

# The impact on patient flow after the integration of nurse practitioners and physician assistants in 6 Ontario emergency departments

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## ABSTRACT

**Objective:** We sought to assess the impact of the integration of the new roles of primary health care nurse practitioners (NPs) and physician assistants (PAs) on patient flow, wait times and proportions of patients who left without being seen in 6 Ontario emergency departments (EDs).

**Methods:** We performed a retrospective review of health records data on patient arrival time, time of initial assessment by a physician, time of discharge from the ED and discharge status.

**Results:** Whether a PA or NP was directly involved in the care of patients or indirectly involved by being on duty, the wait times, lengths of stay and proportion of patients who left without being seen were significantly reduced. When a PA or NP were directly involved in patients' care, patients were 1.6 (95% confidence interval [CI] 1.3–2.1,  $p < 0.05$ ) and 2.1 (95% CI 1.6–2.8,  $p < 0.05$ ) times more likely to be seen within the wait time benchmarks, respectively. Lengths of stay were 30.3% (95% CI 21.6%–39.0%,  $p < 0.01$ ) and 48.8% (95% CI 35.0%–62.7%,  $p < 0.01$ ) lower when PAs and NPs, respectively, were involved. When PAs and NPs were not on duty, the proportion of patients who left without being seen were 44% (95% CI 31%–63%,  $p < 0.01$ ) and 71% (95% CI 53%–96%,  $p < 0.05$ ), respectively.

**Conclusion:** The addition of PAs or NPs to the ED team can improve patient flow in medium-sized community hospital EDs. Given the ongoing shortage of physicians, use of alternative health care providers should be considered. These results require validation, as their generalizability to other locations or types of EDs is not known.

**Keywords:** emergency department, physician assistant, nurse practitioner, wait times, length of stay

## RÉSUMÉ

**Objectif :** Nous avons cherché à évaluer l'impact de l'intégration des nouveaux rôles des infirmières praticiennes (IP) et des adjoints aux médecins (AM) en contexte de soins primaires sur le cheminement des patients, les temps d'attente et le pourcentage de patients qui ont quitté l'urgence sans avoir été vus par un médecin dans 6 services d'urgence en Ontario.

**Méthodes :** Nous avons procédé à un examen rétrospectif de données dans les dossiers de santé des patients sur l'heure d'arrivée à l'urgence, l'heure de l'évaluation initiale par un médecin, l'heure du congé et l'état à la sortie de l'urgence.

**Résultats :** Que les AM ou les IP aient participé directement aux soins du patient ou indirectement, en étant de service, les temps d'attente, la durée du séjour et le pourcentage des patients qui ont quitté l'urgence sans avoir été vus par un médecin ont été considérablement réduits. Quand les AM ou les IP participaient directement aux soins des patients, ces derniers étaient respectivement 1,6 fois (intervalle de confiance [IC] à 95 % de 1,3 à 2,1,  $p < 0,05$ ) et 2,1 fois (IC à 95 % de 1,6 à 2,8,  $p < 0,05$ ) plus susceptibles d'être vus par un médecin dans les délais fixés pour les temps d'attente. La durée de séjour était respectivement 30,3 % (IC à 95 % de 21,6 à 39,0 %,  $p < 0,01$ ) et 48,8 % (IC à 95 %, 35,0 à 62,7 %,  $p < 0,01$ ) plus faible lorsque les AM et les IP participaient aux soins. Lorsque les AM ou les IP n'étaient pas de service, le pourcentage de patients qui ont quitté l'urgence sans avoir été vus par un médecin était respectivement de 44 % (IC à 95 % de 31 à 63 %,  $p < 0,01$ ) et de 71 % (IC à 95 % de 53 à 96 %,  $p < 0,05$ ).

**Conclusion :** L'ajout d'AM et d'IP à l'équipe du service d'urgence peut améliorer le cheminement des patients dans les urgences des hôpitaux communautaires de taille moyenne. Compte tenu de la pénurie actuelle de médecins, le recours à d'autres professionnels de la santé devrait être envisagé. Ces constatations doivent être validées, car leur généralisabilité à d'autres régions ou types de services d'urgence n'est pas connue.

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**INTRODUCTION**

Wait times for health care in Ontario have become a major concern and the focus of numerous provincial initiatives. Emergency department (ED) wait times are a focal point for these initiatives. From 2003 to 2004, there were 4 364 000 patient visits to Ontario EDs.<sup>1</sup> Of these, approximately one-half involved a wait of less than 1 hour to be seen by a physician. For 10% of patients, this wait was less than 10 minutes; another 10% waited 165 minutes or longer.<sup>1</sup> Time to physician varied by assigned acuity level. Patients who were triaged to level I, the most acute Canadian Emergency Department Triage and Acuity Scale (CTAS) score, had a median wait of 5 minutes. Patients who were triaged to levels II, III, IV and V had median wait times of approximately 30, 60, 50 and 40 minutes, respectively.<sup>1</sup> Many of the more acutely ill patients (CTAS I, II and III) are not seen within the operating objectives (benchmarks) of the CTAS.<sup>2</sup>

Delays in assessment and care may have negative effects on patient care and outcomes. Long wait times could potentially result in worse patient outcomes, greater patient suffering, patient dissatisfaction, more difficulty retaining and recruiting staff, a higher risk of infectious disease outbreaks and an increased risk of medical errors.<sup>3</sup> The risk of violence directed toward hospital staff and physicians may also be higher in environments with significant delays. Moreover, in a negative work environment, ED staff may be less productive and less able to effectively teach or perform research.<sup>3</sup>

Prolonged wait times, often exacerbated at peak hours, may lead to patients leaving the ED before being assessed by a physician. In Ontario, in 2003 and 2004, 136 000 patients (3.1%) visiting the ED left without being seen (LWBS).<sup>1</sup> As numbers of patients in the waiting room increase, so too does the proportion of patients who leave without being seen by a physician.<sup>4</sup> Although ambulatory patients do not directly contribute to overcrowding, waiting room numbers are considered an integral variable when considering overcrowding.<sup>5</sup> Many of those who leave have no access to primary health care or have conditions that require immediate attention or follow-up care.

High LWBS rates and lengthy wait times are a result of a variety of factors, one of which is a shortage of physicians and nurses.<sup>6</sup> As part of the Ontario government's Emergency Department Action Plan, the roles of primary health care nurse practitioners (NPs) and physician assistants (PAs) were introduced in 6 medium-sized

community hospital EDs. The purpose of this study was to examine the impact of PAs and NPs in EDs, focusing on patient wait times, lengths of stay (LOS) and LWBS rates. We hypothesized that the addition of these new roles would reduce wait times, LOS and LWBS rates.

**METHODS**

Data for this study were collected as part of a comprehensive project to evaluate the integration of the new roles within EDs. This evaluation included an analysis of administrative changes, team effectiveness surveys, team development sessions with focus groups, and health records data pertaining to patient care and flow. The health record data component is the focus of this analysis.

**Overview of the project**

In 2006, the Ontario government announced the launch of HealthForceOntario (HFO), a health human resources strategy. In its new roles component, HFO supports interprofessional care by introducing new personnel to collaborative health care teams to help reduce wait times for high-demand services, such as emergency care, surgical services and cancer care. Subsequently, 6 interested community hospitals with ED volumes varying from 23 770 to 66 136 patient visits per year (in 2005 and 2006), were selected by the Ministry of Health and Long-Term Care to expand their ED team to include PAs, primary health care NPs and acute care nurse specialists (AC NS). As only one AC NS was recruited, the role was excluded from analysis in this study. A summary of patient volumes and personnel in each of the 6 study sites is provided in Table 1. Although 2 sites had occasional learners on elective rotations, none of the sites were teaching hospitals with

**Table 1. Emergency department volume, number of full-time equivalent physicians and presence of new personnel, by hospital**

Hospital	ED volume (approx.)	Full-time equivalent physicians	PA	NP	AC NS
A	24 750	7	Yes	Yes	No
B	28 000	4	Yes	Yes	No
C	37 500	7	Yes	No	No
D	38 000	10	Yes	Yes	No
E	44 250	11.5	Yes	Yes	Yes
F	60 500	12	No	Yes	No

AC NS = acute care nurse specialist; ED = emergency department; NP = nurse practitioner; PA = physician assistant.

regularly scheduled trainees. The new staff members were expected to function as additions to existing physician staff, not replacements. They were to work shifts covering the predetermined busiest periods for each ED. For all sites, this resulted in extra coverage between 10 am and 10 pm. Since some sites only had one worker, it was not possible to ensure coverage 7 days per week. As a result, each site had periods of time with no extra coverage that could act as control periods for comparative measurements related to this project.

Physician assistants were introduced to Ontario through this project as an unregulated provider,<sup>7</sup> and work without medical directives under the supervision of a registered physician who was responsible for all patient care. Unlike NPs, PAs are precluded from taking independent medical actions. The specific duties of each PA varied by site, but, in general, PAs saw patients with a wider range of acuity levels than NPs. Primary health care NPs are regulated health professionals registered with the College of Nurses of Ontario (CNO). As per CNO's directives, NPs practise autonomously for CTAS-IV and -V patients and work in conjunction with a physician to see CTAS-III or higher acuity patients.<sup>8</sup> Physicians interacted with both NPs and PAs for interpreting any diagnostic imaging and for the management of CTAS-III or higher acuity patients. All members of the new staff were expected to comply with ED policies and guidelines. In some centres with higher volumes, an NP and PA occasionally worked simultaneously, although this was uncommon.

At all sites, integration of the new workers occurred in conjunction with a full-day session that discussed the roles and permitted activities of the NPs and PAs, and involved team-building discussions and small-group sessions to identify local problems and possible solutions.

### **Data collection**

Each participating hospital provided the required data from their administrative health records and the standardized data that is regularly submitted according to provincial reporting requirements. These reporting requirements and the associated collection protocols were not modified during the study. Data collection occurred during 2 periods: Nov. 13, 2006, to Dec. 3, 2006 (baseline) and Jun. 11, 2007, to Jun. 29, 2007 (6-mo postimplementation follow-up). The data collection throughout these 2 periods took place during a 14-day interval; some hospitals started and ended a few days sooner than others.

The following information was obtained for every ED patient during the study periods for each of the 6 sites:

- date of patient visit
- time of triage
- type of physician involved in patient treatment (emergency physician, family physician, etc.)
- type of enhanced provider (PA, NP) involved in patient treatment
- CTAS score
- wait time (triage to initial assessment by physician)
- length of stay in ED (triage to disposition)
- discharge disposition

Personal identifiers, such as name and age, were not included in the spreadsheet to protect the confidentiality of the patients.

Health records data were analyzed to assess both the direct and indirect impact of the presence of the NP or PA. This was done by measuring time intervals for patients treated directly by an NP or PA, as well as by comparing time data between patients who were and were not cared for while an NP or PA was on duty. The impact of the new providers on wait times, LOS and proportion of LWBS between baseline and follow-up was measured using multivariate analysis (logistic regression or analysis of covariance, depending on whether the variable was dichotomous or continuous, respectively) with adjustment for hospital, time of patient visit and acuity level. The analyses were performed using SPSS 15.0 (SPSS Inc.).

We based the determination of whether a provider was involved in patient care on the health records. After adjustment, wait times and LOS were compared between patients with a PA and/or NP directly involved in their care and patients treated without additional workers present in the department.

Similarly, patients' wait times and LOS were analyzed for the possible indirect effect of the PA or NP being on duty, but not directly involved in those patients' care. Wait times and LOS of patients at the time of registration were compared when the PA or NP was on duty versus when a PA or NP was not on duty. Patients who had a PA or an NP involved in their care were excluded to isolate those who would have only indirectly benefited from the provider being on duty.

For wait times (i.e., triage to initial assessment by a physician), we analyzed the data according to whether a patient's wait times met the acuity-related benchmark set by the Canadian Association of Emergency Physicians, National Emergency Nurses Affiliation and the Association des médecins d'urgence du Québec.<sup>2</sup> The

ethics review boards of all involved hospitals approved the release of the data for the purposes of this study.

**RESULTS**

Data on 19 592 patient visits were collected during the 2 periods of data collection. Of those, 9585 (48.9%) visits took place during the baseline period and 10 007 (51.1%) occurred during the follow-up period. The distribution of visits by level of acuity is outlined in Table 2. The PAs were on duty for 1076 visits and were directly involved in patient care for 396 of those visits.

**Table 2. Distribution of patient visits, by acuity level**

CTAS level	No. (%) of visits	
I	76	(0.4)
II	2 736	(14.0)
III	7 893	(40.3)
IV	6 810	(34.8)
V	1 205	(6.2)
Missing	872	(4.5)
Total	19 592	(100.0)

CTAS = Canadian Emergency Department Triage and Acuity Scale.

**Table 3. Proportion of patient visits for which wait time benchmarks were met, by acuity and physician assistant involvement**

CTAS level	PA involvement, %		Difference, %
	No	Yes	
II	12.2	18.2	6.0
III	13.5	12.1	-1.4
IV	29.8	38.5	8.6
V	50.2	72.2	22.0
Total	21.4	28.3	6.8

CTAS = Canadian Emergency Department Triage and Acuity Scale; PA = physician assistant.

**Table 4. Proportion of patient visits for which wait time benchmarks were met, by acuity and nurse practitioner involvement**

CTAS level	NP involvement, %		Difference, %
	No	Yes	
III	17.7	26.7	8.9
IV	33.1	53.8	20.7
V	64.9	91.7	26.8
Total	25.0	52.6	27.6

CTAS = Canadian Emergency Department Triage and Acuity Scale; NP = nurse practitioner.

The NPs were on duty for 1744 visits and were directly involved in patient care for 298 of those visits. Table 3 and Table 4 depict the absolute changes in the proportion of patients who were seen within the benchmarks with PA and NP involvement, respectively. After adjustment for hospitals, time of day and acuity, when a PA was involved in patient care the odds of the patient being seen within the benchmark wait time was 1.6 times greater than when the PA was not involved (95% confidence interval [CI] 1.3–2.1,  $p < 0.05$ ). When the NP was involved, the odds were 2.1 times greater (95% CI 1.6–2.8,  $p < 0.05$ ).

A similar analysis was performed regarding the effect of an NP or PA being on duty, but not being directly involved with the patients' care, and the odds ratios were also positive. Table 5 and Table 6 show the absolute improvements in the proportion of patients who were seen within the benchmarks during these scenarios. After adjustment, when a PA was on duty, the odds of a patient being assessed within the wait time benchmark were 1.9 times higher than when a PA was not on duty (95% CI 1.6–2.4,  $p < 0.01$ ). When an NP was working, the odds were 1.5 times higher (95% CI 1.3–1.8,  $p < 0.01$ ).

**Table 5. Proportion of patient visits for which wait time benchmarks were met, by acuity and on-duty status of physician assistant**

CTAS level	PA on duty, %		Difference, %
	No	Yes	
II	11.8	13.5	1.7
III	11.6	12.7	1.1
IV	26.8	34.8	8.0
V	57.3	60.3	3.0
Total	18.5	23.8	5.3

CTAS = Canadian Emergency Department Triage and Acuity Scale; PA = physician assistant.

**Table 6. Proportion of patient visits for which wait time benchmarks were met, by acuity and on-duty status of nurse practitioner**

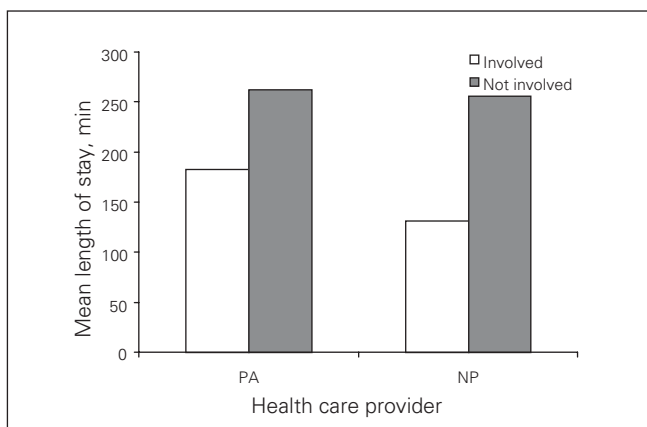
CTAS level	NP on duty, %		Difference, %
	No	Yes	
II	13.6	12.3	-1.3
III	15.5	15.1	-0.4
IV	30.3	35.1	4.8
V	64.2	70.7	6.5
Total	22.0	25.3	3.3

CTAS = Canadian Emergency Department Triage and Acuity Scale; NP = nurse practitioner.

For LOS, in addition to adjusting for hospital, time of day and acuity, we also compared the data between patients with a PA or NP directly involved in their care and patients seen by physicians when an NP or PA was not present (Fig. 1). When a PA was involved in patient care, the length of stay in the ED was 30.3% shorter than when a PA was not present (95% CI 21.6%–39%,  $p < 0.01$ ). The mean LOS changed from 262.4 minutes to 182.9 minutes when a PA was involved. When an NP was involved, the mean LOS was 48.8% shorter (95% CI 35%–62.7%,  $p < 0.01$ ), dropping from 256.3 minutes to 131.1 minutes.

Although not as dramatic an effect, having a PA or NP on duty also had a statistically significant effect (PA: 95% CI 3.6%–14.1%,  $p < 0.01$ ; NP: 95% CI 4.6%–13.9%,  $p < 0.01$ ) on the mean LOS of patients (Fig. 2). For PAs, the mean decreased from 304.2 minutes to 277.2 (8.9% shorter, 95% CI 3.6%–14.1%,  $p < 0.01$ ), and, for NPs, the mean dropped from 257.7 minutes to 233.81 (9.3% shorter, 95% CI 4.6%–13.9%,  $p < 0.01$ ) when they were on duty.

When a PA or an NP was on duty, the proportion of patients who left without being seen was significantly reduced. The absolute improvements, not controlling for hospital or acuity, were 24.6% for PAs (the LWBS rate decreased from 6.5% to 4.9%) and 17.6% for NPs (the LWBS rate dropped from 5.1% to 4.2%). When a PA was on duty, controlling for hospital, time of day and acuity, the likelihood that a patient left without being seen was less than half than when a PA was not on duty (44%, 95% CI 31%–63%,  $p < 0.01$ ). With an NP on duty there was a 29% reduction in LWBS rates (95% CI 4%–47%,  $p < 0.05$ ) compared with those when an NP was not on duty.



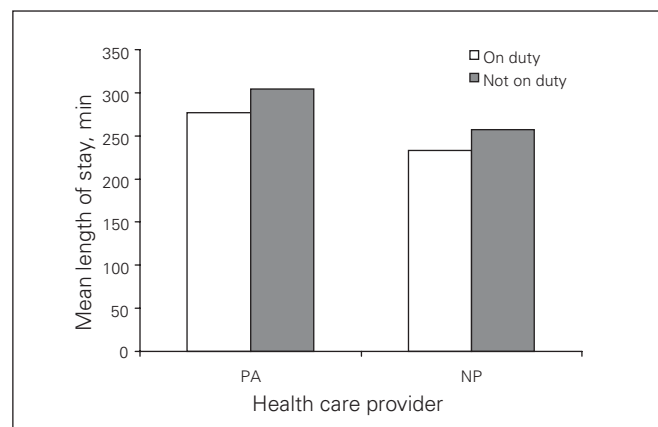
**Fig. 1.** Mean length of stay in patients with nurse practitioner (NP) or physician assistant (PA) involved versus not involved, Ontario emergency departments, 2007.

## DISCUSSION

In what we believe to be the first Canadian study to analyze the impact of NPs and PAs on patient flow in the ED, the integration of these health care roles was associated with reductions in wait times, LOS in the ED and proportions of patients who left without being seen. Past studies in British, US, Australian and Spanish settings have found similar positive results.<sup>9–14</sup> Additionally, a recent Canadian study found that patients are very satisfied with the care they receive from providers other than physicians.<sup>15</sup> It would therefore seem that integrating alternate health care providers into EDs in Canada is a viable option. All but the latter study took place in health care systems outside Canada, and the NPs or PAs were not fully integrated into the ED team but rather in a fast-track unit or working independently of the ED team.

We saw a direct effect on patient flow, presumably because the addition of primary health care providers increases the number of workers able to assess and treat patients. Flow of patients can thus be improved within the ED without establishing a separate fast-track area. An additional indirect effect is likely that physicians can focus on the more ill and injured, knowing that those of lesser acuity will, at least initially, be seen by the PA or NP. As discussed earlier, in the Canadian context there is a shortage of physicians and other staff in EDs and there is regular ED overcrowding.<sup>3</sup> Staff shortages can lead to delays in patient care, which in turn may lead to a lower quality of care, greater morbidity and mortality, and violence aimed at hospital staff.<sup>3,16</sup>

Various initiatives have been developed to meet the increasing demands on health care systems and organizations to provide more timely services with finite



**Fig. 2.** Mean length of stay for patient visits with a physician assistant (PA) or nurse practitioner (NP) on duty versus not on duty, Ontario emergency departments, 2007.



human and financial resources. These include human resource mix initiatives (such as increasing support staff and developing rapid response teams) and human resource supply initiatives (such as increasing educational seats and increasing recruitment). New ways of delivering care are required, and the expansion of interprofessional teams may be one such approach. Our findings support the integration of NPs and PAs as primary health care providers into Canadian EDs. The reductions we found in wait times and LOS suggest that the presence of the new roles can help to improve the efficiency of ED patient care. However, as more patients are assessed, it may well be that such an increase in front-end efficiency may overwhelm other areas already working at peak capacity. For example, nurses and laboratory staff might not be able to keep up with the greater number of orders written up during busy periods. The ability to see increasing numbers could rapidly be offset if the system does not solve the current ED exit block for admitted patients. At many sites where support services, such as diagnostic imaging, provide single-team coverage, such services may not be able to meet the increased demand that would be seen with more primary providers. Initiatives involving NPs and/or PAs require not only buy-in by all ED team members, but system planning and anticipation to succeed. Careful analysis of the impact of additional providers will be needed to ensure that necessary modifications are made if this new model is adopted.

An equally if not more important question to ask is whether the quality of patient care will suffer in the effort to expedite that care. This is a complex question to answer, and was outside the scope of this study. An article by the Society for Academic Emergency Medicine Emergency Department Crowding Task Force discussed the negative impact crowding has on ED patient care and suggests that improving throughput would improve outcomes.<sup>17</sup> Studies have found that NPs are able to practise as well as residents.<sup>18</sup> Moreover, many studies have found that high levels of patient satisfaction are achieved with these health care workers.<sup>19,20</sup> Given the multiple variables involved, it may be impossible to objectively prove that patient care is either better or worse specifically because of PAs or NPs.

### Limitations

The small and retrospective nature of this study carries many potential limitations. The data collection was limited to a 14-day period for each of the baseline and

follow-up periods. Such a study is unable to account for seasonal variation or secular trends including bed availability, hospital administrative changes that might have occurred or varying staffing levels due to recruitment. All 6 sites were medium-sized community hospitals; therefore generalization of these results to other hospital sizes may not be valid. Further studies are required to assess the impact on patient flow on a larger scale and in different provinces.

### CONCLUSION

The addition of PAs or NPs to the ED team can improve patient flow in medium-sized community hospital EDs. Given the ongoing shortage of physicians, use of alternative health care providers should be considered. These results require validation, as their generalizability to other locations or types of EDs is not known.

**Competing interests:** The authors do not have any financial or other conflicts of interest related to this submission. Dr. Tepper is the Assistant Deputy Minister for the Ministry of Health and Long-term Care in the Health Human Resources Strategy Division. A branch of the Ministry under Dr. Tepper's division initiated the project.

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