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Nursing Skill Mix and Health Care Outcomes

David Hailey, Christa Harstall

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Additional information and comments relative to the information paper are welcome and should be sent to:

Director, Health Technology Assessment
Alberta Heritage Foundation for Medical Research
1500, 10104 – 103 Avenue
Edmonton
Alberta T5J 4A7
CANADA

Tel: 780-423-5727, Fax: 780-429-3509

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Ms. Debbie Phillipchuk, Alberta Association of Registered Nurses, Edmonton

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Ms. Debra Allen, Alberta Association of Registered Nurses, Edmonton

Mr. Tyler Cleveland, Calgary Health Region

Ms. Judy Dahl, Registered Psychiatric Nurses Association of Alberta, Edmonton

Dr. David Hailey, Alberta Heritage Foundation for Medical Research (Chair)

Ms. Christa Harstall, Alberta Heritage Foundation for Medical Research

Ms. Sarah Hayward, Alberta Heritage Foundation for Medical Research

Mr. Don Juzwishin, Alberta Heritage Foundation for Medical Research

Ms. Barbara Lowe, Registered Psychiatric Nurses Association of Alberta, Edmonton

Dr. Sue Ludwig, Alberta Health and Wellness, Edmonton

Ms. Rita McGregor, College of Licensed Practical Nurses of Alberta, Edmonton

Ms. Nikki Winters, Calgary Health Region

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INTRODUCTION

This paper has been prepared following interest by the Calgary Regional Health Authority (now known as the Calgary Health Region (CHR)) and Alberta Health and Wellness in obtaining advice on the appropriate skill mix/staff mix of Registered Nurses (RNs) and Licensed Practical Nurses (LPNs) in routine health care.

Specifically, forecasts by the CHR indicated an increased demand for RNs over the next five years due to loss of existing staff and increased volume of health services. In view of this, the CHR wished to investigate use of other health professionals in order to fully utilize available health professionals and possibly assist in alleviating staffing concerns. The CHR had received inquiries regarding its utilization of Licensed Practical Nurses and whether or not more LPNs could be incorporated into its staffing models. Increasing numbers of LPNs was seen as a means to meet an expected shortfall in nursing care, and would not replace RN positions. There was particular interest in changing nursing skill mix in the sub-acute care and mental health areas. These are expanding and would provide an opportunity for new approaches to staffing mix. Use of Registered Psychiatric Nurses (RPNs) in areas previously utilizing RNs would be another option.

It was also recognised that there could also be an increased demand for RPNs and that similar considerations of recruitment and appropriate skill mix might arise.

Currently, the CHR employs about 6,800 RNs and 340 LPNs. Historically, for a variety of reasons, it has utilized a predominantly RN staff mix.

Following discussion with representatives of the Regional Health Authority, Alberta Health and Wellness, and nursing professional bodies, it was agreed that the scope of the review described in this report would be as follows:

Noting that there is interest in obtaining information on the competencies of RNs, RPNs and LPNs; on where the separation exists along the continuum of delivery of patient care between RNs', RPNs' and LPNs' competencies; on the relationship between skill mix and patient/management outcomes; and on the most effective and efficient skill mix in specific areas.

The objectives of the review will be:

1. To summarise the shared and unique competencies of RNs, RPNs, and LPNs.
2. To review empirical research that has examined the relationship between skill mix of RNs or RPNs and LPNs and client/patient outcomes. There will be a

focus on areas that are nursing sensitive such as wound management and rates of infections.

3. To review empirical research on the relationship between skill mix of RNs or RPNs and LPNs and outcomes of different client/patient groups in specific areas such as acute care, sub-acute care, long term care, community care and home care.
4. To comment on any implications for use of RNs, RPNs, and LPNs within the Calgary Health Region that may be suggested by the reviewed literature.

The focus of the study is therefore on the link between nursing skill mix and outcomes and with an emphasis on the changes to the roles and competencies of LPNs in comparison with those of RNs and RPNs.

The study may be of interest to a number of other RHAs in Alberta that reported in a recent survey conducted by Alberta Health and Wellness that they were actively examining/considering changes to the RN/LPN mix.

APPROACH TO THE STUDY

The study has been based on a review of the published evidence, obtained from electronic databases and from material supplied by professional bodies. Details of the literature search are shown in Appendix A. The focus was on those studies that considered outcomes related to skill mix or staffing and provided a comparison between LPNs and RNs or RPNs. Some reference was made in the reviewed literature to other staff classifications or titles. Non-RN nursing titles included licensed vocational nurses (LVNs), enrolled nurses, assistant nurses and auxiliary nurses. Other types of staff included trained medication aides (TMAs), nursing assistants (NAs), nursing aides, respiratory therapy technicians and obstetric technicians.

Advice on the study and comments on drafts of the report were provided by an AHFMR working party that included representatives of the College of Licensed Practical Nurses of Alberta (CLPNA), the Alberta Association of Registered Nurses (AARN), the Registered Psychiatric Nurses Association of Alberta (RPNAA), CHR and Alberta Health and Wellness.

COMPETENCIES OF NURSING STAFF

National nursing competency report

Considerable detail on entry level competencies was provided in the 1997 National Nursing Competency Report ⁽¹⁾ This notes that, generally, competencies are seen to have a variety of components or aspects, including, but not limited to,

knowledge skills, attitudes, values, and judgments. Definitions of competence and competencies are included in entry level competencies for LPNs, RNs, and RPNs and information on which were unique to each group and which were shared. The details were derived from opinions from representatives of nursing groups throughout Canada and included lists of competencies for 1996, with projections for 2001. Each competency statement included was considered to be required by 65% or more of respondents from a particular nursing group.

Tables 1 and 2 have been prepared from data given in Appendix 12 of the National Nursing Competency Report and give an indication of expected levels of autonomy for the different nursing groups and of shared and unique competencies. Table 1 summarizes the number of competencies for each nursing group in terms of levels of autonomy. The data reflect the expectations of increased autonomy for all nursing groups over the 1996–2001 period. LPN competencies relate more to stable than unstable health conditions, with autonomy in each of these areas projected to increase over that five year period.

Table 2 lists numbers of shared and unique competencies for LPNs in 1996 and as projected for 2001. Competencies shared between the three nursing groups were also expected to increase by 2001 (Table 2). The data give some illustration of the overlap in the scope of practice for the three nursing groups. LPNs will typically be working together with RNs and RPNs. In part this will reflect changes to LPN competencies that have taken place over the last five years.

Table 1: Levels of autonomy for LPNs, RNs and RPNs *

All competencies						
	Independent		In consultation		With direction	
	1996	2001	1996	2001	1996	2001
LPN	65	107	36	73	55	40
RN	120	189	58	81	46	34
RPN	132	193	81	64	24	24
Competencies addressing level of autonomy						
	Independent		In consultation		With direction	
	1996	2001	1996	2001	1996	2001
LPN	12	37	36	73	55	40
RN	65	111	58	81	46	34
RPN	72	118	81	64	24	24
Competencies addressing stable health conditions						
	Independent		In consultation		With direction	
	1996	2001	1996	2001	1996	2001
LPN	1	10	32	46	18	28
RN	32	46	10	10	5	0
RPN	18	28	21	13	1	7

Competencies addressing unstable health conditions						
	Independent		In consultation		With direction	
	1996	2001	1996	2001	1996	2001
LPN	0	0	1	6	5	9
RN	0	0	22	41	18	15
RPN	12	23	25	18	3	7

* 65% or greater level of agreement

Source: reference ⁽¹⁾

Table 2: Shared and unique competencies for LPNs *

Area of competency	Unique		With RNs		With RPNs		Common to LPN, RN, RPN	
	1996	2001	1996	2001	1996	2001	1996	2001
All competencies	1	0	6	11	2	0	147	209
Level of autonomy	0	0	6	10	1	0	96	140
Stable health conditions	0	0	5	8	0	0	34	42
Unstable health conditions	0	0	0	1	0	0	6	14

*65% or greater level of agreement

Source: reference ⁽¹⁾

Subsequent information on competencies

It is understood from a number of personal communications that numbers of competencies have increased for all nursing categories over the last five years. However, no comparative data corresponding to the material in the National Nursing Competency Report have been located. A summary of entry to practice competencies for RNs in the province has been published by the AARN ⁽²⁾, and a competency profile for LPNs by the CLPNA ⁽³⁾, and a draft competency profile for RPNs by the RPNAA.

Information from British Columbia (BC)

The report *Licensed practical nurses and care aides in BC. Research on roles and utilization* ⁽⁴⁾ contains useful material on LPN competencies. It points out (Chapter 2) that “One of the interesting aspects of the competency studies is the high number of competencies shared among the nursing groups – LPNs, RNs and RPNs. For example, all three groups share assessment competencies, though

the depth and breadth of the knowledge, skills and judgement used to assess clients varies in the three groups. ... The level of LPN independence becomes important in situations where competencies are shared. LPNs entering practice are prepared to care for individuals who have well defined health challenges and predictable health outcomes. LPNs are also prepared to work in partnership with other members of the nursing team to provide care for clients with less predictable outcomes and/or increasingly acute conditions.”

Also, (p 295) “Competencies are identified and organized in a number of ways, depending on the purpose and use for which the competencies are intended. For example, competencies developed from an occupational analysis are usually present oriented, detailed and context-specific.

On the other hand, competencies developed to guide curriculum development for entry level practice are usually more future oriented, fairly broad, and have less emphasis on a particular context.”

The report includes details of a survey of LPN skill utilization in BC. The survey was mailed to 33 acute care and 29 continuing care facilities. All acute care sites were sent three copies of the survey: one for a medical unit, one for a surgical unit, and one for an extended care unit. In total, 70 surveys from 59 facilities were returned, a response rate of 75%. The College of LPNs confirmed that all of the entry level competencies in the survey are within the scope of practice and reflect the current standards of LPNs in BC. The BC report includes considerable detail on responses to questions on the responsibilities of LPNs in the province. This seems a helpful reference on current roles of LPNs in a Canadian health care system and covers information obtained on patient assessment, medication management, wound management, airway management, elimination management, infusion management, and communication.

Results of the competencies survey indicate an under-utilization in some competencies – for example, administering oral medications, dressing simple wounds, and performing certain assessments – and a higher utilization in others – for example, administering topical medications and assisting with deep breathing and coughing.

The Scope of Practice Review by the BC Health Professions Council includes discussion of the LPN, RN and RPN groups in the province and identifies common and unique competencies for them ⁽⁵⁾. A summary of the Council’s recommendations is given in Appendix B.

Specific training programs

Some reports of training programs for specific tasks that involved LPNs were identified in the literature review.

Wise ⁽⁶⁾ reported a study of training for intravenous (IV) therapy preparation for LPNs and RNs in Kentucky, which used a self report Likert scale survey. They found that 24.5% more post licensure prepared nurses than pre licensure prepared nurses perceived that they were adequately prepared to perform IV therapy. They suggest the finding supports the use of LPNs trained in post licensure courses. A weakness of this study was the low response rate to the questionnaires.

An overview of United States (US) practice by Roth ⁽⁷⁾ concludes that in the scope of intravenous nursing practice, LPNs and LVNs can competently perform specific IV therapy procedures after successfully completing a well-structured IV nursing continuing education process. This article provides an overview of the various processes that need to be employed to ensure IV nursing competency of LPNs and LVNs before effectively integrating them into the specialty of IV nursing. This seems in contrast to the conclusions of Kutner et al. ⁽⁸⁾ in a US study of 19 nursing homes, where provision of IV therapy was the most frequently identified measure to prevent hospital admission and “RN’s are necessary for IV therapy”.

A study by Ringerman and Ventura ⁽⁹⁾ at a community hospital in southern California found that 55% of tasks for critically ill patients could be delegated to LVNs when working in partnership with an experienced RN. A training program is described. After they had completed this program, nine LVNs began working with a RN. Each team of critical care partners cared for a caseload of four patients per shift. Outcomes pre-and post-implementation were unchanged except that patient and physician satisfaction increased, nurse satisfaction decreased, and labour costs per case dropped by 18%.

A US study by O’Connell et al. ⁽¹⁰⁾ describes a nursing home education program on metered – dose inhaler technique that was offered to RNs, LPNs, and TMAs. The program significantly improved inhaler technique for all staff, but retention of material decreased as early as two months after education, so that the program should be repeated frequently.

ROLES OF LPNS IN CANADA

The report on licensed practical nurses and care aides in BC provides examples of the use of LPNs in that province and elsewhere in Canada ⁽⁴⁾.

Within BC, facilities employing LPNs included acute care (40 out of 44), acute with extended care (17 of 24), intermediate care (20 of 77), stand alone extended care (10 of 28) and multi-level care (8 of 18).

In the acute care facilities surveyed, including acute with extended care units, LPNs were most commonly used on medical, surgical, and extended care units. The highest level of utilization (83% of facilities) of LPNs was on medical units. On surgical and extended care units, utilization of LPNs was 74% and 71% respectively. Other units most likely to employ LPNs included: rehabilitation, palliative/oncology, geriatric, pediatric, subacute/ transitional, and operating room/day surgery. Utilization of LPNs on these units ranged from 31% to 57%. Overall, the ratio of RNs to LPNs was 6.4:1 and the ratio of RNs plus RPNs to LPNs was 6.9:1.

Considerable detail on deployment of nursing staff in Canada is given in Volume IV of the Nursing Workforce Study published by the Centre for Health Services and Policy Research, University of British Columbia ⁽¹¹⁾. There is a threefold difference in the deployment of LPNs from East to West.

The report on licensed practical nurses and care aides in BC cites the publication by Dussault et al. ⁽¹²⁾ which reported that the average ratio of RNs to LPNs in Canada is 3:1 and that this ratio varies across Canada from 2:1 in Newfoundland to 5.4:1 in BC. The ratio for Alberta was 4.5:1. The estimates are based on statistics collected by nursing regulatory bodies for the Canadian Institute for Health Information.

Chapter 7 of the report on licensed practical nurses and care aides in BC ⁽⁴⁾ includes profiles of the LPN role in three acute care hospitals and four continuing care facilities in different provinces. One profile covers a pilot project that started in January 1999 at a medical unit in the Royal Alexandra Hospital, Edmonton. Staffing was determined by patient acuity, with patients' needs matched with nurses' competencies (Days: three LPNs and three RNs; evenings: two LPNs and three RNs; nights: one LPN and two RNs). LPNs provided total patient care, including IV maintenance and medication administration. After one year, the project was considered a success as measured by patient and family feedback, job satisfaction from RNs and LPNs, and other outcome measures. The approach taken has been continued at the hospital and has now also been applied to surgical units.

Three examples are given of emerging roles for LPNs and care aides in B.C. (p258). These include a LPN in the fast track emergency unit at a regional acute care facility, a LPN providing foot care to residents at a nursing home in a northern community, and a care aide working as a Total Care Worker in a nursing team at Vancouver General Hospital's psychogeriatric assessment unit.

An earlier project at the Foothills Hospital, Calgary considered issues arising following changes in 1991 to introduce LPNs into active treatment areas ⁽¹³⁾. A profile of the LPN's role was developed according to patient indicators and nursing activities, with observations on 22 LPNs. The high proportion of LPN assignments to Level III patients was seen as a possible concern as "their educational background does not prepare them for some aspects of patient care at this level of acuity." Some general points emerged and the project group made several recommendations:

- The hospital must ensure consistency across all patient units to ensure LPNs can practice to the full extent of their scope and position descriptions.
- Education must continue to ensure LPN's in service and learning needs are met.
- Scope of practice on each unit should be examined to ensure LPNs work to the limit of their scope of practice without going beyond or under it.
- The hospital needs to continuously clarify the supervisory roles of the RN to ensure that LPNs are not working autonomously.
- Careful management of change will be necessary, recognising sensitivities and need for consultation and appropriate education.

Since that time there have been significant changes to the education and competencies of LPNs in Alberta following implementation of recommendations made in 1994 by the Licensed Practical Nurses Educational Standards Advisory Committee to the Health Disciplines Board ⁽¹⁴⁾ and recognized in the provisions of the Health Professional Act.

SKILL MIX OF NURSING STAFF AND PATIENT OUTCOMES

Only issues related to staff/skill mix are considered here – several studies that were reviewed also addressed other issues. Only those studies that in some fashion considered quality of care issues were included. No specific definition of patient outcomes was adopted for this review. Various measures of outcome were used in individual studies.

Very limited information has been located that informs Objectives 2 and 3 of the project. There appears to be a continuing shortage of credible studies that address skill mix of nursing staff in relation to outcomes. Some of the more rigorous studies are summarised in Table 3, though a number of these were considered in an earlier review by the AARN ⁽¹⁵⁾. No study focuses on the points of separation along the continuum of care.

The AARN reviews

The literature review on nursing skill mix and patient/client outcomes published by the AARN provides a useful introduction ⁽¹⁵⁾. The review noted that literature addressing this area was not extensive. The review identified 58 publications through a database search of which only 10 met inclusion criteria. Not all of these were directly relevant to the skill mix issues being explored in the present paper. In two of the studies lower mortality rates were observed in hospitals with a greater proportion of RNs to other nursing staff, but there were a number of other significant variables ^(16, 17). The AARN review mentions that "...it is difficult to conclude that staffing mix alone has a direct relationship to patient mortality. We can, however, confidently state that positive interdisciplinary relationships, effective communication and coordination among team members and professional autonomy have a distinct effect on patient mortality" ⁽¹⁵⁾.

The review draws attention to the relationship between the staffing levels and skill mix with acuity, complications, and length of hospital stay. For the purposes of the present paper, a significant study was that by Carr-Hill et al. ⁽¹⁸⁾. In 15 acute medical or surgical wards at seven hospital sites in the UK they found that "Quality of care was better with the more qualified nurse. This variation was reduced when more qualified staff worked in collaboration with less qualified providers". A further analysis by this group indicated that quality of nursing care improved as the ratio of qualified and further trained staff increased, the authors noting that grade was being used as a proxy for skill ⁽¹⁹⁾. Costs also increased with the quality of nursing care in this study.

The study by Munroe ⁽²⁰⁾ of nursing home care in California found that "The hypothesis that nursing homes with a higher ratio of RN hours to LVN hours per resident day will demonstrate a higher quality of care was supported, though modestly, by this investigation". On the other hand, the study by Pearson et al. ⁽²¹⁾ of Australian nursing homes found that there was no relationship between the level and type of training of nursing home staff and resident outcomes. However, there was a significant relationship between participation in service training and most outcomes.

Papers identified in the 1997 literature update published by the AARN ⁽²²⁾ had a focus on cost issues. Reference is made to two United States publications that reviewed earlier literature and drew attention to associations between increased skill mix and nursing staff numbers and patient outcomes ^(23, 24).

Subsequent literature

A recent study at 19 teaching hospitals in Ontario indicated that a higher proportion of registered nurses in inpatient medical/surgical and obstetrical

units was associated with better health and quality outcomes for patients at the time of hospital discharge and with lower rates of medication errors and wound infections ⁽²⁵⁾. Nursing staff mix was found to be a significant predictor of patients' functional independence, pain, social functioning, and satisfaction with obstetrical care at the time of discharge, after controlling for case mix, baseline health status, patient age, gender, and complexity of illness. The effect of staff mix on patient outcomes was not evident at the time of the 6 week follow-up.

Anderson et al. ⁽²⁶⁾ considered patterns of resource allocation that related to resident outcomes for all nursing homes in Texas. Secondary data were obtained from the state Department of Health Services and 11 items selected that reflected outcomes of care. Comparing pattern scores by resident outcome groups, for those with the best and worst average outcomes, differences in staffing patterns for RNs, LVNs and nursing aides were statistically non-significant.

Comparing groups with the greatest and least improvement in outcomes, differences in staffing patterns when all three staff groups were considered was again non-significant. If only RNs and LVNs were included in the analysis, then nursing homes with the greatest improvement in resident outcomes allocated more RN staff than those with the least improvement in outcomes. There was no significant difference in the level at which LVNs were allocated. Nursing homes in the group with highest levels of RN staffing had generally greater improvement in outcomes than those with lowest levels of RNs, though this was not so for four of the 11 outcome measures.

The study by Blegen et al. ⁽²⁷⁾ considered data from 1992 – 93 for 42 nursing care units at a large university hospital in the United States. There were 1,074 FTE nursing staff members of whom 832 were RNs. Data came from hospital records and included staffing, adverse outcomes, patient complaints and acuity. Nursing system acuity data were used to control for case severity.

The proportion of hours of care by RNs was inversely related to medication errors, decubiti rates and complaints from patients or their families. Similar relationships with urinary and respiratory infections and with death were also suggested by the data, though statistical significance was not reached. Blegen et al. ⁽²⁷⁾ found these effects were present up to a staff mix of 87.5% RNs. Relationship between staffing levels and patient falls was not clear. Total hours of patient care, delivered by RNs, LPNs, and NAs, were associated with higher rates of decubiti, complaints and death, but also with acuity.

These authors suggest that their results lend support to earlier recommendations by Sovie ⁽²⁸⁾ of at least 70% RNs for medical/surgical units and 80% RNs for intensive and intermediate care units.

Gould et al. ⁽¹⁷⁾ briefly describe training and use of NAs in a surgical nursing division in Iowa to enable optimal utilisation of RNs through the two groups working as a team. The process included identification of tasks, consultation with staff nurses and a survey of all staff (RNs, NAs, LPNs, nursing unit clerks), three months after the changes were implemented. The authors give details of reduction in overtime following the change and a decrease in a number of concerns about quality of care, including documentation. It is not clear whether overall patient care hours increased.

Other studies

A Swedish study compared nursing personnel's perceptions of urinary incontinence care routines and patient observations in three different health units (health care centre, a nursing home and a geriatric clinic). The analyses included variances between the different categories of nursing personnel (nurses, assistant nurses and auxiliary nurses) and care units. There were no significant differences between personnel groups and care units in respect to care routines, but registered nurses answered more correctly than the other nursing personnel on the questionnaire about patient observations ⁽²⁹⁾. There were no significant differences between the care units in regards to patient observations.

Peruzzi et al. ⁽³⁰⁾ give a lengthy account of redesign of nurse staffing at a community hospital in Albany, New York. Changes involved increased use of nurse assistants and 'support service associates'. The changes were considered to have been associated with improved or unchanged quality and satisfaction. Changes to duties and organisation of LPNs are not clear.

In a study that pointed to the significance of staffing levels for other types of health care worker, Robertson and Hassan ⁽³¹⁾ analysed United States hospital data from the early 1990s to explore relationships between skill mix, staff resources, and mortality from chronic obstructive pulmonary disease. Results for skill mix were inconclusive and the only group whose staff intensity was positively associated with better outcomes for this patient group was respiratory physicians, therapists and technicians. Absence of significant negative effects of staffing intensities in nursing (both RNs and LPNs were considered) was taken to mean that in the hospitals that were studied staffing levels were above the critical level for staffing intensity that would have affected patient outcomes.

Nursing Skill Mix and Health Care Outcomes

Table 3: Selected studies that considered skill mix and patient outcomes

Study	Issue/Topic	Setting	Approach	Relevant findings	Comments
Nursing resources and institutional performance					
Aiken, 1994 ⁽¹⁶⁾	Association of hospital performance with organisation of nursing services	39 'magnet' and 195 control hospitals in US	Analysis of mortality data for Medicare patients, correlation with hospital characteristics, regression analysis	Target hospitals had 4.6% lower mortality rate These hospitals had greater proportion of nurses as RNs However, no evidence that these differences in skill mix significantly affected mortality	The authors suggest that mortality difference is attributable to hospital-level differences in the organisation of nursing care. This appears to be more assertion than to follow from the data analysis
Bostrom, 1993 ⁽³²⁾	Changes to nursing care with introduction of nurses aides, increased RN/patient ratio, use of LVNs to help in night shift	Stanford University Hospital, CA 600 bed centre	Pre-post change comparison, non randomized design. 3 pilot units, with follow up 9 – 12 months after changes. Survey approach, work study form and patient satisfaction	Proportion of RN time on non-care functions declined. Costs decreased in all units There was no statistically significant difference in patient satisfaction or in quality of care as measured by adverse incidents	No details are provided on numbers or ratios of the nursing staff. Satisfaction survey form did not appear to be a satisfactory instrument.
Carr-Hill, 1992 ⁽¹⁸⁾	Relationship between effectiveness of nursing care, average quality, staff satisfaction with the ward, staffing grade and dependency level of patients.	15 acute medical or surgical wards at 7 hospital sites in the UK.	Nurses trained as observers used to collect data on levels of patient/nurse interaction and effectiveness of nursing care. Questionnaires used to capture descriptive/demographic data on nursing staff. Focus on 2,246 patients with high dependency.	Skill mix had an effect on quality of care. Quality of care was better when provided by higher grades of nurses. Variation in quality was reduced when higher grades of staff worked in combination with lower grade staff.	Authors conclude that 'employing qualified staff, providing post-qualification training appeared to pay dividends in the delivery of good quality patient care.'

Table 3: Selected studies that considered skill mix and patient outcomes (cont'd)

Study	Issue/Topic	Setting	Approach	Relevant findings	Comments
Nursing resources and institutional performance					
Blegen, 1998 ⁽²⁷⁾	Association of nurse staffing levels with adverse outcomes	42 nursing units in large US university hospital	Analysis of hospital data on staffing, adverse outcomes, complaints for 1992-1993, using acuity data to control for case severity.	Proportion of care delivered by RNs inversely proportional to rates of medication errors, decubiti, and patient complaints. Adverse outcomes decreased up to a RN proportion of care of 87.5%. Total hours of care from all nursing staff directly associated with rates of decubiti, medication errors and complaints.	Strong indication of the effect of RN proportion of care on a number of outcomes. Authors suggest their results support earlier recommendations for minimum levels of RN staffing in hospital units.
Anderson, 1998 ⁽²⁶⁾	Association of nursing home resident outcomes with resource allocation	All nursing homes in Texas	Analysis of pattern scores with groups of 11 measures relating to resident outcomes, obtained from administrative data, controlling for case mix.	Resident outcomes were not statistically significantly dependent on staffing patterns for RNs, LVNs and nursing aides. If only RNs and LVNs were included in the analysis, then nursing homes with the greatest improvement in resident outcomes allocated more RN staff than those with the least improvement	RN allocation also correlated with expenditure. Authors state that the results suggest that though RN staffing is more expensive it is key to improving resident outcomes. Some material in the Discussion, covering relationships and use of RNs seems speculative and unrelated to the analysis.

Table 3: Selected studies that considered skill mix and patient outcomes (cont'd)

Study	Issue/Topic	Setting	Approach	Relevant findings	Comments
Nursing resources and institutional performance					
Pearson, 1992 ⁽²¹⁾	Relationship between skills mix, resident dependency and quality of care and life of residents in nursing homes.	Random sample of 200 nursing homes in four Australian states.	Measured relationship between skills mix and resident outcomes, data from questionnaires, regression analysis. Also qualitative case studies of 10 nursing homes.	No significant relationships between proportion of RNs and outcome measures of quality of care and quality of life. Significant relationship between number of therapists and variety of experience. Positive relationships between level of in-service training and all outcome measures except privacy and dignity.	State enrolled nurses were relatively less satisfied with their work on most measures of work satisfaction. Suggest that untrained staff had a clear and legitimate role in nursing homes, no evidence that a high proportion of these had any deleterious effect.
Training/ introduction to new procedures etc					
Clayworth, 1997 ⁽³³⁾	Integration of obstetric technicians (non-licensed nurse assistants) into practice at a tertiary care centre	Kaiser Permanente, Sacramento, CA	Description of workshop to develop better understanding of role of the technicians and of delegation issues. 79 subjects, questionnaires analysed using Likert scale.	Results indicated good increase in knowledge of role of technicians also increase in knowledge on delegation.	Paper mentions that introduction of the technicians went ahead and that the program became very successful. RNs were using the technicians appropriately. No data on outcomes This is more a 'how to do it' paper with a focus on approach to consultation with existing nursing staff

Table 3: Selected studies that considered skill mix and patient outcomes (cont'd)

Study	Issue/Topic	Setting	Approach	Relevant findings	Comments
Training/ introduction to new procedures etc					
DiSario, 1993 ⁽³⁴⁾	Training of gastrointestinal nurses in performance of sigmoidoscopy.	VA Hospital, Phoenix, AZ.	Five nurses (3 LPNs, 2 RNs) undertook training sessions in sigmoidoscopy. 246 consecutive asymptomatic patients recruited, 212 enrolled, randomized to have procedure performed by a nurse or by one of five resident physicians. Objective measures of sigmoidoscopy proficiency were recorded.	Four of the nurses and all physicians deemed proficiency at a mean of 20 procedures. One RN did not achieve proficiency.	Authors conclude the study shows that experienced GI nurses can achieve proficiency in sigmoidoscopy after performance of about 20 supervised procedures. In this small series, success achieved by both LPNs and RN.
Measures of outcomes associated with changes to nurse staffing					
Pratt, 1993 ⁽³⁵⁾	Measures of quality and costs of patient care provided by two staffing regimes in two hospital wards	Large hospital in Sydney, Australia, acute medical ward and acute surgical ward.	Measured patient outcomes and nursing care costs for both wards for 8 weeks under all-RN staffing regime. After introduction of enrolled nurses (ENs) over 4 weeks, repeated measurements over 8 weeks under a 80%RN - 20% EN staffing regime.	Comparatively few differences in patient outcomes (judgements by both patients and assessors) in this short term study. For the medical ward, 12% of 59 items favoured all-RN staffing and 3% RN-EN. For the surgical ward 6% favoured RN-EN, none favoured all-RN. Unclear which regime would be more cost effective.	Authors note that it is unclear how such changes in nurse staffing would work in the longer term. They draw attention to the strong RN opinion that presence of largely experienced ENs increased their already heavy workload and to a lesser extent had made their work more stressful.

OTHER ISSUES

Several studies have found an inverse relationship between nurse staffing levels and adverse events in hospitals. Findings seem more commonly to be in terms of overall nurse levels rather than in relation to differences in skill mix. Kovner and Gergen ⁽³⁶⁾, in a study of 589 acute care hospitals in the United States, found a significant inverse relationship between RNs per adjusted inpatient day and urinary tract infection and pneumonia after surgery. There were less robust relationships between numbers of RNs and post surgical thrombosis or pulmonary compromise. However, they note that it is possible that high overall staffing levels are inversely related to adverse events, rather than to levels for a particular type of health worker such as RNs. Hartz et al. ⁽³⁷⁾, in a study of 3,100 United States hospitals, found that lower mortality rates were associated with the percentage of nurses who were RNs. Flood and Diers ⁽³⁸⁾, in a study at a community hospital in northeastern United States, found improved outcomes (length of stay) and decreased costs when two general medical units were adequately staffed (staffing mix for both budgeted at 10.7 RNs, one LPN, and six nurse aides).

In a study involving 276 nurses in a large hospital in Northern Ireland, grade of nursing was unrelated to job stress and outcome health variables, including work satisfaction ⁽³⁹⁾. The authors cite earlier studies indicating RNs experienced more stress than non-registered nurses, with a UK study suggesting this pattern was only significant for stress associated with organisational features.

Anderson and McDaniel ⁽⁴⁰⁾ in a United States study on nursing homes found that RN participation in organisational decision making was related to improvements in patient outcomes, but did not include skill mix in their analysis.

Daykin and Clarke ⁽⁴¹⁾ have used qualitative interview data to illustrate tensions among nurses and health care assistants in English hospital wards following changes to work organisation in the National Health Service. Importance of interaction between physicians and nurses has been noted in a number of studies, though these have not been considered for the purposes of this review.

Anthony et al. ⁽⁴²⁾ discuss a national survey of licensed nurses in the United States that describes factors associated with patient outcomes when nursing activities are delegated to unlicensed assistive personnel (UAP). Licensed nurses' overall experience and UAP's experience in the work setting were associated with more positive events. When the outcome of the delegated activity was determined by routine observation, more positive events occurred. When there was no direct supervision of the UAP, more negative events

occurred. This survey had a poor response rate and there were insufficient data to undertake a comparative analysis of delegation and supervision of UAP by RNs and LPNs.

IMPLICATIONS FOR RHAS IN CHANGING NURSING SKILL MIX

This review suggests that there is at present rather little in the literature to assist the CHR in their decisions on how to manage expected changes to the nursing workforce. It was hoped that the recent literature would provide examples of empirical studies that addressed skill mix of LPNs and other nursing staff in relation to health outcomes and areas of work. This has not proved to be the case and the papers that have been reviewed can do little more than provide general guidance. An important consideration for the CHR is where there is separation along the continuum of delivery of patient care between the competencies of the three nursing groups. No study was located that addressed this issue.

Buerhaus and Needleman ⁽⁴³⁾ have summarized several current United States projects which include consideration of nurse staffing and patient outcomes potentially sensitive to nursing, which may provide information pertinent to the present project.

Those studies that are available tend to have only marginal relevance to practical issues that will be faced by RHAs and some have methodological limitations. Some of the limitations have been considered by McKenna and include use of small samples and non-representative sampling techniques ⁽⁴⁴⁾. In general, there is a need for caution regarding the generalizability of research findings in this area. There is a need to recognise the importance of context and practice settings and also the influence of non-nursing staff on outcomes. Staffing models may vary from health region to health region and be influenced by such factors as the health services delivered, patient/client loads and acuity levels. Also, patients' needs change over time so that changes in nursing skill mixes may need to be time and case mix sensitive. Practice patterns in Canada will differ from those in the US and some other countries, so that results from studies conducted elsewhere may need to be interpreted with caution.

The material available on competencies provides useful broad guidance, though there is limited information on the current situation and the information on entry to practice competencies needs to be kept in context. Material on the use of LPNs in other Canadian provinces is of interest and, while no related health outcome measures have been obtained, clearly much lower RN:LPN and RPN:LPN ratios than those in Alberta are a reality for other parts of the country. Also, it seems worth considering points made by Hegney et al. in their discussion on activities of rural nurses in Australia ⁽⁴⁵⁾. They state that "The rural nurse, registered,

enrolled or assistant appears to extend their role both up and down the health care hierarchy to ‘fill the gaps’ in the delivery of health care due to the unavailability of other cost effective services.” They also suggest that both registered and enrolled nurses who work in different sized health services require a different skill mix.

The way forward for RHAs may be to continue to introduce additional LPN staffing in specific areas with appropriate evaluation to ‘test the water’. Such a process would require full consultation and involvement of nursing and other health care professionals, appropriate in-service training, monitoring and evaluation of nursing-sensitive health outcomes. The review by Edwardson and Giovanetti ⁽⁴⁶⁾ concluded that research which focuses on costs and outcomes of care, as opposed to methods for staffing predictions, will best inform decisions about skill mix and intensity of required nursing care. It may be that the assessment process would need to be continuous as changes were made to different areas, as generalizability of findings could be limited.

A number of general frameworks and instruments have been suggested which would be helpful in considering how to develop appropriate local level assessment to inform decisions on the role of nursing staff. For example, the need for use of nursing – sensitive outcomes and some general approaches to measuring these are discussed by Oermann and Huber ⁽⁴⁷⁾. From the indications obtained in the present review, local assessment to inform local decisions, rather than reliance on findings and recommendations in the available literature, would seem to be the way to go.

APPENDICES

APPENDIX A: LITERATURE REVIEW

Details of the literature search are shown in the following table.

Inclusion criteria: Any studies describing Canadian nursing competencies that included consideration of LPNs. Any scientifically credible empirical study that considered the relationship between skill mix and patient outcomes.

Exclusion criteria: Studies on skill mix that did not consider outcomes issues; studies that considered only cost issues as outcomes; general reviews without empirical data.

<i>Database Searched</i>	Subject Headings/Textwords Combinations
MEDLINE (Ovid) 1991-May 2001	Group A terms: *nurses OR exp *nursing, practical OR exp *education, nursing, baccalaureate OR exp *licensure, nursing OR exp *nursing For Project Objective #1: Group A terms AND Exp *clinical competence OR exp *professional competence AND comparative study OR Compar\$.mp. For Project Objective #2 Group A terms AND exp *personnel staffing and scheduling OR Skill mix.mp. OR staff\$ ratio\$.mp. OR staff\$ level\$.mp. OR rn mix.mp. AND outcome\$.mp. Note: Bolded are MeSH in this database

Nursing Skill Mix and Health Care Outcomes

Database Searched	Subject Headings/Textwords Combinations
PubMed 1991-July 2001	nurse OR nurses OR nursing AND Skill mix OR competenc* AND patient* AND outcome*
EMBASE (Ovid) 1991- April 2001	Exp * nurse AND Exp * competence OR competenc?.mp. OR skill mix.mp. OR staff\$ ratio\$.mp. OR staff\$ level\$.mp. OR exp * treatment outcome OR exp * outcomes research
Best Evidence (Ovid) 1991-Feb 2001	Nurs\$.mp. AND competenc\$.mp. OR skill\$.mp.
HTA	Nurs* AND (skill* OR competenc*) Note: No relevant retrieval in these databases
EED	
DARE	
Cochrane Database of Systematic Reviews 2001 Issue 2	
ECRI website	
Database Searched	Subject Headings (Bold) / Textwords Combinations
HealthSTAR (Ovid) 1991- Dec 2000	Same as MEDLINE search, limit to non-medline
CINAHL (Ovid) 1991-March 2001	For Project Objective #1: Exp * registered nurses OR exp * practical nurses AND Exp * education, competency-based OR exp * clinical competence OR exp * professional competence OR exp * national vocational qualifications OR exp * competency assessment For Project Objective#2: Exp * registered nurses OR exp * practical nurses AND Exp * skill mix OR staff\$ ratio\$.mp. OR staff\$ level\$.mp. AND * nursing outcomes OR * outcome assessment OR outcomes (health care) OR * treatment outcomes
PsycInfo (Ovid) 1991-Feb 2001	Exp * nurses AND exp * professional competence OR skill mix.mp. OR staff\$ ratio\$.mp. OR staff\$ level\$.mp.

Nursing Skill Mix and Health Care Outcomes

<i>Database Searched</i>	Subject Headings/Textwords Combinations
InfoTrac Health Reference Center-Academic 1991-July 17, 2001	Nurs? AND (skill mix OR skill-mix)
CMA Practice Guidelines-CPG Infobase (July 12, 2001)	Nurse OR nurses No relevant retrieval
National Guideline Clearinghouse (July 12, 2001)	Nurs* AND (competenc* OR skill mix) No relevant retrieval
WWW	Browsing Alberta Association of Registered Nurses and Canadian Nursing Association websites to look for competence related publications
Other material	Publications supplied by AARN librarian.

- Date Limits: 1991-2001 see individual database for specific months
- Publication type limit to: no limit

APPENDIX B: EXCERPTS FROM THE BC HEALTH PROFESSIONS COUNCIL SCOPE OF PRACTICE REVIEW ⁽⁵⁾

Shared scope and reserved acts

Scope of practice statements describe in general terms what a profession does and how it does it. On the other hand, reserved acts, defined as those "tasks and services involving a significant risk of harm," need to be restricted, and may only be performed by professions to whom they are, on a non-exclusive basis, assigned, and so long as those performing them are acting within the scope of practice of their profession.

The Council developed a list of such activities, the *Reserved Acts List*, and in its review of each profession determined which of the reserved acts it was qualified, as a profession, to perform.

Nurses, licensed practical

Scope of practice

The practice of nursing by licensed practical nurses is the provision of health care for the promotion, maintenance and restoration of health; and the prevention, treatment and palliation of illness and injury, including assessment of health status and implementation of interventions.

Reserved acts

- 2(e) For the purpose of assessing an individual or assisting an individual with activities of daily living, performing the physically invasive or physically manipulative act of putting an instrument, hand or finger(s)
 - i. into the external ear canal, including applying pressurized air or water, for the purpose of cleaning patients' external ear canal, taking their tympanic temperature and using an otoscope to examine cerumen build up;
 - v. beyond the labia majora, but excluding the insertion of intrauterine devices, for the purpose of performing hygiene measures and washing beyond the labia majora to the urethral and vaginal orifice;
 - vi. beyond the anal verge, for the purpose of performing rectal checks on patients whose assessment warrants this intervention.

Reserved acts to be performed only if the act is ordered by a health professional who is authorized by legislation to perform the act:

2. Performing the following physically invasive or physically manipulative acts:
 - (a) procedures on tissue below the dermis or below the surface of a mucous membrane;
 - (d) administering a substance, other than a drug, by subcutaneous injection, inhalation, irrigation or instillation;
 - (e) putting an instrument, hand or finger(s)
 - i. into the external ear canal, but excluding cerumen management; iv. beyond the opening of the urethra; v. beyond the labia majora, but excluding the insertion of intrauterine devices; vi. beyond the anal verge; or vii. into an artificial opening into the body.
- 5(a) Administering orally or by subcutaneous injection a drug listed in Schedule I or II of the *Pharmacists, Pharmacy Operations and Drug Scheduling Act*.

Nurses, registered

Scope of practice

The practice of nursing by registered nurses is the provision of health care for the promotion, maintenance and restoration of health; the prevention, treatment and palliation of illness and injury, primarily by assessment of health status, planning and implementation of interventions; and co-ordination of health services.

Reserved acts

1. Performing a nursing diagnosis by making a clinical judgment of the patient's mental and physical condition that can be ameliorated or resolved by appropriate interventions of the nurse or nursing team to achieve outcomes for which the nurse is accountable.
- 2(a)(i) For the purpose of wound care, performing the following physically invasive or physically manipulative act of procedures on tissue below the dermis or below the surface of the mucous membrane:
 - cleansing,
 - soaking,
 - irrigating,
 - probing,
 - debriding,

- packing,
 - dressing.
- 2(a)(ii) For the purpose of establishing peripheral intravenous access and maintaining patency using a solution of normal saline (0.9 per cent), performing the physically invasive or physically manipulative act of venipuncture.
- 2(e) For the purpose of assessing an individual or assisting an individual with activities of daily living, performing the physically invasive or physically manipulative act of putting an instrument, hand or finger(s)
- i. into the external ear canal, including applying pressurized air or water;
 - ii. beyond the point in the nasal passages where they normally narrow;
 - iii. beyond the pharynx;
 - iv. beyond the opening of the urethra;
 - v. beyond the labia majora;
 - vi. beyond the anal verge; or
 - vii. into an artificial opening into the body.
- 5(a) Administering or compounding a drug listed in Schedule II of the *Pharmacists, Pharmacy Operations and Drug Scheduling Act*.
- For the purposes of this reserved act, "compounding" means mixing ingredients, at least one of which is a drug listed in Schedule II of the *Pharmacists, Pharmacy Operations and Drug Scheduling Act*.

Reserved acts to be performed only if the act is ordered by a health professional who is authorized by legislation to perform the act:

- 2(a) For purposes other than wound care, performing the physically invasive or physically manipulative act of procedures on tissue below the dermis, below the surface of a mucous membrane, and in or below the surface of the cornea.
- 2(d) Performing the physically invasive act of administering a substance, other than a drug, by injection or inhalation, except as provided in reserved act 2(a)(ii).
- 2(e) For the purpose of treatment, performing the physically invasive or physically manipulative act of putting an instrument, hand or finger(s)
- i. into the external ear canal, including applying pressurized air or water;
 - ii. beyond the point in the nasal passages where they normally narrow;

- iii. beyond the pharynx;
 - iv. beyond the opening of the urethra;
 - v. beyond the labia majora;
 - vi. beyond the anal verge; or
 - vii. into an artificial opening into the body.
4. Applying a hazardous form of energy, including diagnostic ultrasound and X-ray.
- 5(a) Administering or compounding by any means a drug listed in Schedule I of the *Pharmacists, Pharmacy Operations and Drug Scheduling Act*.
- For the purposes of this reserved act, "compounding" means mixing ingredients, at least one of which is a drug listed in Schedule I of the *Pharmacists, Pharmacy Operations and Drug Scheduling Act*.
- 5(b) Designing, compounding or dispensing therapeutic diets where nutrition is administered through enteral or parenteral means.
- For the purposes of this reserved act, the following definitions shall apply:
- "designing": the selection of appropriate ingredients for enteral or parenteral nutrition.
- "compounding": mixing ingredients for enteral or parenteral nutrition.
- "dispensing": filling a prescription for enteral or parenteral nutrition.
7. Allergy challenge testing or allergy desensitizing treatment involving injection, scratch tests or inhalation, and allergy challenge testing by any means with respect to a patient who has had a previous anaphylactic reaction.

Nurses, registered psychiatric

Scope of practice

The practice of nursing by registered psychiatric nurses is the provision of health care for the promotion, maintenance, restoration and palliation, primarily of mental and emotional health and associated physical conditions by assessment of mental and physical health, planning and implementation of interventions and co-ordination of health services.

Reserved acts

1. Performing a nursing diagnosis by making a clinical judgment of the patient's mental and physical condition that can be ameliorated or resolved by appropriate interventions of the nurse or nursing team to achieve outcomes for which the nurse is accountable.

2(a)(i) For the purpose of wound care, performing the following physically invasive or physically manipulative act of procedures on tissue below the dermis or below the surface of the mucous membrane:

- cleansing,
- soaking,
- irrigating,
- probing,
- debriding,
- packing,
- dressing.

2(a)(ii) For the purpose of establishing peripheral intravenous access and maintaining patency using a solution of normal saline (0.9 per cent), performing the physically invasive or physically manipulative act of venipuncture.

2(e) For the purpose of assessing an individual or assisting an individual with activities of daily living, performing the physically invasive or physically manipulative act of putting an instrument, hand or finger(s)

- i. into the external ear canal, including applying pressurized air or water;
- ii. beyond the point in the nasal passages where they normally narrow;
- iii. beyond the pharynx;
- iv. beyond the opening of the urethra;
- v. beyond the labia majora;
- vi. beyond the anal verge; or
- vii. into an artificial opening into the body.

5(a) Administering or compounding a drug listed in Schedule II of the *Pharmacists, Pharmacy Operations and Drug Scheduling Act*.

For the purposes of this reserved act, "compounding" means mixing ingredients, at least one of which is a drug listed in Schedule II of the *Pharmacists, Pharmacy Operations and Drug Scheduling Act*.

Reserved acts to be performed only if the act is ordered by a health professional who is authorized by legislation to perform the act:

2(a) For purposes other than wound care, performing the physically invasive or physically manipulative act of procedures on tissue below the dermis, below the surface of a mucous membrane and in or below the surface of the cornea.

- 2(d) Performing the physically invasive act of administering a substance, other than a drug, by injection or inhalation, except as provided in reserved act 2(a)(ii).
- 2(e) For the purpose of treatment, performing the physically invasive or physically manipulative act of putting an instrument, hand or finger(s)
- i. into the external ear canal, including applying pressurized air or water;
 - ii. beyond the point in the nasal passages where they normally narrow;
 - iii. beyond the pharynx;
 - iv. beyond the opening of the urethra;
 - v. beyond the labia majora;
 - vi. beyond the anal verge; or
 - vii. into an artificial opening into the body.
4. Applying a hazardous form of energy, including diagnostic ultrasound and X-ray.
- 5(a) Administering or compounding by any means a drug listed in Schedule I of the *Pharmacists, Pharmacy Operations and Drug Scheduling Act*.
- For the purposes of this reserved act, "compounding" means mixing ingredients, at least one of which is a drug listed in Schedule I of the *Pharmacists, Pharmacy Operations and Drug Scheduling Act*.
- 5(b) Designing, compounding or dispensing therapeutic diets where nutrition is administered through enteral or parenteral means.

For the purposes of this reserved act, the following definitions shall apply:

"designing": the selection of appropriate ingredients for enteral or parenteral nutrition.

"compounding": mixing ingredients for enteral or parenteral nutrition.

"dispensing": filling a prescription for enteral or parenteral nutrition.

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