a particular skill mix of health workers would be defined by its costs, and by the effect it has on patients’ outcomes. There are several reasons why this ideal approach virtually never happens in practice.

First, it is often difficult to identify suitable indicators of patient outcome. Secondly, patient outcomes are affected by a wide range of factors, aside from the care provided by any specified group of health care personnel. It is extremely challenging to determine the effects of one group of staff while controlling the effects of others. Thirdly, comparing the outcomes produced by one skill mix with those produced by another demands an assiduous application of controls. It is extremely problematic to control adequately for the huge number of variables (related to patients,

staff, interventions and the environment) that are likely to influence patient outcomes.

EVALUATION THE IMPACT OF SKILL MIX

Irrespective of the method used to examine skill mix, a complete evaluation will require consideration both of the effectiveness of care provided by the mix of staff, and the associated costs. Several main methods of evaluation these aspects of the impact of skill ix are described below.

PATIENT OUTCOMES

In an ideal study, the effectiveness of a particular combination of health workers would be defined by the effect they have on patients' outcomes. The outcomes produced by one mix could then be compared with those produced using another, and a judgment made about which is the more effective. There are several reasons why this ideal approach is rarely found in the evidence base, namely: identifying the indicators, controlling for context and comparing the outcomes.

Identifying the Indicators

It is difficult to identify suitable indicators of patient outcome. General indicators such as mortality rates or LOS, are useful in that they can be applied to all patients, and can be considered to be an end result of care. However, their crudeness as an indicator of outcome means that they may not be sufficiently sensitive to pick up changes related specifically to staffing mix.

The problem with using more specific indicators such as the incidence of pressure sores, or level of pain management is that they are only applicable to some patients and that they report on the effects of a few selected aspects of care whilst the rest remain untested. These "micro" indicators may be more useful at team or ward level.

One solution that has been developed is to attempt to use a battery of outcome measures in combination with each other (43, 61, 62).

Controlling for Context

Patient outcomes are affected by a wide range of factors aside from the care provided by a group of health care personnel. In many cases it would be helpful to be able to link specific outcomes to the input of specific staff

groups for example in reviewing the effectiveness of all registered nurse staffing, it would be useful to define those outcomes that can be considered 'nursing outcomes'. Teasing out the effects of one group of staff whilst controlling for the effects of others is an extremely challenging task that has not currently moved beyond the exploratory stage and requires detailed research. This is particularly the case where health systems are moving to support multi-disciplinary team working, or using "cross trained" or multi-disciplinary workers.

Comparing the outcomes

To control adequately for the huge number of variables (related to patients, staff, interventions and the environment) that are likely to influence patient outcomes is extremely problematic.

QUALITY

Due to problems associated with using patient outcomes, quality of the care provided or reported patient satisfaction is often used as a proxy for outcomes. Although this has its limitations in that it is a process indicator, not a measure of output, it has the advantage that the reported quality of care provided by specific staff groups can be measured. Several recent randomised control studies comparing the care given by nurses and general practitioners in the UK have used patient satisfaction as one of a "basket" of indicators (63, 64).

A second broad group of studies can be identified, in which an attempt is made to consider the relationship between cost and quality. Many of these studies are informed by the work of Donabedian (62). The difficulty of linking an assessment of cost with measures of quality and/or outcome of care is fraught with difficulty. A broad indicator of quality, such as patient LOS or a patient satisfaction survey is often used as a proxy measure for outcome. The use of such proxies can in themselves create difficulties.

Variations in LOS may not be an accurate reflection of the care provided, but may be linked to broader organisational requirements to decant patients more quickly to free up bed space.

COSTING METHODS

The cost data used in studies of skill mix varies markedly, in terms of configuration and accuracy. This is partly a reflection of the differing financial requirements of different health systems for example, in privatised systems there may be an organisational need for accurate staffing costs per patient day, and the costs of other inputs, to ensure reimbursement. In other systems, cost data may be more frequently expressed only in broad terms of wage costs.

WAGE COSTS

Most studies in the evidence base, which examine skill mix from the perspective of costs, use wage data. It is important to stress that where “before and after”, or comparative evaluations of costs are being undertaken, a reliance on wage costs as the cost indicator will make the evaluation highly sensitive to wage differentials between groups of personnel. These differentials can vary markedly between employing units, healthcare systems and countries and across time. At the simplest level, if a wage differential between a doctor and a nurse is 5:1, the potential cost savings of substitution will appear much greater than in a system where the wage differential between the two groups is only 2:1 (8).

UNIT COSTS AND DIAGNOSTIC RELATED GROUPS (DRGs)

The different methods used to assess the cost of health care represent different responses to the same problem how can the total costs of providing care be disaggregated to produce a cost per unit? The approach used to assess costs will in turn have an impact on how cost effectiveness or cost variation is assessed in relation to staffing levels and skill mix. Many studies relate costs to DRGs, or other form of patient classification system. These systems use a measure of patient dependency to calculate the amount of care that is required, and “translate” this into staff time required- for example costs per patient day, or per minute of care provided.

Many studies conducted in the United States of America (USA) concentrate on the use of patient classification systems (usually in relation to DRG) as a means of assessing the cost of nursing care, for charging and reimbursement purposes. These studies focus on establishing a cost methodology, usually within a specific work environment. Quality of

outcome is given little or no consideration, the prime concern being the need to more accurately measure and cost the use of nursing resources (63).

Results from these studies are not readily synthesised into any general conclusions or lessons, other than that actual needs per patient within and between DRG vary markedly, and hence there is a considerable range in staff costs (usually measured as nursing costs within and among DRG categories) .

In short, different patients within DRG have different acuity levels, different lengths of stay, and therefore different levels of demand for nursing resources. Most of the studies reported above concentrate on small samples of patients in one or two units, and hence the effect of any “outlier” patients whose demands are above or below the DRG norm may be magnified. Indeed, a number of the authors caution against drawing any general conclusions from their work, which they regard as exploratory.

The approaches outlined above represent some of the main reasons for, and methods used by healthcare organisations to review the mix and level of personnel. Each approach has pros and cons, and often more than one method will be used in combination, to attempt to combat limitations. A distinction must be drawn between the pragmatic approach necessarily adopted by many organisations, due to resource limitations and time constraints, and the ‘purist’ approach which would be dictated by an ‘objective’ research study, which requires a certain distance from day to day organisational priorities.

In practice, many of the studies reviewed in the next chapter relate to an organisationally based description of an approach to determining personnel mix, rather than a research based evaluation of an approach or of a particular mix. This pragmatism is highlighted by the stated need in many of these studies for broader contextual matters of “change management” to be a priority for the organisation. In this situation, the method of reviewing and determining personnel mix is a means to the end of achieving organisational changes, it is not a conceptual model to be continually refined in the abstract.

Finally, one further aspect of evaluation must be mentioned. Given that many skill mix studies relate to a change in staffing levels or mix, there is a need to examine the evidence on the impact on the workforce. Was the change achieved with no negative impact on job satisfaction or motivation of workers? What has been the effect of any change in role or workload

subsequent to the change in mix? These aspects of skill mix and role overlap related changes are rarely given any research-based consideration. As such there may either be hidden costs or benefits of such change, depending how the process of change was managed, where costs really were incurred, and where benefits accrued (64).

SKILL MIX: DRIVERS AND CONTEXT

Most health systems around the world are coming under increasing cost containment and quality improvement scrutiny, often as a direct or indirect result of health sector reform; in such a situation the level and mix of staff deployed to deliver health care is a central element in the cost of care, and a major determinant of the quality of that care (1).

It is important to note that whilst there may be general trends in the changing utilisation of health personnel, there is no common starting point for different countries, sectors and health systems. Resource availability, regulatory environments, culture, custom and practice will all have played a role in determining the “typical” mix of staff in a health system. To the extent that these factors vary, so will the typical mix. This variation may limit the potential for transferability of results of studies, and highlights the need for more cross comparison. These are marked variations between countries and regions (2).

Table 2 highlights some of the key issues, which explain why skill mix is an important issue in many health systems.

Table 2. Skill Mix Drivers, Issues and Possible Interventions

<i>Driver</i>	<i>Issue</i>	<i>Possible Interventions</i>
Skill shortages.	Respond to shortages of staff in particular occupations or professions.	Skill substitution; improve utilisation of available skills.
Cost containment.	Improve management of organisational costs, specifically labour costs.	Reduce unit labour costs or improve productivity by altering staff mix or level.
Quality improvement.	Improve quality of care.	Improve utilisation and deployment of skills of staff through achieving best mix.

<i>Driver</i>	<i>Issue</i>	<i>Possible Interventions</i>
Technological innovation; new medical interventions.	Achieve cost effective use of new medical technology and interventions.	Re-training of staff; new skills; different mix or new type of worker introduced.
New health sector programmes or initiatives (e.g. "Roll Back Malaria).	Maximise the health benefits of the implementation of the programme through having appropriately skilled workers in place.	Assess cost effective mix of staff required; skill enhancement of current staff; introduction of new workers.
Health sector reform.	Achieve cost containment, improvements in quality of care and performance and responsiveness of health sector organizations.	Re-profiling, "re-engineering"; labour adjustment; new roles; new workers.
Changes in legislative/regulatory environment.	Scope for changes in (or constraints on) roles of different occupations, professions.	Role change or enhancement; new skills required; introduction of new workers.

SOURCE: Buchan *et al* (3).

These driving forces for focusing on aspects of skill mix are not mutually exclusive. In practice, many healthcare units are attempting to meet the combined challenges of all three.

It must be also be stressed that changing skill mix is not the only potential solution to these challenges. Employing organisations also seek to review other options, including: improving utilisation of hospital beds, capital equipment and other resources; improving staffing patterns in relation to day-to-day fluctuations in workload and patient dependency; and reviewing and altering resource allocation and distribution (e.g. between tertiary, secondary and primary care).

REVIEWING SKILL MIX

This section reviews the evidence base, in terms of reports and publications, which have examined aspects of health worker skill mix, and the introduction of new workers to health systems. To help evaluate the design

of research studies, Woolf *et al.* (4) described a hierarchy of evidence (in descending order of utility, from “most” to “least”) as follows: well designed randomised controlled trials; other types of trial: well designed controlled trial without randomization; quasi experiments; well designed cohort (prospective) study, preferably from more than one centre; well designed case control (retrospective) study, preferably from several centres; large differences from comparisons between times and/or places with or without intervention; opinions of respected authorities based on clinical experience; descriptive studies and reports of expert committees.

Of the methods listed, randomised control trials (RCTs) are generally regarded as being the most effective method of contributing to the development of an evidence base. However, few published studies on skill mix conform to the requirements of the higher levels as listed above; the majority of study designs fall into the lower categories in the hierarchy of evidence, most being opinion based descriptive studies. This means that there are a number of basic limitations to the current evidence base on skill mix. This includes: narrow or incomplete focus, incomplete reporting, methodological weakness and non-comparability of approaches adopted for studies.

Narrow or incomplete focus

Because of the complexity of determining and evaluating skill mix and the wide range of methods that can be used, many of the papers focus on a particular aspect of reviewing skill mix (e.g. they describe the development of a dependency scoring tool or activity analysis methodology), rather than describing all the elements of a comprehensive skill mix review. In particular, specific measures of patient outcome (or even proxy measures of process) are rarely used.

Incomplete reporting

Many papers do not give complete details of the context in which the skill mix is being examined, or the methods and data used in the examination. This limits the utility of the report, both in terms of its contribution to the evidence base, and the scope for comparing its findings with other evidence. For example, even in the few studies that include a comprehensive assessment of costs, the exact method of calculation used in the study is often not reported. Different methods of remuneration and calculation of

wages (i.e. are training costs to be allocated?; are unsocial hours premiums paid for certain times/days for certain groups?; are “on costs”, such as employers pension contribution included?; are wage costs ‘standard’ for each grade/occupation or do they vary between individuals?) are major constraints on cross comparison of study results or generalisability of study conclusions, and are often a major weakness in individual study design.

Methodological weaknesses

Many studies fail to cover both measures of quality/outcome and costs, and many are methodologically weak with small sample sizes. Even when cost and quality are assessed, the multiplicity of different methods that are used for assessment mean that there is extremely limited scope to synthesise an aggregate overviews of the results of these studies. Focusing only on an evidence base in one country or health system could limit some of the difficulties inherent in cultural, organisational and country cross comparison. However even studies examining the same skill mix issue in the same country or health system often use different methods, which leads to non-comparability of results.

Non-comparability

One of the key findings of this review is the non-comparability of approaches adopted for studies. This highlights the need to move towards the replicated use of reliable and valid research methods for assessing the effectiveness of personnel mix which have scope for utility and general applicability. The identification and replicated use of the methods which have greatest potential for transferability will lead to results which have greatest scope for generalisability.

REVIEWING THE EVIDENCE BASE

The review of publications that examined skill mix in healthcare is mainly based on two literature searches: a review which focused on English language publications that were published in the period 1986-1996 and searched CINAHL, Medline, RCN Nurse ROM, ASSIA Plus, FirstSearch; and a follow up review of English language publications, from 1996 to 2000, covering CINAHL, Medline, ASSIA and Nurse online.

The search terms used for both reviews were: skill mix, skill substitution, personnel mix, reprofiling, staffing levels and staffing mix. To the second review it was added changing roles.

The publications identified cover a range of issues related to skill mix in health care. It should be noted that there are limitations in the review: there may be “publication bias”, because unsuccessful attempts and changing skill mix are less likely to be written up and published; on line searches rely on the use of key words; it is likely that some relevant publications may not be identified; mainly English language publications are reviewed; this will lead to bias in terms of the countries and health systems being examined. In particular, it should be noted that the majority of the publications are from the USA, a country with a mainly private sector health system and a generally “free market” approach to employment legislation and job stability.

With these limitations in mind, it is important also to note that appears to be a growing interest in skill mix, if rates of publications are used as an indicator. More than twice as many publications were recorded for the four year period of 1996 to 2000 than for the previous ten years (1986-1996) . The key findings of the review are highlighted below. The review is in five sections: reviews and meta analyses, “macro” large scale data surveys, “micro” single site examination of roles and mix in nursing and other non-medical health professions, “micro” single site examination of role overlap between doctors and other health professionals and the introduction of “new” workers or the changing roles.

KEY THEMES IN THE EVIDENCE BASE

Reviews and meta-analyses

A number of other literature reviews and meta-analyses of skill mix and related issues have been published. Most English language publications in this area are from the USA or the UK. These are of two types: reviews which take a broad focus in examining all aspects of skill mix, and those which examine one specific aspect- most often doctor-nurse overlap.

A small number of meta-analysis has been conducted on skill mix related issues, in the North America (Canada/USA) (5, 6). Both these papers focus on doctor-nurse roles and overlap. Two international reviews (drawing heavily from USA sources) have also recently been undertaken in Britain (7, 8). A review focusing specifically on doctor-nurse mix in primary

care was also recently conducted in the UK (9). The use of anaesthetist nurses worldwide has also been examined (10).

The use of meta-analysis and the comparatively robust research approach adopted in the small number of studies in this area supports a more conclusive overview than can be drawn from single studies of skill mix. The general picture presented is that in certain specified areas of health delivery and clinical intervention, there is clear evidence, (mainly, but not exclusively from the USA) that there is scope for a cost effective increase in the role and deployment of registered nurses where there is actual or potential role overlap with doctors.

For example, one review suggest that between 25% and 70% of doctors' tasks could be undertaken by nurses or other professionals (7). In particular, there is evidence that the use of clinical nurse specialists, nurse practitioners and clinical nurse midwives, whilst maintaining or reducing costs, can improve care outcomes (often measured as patient satisfaction).

However, the extent of scope for substitution or development of alternative models of care delivery cannot be detailed or quantified, as the available research does not fully map out the parameters of role overlap/substitution, and many possible alternative models remain untested. Furthermore, the "starting point", in terms of the current roles and models vary from country to country. The identification of 'theoretical' or 'ideal' skill mix between doctors and nurses, as between any professions or occupations, also has to take account of potential constraints on change relating to legislation, professional regulation and associated organisational factors.

"Macro" large data surveys.

These studies report on large data set analysis, often using staffing and outcome data from multiple sites to assess the extent to which variations in measures of outcome can be attributed to differences in staffing level of staffing mix. As with above, the majority of these studies have been conducted in the United States. Recent studies are summarised in Table 3.

Table 3. Examples of Large Data Surveys on Skill Mix

<i>Focus</i>	<i>Key Findings</i>
Registered nurse (RN) staffing in relation to total staffing and outcomes in 494 US nursing homes (11).	“...although RN staffing is more expensive, it is the key to improving resident outcomes”.
Hospital characteristics, staffing level, mortality rates, 3763 US hospitals. Multiple regression, controlling for severity of illness (12).	Mortality rates decreased as staffing per occupied bed increased, for medical residents, registered nurses, registered pharmacists, medical technologists. Mortality rates increased as staffing levels per occupied bed increased for licensed practical nurses and for administrators.
Relationship between RNAPD (Registered Nurse Adjusted Patient Days) measure of nurse staffing levels and various “adverse events” (e.g. urinary tract infections after major surgery, pneumonia after surgery; thrombosis after surgery) .(13).	Study found inverse relationship between nurse staffing and adverse events. Higher ratio of RN, the lower the incidence of adverse events.

These large-scale macro analyses of secondary data can give some insight into the relationship between staffing level or mix and indicators of cost or quality. They can also give some potential for benchmarking between employing organisations such as the discussion of early stages of a multi- country comparative study using this approach (14, 15), the multi country benchmarking study examining extent of used of “trained” nurses and overall resource use in long term care in Sweden, Spain, USA, England and Japan (16) as well the multi country analysis of variations in doctor-nurse ratios (17).

Macro surveys have the potential to increase our understanding of the complex interrelationship between different staffing, cost and outcome variables, but have two main weaknesses. By definition, they are retrospective, and it may be some time before the lessons of the analysis are known (for example, the Kovner study above was published in 1998, but uses 1993 data sets (13). Whilst they may inform policy, they are less likely to have an immediate impact on practice at operational level. The other limitation is that the reliance on secondary data from available datasets means that the findings of the studies are predicated on this data being accurate and complete for analytical purposes.

Local case study examination of role overlap and mix in nursing and other non-medical health professions

The literature on the effect of different mixes of health professionals and unqualified nursing aides, assistants and/or support workers is primarily based on single study descriptive papers. The vast majority of these papers focus on mix between different grades of qualified nurse, or mix between qualified nurses and nursing auxiliaries/ care assistants. There are relatively few published analytical studies of other, non-medical, health professions or health care workers.

The two most common themes, which have been examined in this field, are the effectiveness of an all qualified (“all-RN”) nursing workforce, in comparison to a qualified/unqualified mix, and the impact on organisational costs and effectiveness of increasing the proportion of care assistants/support workers in the nursing workforce.

A third theme, which is relatively under explored, is the implications for cost and quality of care of the traditional practitioners (e.g. traditional birth attendants) (18), the use of relatives (19), and other “volunteers” (20, 21) as part of the care team.

The first theme, of “all RN” provided care, was mainly examined in North America in the period up to the mid/ late 1980s; since then it has become less apparent, as cost containment pressures have impacted on most health systems, nevertheless a recent study argue that “all RN” care increases flexibility and can be effective (22). The latter theme, of “qualified/ unqualified” mix has been a continuing issue of examination, but has become particularly apparent in the 1990s, as cost containment has led to a re-examination of nursing skill mix in many countries, organisations and sectors. Non-nursing examples include the use of care assistants in physiotherapy (23).

Cost containment led substitution of “cheaper” care assistants for more “expensive” nurses, has become increasingly apparent in recent years in many countries. Many of the publications in this area are written by and for qualified nurses, and set out their concerns about being “replaced” or their skills undervalued (24, 25). The argument that a “cheaper” skill mix may not be more cost effective because of various hidden costs associated with skill dilution are often made in these papers. This argument cites factors such as higher absence and turnover rates in less qualified staff; higher levels of “un productive” time because care assistants have less

autonomy and capacity to act independently, and reported concerns about possible harm to patients if care assistants are required to work beyond their technical or legislated capacity.

Regulatory or legislative concerns have led to some constraints being imposed on the extent of substitution. This last point has led to independent review or legislative change in some countries; for example legislation enacted in the State of California in 1999 required hospitals to determine a “safe” minimum skill mix operating theatres and intensive care. This in turn leads to debate and analysis about what is meant by a “safe” staffing level, and how it can be determined (26).

Despite the growing debate about cost effectiveness and “safe” staffing mix and levels in the health care workforce, there are comparatively few published research studies examining the cost/quality implications of this trend, and (setting aside methodological and comparability issues) there is no unanimity in results or conclusions. Most of these studies tend to be unit level “before and after” examinations of the effects of introducing or increasing the use of care assistants.

Most published work stems from the USA, and there are examples of studies which report cost and quality improvements in the “after” phase, whilst other studies suggest that the scope for real cost savings when substituting or supporting registered nurses may be more apparent than real.

Drawing from the work reported by Gardner (27) and Krapohl and Lawson (28), a number of models of qualified/unqualified mix in nursing can be identified: “traditional” aides/assistants/auxiliaries, mainly trained “on the job”, performing simple nursing tasks in support of registered nurses; non-clinical assistant/“extender” clerk/aides role, mainly involved in non clinical clerical/housekeeping work (can be a “multi-skilled” support worker); technical assistant/operating department assistant role with specified remit in relation to use of complex technological processes, assisting nurses; primary practice partner nursing assistant “paired” with primary nurse to maintain delivery of care by primary nursing; vocationally trained/qualified career an additionally trained version of the “traditional” nurses aide; training programme of several weeks or months, in some countries leading to vocational qualification; career undertakes nursing care responsibilities under direction of RN or other health professional.

The fundamental issue in determining which model is in use is to identify if the aide/support worker/"extender" is being used to supplement, complement or replace ("substitute") the work of a qualified nurse (29).

The impact on outcomes of the introduction of "unlicensed assistive personnel" (UAPs) in the USA was reviewed by Siehoff (30). There have also been "one off" local studies which have evaluated the introduction of "extender". Some of these studies report mainly positive results include claimed costs savings using patient care assistants, (31) and using nurses' aides without change in patient satisfaction (32).

Other studies have been more equivocal in their conclusions, and have highlighted problem areas. These studies include the use of "co-workers", that found slightly increased productivity, but decreased quality and increased on call, sick leave and overtime working (33) and the use of patient care technician (PCT) reported cost savings, but reported higher workload, and initially a higher turnover of PCTs (34). A multi site examination of grade mix in nursing conducted in Britain reported that investing in additional training, and the use of a "richer" (and therefore more expensive) staff mix in nursing was related to higher reported quality of care (35).

An Australian study of nurse mix reinforces one of the major caveats of the danger of "generalisation" of the findings of small scale or single case studies on skill mix (36). This study compared the registered/enrolled nurse mix in relation to cost and outcome, in two ward configurations - one all-RN, one a RN/EN mix¹. The researchers found that an all-RN mix was more cost effective in one study ward, whilst the RN/EN mix was more cost effective in the other study ward.

This study demonstrates that the application of a standard battery of research instruments to two different work environments can provide results which suggest that different mixes may be more appropriate in different environments (or, alternatively, it could be interpreted that no battery of research instruments can be so robust and comprehensive as to include the effect of all local demographic and contextual variables) (36).

Whilst the issue of qualified/unqualified mix in nursing has received a comparatively high level of attention, there are major limitations in the utility of these studies. Many are methodologically weak and often report on short timescale implementation, and tend to be written by the "champions"

¹ Enrolled nurses are vocationally trained nursing staff.

of the use of the nurse “extenders” /UAPs/ aides. As with other areas of nursing and medical research publication, there will also be a publication bias towards publishing studies with clear and positive findings.

Relatively speaking, groups other than nurses have received little attention in terms of evaluation of skill mix. In some countries, especially in Latin American and Caribbean, there has been some examination of different mixes of technicians (37). Although the number of these technicians is very big and even growing in some cases, no analytical study was identified.

The other fundamental limitation is that very few studies and reports really examine role or skill. In practice, most of the publications identified which attempt to assess costs and quality implications focus on grade, qualification or job title rather than skill or role. Grade or job title is used as a proxy for a level of skills or a definition of a role.

Doctor-Nurse role overlap and substitution

As previously noted, issues relating to the scope for extending the role of the nurse and developing clinical nurse specialists, nurse practitioners, clinical nurse midwives and nurse anaesthetists is one of the relatively robustly researched area of skill mix in healthcare.

Skill substitution and the development of alternative models of care delivery based on nursing/midwifery staff rather than doctors has been examined in a number of studies which have adopted a methodologically sound approach. This is the only area where there has been some use of randomised control trials, to assess quality/outcome, and it is also the only area where there has been any real attempt at meta-analysis of research studies. The evidence base on overlap and scope for substitution between nurses and doctor was reviewed by several authors (7,38-41).

A ground breaking issue of the British Medical Journal in April 2000 argued that the “time was ripe for a major reconstruction” of the working relationship between doctors and nurses (42-44). The edition of the journal included a series of randomised control based studies, which examined the scope for the extended role of nurses (reported below). The editorial, and the research, highlight a growing theme in skill mix that the relatively expensive (and often scarce) skills of medical practitioners require to be better deployed, with less role overlap with nurses.

A recent issue of the British Medical Journal reported on three randomised control trials examining general practitioner (GP)/nurse practitioner overlap. The first examined nurse-led management of patients with minor illnesses in general practice, using a multi-centre randomised control trial, and found that the nurses were effective and that patients reported higher levels of satisfaction than with GP (42). The second report examined the care given by nurse practitioners and (medical) general practitioners in a multi site randomised control trial (43). They found that patients were more satisfied with the care given by the nurse practitioners, that drug prescription rates were similar between the two groups, and that the nurses provided more relevant information to patients than the doctors. Finally, the third report examined the cost effectiveness of (medical) GP and nurse practitioners in a randomised control trial (44). They found similar patterns of drug prescription between the two groups, and no significant cost differences, because the nurses spent more time, on average with each patient than did the doctors. Reported patient satisfaction was higher for the nurses.

Other recent studies on the nurse doctor overlap of roles have included the use of a computer based decision analysis model to compare the cost effectiveness of five different staff mixes in anaesthetics, from “nurse intensive” to “physician intensive”, finding that physician intensive was not cost effective (45), and another which examined the role overlap and the scope for GP in England to “delegate” tasks to practice nurses (46).

The general picture presented by a review of research in this area is that in certain specified areas of health delivery and clinical intervention, there is evidence, (mainly, but not exclusively from North America) that there is scope for maintaining or improving quality of care (whilst maintaining or reducing organisational) by increasing the role and deployment of clinical nurse specialists, nurse practitioners and clinical nurse midwives. However, the extent of scope for substitution of doctors by nurses, or the development of alternative models of care delivery, cannot be detailed or quantified, as the available research does not fully map out the parameters of role overlap/substitution, and many possible alternative models remain untested.

Furthermore, the “starting point”, in terms of the current roles and models of care delivery varies from country to country. The identification of ‘theoretical’ or ‘ideal’ roles and skill mix between doctors and nurses, as

between any professions or occupations, also has to take account of potential constraints on change relating to legislation, professional regulation and associated organisational and contextual factors.

“NEW” WORKERS / ROLES

Many health systems have considered, or have implemented “new” cadres or groups of health worker, either to fill a skills gap, or improve cost effectiveness of the skill mix of the workforce. In practice, the “new” worker is in fact often a current occupation or grade with additional skills or an extended role. Many of these types of amended roles are in one of four categories: “multi-skilled” or extended roles in “traditional” support workers: catering, patient transport, cleaning, catering and food distribution, and clerical duties; multi-skilling, “cross training” or extended roles for care assistants and auxiliaries (e. g. health community agents of family health program in Brazil (47)); extended roles for current health care professional (e.g. nurse practitioners); new technician roles (e.g. surgery or anaesthesiology, in some countries, as Mozambique) (48).

The extent to which truly “new” cadres of worker have been introduced to health systems is therefore difficult to identify, as there is much blurring of roles between what was “traditional”, what is an extension of the roles of traditional workers (perhaps with a new job title), and what does relate to the introduction of a completely new cadre.

One group which can be identified is the doctors / physicians assistant. Recent debate in the UK National Health System has focused on whether or not to initiate the use of doctors assistants (49).

A recent study in Latin American and Caribbean region identified more than 50 health technicians careers which were not nursing-related. The more frequent careers, by type of technology are laboratory (20%), physical therapy (19%), radiology (16%) and sanitation/health environment (12%) (37).

CONCLUSION

In the previous section, it was noted that there are extreme limitations to deriving general conclusions and lessons from the available published literature in this area. There are four main reasons for this. Firstly, many published ‘studies’ are, in practice, descriptive accounts, which add little to

the evidence base in terms of use of methods or interpretation of results. Secondly, where studies do move beyond description, their utility is often constrained by methodological weaknesses, or the lack of appropriate evaluations of quality/outcome and cost, or the use of small sample sizes (or all three) Thirdly, with few exceptions, the published analytical studies are derived from the USA, and therefore the findings may not be relevant to other systems and countries. Finally, publication bias has to be considered.

The end result is that the end results of some evaluative studies may be suspect, and the results of many other studies are difficult to compare or generalise. Aside from the methodological weaknesses that prevent the results of individual studies from being aggregated both produce general conclusions about the cost-effectiveness of different mixes, there is a more fundamental reason why such general conclusions cannot be reached. The results from even the most rigorous studies, incorporating all of the features of an “ideal study”, cannot necessarily be applied to a different setting, organisation or health system.

The results of each study only remain true for the time and place from which they are derived. This is the basis on which skill mix is examined – the need to identify the care needs of a specific patient population and match these to the skills of staff available. It is thus impossible to prescribe in detail a “universal” ideal mix of health personnel.

The two main areas where current research does make a significant contribution to issues of personnel mix are in relation to mix of staff within nursing and in doctor/nurse mix.

In nursing staff mix (often termed “skill mix”, but rarely examining skills), the evidence suggests that increased use of less qualified (“cheaper”) staff will not be effective in all situations (it is equally important to stress that in certain situations as measured by specific studies greater use of care assistants has led to greater organisational effectiveness).

The evidence base on the doctor/nurse overlap, suggests that there is unrealised scope, within the constraints of country and system specific regulations, for extending the use of nursing staff and for further developing nurse/midwife led forms of care delivery, such as midwife led maternity units. What remains comparatively under-explored in terms of published work is the associated issue of developing medical assistant roles.

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