Round Table Discussion

Determining Skill Mix : Lessons from an International Review

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Abstract

As many countries initiate health sector reform-led cost containment and quality improvement measures, there is an increasing need for health care organisations to identify the most appropriate mix of staff. This paper examines why achieving the right mix is so important, critiques the main approaches used in determining personnel mix in health care, and discusses the main lessons from research in this area. The paper discusses eight methods of determining personnel mix: task analysis, activity analysis, self recording of activities, case mix/dependency, zero-based reprofiling, professional judgement, job analysis interviews, and group brainstorming. Methods of evaluating cost effectiveness are also considered. In reviewing relevant research in this area the authors provide a conceptual model of the elements involved in determining skill mix.

Key Words : skill mix, personnel mix, skill substitution,

Introduction

This paper examines some of the main approaches to determining skill mix in health care. It is based on a research review commissioned by the World Health Organisation (Buchan, Ball, O' May, 1996). The research review undertaken for the WHO focused on English language publications published in 1986-1996. Search words used were skill mix, skill substitution, personnel mix, reprofiling, staffing levels, staffing mix. Databases searched were CINAHL, Medline, RCN Nurse ROM, ASSIA Plus, FirstSearch. A total of 473 publications were identified, and a sample of 79 subject to detailed review. This paper provides an overview and discussion of key findings of the study.

Healthcare is labour intensive, and with the cost of labour accounting for such a high proportion of total operating costs (often 75% or more), managers and health professionals are striving to identify the most effective mix of staff achievable within available resources (Kolehmainen-Aitken and Shipp, 1990). Many 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 (Buchan and Seccombe, 1994, Kolehmainen-Aitken, 1998); 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. Whilst issues of staff mix and skill mix are often characterised as being cost driven, there are a number of reasons why examining skill mix is a major challenge in health care:

(1) In guiding an organisational response to **skills shortages** in particular professions or occupations;

(2) In improving the management of organisational costs, specifically unit labour costs (i.e. to reduce costs per unit of "output", or **improve** "**productivity**");

(3) To sustain quality improvements (or **maintenance**) whilst reducing unit costs;

(4) As an organisational response to **technological innovation;**

(5) As an organisational response to **sector reform** or changes in professional regulation/legislatio; and

(6) To assist in the development of explicit care standards or skills/**competency based training** of staff (subsequently these may be developed as criteria for performance assessment).

These driving forces for focusing on skill mix are not mutually exclusive; in practice, many healthcare units are attempting to meet the combined challenges of more than one factor. It is also important to note that **determining skill mix should not just be about a "numbers game", it should require an assessment of the quality and competence of staff required**.

Organisations must also recognise that reviewing and perhaps altering skill mix may not be the only potential solution to meeting these challenges. Other options could include improving utilisation/distribution 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 within the health system (e.g. between tertiary, secondary and primary care; see, e.g., Adams, 1994).

Approaches to Determining Skill Mix.

A number of common approaches to reviewing and determining mix can be identified. Staff mix can be examined within occupational groups, or across different groups- e.g., nurses and doctors (Vargos-Lagos,1991; Bhopal, 1994). These can be categorised as adopting a mainly **quantitative** or **qualitative** approach (see, e.g., WHO, 1990). Some of the main methods are listed in Table 1 and are discussed below:

Table 1 Main Approaches to Determining Skill Mix

Approach	Methods	Strengths/Weaknesses
Task Analysis	Frequency and cost of 'task' elements of jobs identified. Skills and knowledge required for 'tasks' agreed; use 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 performed by each staff member recorded by observers at predetermined intervals, for agreed time period. Frequencies 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 limit cost implications of using observers (but 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 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. Primarily gives only overall numbers of staff; further work required to determine mix.
Zero Base Reprofiling	Detailed analysis of current mix, activity, skills and costs. Working group considers alternatives within available resources; aim is to achieve 'ideal' mix.	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 Judgement	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 that can be lack of transparency/objectivity; possibility of little change.
Job Analysis Interviews	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 of discussion.	Can be quick - often used as 'diagnostic' phase of approach. Involves staff. Requires skilled facilitation; raises expectations and can generate mass of contradictory information.

1. Task Analysis

(1) Jobs within the area under review are broken down into individual tasks - and each task is assessed in terms of by whom, when, how often (frequency) and for how long they are undertaken.

(2) A staff cost per minute of each grade/occupation of staff time is derived from wage costs.

(3) A cost per task is derived, using the appropriate staff cost, task time and frequency.

(4) Using the data and analysis from (1) to (3), a working group of relevant staff and management define the skills and knowledge required for the service and for each defined task.

(5) The working group also agree to the correct staff "profile", in terms of current skills and knowledge possessed by each grade/occupation.

(6) The working group then identifies "gaps" and mismatches between the current allocation of tasks to skills/knowledge.

(7) In turn, this allows identification of the 'ideal' task allocation - that which would maximise efficiency and effectiveness by ensuring that tasks are allocated to the "least expensive" appropriately skilled staff - and also the identification of training needs for staff.

This method is usually **most appropriate where activities and tasks are easily definable and "measurable"**. Reliance on trained observers contributes significantly to the cost of this approach, which can also be problematic where there is no agreement, or differing interpretations or skills/knowledge required for specific tasks. The task based approach has also been criticised by some commentators because in disaggregating jobs and roles into "measurable" tasks, it may fail to capture much of what "holistic" caring roles encompass.

2. Activity Analysis/Activity Sampling

(1) The activity being performed by each staff grade/occupation at predetermined specific intervals (e.g. every five minutes, or fifteen minutes) is recorded. Activity is recorded by trained observers on a form, template or hand-held computer, using a pre-agreed comprehensive list of possible activities.

(2) This activity data is collected for all involved staff for an agreed time period - usually between one week and one month (care must be taken to control for the representativeness of the particular time period).

(3) The data is normally inputted and analysed on computer, enabling the frequencies of different activities and time required for each to be assessed, and the mix of staff/grade occupation undertaking each activity to be profiled.

(4) Analysis of the activity data and staffing profile enables decisions on reallocation of activities to different staff grades/occupations to be undertaken from an informed standpoint.

The main benefit of this approach is that the quantitative data can be used to inform judgments and allows discussion and debate using commonly agreed "measures". The limitations relate to the use of observers (who are comparatively "expensive", and may not fully understand or record what they are observing); the difficulties of using this approach in any work environment other than a "fixed" ward or unit (i.e. it is difficult to use in community/primary health settings); and the danger that a lack of staff involvement in the approach may limit its acceptability.

3. "Daily Diary"/Self Recording of Activities

This approach uses the same methods as activity analysis, by recording activity over an agreed time period on a predetermined checklist. It differs in that the staff members themselves undertake the recording and complete the forms, rather than external observers.

The approach may limit the problems of cost and comprehension created by using external observers and give staff "ownership" of the data and the method. However the main limitations are that individual staff may not provide accurate details (this can be mitigated by "quality assurance" sampling and by using a pilot exercise) and the opportunity cost of time spent by staff during the exercise.

4. Case Mix/Patient Dependency

(1) This approach relies on the assumption that certain types of patients, for example those with the same diagnosis, will have similar needs, and therefore the care of patients in the same grouping will require similar levels and types of care. Thus a patient classification system is used as an indicator of staffing requirements. The focus is generally on numbers of nursing staff.

(2) Two main ways of classifying patients. One is to use a medical diagnosis as the basis of classification. In the USA, Diagnostic Related Groups (DRGs) are used and their equivalent in the UK is Health Resource Groups (HRGs). Benefits of using the clinical diagnosis are that medical diagnoses are common currency with health care staff, they are relatively clear cut, and can be extracted from existing records or case notes without having to make a new assessment of the patient. A disadvantage is that the care requirements of patients in the same DRG can vary widely.

The alternative approach is to group patients according to their level of dependency on, e.g., nursing care. Typically, patients are classified on a numerical scale (e.g., 1 to 5) by either the nurse in charge or by the nurses with most contact with each patient. The patient classification relates directly to the staffing input that is likely to be required. At the heart of this system is a formula relating patient scores to minutes of, e.g., nursing care required. The accuracy and usefulness of a patient dependency scoring system depends on how the link between patient scores and the staff required is made. Ideally, the equation relating patient scores to the staff required should be based on locally derived activity data. The less locally specific the timings, the greater the scope for inaccuracy.

(3) Patient dependency scoring systems use a combination of qualitative and quantitative techniques. The classification of patients into groups relies on a professional judgment, but translating the scores into staffing figures requires data derived from activity analysis.

(4) Most of the systems that rely on patient classification are used to determine overall numbers of nursing staff rather than the specific *mix.* Some use nurses' opinions of the roles to calculate the proportion of each grade of staff required.

(5) Patient classification systems are particularly useful for determining how the staffing profile may need to be changed over time — either to identify peaks and troughs of staffing needs over the course of a typical week or seasonal changes in case mix and dependency of patients. Patient classification systems can be used to adjust staffing accordingly.

5. "Zero-based" reprofiling

(1) As a starting point, a detailed analysis of current staffing mix, activity, skills and costs is undertaken, for consideration by a working group.

(2) The working group also reaches agreement on the purpose and strategic plan for the particular unit.

(3) A "zero base" alternative to personnel mix is then considered. This approach assumes a 'blank sheet of paper', it requires construction by the working group of what they regard as the "ideal" personnel mix to provide the agreed activities and skills required to meet the purposes of the unit, within the identified costs.

(4) This 'ideal' should be subjected to comprehensive testing of assumptions, using an iterative approach. In essence, it is attempting to answer the question "Setting aside correct staffing configurations and constraints, what would be the ideal mix of staff to meet agreed service purposes and strategic plans?"

This radical approach to reviewing personnel mix represents a fundamental restructuring of an organisation, and in practice is rarely attempted, because of organisational constraints and considerations. A variation on the zero budget approach to the justification of resource allocation, the main strength of the approach is its requirement to **think** "**alternatively**" and to address the fundamental question of "**what are the purposes and strategic objectives of the organisation?**". The major limitation of the approach is that, even if it secures the support of staff, it can become a 'wish list', an ideal of "where we want to be", rather than a method of "**how we get there**".

6. Professional Judgment

(1) Staff/managers familiar with the work area to be reviewed form a working group to discuss/assess work.

(2) The group reviews available information on activities/skills, and uses the professional judgment and knowledge of the work area to agree any reallocation or reconfiguration of work which will improve effectiveness.

This approach can be comparatively quick to undertake, has the benefit of involving staff from the beginning and has limited resource implications. However the major constraints of the approach is that if used in isolation, it can have a lack of transparency and objectivity; and there is also a likelihood that any outcome, in terms of proposed changes, may be marginal.

7. Job Analysis Interviews

(1) The use of detailed interviews with individual job holders or small groups of staff can be undertaken to assess skills and activities.

(2) Job analysis is usually undertaken using a structured interview approach, to elicit details of job content and how different tasks and activities fit together. The approach can incorporate elements of the "**critical incident technique**" (e.g. Cheek et al, 1997), which attempts to differentiate between tasks and activities which are central to excellent performance in a job, and those that are not, by requiring the job holder to describe several examples of 'excellent' and 'poor' performance in their job. Another technique which can be applied is that of "**repertory grid**" (see Stewart and Stewart, 1981), which requires job holders to compare activities and tasks, in terms of their components, the skills required to perform them well, and the cognitive processes which underpin them. Repertory grid can also

be used by job holders to rank, in order of difficulty and frequency, different tasks and required skills.

(3) Interviews of individual job holders and managers is likely to comprise one element of any approach to determining personnel mix: they may be used to supplement data derived from the quantitative approaches, but alternatively may comprise the main source of descriptive information or activities and skills required on which to make decisions.

The main benefit of using job analysis interviews is that a structured approach, conducted by skilled interviewers, can generate much relevant information on job contact and skills. Staff are also involved in the process from the outset. The limitations of the approach, if used in isolation, are its restricted objectivity and potential for interviewer bias.

8. Group Discussion/"Brainstorming" Session

(1) A facilitated workshop of staff is organised, to cover topics of activity lists, job roles and overlap, job dissatisfaction, organisational "blockages" on staff performance, scope for "doing things differently", etc.

(2) The results of the workshop, in terms of lists of activities, opinions on current problems and suggestions for change, can assist in determining the scope for altering practice in relation to staff mix and deployment.

This approach is comparatively quick, requires skilled facilitation, and can lead to an 'honest' debate about working practices, but is likely to generate a mass of opinions (some contradictory), many of which will be unsettling and will create expectations of positive change amongst staff. As such, it may be conducted as the initial "diagnostic" phase of a review, rather than acting as the main source of data and information.

Evaluating cost-effectiveness

In an ideal study, the effectiveness of a particular skill mix of health workers would be defined by the effect it has on patients' outcomes. The care 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 virtually never happens in reality.

Firstly, it is difficult to identify suitable indicators of patient outcome. General indicators such as mortality rates or length of stay 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 they are not 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. One solution that has been developed (see for example Higgins et al. 1992; Bostrom and Zimmerman, 1993) is to attempt to use a battery of outcome measures in combination with each other.

Secondly, patient outcomes are affected by a wide range of factors aside from the care provided by any specified 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 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 would require much detailed research.

Thirdly, comparing the outcomes produced by one mix with those produced by another demands assiduous application of controls. 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.

Due to problems associated with using patient outcomes, quality of the care provided 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 quality of care provided by specific staff groups can be measured.

To assess cost effectiveness, accurate information on total costs are required. Most studies which examine skill mix rely only on a measure of direct costs using wage data - and in some cases this is average rather than actual data. 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. If a wage differential between a doctor and a nurse is 5:1, the potential cost savings of substitution appear much greater than in a system where the wage differential is 2:1.

The approaches outlined above represent some of the 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. It must also be emphasised that 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 (see Table 2) which would be dictated by a research study where a certain distance from day to day organisational priorities is required.

Table 2 Criteria for an "ideal" study of skill mix

- Relevant contextual information
- Staffing profile detailed (includes numbers, grades, qualifications, etc.)
- Workload data available (includes dependency/complexity)
- Quality assurance/outcome measures valid and reliable
- Comprehensive costing data
- Overall approach methodologically robust, reliable, replicable

Skill Mix in Context

There are a number of contextual factors which are rarely made explicit or enumerated in studies in skill mix. These relate to **organisational structure, labour market dynamics, training/education** implications, and the "**specialist versus generalist**" debate.

It was noted earlier that studies of personnel mix are often undertaken as a precursor to (or a stimulus for) **organisational change**. Many studies focus on the level of the employing

unit and fail to fully explore **alternatives** to changing personnel mix. These could include exploring the questions "would a different pattern of employment of current staff achieve similar objectives?"; "what would be the effect on cost and quality of decentralising or centralising of support services, or contracting out of support ?". Furthermore, the 'knock-on' effect of changes in personnel mix, and the interdependence of issues of staffing levels and mixes with these organisational factors is rarely evaluated.

Labour market dynamics are also likely to play a part in skill mix - either in terms of demand for appropriately skilled staff (e.g., a skills shortage may be the 'driver' for change in personnel mix), or because a supply constraint may limit the potential for changing personnel mix (e.g., an organisation may decide to alter personnel mix, and find it cannot recruit suitably skilled "new" workers).

This points to the need, at micro- and macro- level, for an awareness of the links between labour market dynamics and the determinants of personnel mix, and for workforce planning mechanisms to take account of trends in demand for various types of skills.

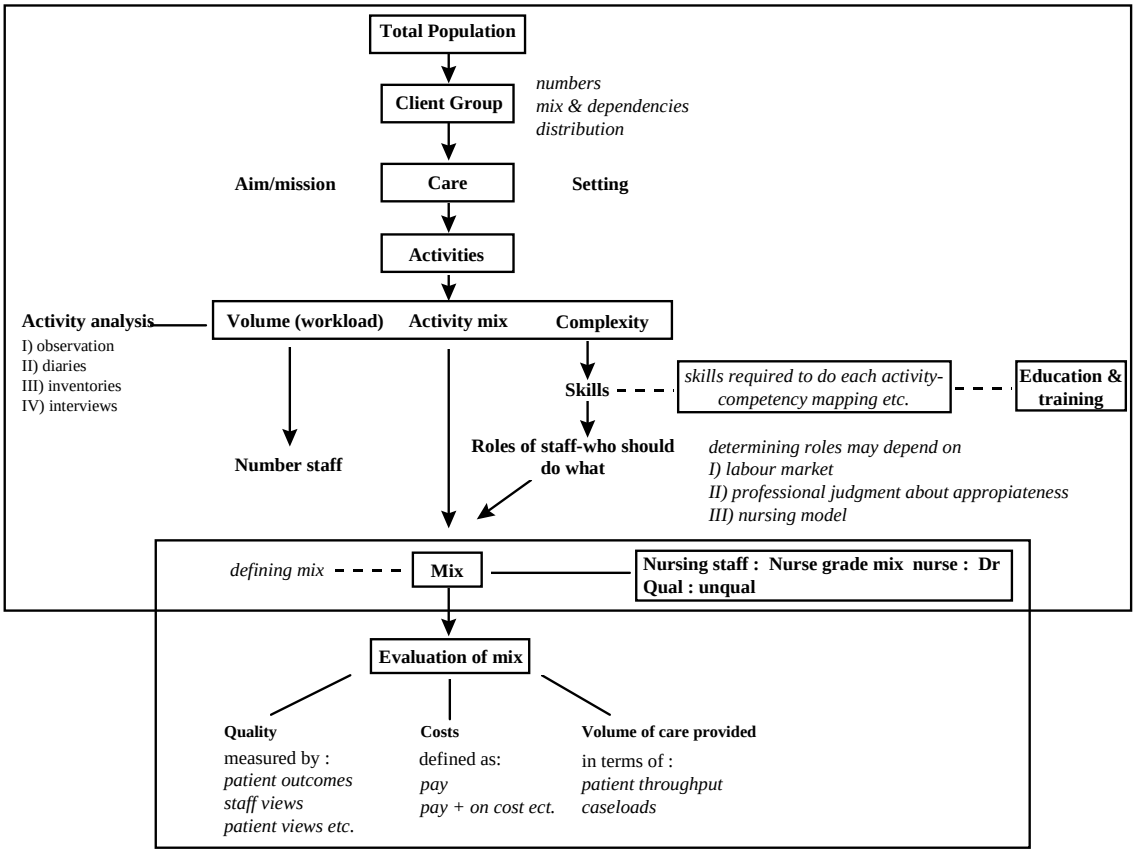
In relation to **training**, the need for close collaboration between health sector employing organisations and education and training "providers" is highlighted, to ensure that any significant proposed changes in personnel mix are accounted for in curricula and training targets. In addition, it has to be recognised that any such significant changes in roles of health personnel may be constrained by professional regulations and/or legislative barriers. Any attempt to evaluate the cost/quality dimensions of changing personnel mix should attempt to assess training costs. It is likely that depending on who is paying for training (individual staff?; the health sector employer?; public funded education sector?), there will be a different pattern of training uptake, and a different level of impact on the acquisition of new skills or development of new roles.

The issue of "**specialist vs. generalist**" is at the heart of the debate on personnel mix in healthcare, for determining the "right" mix is not just about exploring the balance between professions or staff groups, but the divisions within them. In some healthcare systems there is a trend towards using generalist "**multiskilled**" workers. It is agreed that this can reduce the requirement for staff, simplify the processes of delivering healthcare, improve access and enhance distribution of skills. However, for a complete evaluation of the potential benefits of multiskilling to be achieved, associated factors have also to be considered - these will include training and retraining costs, and the requirement to maintain skills and competencies across a broader range of areas of practice.

A Model of Approaches to Skill Mix

Figure 1 shows the hierarchy of information that can be used in determining a skill mix. The specificity and level of detail increases from top to bottom in this model, illustrating the need for more elaborate types of data.

Figure 1 Determining mix



Ideally, it might be hoped that skill mix decisions would be based on information at each level in Figure 1 - starting from an understanding of the client group served, the type of care provided and how this relates to the aim of the unit, and going through to identifying the competencies and skills required to perform each of the activities that constitute the service. In this 'ideal' scenario, to work out the skills required and the staff needed you have to work "backwards", beginning with a decision about what the activities are that make up the care for the particular group of patients.

In reality, staffing patterns are often determined on the basis of just one or two types of information, and several or most of the steps in the model may be omitted or jumped - they will not be considered in the decision making process of determining staffing levels and mix. For example, patient dependency scores may be used as an indicator of the level of nursing care required, or the case mix might be looked at to estimate the mix of staff needed. The "higher up" in the hierarchy of information, the more broad brush the data, and the greater the number of assumptions made about the link between the information and staff required. For example, staffing based on ratios, e.g., community nursing staff for every head of population - do not take into account any variation in the proportion of the population with health care needs, the type of care required, the activities involved in providing care, etc.

In practice, most of the published studies on skill mix 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. They do not consider most of the elements

of the Figure 1. 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 - 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.

In short, reported organisational approaches to determining skill mix will often use one or more of the methods outlined above, but in a context where achieving change is the main priority, and not ensuring research "objectivity" or methodological rigour.

Perhaps because of the complexity of determining and evaluating personnel mix and the wide range of methods that can be used ,as described earlier, many published studies focus on a particular aspect of reviewing personnel mix (e.g., describing the development of a dependency scoring tool or activity analysis methodology, or focusing on quality assurance) rather than describing all the elements of a complete skill mix review. In particular, specific measures of patient outcome (rather than proxy measures of process) and complete information on costings are rarely examined or defined.

There are extreme limitations to deriving general conclusions and lessons from the available published literature in this area. Firstly, many published 'studies' are, in practice, descriptive accounts, which add little to the body of knowledge in terms of use of methods or interpretation of results. Secondly, where studies do move beyond description, their utility is often constrained by incomplete reporting, by methodological weaknesses, or by the lack of appropriate evaluations of quality/outcome **and** cost, or the use of small sample sizes (or all three).

The end result is that the results of some evaluative studies may be suspected, and the results of many other studies are difficult to compare or generalise. Aside from the methodological weaknesses that prevent the results of the individual studies from being considered together to 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 of each study only remain true for the time and place from which they are derived. This is the basis on which personnel mix exercises are based — the need to identify the care needs of a specific patient population and match these to the skills of staff available.

With these caveats in mind, the two mains areas where current research does make a significant contribution to issues of skill 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 simplistic notion that increased use of less qualified ("cheaper") staff will in all cases be effective, is not supported by all studies (it is equally important to stress that in certain situations as measured by specific studies greater use of care assistants **does** lead to greater organisational effectiveness).

In relation to the doctor/nurse overlap, there is clear evidence from the available research that there is as yet unrealised scope within the constraints of country and system specific regulations for extending the use of clinical nurse specialists, nurse practitioners and clinical nurse midwives, 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 support.

Conclusions

This paper has highlighted the reasons why examining and determining skill mix is important, and has outlined some of the different approaches to determining personnel mix. It is apparent from the findings of the review that four major conclusions can be drawn:

(1) There is no single "correct" way to determine the "right" skill mix or staff mix in health care; a number of options are available, each of which has strengths and weaknesses.

(2) Most of the published studies evaluating the effects of different mixes of staff are narrow in focus, small in sample size and short in timescale.

(3) It is not possible to derive any generalisable indicators or lessons from available research, partly because the research base is fragmented and partly because the organisational context of each study is different, with many contributory (and potentially confounding) variables.

(4) In order to achieve a more robust series of guidelines and "lessons" on determining skill mix, there is a need to standardise methodologies in research and evaluation studies, to replicate these studies, and to improve the networking of study results.

Determining the "right" mix of staff in any healthcare context is likely to present a continuing challenge to managers and professionals in any healthcare organisation. It is apparent from this review that there is also a continuing tension between the organisational priority of implementing change and containing costs in the short term, and the need for 'objective' evaluation of the broader effects of such change in the longer term. Determining the appropriate skill mix of staff should not be regarded as a "one off" exercise, it should be about reviewing this mix, and managing the tension between cost and quality issues over the longer term.

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Discussion

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Dr. Buchan's paper provides a detailed lesson on the various methods available for assessing skill mixes and for supporting development of appropriate staff profiles required for specific services delivery. It clearly elucidates some of the problems that those of us working in developing countries face in trying to reform the role our human resources/staff play in ensuring appropriate service delivery.

In my situation, belonging to a profession or group is often equated with possession of certain skills (often irrespective of the service location or type they may be involved in). Obviously, developing the appropriate skill mix may not involve changing the "Staff Mix" or "Cadre Mix" but should mainly involve providing the appropriate skill for the particular tasks to whoever is best suited to provide the service. This can be "politically" sensitive especially with respect to Unions, Professional Associations and Professions Regulatory Bodies.

In Ghana, it was determined in 1991[1] that a fundamental "Zero Based" reprofiling was necessary at certain service levels (even if only to provide a "baseline") to set out the framework of tasks really needed to comprehensively serve clients and to develop the staff types to match these needs. To a large extent skills and cadre mixes in our Ghanaian setting have been based on the historical roles derived from the colonial era, which are reinforced by outdated regulatory laws that reflect a different era and focus of health service priorities. However, without undertaking such reprofiling, some necessary skills needed may fall between the gaps created between different cadres (some services may not be provided at all because it is not clear who is "allowed" to perform them).

In Ghana where the Ministry of Health and the Civil Service dominates health service delivery, we are guided by laws, regulations and even training curricula that prescribe and to some extent restrict skills that a cadre can acquire. Will these skill mix determination processes achieve any usable results without fundamental changes in the policy environment? The legal "Skill monopolies" enjoyed by some professions will remain a constraint to achieving appropriate skill mixes (or as is often debated, be a protection against subverting rigorous quality standards and effective service delivery).

The labour market will to a large extent determine how far skills can be delegated or monopolised in order to retain adequate skill levels and availability at service delivery points. In Ghana, the health labour market is depleted by emigration of professional health workers (e.g.; doctors and nurses), and a seriously skewed rural : urban distribution pattern. Perhaps then, in a least developed country situation, a major factor that will influence skill distribution and mix among cadres will be the level of resources available for salaries and

[1]National Policy Conference, Akosombo. Jan 1991 agreed to develop "multi-purpose" cadres at the sub-district level.

other incentives. Poor salaries mean that skilled professional staff are not easily retained and auxiliary staff are increasingly required to perform tasks over and above their prescribed training and skills. Without accepting this situation and providing appropriate training for these cadres, service will then still be provided but often with limited competence (and disastrous consequences?).

Dr. Buchan refers to the "Generalist versus Specialist" debate which in a sense also reflects the "Professional versus Auxiliary" and the "Multi-Purpose" worker debates we have in Ghana and rightly points out that whilst the service might be cheaper in terms of staff costs, overall outcome and results (e.g.; residual morbidity, etc.) may result in loss of cost-effectiveness. However where coverage of professionals is so low and services do not reach a vast majority of people, the overall relief may be substantial.

Skill enrichment and delegation may involve delegating skills from one cadre to another, e.g., from Doctors to Nurses or Medical Assistants, or from Registered Nurses to Auxiliaries. Each situation involves some cost and quality of care considerations which should be factored into skill mix studies.

Use of these methods may need to involve essential decentralization which will allow each individual unit to carefully plan and provide the skill mixes appropriate for them. The national level would then serve a more generic role by providing guidance as to skill and competency levels required for types of services in addition to prescribing types of staff.

It was clear from the discussion by Dr. Buchan that no single method will fit all situations and each had its advantages and disadvantages. We may begin to further elucidate these methods by identifying various job situations existing within the health services (e.g., Clinics, Outreach services, Specialist surgery) and determining the method (or method mix?) most likely to be best suited for that situation. We can also begin to define more specifically the influence of various social, political and other environmental factors on the use of the various methods which will assist poorer countries in making choices. They are a useful set of tools for the human resources manager and planner.

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I first want to commend Dr. Buchan for his excellent paper and the worthy WHO review project on which it is based. Despite the huge number of publications on health personnel topics, there is little of value regarding the methods for determining skill and staff mix. His "Conclusions" section accurately summarizes the current situation regarding what we know and what we need to know. I would suggest only two additions to this section.

1) Regarding further research, it would be very useful for skilled research teams to develop, concurrently, staffing standards for the *same* type of institution or institutions using several *different* analytical methods. Comparisons of the results obtained by different methods applied to the same situation would help inform us as to the kinds of biases likely to develop depending on the method used. Such research would, of course, have to ensure reasonable independence for the persons applying each of the several methods used to determine skills mix.
2) It would also be useful to have comparative staffing standards for *different* countries at several *different* levels of economic and health system development. These should be available for major types of health facilities, e.g., health centers, small district hospitals, and referral hospitals. Such standards, with due attention

to the limitations and interpretational hazards of cross-national comparisons, could help guide countries trying to improve their staffing norms. Obvious problems that complicate cross-national comparisons include differences in staff deployment, utilization, availability, and morbidity patterns encountered.

Now for several more specific comments. Dr. Buchan is right to emphasize that determining skill mix should not be just about the "numbers game". Especially important is the way staff are used and the problems they address. Well trained and managed staff, working efficiently but at low priority activities, contribute little to health status. A prime example of this problem, evident in many countries, is the tendency to give higher priority to hospital care and to using advanced medical technology than is justified by predominant morbidity patterns and resource availability. In these situations the skill mix may be "appropriate" and the care of high-quality but the end results are not cost-effective.

Dr. Buchan's observations about "task analysis" and "activity analysis/activity sampling" are useful and his cautions appropriate. These methods can provide much guidance but they are time-consuming and costly. Readers should be aware that these methods have been deployed on a experimental basis in several low income countries. The WHO *Toolkit for the Development of Human Resources for Health* contains a detailed description of functional job analysis as developed by Dr. Frank Moore of the University of Texas. Pilot project efforts at applying this method have been made in China and in Papua New Guinea. Dr. Moore estimates that a "task bank" with a bit over 1,000 entries would cover virtually all required health system tasks. Once a comprehensive task bank has been developed the information it contains can be used in a variety of ways to help with planning, training, recruitment, selection and management of all types of health personnel.

Functional job analysis was carried out in India and Turkey by country research teams in collaboration with investigators at the Johns Hopkins University School of Hygiene and Public Health [Ref: The Functional Analysis of Health Needs and Services. New Delhi: Asia Publishing House, 1976]. This project demonstrated how job analysis could improve staff deployment. Further work in this area, especially in low income countries, will be valuable but given the substantial costs and requirement for skilled task analysts, it should not be applied on a widespread level until its utility and cost-effectiveness can be established.

The "case mix/patient dependency" method is conceptually very attractive but methodologically time-consuming. In the course of my work I have had occasion to review many different patient dependency methods used in the UK, US and Canada. This method is most appropriate for nursing personnel since nursing requirements are highly related to patient needs. However, for this method to be useful a hospital must (1) collect and analyze individual patient information at frequent intervals and (2) be able to increase or decrease staff density on individual wards according to shifting patient needs.

Several brief final observations may be helpful. First, "professional judgment" and "brainstorming" methods continue to be frequently used. Though inexpensive and relatively quick, the risk is that those involved will opt for the "more is better" approach, with the result that existing staffing densities are arbitrarily increased rather than giving serious consideration to more innovative and cost-effective ways of using personnel. Second: Training cost estimates are useful but should not be given undue weight in decisions about personnel. In most situations the cost of training a worker is equaled in only one or two years of employment so the important objective is to avoid training more personnel than required. Third, Dr. Buchan's cautions regarding the "specialist vs. generalist" issue and "multi-skilled" workers are valid. The greater the number of skills the more costly is training, employment, and the cost of maintaining competencies. Many situations justify such training

but in others it can be wasteful and even hazardous to patient health. Finally, I want to commend Dr. Buchan for his fine section which discusses model approaches to skill mix and his comments on the mix of nursing staff and on the doctor/nurse mix. I hope his review of skill mix methods will provide those of us concerned with making good use of health personnel with both a stimulus to undertake further research in this area and a good point of departure for such work.

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Health care is not just labor intensive work. It also needs adequately trained personnel well versed in ethics and morals to address patient needs. Health care providers must work in teams at every level of the organization. Staff configuration in a team is recognized as an essential issue of human resources for health management (HRM). New organizational paradigms also require appropriate skill mixes of personnel. On the other hand, skill mix is an attractive commodity in the internal market. In economic crisis situations, with high competitiveness in the health care market and quality concerns among professionals, skill mix determination is supposed to contribute to decision making in terms of restructuring the team. We basically agree with the purpose of the staff mix study in this article. The approaches mentioned are also worthwhile and pragmatic even though some weaknesses have been found. The findings in this article actually cover all the related points of each approach, as well as the pitfalls.

Staff mix deployment is mainly determined by economic conditions. While health care is recognized as a public goods, which needs to be regulated, it could possibly be viewed as umethical if it is not carefully implemented. In general, every method referred to in this article is acceptable in terms of scientific interventions. It particularly deals with tangible variables, which are quantifiable in statistical ways. Some points may be missing from the skill mix study, however.

Cost containment is concerned with maintaining a high quality of care and increasing productivity. It does not mean substitution of current staff with lesser-skilled and lower-paid staff. Frequently, heated debates come up among professionals and managers regarding these different perspectives. Expectations of those who are involved may be diversified by orientations to professionalism, centers of excellence and individual benefits. Some arguments concerned the use of all qualified staff or a generic multi-skilled workforce. Professional values sometimes need assessment. This might cause distortion of data collected. Bias is a never ending argument. Nevertheless, stakeholders agree that in order to deliver quality care while reducing costs, there is a need for highly creative strategies and strong efforts. Consequently, restructuring of organizations and redeployment of staff, which subsequently leads to proper skill mix, may create, tension within professional groups. They may feel themselves to be under attack, inducing insecurity and resistance.

In addition, the skill mix study should not only be concerned with, economic reasons, i.e. cost, productivity and quality, but also human dimensions. Emotional and psychological well being of the staff should not be neglected. The existing competence of staff does not

solely reflect their pre-service education or training. Cultural circumstances, overall educational background of staff and organizational policies may effect competencies as do ethical and moral considerations and individual enthusiasm. Technical proficiency of staff depends not only upon external factors, e.g., training and case mix, but also internal factors, which are difficult to collect. Several data sets on human dimensions are complicated, subjective and hardly quantifiable. Social science research methodology could be applied to some extent. The implications of such analysis should be carefully considered. Although the author provides warning on the misleading "numbers game", many traditional researchers are still likely to play this game.

Skill mix determination might effect cost containment and vice versa. In some situations where staff management is rigid and bureaucratic, the study may be distorted. In organizations where HRM is not sincere or systematic, data collection by means of estimation may contribute to unreliable results. The authorities of some units may not have the primary motivation to get involved with staff reconfigurations. Most of them may prefer to handle rather urgent, but not important, incidents. Sometimes the skill mix issues are complex and often highly political. Labor cost reduction is likely to be a last intervention because its sensitivity.

Each approach has its particular strengths and weaknesses. We agree with the conclusion that no single method is suitable on its own. The following important issues have been discussed. Determination of skill mix may deal with subjectivity, dynamics, situational bias, prevalence of activities, expected activities and quality of performance, so a holistic approach might be the substantial strategy of study. The transformation of health care, through emerging new demands and shortages or surplus of qualified health personnel, is momentous. Unclear definitions of activities may lower the validity of tools employed. Care mapping may be used in some approaches. In many cases empirical information may be useful. In organizations where the working protocol has not been appropriately used, the objectivity of the actual activities implemented should be taken into account. In some cases, there may be an internal hidden agenda, so distortion of data collection may occur. Time constraints seem to be decisive fartors in determining the method used for study. Organizational based and traditional research-based studies are static, so action research would be preferable. It is dynamic, pragmatic and requires a situational analysis. Participation of stakeholders along with the researchers should peal to the discover of the most suitable way to find an appropriate mix. Stakeholders in this sense would comprise practitioners, managers and educationalists. A skill mix study of any method needs continuous and regular revision to respond to the rapidly changing circumstances. Accordingly, it is suggested that information systems should be established to provide data for such a determination.

Although the end results of skill mix study is exclusive and incomparable. Replication of the results is not recommended. Standardization of methodology within each study is acceptable. Experiences sharing among common interest group would rather be meaningful.

Cost containment and increasing productivity of quality health care are not the only contributions of skill mix determination leading to organization restructuring and reconfiguring of staff. All human resources management measures, for instance organization development, training and education, redeployment, career advancement, improvement of working environment, incentive payment and so on, have to be reconsidered.

One of the benefits from the skill mix study is the encouragement of target groups. Keep in mind that the observer and interviewer are also changing agents along with the research. This could initiate change to some extent. In particular study, skill mix has been more successful where health visitors control over the process and are supported during the change. Skill dilution may become a consequence of skill mix intervention.

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Thank you, Dr Buchan, for a very handy tabulation and exposition of skill mix approaches, methods and their respective applicability, strengths and weaknesses. Your listing of the reasons which prompt staff mix and skill mix examination and change, and your mix-determination model will also be useful as a discussion starter in some of our training courses. We will of course have to give quite a bit of attention to what we really mean by such terms as “staff mix”, “skills mix”, “role definition”, “skills substitution” and so on, and also differentiate between “procedural skills” and skills which demand a strong and wide “knowledge base”. (I will for convenience include all these terms under the generic term “staffing pattern”.) Important, too, will be defining the level of service with which we are concerned - the scope for planning on the basis of action-oriented research obviously varies between, say, determining appropriate staffing of small dental clinics and that for a country-wide environmental health service. And, as always in our management oriented teaching, we must be very aware of the many factors constraining an “evidence-based management” approach.

The paper recognises that changes, or lack of change, in the mix of personnel and their roles are often, at least in part, responses to pressures from interests from both inside and outside the formal structure of a health service authority. Chunharas’s account of the outcome of dental HRH requirement estimation in Thailand, published recently in this journal[(1)], provides a good example of the dynamics of resistance and the difficulties to be anticipated in attempts to implement change.

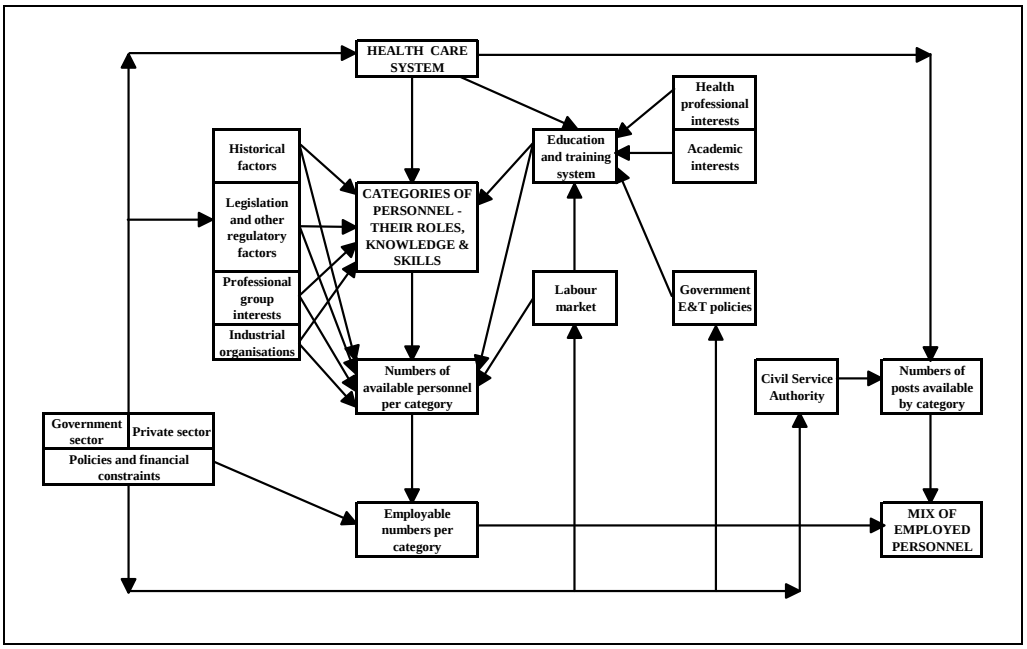
That account also show clearly two distinct processes involved in determining the actual composition of a health workforce. One of these processes is the formulation of a proposal or proposals relating to service staffing. The other is the decision making process which determines how far the proposal/s can and will be implemented. The formulation process may make use of one or more than one of Buchan’s eight “Main Approaches” or their variants, and some elements of his mix model. It may also include input from representatives of interests which might be affected by changes in or the maintenance of the existing staffing pattern.

The power to make decisions actually to change or not to change the training of health personnel and the staffing pattern of health services is likely to be principally in the hands of senior officials within government agencies - ministries of health, finance, education and the civil service authority, for example. But pressure from other interested parties may influence their decision making, leading to compromises and concessions not provided for in the original formulation of staffing proposals.

Figure 1 below is an attempt to show the constellation of major interests which continue to influence the actual pattern of staffing of national and similar large scale health care systems. Among omissions from the diagram are pressures arising from demographic and epidemiologic factors, and pressures from community based sources and the media. It is

not difficult to think of other boxes and arrows which one might add to the diagram - but it's complicated enough already!

Figure 1 Some major determinants of staffing mix and knowledge/skills mix



I think the discussion paper shows how unhelpful the plethora of "bits and pieces" studies has been in providing staff mix and knowledge/skills mix guidelines to decision makers. Health service authorities throughout the world face the prospect of ever tighter budgets, driving decision makers to adopt a "risk management" approach to resource allocation. It may be helpful to develop sets of minimal standards for staffing, each set directed to a specified range of per capita health expenditures, with the expenditure ranges expressed in purchasing power parity units (PPP)[(2)]. Staffing of district level health services might be an appropriate starting point for the development of minimal staffing standards, with the first set directed to district services in countries at the bottom end of the per capita health expenditure range. It is important that in developing standards attention is given to a reasonably comprehensive range of service provision, recognising for example that an appropriately staffed environmental health unit may be expected to have a significant effect on the demand for acute personal health care.

How would such work be initiated and funded? It is unlikely that any of the countries which might make use of the standards either has or is prepared to provide the requisite resources; university initiated activity may likely contribute a few more papers of limited applicability to the more than 470 already identified by Buchan and his colleagues[(3)]- perhaps this a job for a United Nations agency?

References

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Dr. Buchan provides a useful overview of the main approaches for determining skill mix, but reminds us that there is a clear distinction between an 'ideal' (and often research-based) approach and the pragmatic approaches that organizations have adopted. He emphasizes that contextual factors play a very important role in any skill mix determination in the 'real world'.

Health sector reform is now the context in which health care organizations operate in many developing, as well as developed countries. The reform brings many pressures that should push these organizations to improve their skill and staff mix. Such pressures include the creation of new health provider organizations, as well as increased competition between existing ones. Individual organizations may be allowed much greater latitude than before the reform to manage their own resources, including their human resources. Invariably, the roles of both the organizations themselves and their staff members change as a result of reform. With such changes, completely new skills are needed in job profiles of individual occupations, and the skill mix across different health worker categories also needs to change.

Why then are we not seeing greater improvements in the skill and staff mix of health care organizations in developing countries? I see four main reasons for this: (1) lack of capacity and resources to undertake appropriate studies, (2) inappropriate methodologies, (3) unclear responsibilities, and (4) increased separation between training institutions and employing organizations.

Skill and staff mix studies often demand much more capacity and resources than individual health care organizations in developing countries possess. These organizations, both old and new, are often quite weak, particularly in their capacity to manage human resources. Their effort at human resource management often consists of little more than supervision and some training. The managers responsible for this area commonly have no or only very little experience in the determination of skill and staff mix. Furthermore, these organizations generally possess few links to universities and other research organizations that could undertake such studies on their behalf, and in any case, have very scant resources – human or financial – to devote to these types of studies.

The second challenge is that of methodology. The new skills that health sector reform demands are largely in the area of management. Examples of such new skills include contracting, advocacy, and negotiation. Many of the existing methods for determining skill and staff mix, such as activity analysis, 'daily diary' or case mix/patient dependency, are based on examining existing (and usually clinical) skills, not new management-related skills. These methods are thus unsuitable for determining, for example, the skill mix that a district health director should possess.

In countries where health sector reform includes decentralization of power to local levels, the responsibility for developing staffing standards and determining skill mixes is often left vague. This lack of clarity about the appropriate roles of central, local and health facility levels is a great impediment to the identification of the most appropriate mix of staff for each level and facility type.

Health sector reform, through its push toward increased privatization, may considerably weaken the link between health care organizations and training institutions. Gaining improvements in skill and staff mix may be very slow, when each health care organization is given the freedom to determine its own staffing standards, without a clear mechanism to channel the information on its needs to training organizations.

As Dr. Buchan points out, there is no single ‘correct’ way to determine the ‘right’ skill or staff mix. Instead, each method has its strengths and weaknesses. Managers of health care organizations, who are faced with the challenges of health sector reform, would greatly benefit from the development of standardized methodologies and guidelines for skill mix studies, as well as their wide distribution.