

PHYSICIAN ASSISTANTS AS HOSPITALISTS IN CANADA: A LITERATURE REVIEW

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Abstract:

Physician Assistants (PAs) are currently working as hospitalists in Canada, and there is an increasing demand to create more PA hospitalist positions. There is currently little research available on Canadian PAs and even fewer research on PAs working as hospitalists worldwide.

There are various stressors on the Canadian healthcare system, such as fiscally limited resources due to a publicly funded model as well as physician burnout. A possible solution may be the implementation of hospitalist PAs.

Articles examined for this literature review were identified using a PubMed search of the term “physician assistant hospitalist,” through manually searching journals, and an examination of references from relevant papers. Inclusion criteria for articles in this review were as follows: primary research, those written in English, focused on PAs, as hospitalists in an inpatient setting.

The PubMed search resulted in a total of 114 articles, of which five were relevant, and four articles through references and manual exploration of journals for a total of nine articles.

There are several limitations to this review that include generally limited data on PAs, even further limited on PAs in Canada and therefore no Canadian studies that examined PA hospitalists. Additionally, none of the performed were randomized control trials, and all were retrospective chart reviews.

PAs stakeholders in the Canadian healthcare system including the economist, physician and patient. They provide accountability through a cost-effective, resource efficient means. Physicians can be pleased by PAs providing safe, high-quality patient care. These elements contribute positively to fostering the integral trusting relationship between physician and PA. Finally, patients are satisfied with their care by PAs.

Based on the data review, PAs are economically efficient, patients are satisfied with care and PAs to provide quality, safe patient care, which allows for a trusting relationship between PA and physician.

Introduction:

Physician Assistants (PAs) have been working in the Canadian healthcare system for the last 35 years (1). Over the years, increasing recognition of the PA role within medical and surgical disciplines by involved healthcare providers has stimulated demand to expand the PA reach within Canada’s healthcare system. Furthermore, this increasing PA exposure within the healthcare system through direct collaboration with PAs or indirect discovery of the role has stimulated a drive for expansion into previously PA-naïve medical and surgical disciplines. Currently, PAs within Manitoba work as mainly as hospitalists providing inpatient care (2). This literature review aims to add to the body of knowledge on

the impact of PAs as hospitalists in Canada and the international healthcare system. This review specifically exams cost efficiency, quality of care, patient safety and patient satisfaction.

Background:

Canada's publicly funded system is advantageous in its universality yet imposes limitations on services provided due to financial constraints. Innovative ways to improve access to care in cost-effective and efficient ways must be sought and improved. One solution to improve cost-effectiveness and providing quality patient care is PA utilization beyond that which currently exists in Manitoba, Ontario, New Brunswick and Alberta (6). The utilization of PAs improves patient access to care through physician task substitution (7). PAs work collaboratively with physicians as medical generalists using their skills in various clinical settings. PAs have a dynamic relationship with their supervising physicians in which their level of autonomy may increase as they gain experience in their particular field of practice (7).

In Manitoba, a majority (76.7%) of PAs are hospitalists assigned to in-patient clinical services such as Emergency, Neurosurgery, Cardiac Sciences, Psychiatry, or Internal Medicine. As of May 2019, the College of Physicians and Surgeons of Manitoba (CPSM) registered 116 PAs in the province of which 15 are in primary care roles. (2). From the University of Manitoba PA program's post-graduate employment records and tracking mechanisms, 43% of Manitoba PAs (n=50) work on Surgery services, 12% (n=14) work in Emergency Departments, 14.6% have identified in-patient Hospitalist roles specific to medicine. Seven percent (7%) of the provincial PAs work in in-patient Mental Health or Psychiatry. Six PAs are currently on other services or employed in education.

It is challenging to track PA employment in Ontario due to the lack of centralized records. The Canadian Association of Physician Assistants 2017 membership survey estimates 65% of all Canadian PAs live in Ontario, but not if they are Military or working as civilians (www.capa-acam.ca).

In other parts of the world, including the United States of America, there has been a shift in coverage of inpatient care toward that of a hospitalist. The term, "hospitalist" was first defined in 1996 in *The New England Journal of Medicine* as "specialists in inpatient medicine who will be responsible for managing the care of hospitalized patients in the same way that primary care physicians are responsible for managing the care of outpatients" (8). Perhaps a more encompassing definition is that from the *Society of Hospital Medicine*, a hospitalist is "a physician whose primary professional focus is the general medical care of hospitalized patients. Their activities include patient care, teaching, research and leadership related to Hospital Medicine" (9).

PAs joined physicians in the hospitalist movement, working in multidisciplinary teams to provide inpatient care (11)(12)(13). The PA hospitalist role includes providing continuity of care, inpatient evaluation, ordering of tests, communication to all members of the healthcare team, and initiation and management of treatment (11). Depending on the nature of the inpatient service, the hospitalist PA provides procedures specific to their medical service (14).

In 1998, Herbert et al. conducted a retrospective cohort study to determine the effect of hospitalists on inpatient care in a community teaching hospital. They discovered with the implementation of hospitalists the median length of stay (LOS) decreased from 6.01 to 5.01 days, cost of care decreased by nearly US\$1000 per case, and the 14-day readmission rate decreased from 9.9 to 4.64 per 100 admissions. They describe potential advantages of hospitalists on inpatient care such as physician expertise and experience with hospital medicine, improved efficiency of the outpatient physician and increased availability of the hospitalist throughout the day (10).

Methods:**Article Search**

Articles examined and reviewed for this report were primarily found by conducting a PubMed search: “physician assistant hospitalist.” From this search, several Medical Subject Headings (MeSH) terms were generated such as “hospitalist(s),” “physician(s),” and “physician assistant(s).” The remaining papers examined in this review were found by manually searching journals and through searching the reference lists for nine relevant articles.

Inclusion Criteria

Criteria used to determine study eligibility included: primary research, studies published in English, focus on PAs as opposed to other non-physician providers (nurse practitioners, advanced practice nurses) as well as articles that focused on the inpatient setting where PAs were functioning as hospitalists. The Articles selected were from the Netherlands, England and the United States of America. One included article did not explicitly outline a PA focus referring to the generic term of mid-level practitioners (MLPs), which may include PAs, NPs and others. This article was included to give more depth to the subject matter and provide a broader context. There were no Canadian peer-review pieces identified.

Ethics

Direct ethics approval was not required for this project as it was considered secondary research examining the results compiled from ethics approved primary research.

Result Measurements

To measure safety and quality of care provided by PAs as hospitalists, we utilize surrogate markers, including mortality, readmission rate, quality-adjusted life years (QALY) and eleven clinical and process indicators. The measure of the Cost of care occurred in two different currencies, the American Dollar, and the Euro. This review also examines resource use by PAs as measured by consultant use, radiology and laboratory testing.

Results:

A summary of the examined articles is in Table 1 of the Appendix section.

The PubMed search yielded a total of 114 results, of which five articles were relevant and met eligibility criteria, four additional articles were located by searching journals, following the provided citations for relevant articles. In total, nine articles were reviewed.

Safety and Quality of Care

Roy et al. and Singh et al. both compared traditional house staff or the resident-based model to the PA-hospitalist model and found that there was no significant difference in mortality or readmission rate (15)(16). Roy et al. comment on safety, concluded that the PA/hospitalist model proves to be a safe alternative to traditional house staff services (15).

Capstack et al. examined two alternative PA staffing models involving a conventional model with low PA-to-physician ratio (9 physicians to 2 PAs, with PAs rounding on 9 patients a day), to the expanded model with a high PA-to-physician ratio (3 physicians to 3 PAs, with PAs rounding on 14 patients per day). They discovered that the increased PA:MD ratio imposed no statistical significance on mortality and readmission rate (17).

Timmermans, van den Brink et al. examined the cost-effectiveness of MD versus PA-MD model and used QALY as a generic measure of disease burden evaluated at admission, discharge and 1-month

post-discharge. The PA-MD and MD model each had a QALY of 76% with no significant difference, suggesting the equivalent quality of care between the two groups. The QALY gain during admission was 0.07 for the PA-MD model and 0.04 for the MD model and not statistically different. The QALY gain after discharge was 0.04 for the PA-MD model and 0.05 for the MD model with no significant difference (18).

Timmermans, van Vught et al. specifically examined the safety and quality of care by utilizing eleven clinical and process indicators guided by indicators for quality care in use by the Dutch Health Care Inspectorate. Those measures included:

- in-hospital mortality (PA-MD– 0.2%, MD – 0.1%),
- unplanned transfer to the intensive care unit (PA-MD– 2%, MD – 2%),
- cardiopulmonary resuscitation (PA-MD– 0.1%, MD – 0.1%),
- pressure ulcer developed during admission (PA-MD– 4%, MD – 1%),
- fever over two days (PA-MD– 10%, MD – 10%),
- pain score over two days (PA-MD– 6%, MD – 3%),
- hospital infections (PA-MD– 6%, MD – 5%),
- emergency department presentation within one month after discharge (PA-MD– 16%, MD – 18%),
- readmission within one month after discharge (PA-MD– 9%, MD – 8%),
- days between discharge and letter of discharge (PA-MD– 1 day, MD – 4 days) and,
- introduction of the patient to the hospitalist team within 24 hours of admission (PA-MD– 69%, MD – 69%).

In examining all eleven indicators between the two groups, they found no significant difference in the quality of care and derived that PAs provide safe care (19).

Iannuzzi et al. made a direct comparison of the resident to the midlevel practitioner (MLP) by examining resident-hospitalist versus MLP-hospitalist models, finding no significant difference between the two models in terms of readmissions and mortality. The readmission rates for the resident and MLP-hospitalist models were 8.8% and 7.8% respectively. The mortality for the resident model was 2.2%, and the MLP-hospitalist was 2.3% (20).

Dhuper et al. compared the medical resident model to the PA-hospitalist model and found that readmission rate was 64% for the PA-hospitalist and 69% for the resident model and not significantly different. However, mortality was significantly lower in the PA-hospitalist model at 1.94% as compared to 2.85% in the resident model (21).

Finally, Van Rhee et al. examined resource use among PA services and teaching services and measured mortality, finding no significant difference between groups for the majority of disease conditions with the exception being pneumonia. The PA service had a higher mortality rate for pneumonia. Mortality rates for the PA versus resident models for the given diagnoses are as follows: CVA/stroke (PA – 8.0%, resident – 11.5%), Pneumonia (PA – 12.7%, resident – 6%), Acute Myocardial Infarction (PA – 0%, resident – 0%), CHF (PA – 6.5%, resident – 4.1%), GI hemorrhage (PA – 2.2%, resident – 0%) (22).

Of all papers reviewed, the results from a safety and quality perspective, including mortality, readmission rate and quality measurements had very similar outcomes. For eight of nine papers, these measurements of quality and safety did not significantly differ between the control and PA model. One article was the exception and did find significantly lower mortality among the PA service as compared to

the resident service (21). Additionally, all papers agreed with the view that PAs provide safe, quality inpatient care.

Length of Stay (LOS)

LOS was a measurement used in seven of nine articles reviewed, and results were not consistent across those examined. Outcomes varied between studies and demonstrated either unchanged or increased LOS in the PA-hospitalist models.

LOS was not significantly different between PA-hospitalist services and comparison groups in studies by Roy et al., Timmermans, van Vught et al. or Van Rhee et al. (15)(19)(22). Roy et al. reported LOS as a median, they found that both the PA-hospitalist model and the traditional house staff model had a median of 2.6 days (15). Timmermans, van Vught et al. also measured LOS as a median, the PA-MD model was six days versus the MD model of 5 days, which was not statistically different (19). Last, Van Rhee et al. measured LOS as it pertained to diagnosis-related groups including cerebrovascular accident (CVA)/stroke, pneumonia, acute myocardial infarction (AMI), congestive heart failure (CHF) and gastrointestinal hemorrhage (GI hemorrhage). For patients with CVA/stroke, the mean LOS for the PA service was 5.93 days versus the resident service's 5.75 days (22). Those with pneumonia had a mean LOS for PA service of 5.80 days versus the resident service of 6.16 days (22). Patients with AMI had a LOS on the PA service of 5.05 days versus the resident service of 4.97 days (22). Patients admitted with CHF to the PA service had a LOS of 5.12 days versus the resident service with LOS of 5.44 days (22). Finally, patients with GI hemorrhage had a LOS on the PA service of 3.96 days versus 3.84 days for the resident service (22).

Additionally, we examined the effect on LOS with an increased PA-MD ratio from the traditional model to the expanded PA model as reported by Capstack et al. who found no significant change in LOS between the two groups (17). The mean LOS for the expanded PA model was 4.1 ± 3.9 days and 4.3 ± 5.6 days for the conventional PA model (17).

LOS increased in the PA models studied by Singh et al. as compared to the traditional resident model as well as by Timmermans, van den Brink et al. when compared to the strictly MD model (16)(18). Singh et al. reported the median LOS for the hospitalist-PA model as 3.17 days as compared to 2.99 days in the resident model with a +8.9% difference between the two groups (16). Timmermans, van den Brink et al. reported a LOS as a measure of cost and found that the mean-cost associated with LOS was 1780 Euros for the PA-MD model and 1421 Euros for the MD model (18). Additionally, Iannuzzi et al. also recognized an increased LOS with the MLP team as compared to the resident team, they reported the MLP LOS as 7.84 ± 14.49 days whereas the resident LOS was 6.88 ± 9.37 days (20).

Cost of Care

Cost of care measurements in five of nine papers reported mixed results with cost decreased with PAs on board, and others are reporting no change or increased cost.

Roy et al. discovered a marginally lower cost of care favouring the PA-hospital service over the traditional house staff service. Cost of care was calculated based on healthcare provider salary as well as from the hospital's cost accounting system. The total cost in USD for the PA service and house staff service were \$4,536 and \$4,749, respectively (15).

Contrarily to the numbers provided in other studies, Iannuzzi et al. reported that direct patient care costs favoured the resident-hospitalist model as compared to the MLP-hospitalist model. The cost associated with the labour portion of the cost-of-care is hospital charges with the human resource wage

index included. The direct cost of care provided by the hospital-resident model was US\$617 lower than that provided by the MLP model (20).

Singh et al. recognized that there were similar costs between the PA-hospitalist compared to the traditional resident-based model. The cost of the PA-hospitalist model was \$9,390 versus \$9,044 in the resident model (16). In agreement with these findings, Timmermans, van den Brink et al. reported a similar theme, finding the total cost per patient to be equivalent between the two groups examined. Total cost in the PA-MD model was 3480 Euros versus 2869 Euros in the MD model (18). However, upon further examination of the cost breakdown, they discovered that cost per patient in terms of LOS was higher for the PA-MD model as compared to the MD model. The personnel cost offset noted in the PA-MD model from the MD model is defined as the cost per patient for the primary provider responsible for the medical care for that patient. The personnel cost per patient in the PA-MD model was significantly lower than that of the MD model (18).

Finally, Capstack et al. demonstrated that inpatient care management with an increased PA-MD ratio as compared to the traditional ratio had a decreased cost of care. The cost of care for the traditional PA-MD ratio team was \$2,724 compared to the increased PA-MD ratio of \$2,644(17).

Patient Satisfaction

Patient satisfaction was another common theme in five of nine articles. Results were either not significantly different among comparators or overwhelmingly positive for the PA-hospitalist model, with one study observing that satisfaction was lower among the MLP model.

Two studies did not note a difference in patient satisfaction with the implementation of PAs on inpatient wards. Dhuper et al. examined patient satisfaction by conducting an inpatient survey administered to 100 patients per month over the 4-year study period. They found that patient satisfaction during the resident model was 96% as compared to 95% during the PA-hospitalist model and concluded no statistical difference between the two (21). Another study conducted by Roy et al. also found no significant difference in patient satisfaction between the traditional house staff model and the PA-hospitalist model. They examined patient satisfaction by administering the Press-Ganey survey to 70% of randomly selected recently discharged patients (15). This survey did not explicitly ask about patient satisfaction with PAs focusing on questions surrounding perceived MD care and details around discharge. Scores obtained from the survey across the two periods compared the traditional house staff to PA-hospitalist models.

Timmermans, van Vught et al. dispensed a self-administered questionnaire at discharge to evaluate patient satisfaction with communication, continuity of care, cooperation between care providers, and perceived competency of the PA or MD. Communication was evaluated by utilizing the Communication Assessment Tool (CAT) and accompanying photos of their care provider(s). These photos ensured the patients identified their provider (either a PA or MD) but not the professional designation. Based on the specific patient evaluation, they discovered that PAs were associated with more positive overall evaluations of care. More positive scores of patients' satisfaction occurred in wards with PAs (19). Drennan et al. organized semi-structured interviews with patients and their relatives to evaluate their satisfaction with care. The responses regarding care by PAs were very positive, and patients commented on the many ways in which PAs improved their care, such as approachability on the ward, time spent explaining decisions and care plans, as well as noting that PAs followed up on concerns following rounds (14).

Iannuzzi et al. observed that patient satisfaction was higher for those who received care from the resident model differed from the other four papers examined. Patient satisfaction evaluation used the

Press Ganey physician performance survey and the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) at discharge. The HCAHPS scores were statistically higher for the resident model as well as all five measurements for the Press Ganey score with the “physician time with the patient” measurement being statistically higher (20).

Healthcare Professionals Satisfaction

Other healthcare professionals (physicians, nurses, managers) satisfaction with the PAs implementation used a qualitative analysis approach of semi-structured interviews in one of the nine paper. Drennan et al. established that the majority of professionals interviewed regarding services provided by PAs viewed the role as positive with only a small number of doctors and nurses not seeing PA value within some specialties. One consultant in the study went as far as regarding PAs as “invaluable” to the clinical team. In this article, they were able to develop themes relating to PAs contribution based on interview responses. These themes included continuity, patient flow, patient safety and increasing physician time for training and complex patients. The continuity provided by PAs was beneficial to the healthcare team in three different ways. First, PA presence on the ward allowed for timelier patient evaluation, communication to the rest of the team, which ultimately permitted resolution of issues more quickly than wards without PAs. Second, the PAs inpatient knowledge specifically regarding status, care plans and progress was particularly helpful when resident turnover occurred. Third, the PAs familiarity with hospital policy and practices specific to the particular department proved beneficial with the residents rotations through the wards (14).

Resource Use (Consultant, Radiology and Laboratory Testing)

Consultant use measured by Capstack et al. in the conventional PA-hospitalist model to that used in the expanded PA-hospitalist model, found the conventional PA-hospitalist model used a mean of 0.56 consultants per case whereas the expanded group used 0.55. They reported no significant difference in consultant use between the two PA-hospitalist models (17).

Radiology imaging and laboratory testing were examined by Van Rhee et al. and classified as they pertained to varying disease states. They measured diagnostic testing in relative value units (RVUs) and categorized patients by the diagnosis-related group of cerebrovascular accident (CVA)/stroke, pneumonia, acute myocardial infarction (AMI), congestive heart failure (CHF) and gastrointestinal hemorrhage (GI hemorrhage). They found that PAs generally used the same or fewer resources as compared to residents for patients with the same diagnosis. Specifically, PAs used fewer radiologic tests for patients with pneumonia with a mean of 79.69 RVUs as compared to residents with 98.35 RVUs. PAs also used fewer laboratory tests for patients with stroke (PAs mean 149.13 vs. residents mean 182.30), pneumonia (PAs mean 208.77 vs. residents mean 271.01) and CHF (PAs mean 200.43 vs. residents mean 236.97) (22).

Discussion:

The Canadian Healthcare System must aim to satisfy requirements surrounding patient care from various stakeholders with differing values of importance. Implementing PAs as hospitalists is responsive to three main stakeholders; the patient, other healthcare providers (attending physicians), and the economist/taxpayer. We will examine how the implementation of PAs as hospitalists in Canada satisfies each participant.

The implementation of PAs from an economic standpoint considers cost-effectiveness, resource efficiency, and Length of Stay (LOS). The consensus viewed PAs as a cost-effective option for care with either a comparable or marginally lower cost (15)(16)(18). Furthermore, cost efficacy, as determined by Capstack et al., utilizing an expanded ratio of a PA-MD service proved more cost-effective care than that

of the traditional ratio model (17). One exception to these findings was the study by Iannuzzi et al., who demonstrated an increased cost of care by the PA group (20). However, the relevance to PAs is uncertain as this paper compares MLPs (an umbrella term used to encompass PAs and NPs) to residents and does not explicitly show a breakdown comparison to PAs directly. Resource efficiency and consultant use proved to be as efficient or more so in the PA groups inferring that cost for resources would be similar or decreased with the addition of the PA role to hospitalist teams (22)(17). LOS is another marker of efficiency and indirectly as a marker of cost efficiency. Again, a more substantial proportion of studies reviewed deduced no significant difference in LOS between the prior service and the implementation of PAs (15)(19)(22)(17). These findings allude to conserved efficiency in managing inpatient care as well as the fixed cost of care as it pertains to LOS. Increased LOS with the PA service provided in three articles more convincing evidence to relate the increase in LOS to implementation of PAs. The article by Iannuzzi et al. examined MLPs as compared to residents, and it is uncertain if these results can be directly related to PAs (16)(18)(20). Therefore, from an economic perspective, the implementation of PAs as hospitalists in Canada seems to be congruent with our resource-limited healthcare system.

Attending physicians and other healthcare team members want to ensure equivalent or improved patient safety, quality of care and healthcare provider satisfaction with the implementation of PAs as hospitalists. Patient safety as measured by mortality and readmission rate supports the implementation of PAs such that these measures did not statistically differ in papers examined (15)(16)(17)(20)(19)(18). One study examined demonstrated improved safety with the implementation of PAs as the mortality measured was lower in the PA model (21). There is one exception to these overwhelmingly positive findings; Van Rhee et al. discovered that the mortality rate was higher in the PA model for those patients with pneumonia (22). It is uncertain as to why this difference exists and may be due to additional factors not reported, such as a high disease severity index score.

Quality of care was examined differently in two articles via QALY and across eleven quality indicators. Both noted no significant difference in the quality of care delivered by the control model as compared to those models including PAs (19)(18). Drennan et al. examined healthcare provider satisfaction with the PA role in a qualitative analysis of semi-structured interviews. The PA role positively contributed to continuity, patient flow, patient safety, and increasing physician time for training and complex patients (14).

The continuity of care provided by PAs consistently acted to improve timely response to address ward issues, improved knowledge of inpatients status, and the familiarity with hospital-specific policy (14). In this study by Drennan et al., the PA role on the healthcare team was likened to the function of “oil” or the “glue” by a manager and consultant respectively (14). Consequently, this review reported findings positively supporting the utilization of PAs as hospitalists in Canada. PAs provide quality care, which helps to foster the necessary trusting relationship between PA and supervising physician and other members of the healthcare team.

The patient’s perspective and satisfaction with the implementation of PAs as hospitalists was reviewed in five articles, four of which were neutral or favourable for the implementation of PAs as hospitalists. The two articles that appear neutral demonstrated no significant difference in patient satisfaction, and neither study directly asked about patient satisfaction with PA care. Dhuper et al. examined patient satisfaction of the medical providers through a survey and compared evaluations of medical providers in the PA model as compared to the resident model, thereby combining MDs and PAs into the PA model (21). Whereas Roy et al. evaluated patient satisfaction of the MD medical providers and compared them during the Resident period and the PA period, without any PA specific questions (15). The two studies that both reported positive feedback regarding patient satisfaction with PA care

directly asked about the PAs. First, Timmermans, van Vught et al. dispensed surveys to patients and went as far as to administer pictures of the care provider(s) including MDs and PAs for reference. With this evaluation tool, patients evaluated their overall care more positively when PAs were their primary provider.

Additionally, the evaluations from wards with PAs as compared to those without, had higher overall evaluations (19). The second study by Drennan et al. gathered responses from semi-structured interviews with patients; they did not make comparisons to other providers. However, they asked direct questions regarding the perception of PAs (14). These responses to PAs were wholly positive with observational remarks on how PAs contributed to the care provided (14).

The one exception to these otherwise positive findings was the study performed by Iannuzzi et al. who determined that patient satisfaction was higher for the resident model as opposed to care by the MLP model (20). The findings demonstrated in this study may not be completely applicable in the context of this review as their focus was not specifically PAs and included NPs.

When asked about the care received from PAs, patients overwhelmingly provided positive feedback, further supporting the implementation of PAs as hospitalists in Canada.

Study Limitations and Further Directions:

We recognize several limitations that exist in this literature review. This review aimed to illustrate the role of Hospitalist PAs with an emphasis on Canadian relevance. We were not able to include any articles on Canadian PAs Hospitalists as they do not exist, yet. There is limited data published on the role of PAs in healthcare throughout the world and subsequently limited data on PAs functioning in Canada. Expanding the search to the global PA literature resulted in examining PAs functioning in the United States of America, the Netherlands, and England. The data and conclusions extrapolated for relevance and implications to Canada's healthcare system. Studies performed in different geographic locations and different health care institutions may not be as directly generalizable to Canada.

Examining articles from a wide variety of locations, we assume that the patient populations are identical among the articles examined when in fact comparator data such as disease severity indices, medical complexity and socioeconomic status were not evaluated. We were not able to consider the effect of political structure on the health of patients in different countries.

The studies reviewed were retrospective and not randomized control trials. The results are observational rather than interventional, and sample sizes in some of the examined studies varied with some being rather small. The smaller sample sizes impact the quality of the evidence provided.

Studies were facilitated in several institutions within a given region while others conducted at a single facility. The studies performed in a single institution may not be generalizable to other facilities and regions of the world, whereas those from numerous facilities may have more generalizability.

Future directions for PAs as hospitalists in Canada may include the development of post-graduate fellowship or residency programs in hospitalist medicine such as those described by Will et al. and Lackner et al. (23)(24). These two studies articulate the efficacy of creating a one-year fellowship for PAs with a focus on specializing in hospitalist medicine (23)(24). They both utilize a schedule that allows for a combination of didactic and clinical education with more time spent on clinical experience (23)(24). The Residency objective is to certify PA graduates in hospital medicine for a more seamless transition into the

workforce (23)(24). Implementation of a similar PA fellowship/residency program may prove to be effective in Canada recognizing that a majority of Canadian PAs currently work in the hospital setting and increasing numbers of students enrolled in PA programs are people without prior hospital experience.

This literature review elicits the potential for numerous future research opportunities and aims to urge the PA and healthcare community of Canada to conduct more research on the impact of PAs. Future research endeavours specific to this literature review may include quantitative as well as qualitative analysis on PAs functioning as hospitalists in the Canadian healthcare system.

From a quantitative perspective, studies utilizing hospital records to examine various elements of healthcare provided by PAs in Canada, including quality, efficiency, safety and cost of care are needed. Within the qualitative niche, surveys should be conducted to analyze perceptions of PAs as hospitalists in Canada's healthcare system from the perspective of patients or members of the healthcare team.

Ongoing analysis and research on Physician Assistant utilization would be instrumental in guiding both future Canadian healthcare policy and funding allocation within Canada's healthcare system. Exploring PA research may include evaluating specific interventions that PAs fulfill to improve quality and efficiency of care by recording daily tasks and duration of time spent on each.

Conclusion:

Current research in the Netherlands, England and the United States of America demonstrates that PAs as hospitalists are economically efficient, provide safe, quality patient care recognized by patients and other healthcare providers. As Canada's healthcare costs rise, politicians and taxpayers should further implement PAs as hospitalists. Globally and in Canada, Physician Assistants are a cost-effective solution to improving healthcare quality. Additional Research will demonstrate the impact PAs current make as hospitalists in Canada.

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