Physician Assistants as Hospitalists In Canada: A Literature Review

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Abstract:

Intro: 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.

Background: 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.

Methods: 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.

Results: 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.

Limitations: 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.

Discussion: 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.

Conclusion: 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.

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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 are largely working as hospitalists providing inpatient care (2). Given this increasing demand for PAs within our healthcare system, there has been relatively little Canadian research performed on the efficiency of the PA role on the medical team. Furthermore, there has been even less research conducted on PAs as hospitalists on a worldwide basis. This literature review aims to outline the impact of PAs as hospitalists in Canada's healthcare system, specifically examining cost efficiency, quality of care, patient safety and patient satisfaction.

Background:

Canada's Healthcare System is a publicly funded model with aspects of federal and provincial or territorial government who are responsible for the delivery of healthcare services (3). The publicly funded system is advantageous for obvious reasons. However, this model imposes limitations to the resources and services provided to Canadians due to financial constraints. Therefore, we must seek to discover innovative ways to improve access to care in cost-effective and efficient ways.

In addition to the limited fiscal resources, another factor affecting the quality of care Canadians receive is physician burnout. In 2016 a study was published examining healthcare provider stress and burnout within the general internal medicine specialty. They found that 67% of respondents reported high stress and 38% reported burnout (4). Later, in 2017, a systematic literature review examined the correlation between physician burnout and quality of care relating to safety and patient identified acceptability of care. Safety was gauged by examining papers that addressed medical errors in the context of physician burnout, and acceptability of care explored in papers discussing physician burnout and corresponding patient satisfaction. They determined that there is moderate evidence to support compromised patient safety in the context of physician burnout (5).

One solution to this ongoing dilemma is the introduction and expansion of Physician Assistant (PA) utilization across Canada, which currently exists in Manitoba, Ontario, New Brunswick and Alberta (6). PAs are healthcare professionals who work collaboratively in a trusting relationship with physicians to extend the medical services they provide (7). PAs are educated as medical generalists and use their skills in various clinical settings. The utilization of PAs improves patient access to care through task substitution (7). PAs practice of medicine includes gathering patient's histories, performing physical exams, ordering and interpreting diagnostic testing and performing procedures as well as developing and executing treatment plans. 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).

The PA role has existed in Canada's Healthcare System since 1984, first implemented in the Canadian Armed Forces. PAs began practicing in Manitoba's public health sectors under the title of Certified Clinical Assistants in 1999. In 2009, PAs separated from the Clinical Assistant

title and began practicing as a regulated profession under a unique Physician Assistant registry as Regulated Associate Members of the College of Physicians and Surgeons of Manitoba (CPSM) (1). Where the PA title may be new to patients and other healthcare professionals in Canada, it has formally existed in the United States of America since 1965. (Jones IW Can Fam Physician 2011:57:e83-8).

This is an exciting time for PAs in Manitoba as they are currently exploring the extent of their role within the healthcare team and adapt to the ever-changing patient population, advancing healthcare technology and demands on the healthcare system. PAs are currently practicing in different medical specialties in Manitoba including pediatrics, family medicine, emergency medicine, neurosurgery, general surgery, psychiatry, orthopedics and internal medicine (Ian Jones MPAS Program Director personal communication). Since the entrance of PAs into Canada's Healthcare System, there has been limited data regarding the effectiveness of their role the mentioned specialties.

Canadian Physicians traditionally manage the inpatient hospital care of their patients as part of their clinic practice. 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).

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).

PAs have joined physicians in the hospitalist movement, working in multidisciplinary teams to provide inpatient care (11)(12)(13). The role of a hospitalist PA may include but is not limited to providing continuity of care, timely inpatient evaluation, ordering of tests, communication to supervising physician and initiation of treatment (11). Additionally, depending on the nature of the inpatient service, the hospitalist PA may be trained to provide procedures specific to their service (14). In Manitoba, a majority of PAs work as hospitalists. According to the College of Physicians and Surgeons of Manitoba (CPSM), there are currently 116 PAs working in the province, of which 57% function as hospitalists in surgery, internal medicine or other inpatient medicine (2).

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. One article was included that did not explicitly outline a PA focus and instead refers to mid-level practitioners (MLPs), which may include PAs and NPs. This article was included to give more depth to the subject matter and provide a broader context. Qualitative, as well as quantitative research, included for this review allowing further exploration of patient and physician satisfaction with PAs as hospitalists. Papers were not excluded based on the location of research performed because there is limited literature available on PAs. The search became more refined when examining PAs functioning to fulfill a designated role such as hospitalist. Therefore, articles included different health care systems, including the Netherlands, England and the United States of America in the review.

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 indicated mixed results. Some reported that that cost was decreased with PAs on board, while others reported 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. Cost of care is derived from hospital charges the wage index from the cost associated with the labour portion. The direct cost of care provided by the hospital-resident model was US$617 lower 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 USD (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 rotatations 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 which included 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 were effective in 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 patients are asked about the care received from PAs, they overwhelmingly report positive feedback. Patient feedback further supports 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 encounters rising healthcare costs, politicians and taxpayers should consider the further implementation of PAs as hospitalists across the country as a solution to improving healthcare quality and cost-effectiveness. Furthermore, as further research is required on the PAs currently working as hospitalists in Canada.

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Appendix

Table 1. Summary of included studies

First Author (year)	Journal	Objective	Target Population & Number Studied	Methods	Measurements	Conclusion
Roy (2008)	Journal of Hospital Medicine	To compare the quality and efficiency of patient care provided by the PA/hospitalist model vs. traditional house staff	N = 5,194 in an urban academic medical center in northeastern United States	Retrospective cohort study	LOS, cost, inpatient mortality, ICU transfers, readmissions, patient satisfaction	PA/hospitalist service provides quality and efficiency of care that is comparable to that of traditional house staff
Singh (2011)	Journal of Hospital Medicine	To compare quality of inpatient care provided by the hospitalist/PA model vs. traditional resident model	N = 9,681 in an urban academic medical center in midwestern United States	Retrospective cohort study	LOS, cost, readmission rate, inpatient mortality	Hospitalist/PA model provides comparable care to that of the traditional resident model with a slightly longer LOS
Capstack (2016)	Journal of Clinical Outcomes Management	To compare clinical outcomes between the conventional PA model to the expanded PA model	N = 16,964 in a community hospital in Annapolis, Maryland	Retrospective cohort study	In-hospital mortality, cost, readmissions, LOS, consultant use	Expanded PA model had similar clinical outcomes, equal quality and safety of care at a lower cost of care
Timmermans, van den Brink (2017)	British Medical Journal Open	To compare cost-effectiveness of inpatient care provided by the MD model vs. PA/MD model	N = 2,292 in 34 hospital wards across the Netherlands including teaching and non-teaching	Cost-effectiveness analysis embedded within a multicenter, matched-controlled study	QALY, LOS, total costs per patient, cost per patient regarding LOS, personnel cost per patient for primary provider	Cost-effectiveness in the MD model and PA/MD model are comparable, the PA/MD model does

						not decrease overall healthcare costs
Drennan (2019)	British Medical Journal Open	To investigate factors supporting and inhibiting physician associate employment	N = 43 PAs, 77 other health professionals, 28 managers, 28 patients and relatives in six acute care hospitals in England	Mixed methods case study design, including: interviews, PA self reported work logs, observation of PAs, documentary analysis	Patient satisfaction, patient safety, patient flow, continuity, physician satisfaction	PAs may help to support healthcare demands, budgetary constraints, provider shortages as well as providing continuity however an inhibiting factor is the inability to prescribe and order diagnostic imaging
Iannuzzi (2015)	Journal of Graduate Medical Education	To compare inpatient care cost and LOS between the resident-hospitalist and MLP-hospitals models	N = 13,553 from 120 academic medical centers and 299 affiliate hospitals through Upstate Medical University Department of Medicine	Retrospective cohort study	LOS, cost, patient satisfaction, daily discharge rates, readmissions, mortality	Resident-hospitalist teams are economically more efficient than MLP-hospitalist teams with higher patient satisfaction
Timmermans, van Vught (2017)	PLOS ONE Journal	To compare LOS, quality and safety of care and patient experience between the MD model and PA/MD model	N = 2,307 in 34 hospital wards in the Netherlands	Multicenter matched-controlled study	LOS, quality and safety (measured by 11 indicators) and patient experience	No difference in LOS, quality and safety between MD and PA/MD model, better patient experience in

						PA/MD model
Dhuper (2009)	American Journal of Medical Quality	To compare patient outcomes in the medical resident model vs PA-hospitalist model	N = 10,966 in a community hospital in New York	Retrospective and prospective cohort study	Mortality, adverse events, readmissions, patient satisfaction, documentation	Quality of care was equivalent between the medical resident and PA-hospitalist model, mortality was significantly lower during the PA-hospitalist period
Van Rhee (2002)	JAAPA	To compare resource use on an inpatient ward between PAs and resident teaching services	On an internal medicine service in midwestern United States teaching hospital	Mixed model analysis	LOS, mortality, radiology imaging and laboratory testing	PAs resource use was equivalent or less than that of residents which can be extrapolated to suggest PAs are cost-effective and efficient

PA = Physician Assistant, LOS = Length of Stay, ICU = Intensive Care Unit, QALY = Quality-Adjusted Life Years, MLP = Midlevel Practitioner