

**Community Paramedicine for Long-Term Care Patients;
Examining Clinical Conditions Manageable by Paramedics,
Avoiding Emergency Department Visits**

by

Shannon Leduc BClinicalPrac(Paramedic), ACP

Thesis submitted to the University of Ottawa
in partial fulfilment of the requirements for the
M.Sc. degree in Epidemiology

School of Epidemiology and Public Health
Faculty of Medicine
University of Ottawa

© Shannon Leduc, Ottawa, Canada, 2021

ABSTRACT

Background: Long-term care (LTC) patients have high needs for care and are at increased risk when transferred to the emergency department (ED).

Objective: This thesis evaluates how paramedics can provide enhanced care to LTC patients, avoiding ED visits.

Methods: We completed a systematic review, a national survey, and a health records review. We systematically reviewed existing programs in LTCs seeking to avoid ED visits, assessed program needs through surveying paramedic services, and determined what conditions could be treated by paramedics at the LTC, with a health records review.

Results: We found programs reducing ED visits and hospitalizations from LTC patients. Few paramedic services have such community paramedic programs; most would welcome them. Community paramedics could treat 11% of LTC patients on-site, avoiding an ED visit, within current emergency paramedics medical directives.

Conclusion: Community paramedics can reduce ED visits and hospitalizations from LTC patients. However, there are barriers to program implementation.

Abstract: 150

ACKNOWLEDGEMENTS

I have been incredibly fortunate to have a dedicated team of people supporting me through this research.

First, I would like to thank my supervisor, Dr. Christian Vaillancourt. While the debt of gratitude I owe you is enough to fill its own manuscript, I will summarize by thanking you for your kindness, expertise, mentorship and unwavering support.

I am also grateful to my advisory committee, Dr. George Wells, Dr. Venkatesh Thiruganasambandamoorthy and Deputy Chief Peter Kelly. I have benefited greatly from your insights, feedback and guidance. Peter, thank you also for seeing the value in this education.

I would like to thank several people who have contributed to this work. Lindsay Sikora whose ninja librarian skills guided our search strategy, Micah Reitschelin who helped find our prehospital cases and Zach Cantor who is somehow still speaking to me after screening over 11,000 abstracts. I very much appreciate the support and advice I've received from the Emergency Medicine Research Fellows Group. I would also like to thank Manya Charette, Anne Gray and Angela Marcantonio for facilitating various administrative pieces.

I am greatly appreciative of the many outstanding mentors I have had throughout my paramedic career, and particularly Frank McGregor and Penny Price who have provided me with constant encouragement and support throughout this thesis. Thank you, Penny, for your wisdom and

invaluable advice and thank you Frank for your perspective and for reminding me that everything can be solved with a bigger boat.

I am extremely grateful to my family, my husband Rob and adventurous boys Nicholas, Matthew and Alexander. I will forever be grateful for your love and support, patience and of course, tolerance of takeout. Special thanks to Lori and Tom, your weekly delivery of a homemade meal made it easier to endure writing this thesis while being so heavily involved in COVID management. I couldn't ask for better friends.

AUTHOR CONTRIBUTIONS AND REQUIRED ETHICS APPROVALS

Manuscript #1 “The Safety and Efficacy of On-site Paramedic and Allied Health Treatment Interventions Targeting the Reduction of Emergency Department Visits by Long-term Care Patients: Systematic Review Protocol”

Authors Contributions: SL and CV contributed to the concept and study design and drafting the manuscript. PK, VT and GW contributed to the revision of the study design and to critically revising the manuscript. All authors have read and approved the final manuscript.

Required Approval: None

Manuscript #2 “The Safety and Effectiveness of On-site Paramedic and Allied Health Treatment Interventions Targeting the Reduction of Emergency Department Visits by Long-term Care Patients: Systematic Review”

Authors Contributions: SL and CV contributed to the study concept and SL, CV, VT contributed to the study design. SL and ZC screened studies for inclusion and completed data extraction. SL drafted the manuscript and CV, PK, VT, ZC and GW critically revised the manuscript.

Required Approval: None

Manuscript #3 “Alternative Care Models for Paramedic Patients From Long-term Care Centers; a National Survey of Canadian Paramedic Services”

Authors Contributions: SL, CV and PK contributed to study design. SL and PK contributed to survey design and piloting. SL drafted the manuscript and PK, CV, VT and GW critically revised it.

Required Approval: We received a waiver of ethics review on February 8, 2018 following application to the Ottawa Health Science Network Research Ethics Board (OHSN-REB)

Manuscript #4 “The Hospital Care and Outcomes of Long-term Care Patients Treated by Paramedics During an Emergency Call: Exploring the Potential Impact of Community Paramedicine”

Authors Contributions: SL, CV, PK, VT and GW contributed to the conception and study and SL, GW and CV contributed to study design. MR assisted with designing search strategies to find prehospital records. SL conducted statistical analysis and SL, GW and CV contributed to data interpretation. SL drafted the manuscript which was critically revised by all authors.

Required Approval: We received ethics approval on March 8, 2018 following review by the Ottawa Health Science Network Research Ethics Board (OHSN-REB)

TABLE OF CONTENTS

ABSTRACT	ii
ACKNOWLEDGEMENTS	iii
AUTHOR CONTRIBUTIONS AND REQUIRED ETHICS APPROVALS	v
TABLE OF CONTENTS	vii
LIST OF TABLES	ix
LIST OF FIGURES	x
GLOSSARY	xi
Chapter 1 - INTRODUCTION	1
1.1 Objectives	1
1.2 Thesis Overview	2
Chapter 2 - BACKGROUND	4
2.1 Healthcare Use and the Ageing Population	4
2.2 Risk of Harm of ED Transfers	5
2.3 Healthcare System Pressures	5
2.4 Alternative Models of Prehospital Care	6
2.5 Community Paramedicine	6
2.6 References for the Background Section	8
Chapter 3 – SYSTEMATIC REVIEW OF ALLIED HEALTH INTERVENTIONS TO TREAT LONG-TERM CARE PATIENTS ON-SITE	13
3.1 The Safety and Efficacy of On-Site Paramedic and Allied Health Treatment Interventions Targeting the Reduction of Emergency Department Visits by Long-Term Care Patients: Systematic Review Protocol	15
Abstract	17
Background	19
Methods	20
References	31
Appendix 1 - Search Strategy Medline	35
3.2 The Safety and Effectiveness of On-site Paramedic and Allied Health Treatment Interventions Targeting the Reduction of Emergency Department Visits by Long-term Care Patients: Systematic Review	36
Abstract	38
Introduction	40
Methods	41
Results	43
Discussion	52
Conclusion	54
References	56

Appendix – Medline Search Strategy	82
Chapter 4 – NATIONAL SURVEY OF CANADIAN PARAMEDIC SERVICES	83
4.1 Alternative Care Models for Paramedic Patients From Long-term Care Centers; a National Survey of Canadian Paramedic Services	84
Abstract	86
Introduction	88
Methods	89
Results	91
Discussion	94
Conclusions	96
References.....	98
Chapter 5 HEALTH RECORDS REVIEW OF LONG-TERM CARE PATIENTS TREATED BY PARAMEDICS.....	108
5.1 The Hospital Care and Outcomes of Long-term Care Patients Treated by Paramedics During an Emergency Call: Exploring the Potential Impact of Community Paramedicine	109
Abstract	111
Introduction	113
Methods	114
Results	118
Discussion.....	122
Conclusion	125
References.....	126
Chapter 6. DISCUSSION.....	147
6.1 Research Summary	147
6.2 Key Study Findings	148
6.3 Importance of Findings / Implications	149
6.4 Strengths and Limitations	150
6.5 Future Research.....	150
6.6 Conclusion	151
Appendices.....	152
Appendix 1. Waiver of Ethics Review – Survey.....	152
Appendix 2. Letter to Paramedic Chiefs Introducing Survey	153
Appendix 3. Direct Email to Introduce Survey	156
Appendix 4. Survey of Canadian Paramedic Services.....	160
Appendix 5. Ethical Approval - Health Records Review	174
Appendix 6. Data Collection - Tool Health Records Review (Prehospital)	175
Appendix 7. Data Collection Tool - Health Record Review (In Hospital).....	179
Appendix 8. Sample Size Calculation - Health Records Review	182

LIST OF TABLES

Table 3-1 Characteristics of Included Studies.....	63
Table 3-2 Risk of Bias for Randomized Control Trials as Assessed by the Cochrane Risk of Bias Tool	64
Table 3-3 Risk of Bias for Observational Studies as Assessed by the Newcastle-Ottawa Scale.....	65
Table 3-4 Supplemental Main Findings.....	66
Table 4-1 Population Represented by Respondents.....	101
Table 4-2 Demographics of Responding Services.....	102
Table 4-3 Alternative Models of Care.....	103
Table 4-4 Programs in Long-Term Care Centers to Treat Patients On-Site and Reduce Transfers to the ED.....	105
Table 4-5 The Impact and Feasibility of Implementing Treat On-Site Programs in LTC.....	106
Table 4-6 Barriers to Implementing Programs to Treat Patients On-Site in LTC.....	107
Table 5-1 Patient and LTC Intervention Characteristics.....	133
Table 5-2 Paramedic Response Characteristics for the 381 Long-Term Care Patients.....	136
Table 5-3 Emergency Department Management and Outcomes of 381 Long-Term Care Patients.....	138
Table 5-4 Comparisons Between Groups with Standardized Differences.....	141

LIST OF FIGURES

Figure 3-1 Study Flow Diagram.....	80
Figure 3-2 Summary of INTERACT Tools.....	81
Figure 4-1 Program Priority Ranking.....	100
Figure 5-1 Categorization of Patients.....	131
Figure 5-2 Study Flow.....	132

GLOSSARY

ALSPCS - Advanced life support patient care standards

ASA – Acetylsalicylic acid

CADTH – Canadian Agency for Drugs and Technologies in Health

CHF - congestive heart failure

CINAHL – Cumulative Index to Nursing and Allied Health Literature

COPD - chronic obstructive pulmonary disease

CP - community paramedic

CSSP – Canadian Safety and Security Program

CTAS – Canadian Triage and Acuity Scores

ECP - Extended care paramedic

ED – emergency department

EMBASE – Excerpta Medica Database

ePCR - electronic paramedic call report

GRADE – Grading of Recommendations Assessment Development and Evaluation

INTERACT – Interventions to reduce acute care transfers

IQR – Interquartile range

LTC - Long-term care

OCACC – Ottawa Central Ambulance Communications Centre

OHDW – Ottawa Hospital Data Warehouse

OR's – odds ratios

PAC - Paramedic Association of Canada

PCC - Paramedic Chiefs of Canada

PRISMA - Preferred Reporting Items for Systematic Review and Meta-Analysis

PRISMA-P – Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols

QoL – quality of life

SBAR – Situation, background, assessment, recommendations

SD – Standard deviation

SVT - supraventricular tachycardia

Chapter 1 - INTRODUCTION

This chapter provides the objectives of the thesis and an overview of the thesis organization.

1.1 Objectives

The primary objective of this thesis was to evaluate what role paramedics could play in providing enhanced care to residents of long-term care (LTC) facilities, avoiding transportation to the emergency department (ED).

Specifically, we sought to:

1. Determine what strategies have been implemented in LTC facilities by any allied health professionals to reduce the unscheduled transportation of patients to the ED as well as what the safety and efficacy of those strategies have been;
2. Determine what programs exist across Canada where paramedics are providing alternative models of care to patients living in LTC, what the outcomes of those programs are on a patient and health care system level, what the needs are for future programs, and what barriers exist to implementing future programs; and
3. Determine which medical and traumatic conditions occurring in patients living in LTC facilities could be treated by paramedics on site, preventing unscheduled transport to the ED.

1.2 Thesis Overview

The following is an overview of each chapter:

Chapter Two - Background

This chapter describes the ageing population, their increasing healthcare needs, and the risk LTC patients face when being transferred to the ED for care. It describes alternative models of care that are being explored to address the subsequent pressures on the healthcare system resulting from ED transfers from LTC, and describes community paramedicine.

Chapter Three – Systematic Review of Allied Health Interventions to Treat Long-Term Care Patients On-site

This chapter describes the existing literature on programs by allied health providers in LTC centers, such as nurses and paramedics, that target the reduction of ED visits. We conducted a systematic review to identify existing programs and evaluate their effectiveness and safety. We include both published protocol and systematic review manuscripts.

Publication: Leduc S, Kelly P, Thiruganasambandamoorthy V, Wells G, Vaillancourt C. The Safety and Efficacy of On-Site Paramedic and Allied Health Treatment Interventions Targeting the Reduction of Emergency Department Visits by Long-Term Care Patients: Systematic Review Protocol. *Systematic reviews*. 2018;7(1):206;1-6. doi:10.1186/s13643-018-0868-5

Publication: Leduc S, Cantor Z, Kelly P, Thiruganasambandamoorthy V, Wells G, Vaillancourt C. The Safety and Effectiveness of On-Site Paramedic and Allied Health Treatment Interventions Targeting the Reduction of Emergency Department Visits by Long-Term Care

Patients: Systematic Review. Prehospital Emergency Care. 2020:1-10.

doi:10.1080/10903127.2020.1794084

Chapter Four – National Survey of Paramedic Services

This chapter describes existing community paramedic programs in LTC and the priorities, needs, feasibility and barriers to such programs as determined by paramedic services. We include the manuscript “Alternative Care Models for Paramedic Patients From Long-Term Care Centers; A National Survey of Canadian Paramedic Services”

Chapter 5 – Health Records Review of Long-Term Care Patients Treated by Paramedics

This chapter details a health records review describing the care LTC patients treated by paramedics later received in the ED. We include the manuscript “The Hospital Care and Outcomes of Long-Term Care Patients Treated by Paramedics During an Emergency Call: Exploring the Potential Impact of Community Paramedicine”

Chapter 6 – Thesis Summary

This chapter provides a summary of the thesis, key findings, strength and limitations, and next steps for future research.

Chapter 2 - BACKGROUND

This chapter describes the ageing population, their increasing healthcare needs, and the risk LTC patients face when being transferred to the ED for care. It describes alternative models of care being explored to address the subsequent pressures on the healthcare system resulting from ED transfers from LTC and describes community paramedicine.

2.1 Healthcare Use and the Ageing Population

Canada's population is ageing and challenging healthcare resources, a trend that is expected to continue for some time.(1) In the most recent 2016 census, those aged 65 years and older outnumbered those aged 14 and under for the first time. This growing demographic is expected to account for almost a quarter of the Canadian population by the year 2031.(2) Older adults have more complex healthcare needs, and have an estimated per person healthcare cost which is four times that of those aged 15-64.(1) Although approximately only 1% of older adults live in LTC facilities, frequently referred to as nursing homes, the demand for long-term care is growing with over 40, 000 people in Canada waiting for long-term care.(3) Long-term care residents have high rates of healthcare utilization. Living with higher rates of frailty and dementia (4, 5), LTC residents are more likely to be treated and transported by paramedics, utilize the ED, and are more likely to be admitted to hospital than those living in the community.(6) These patients spend twice as long in the ED as community dwelling seniors and 1 in 3 ED visits are considered potentially preventable.(7) The most common reasons for ED visits by LTC patients are urinary tract infections, pneumonia, and falls.(6, 7)

2.2 Risk of Harm of ED Transfers

LTC patients are more vulnerable to adverse events when visiting the ED and when hospitalized.(7-9) LTC patients require significant assistance with activities of daily living (10) and are often unable to communicate their needs.(11) They are at higher risk of functional decline than seniors living in the community.(9) Frailty and advanced age make LTC patients more susceptible to stresses and more likely to suffer from dehydration, malnutrition and falls. Prolonged time in bed may exacerbate muscle loss, decreased aerobic capacity and lead to pressure sores. Being transferred without adjuncts like glasses and hearing aids leads to sensory deprivation and delirium.(8) Visits to the ED by LTC patients has been associated with a 3-fold increase in risk of an acute respiratory or gastrointestinal infection and studies have found that important information about the patient is frequently not transferred from the LTC to the ED physician increasing the potential for patient safety issues.(12) LTC patients face numerous significant risks when visiting the ED, making it possible that the ED is not the best place for them to receive care in some circumstances.

2.3 Healthcare System Pressures

The characteristics and needs of the ageing population has created concern with regard to their potential impact on the healthcare system that we are not prepared to face.(13) The growing needs of an ageing population is putting strain on an already stressed health care system.(1) As gateways to the healthcare system, paramedic services and EDs feel this strain acutely. EDs are

experiencing crowding and paramedics face long delays waiting to transfer patient care to ED staff, which in turn leads to less paramedics available to respond in the community and longer response times to emergency calls.(14-18)

2.4 Alternative Models of Prehospital Care

In response to increasing 911 call volumes, long offload delays, and a healthcare system under pressure, the Ontario Ministry of Health has begun to consider alternative ways paramedics can be utilized to complement existing care and address some of the gaps in the healthcare system.(19,20) A report commissioned in 2005 made the recommendation that transport destinations other than EDs be considered as options for emergency patients.(21) The same report, recognized that many LTC patients requiring acute interventions could be better served by treating them at the LTC residence and recommended the creation of multidisciplinary outreach teams, including paramedics, to provide this care in the community and reduce ED visits. Most recently, the Government of Ontario has announced they will be engaging in ‘healthcare modernization’ and make changes to the Ambulance Act that support alternative models of care such as “treat and release” or “refer” protocols as well as the transport of patients to places other than an ED.(20, 22) Public opinion polls suggest patients would welcome these new approaches to accessing healthcare.(23)

2.5 Community Paramedicine

One alternative models of care being explored where paramedics adopt an expanded role to augment current care, is often referred to as “community paramedicine”.(24) Increasing in

prevalence, its exploration has been identified as a top research priority by the Canadian Safety and Security Program (CSSP) Paramedic Services Community of Practice which includes the Paramedic Chiefs of Canada and the Paramedic Association of Canada.(25) The value of community paramedicine has been recognized in several government reports and has been the recipient of pilot project funding.(19) Reducing the transport of LTC patients and treating them on site could decrease costs, increase the quality of care, and decrease the burden on an overstrained healthcare system.(26-30) There are a small number of community paramedic programs in place that focus on treating LTC patients in their residence and avoiding emergency transport to the hospital.(31, 32) These programs vary considerably from those organized to treat a single patient condition to those encompassing a wider group of patient conditions.(33, 34) Currently, there is no standardized program model and no evidence determining which LTC patient conditions could be safely and efficiently treated by a community paramedic program. Early research has been done to characterize which patients could be amenable to community paramedic care and avoid an ED visit. However, this research was not specific to the LTC population, and has not yet been validated in a second independent patient group.(35)

2.6 References for the Background Section

1. Canadian Institute for Health Information (CIHI). National Health Expenditure Trends, 1975 to 2016. Ottawa, ON.; 2016.
2. Statistics Canada. Age and Sex, and Type of Dwelling Data: Key Results from the 2016 Census Ottawa, ON2016 [updated May 3, 2017.
3. National Institute on Ageing. (2019). Enabling the Future Provision of Long-Term Care in Canada. Toronto, ON: National Institute on Ageing White Paper
4. Canadian, Medical, Association. A Policy Framework to Guide a National Seniors Strategy for Canada.
5. LaMantia MA, Lane KA, Tu W, Carnahan JL, Messina F, Unroe KT. Patterns of Emergency Department Use Among Long-Stay Nursing Home Residents With Differing Levels of Dementia Severity. *Journal of the American Medical Directors Association*. 2016;17(6):541-6.
6. Gruneir A, Bell CM, Bronskill SE, Schull M, Anderson GM, Rochon PA. Frequency and pattern of emergency department visits by long-term care residents—a population-based study. *Journal of the American Geriatrics Society*. 2010;58(3):510-7.
7. Canadian Institute for Health Information. Sources of Potentially Avoidable Emergency Department Visits; Report. Ottawa: CIHI; 2014.
8. Creditor MC. Hazards of hospitalization of the elderly. *Annals of internal medicine*. 1993;118(3):219-23.
9. Quach C, McArthur M, McGeer A, Li L, Simor A, Dionne M, et al. Risk of infection following a visit to the emergency department: a cohort study. *CMAJ*. 2012;184(4):E232-E9.

10. Government of Canada. Long-term facilities-based care [Website]. Home and continuing health care: Canada.ca; 2004 [Available from: <https://www.canada.ca/en/health-canada/services/home-continuing-care/long-term-facilities-based-care.html>].
11. Evashkevich M, Fitzgerald M. A Framework For Implementing Community Paramedic Programs In British Columbia. Richmond, BC: Ambulance Paramedics of British Columbia 2014.
12. Parashar R, McLeod S, Melady D. Discrepancy between information provided and information required by emergency physicians for long-term care patients. Canadian journal of emergency medicine. 2018;20(3):362-7.
13. Canadian Medical Association. A policy framework to guide a national seniors strategy for Canada. 2015.
14. Cooney DR, Millin MG, Carter A, Lawner BJ, Nable JV, Wallus HJ. Ambulance diversion and emergency department offload delay: resource document for the National Association of EMS Physicians position statement. Prehospital Emergency Care. 2011;15(4):555-61.
15. Hoot NR, Aronsky D. Systematic review of emergency department crowding: causes, effects, and solutions. Annals of emergency medicine. 2008;52(2):126-36. e1.
16. Ospina M, Bond K, Schull M, Innes G, Blitz S, Friesen C, et al. Measuring overcrowding in emergency departments: a call for standardization. Technology report. 2006(67.1).
17. Porter K. Ottawa Exposed to Lawsuits over Failure to Meet Ambulance Response Targets: Report. CBCnews CBC/Radio Canada. 2016 14, Oct. 2016.
18. Gillis M. Offload delays had at least 18 ambulances stuck at ER, paramedic group says. Ottawa Citizen. 2020.

19. Council on Improving Healthcare and Ending Hallway Medicine. A Healthy Ontario: Building a Sustainable Health Care System; Second Report from the Premier's Council on Improving Healthcare and Ending Hallway Medicine. Toronto, ON; 2019 June 2019.
20. Ontario's Regulatory Registry. Enabling New Models of Care for Select 9-1-1 Patients Toronto, Ontario 2019 [Available from: <https://www.ontariocanada.com/registry/view.do?postingId=30268&language=en>].
21. Schwartz B, Cass P, Michael C, Dundas P, Farr B, LeBlanc L, et al. Improving Access to Emergency Services: A System Commitment. 2005;7.
22. Ministry of Health and Long-Term Care. Emergency Health Services System Modernization; Briefing Paper on Legislative Amendments to the Ambulance Act. Toronto, ON July 2017.
23. Munjal KG, Shastry S, Loo GT, Reid D, Grudzen C, Shah MN, et al. Patient Perspectives on EMS Alternate Destination Models. Prehospital emergency care. 2016;20(6):705-11.
24. CSA Group. Community paramedicine: Framework for program development. 2017(Z1630-17).
25. Paramedic Association of Canada. 2017 Paramedic Community of Practice Priorities; Appendix B. 2017 July 13, 2017.
26. Agarwal G, Angeles R, Pirrie M, McLeod B, Marzanek F, Parascandalo J, et al. Reducing 9-1-1 Emergency Medical Service Calls By Implementing A Community Paramedicine Program For Vulnerable Older Adults In Public Housing In Canada: A Multi-Site Cluster Randomized Controlled Trial. Prehospital emergency care. 2019;23(5):718-29.
27. Brohman MK, Green M, Dixon J, Whittaker R, Fallon L, Lajkosz K. Community Paramedicine Remote Patients Monitoring (CPRPM): Benefits Evaluation & Lessons

- Learned 2015.17. Toronto, ON: Sustainable Execution Research Collaborative (SERC). 2018.
28. Condino AE. 179 The Impact of Community Paramedicine Programs on the Health of Rural Communities in the United States and Canada: A Systematic Review. *Annals of Emergency Medicine*. 2016;68(4):S71-S.
 29. Dainty KN, Seaton MB, Drennan IR, Morrison LJ. Home visit-based community paramedicine and its potential role in improving patient-centered primary care: a grounded theory study and framework. *Health services research*. 2018;53(5):3455-70.
 30. Michel RR, Chris WA, Jeffrey M. Community Health Evaluations Completed Using Paramedic Service (CHECUPS): Design and Implementation of a New Community-Based Health Program. *Journal of health and human services administration*. 2017;40(2):186-218.
 31. Jensen JL, Marshall EG, Carter AJ, Boudreau M, Burge F, Travers AH. Impact of a Novel Collaborative Long-Term Care -EMS Model: A Before-and-After Cohort Analysis of an Extended Care Paramedic Program. *Prehosp Emerg Care*. 2016;20(1):111-6.
 32. Marshall EG, Clarke B, Peddle S, Jensen J. Care By Design; New model of coordinated on-site primary and acute care in long-term care facilities. *Canadian Family Physician*. 2015;61:e129 - 34.
 33. Jensen JL, Travers AH, Marshall EG, Cain E, Leadlay S, Carter AJ. Insights into the implementation and operation of a novel paramedic long-term care program. *Prehosp Emerg Care*. 2014;18(1):86-91.
 34. Snooks HA, Dale J, Hartley-Sharpe C, Halter M. On-scene alternatives for emergency ambulance crews attending patients who do not need to travel to the accident and

emergency department: a review of the literature. *Emergency Medicine Journal*.
2004;21(2):212-5.

35. Tavares W, Drennan I, Van Diepen K, Abanil M, Kedzierski N, Spearen C, et al. Building Capacity in Healthcare by Re-examining Clinical Services in Paramedicine. *Prehospital emergency care*. 2017;21(5):652-61.

Chapter 3 – SYSTEMATIC REVIEW OF ALLIED HEALTH INTERVENTIONS TO TREAT LONG-TERM CARE PATIENTS ON-SITE

Chapter Overview

This chapter addresses our first research question: *What strategies have been implemented in LTC facilities by allied health professionals to reduce the unscheduled transportation of patients to the ED and what is the safety and efficacy of those strategies?*

An ageing population and increasing health system stress have led to increased interest in decreasing ED visits by long-term care patients. Several such programs have been put in place by allied health providers such as nurses and paramedics however, prior to this study, there has been no thorough identification of what programs exist and no comprehensive evaluation of the effectiveness and safety of these programs. The objective of this chapter was to identify and appraise programs in LTC centres that avoid sending their patients to the ED by providing treatment on-site, and to gain an understanding of what programs currently exist and how well they are working.

Chapter 3 contains two manuscripts (Sections 3.1-3.2), both of which have been published. Each manuscript is described below.

Chapter Contents

Section 3.1 contains the protocol for a systematic review to identify existing programs provided by allied health providers in LTC centers targeting the reduction of ED visits. This manuscript was published in Systematic Reviews.

Section 3.2 presents the results of a systematic review identifying and evaluating programs led by allied health providers treating LTC patients on site and avoiding ED visits. This manuscript was published in *Prehospital Emergency Care*.

3.1 The Safety and Efficacy of On-Site Paramedic and Allied Health Treatment Interventions Targeting the Reduction of Emergency Department Visits by Long-Term Care Patients: Systematic Review Protocol

Section Overview

This section presents a manuscript describing a protocol for a systematic review identifying and evaluating programs led by allied health providers that treat LTC patients on-site, avoiding ED visits. The findings of this review are described in Section 3.2.

Manuscript Status

This manuscript has been published:

Leduc S, Kelly P, Thiruganasambandamoorthy V, Wells G, Vaillancourt C. The Safety and Efficacy of On-Site Paramedic and Allied Health Treatment Interventions Targeting the Reduction of Emergency Department Visits by Long-Term Care Patients: Systematic Review Protocol. *Systematic reviews*. 2018;7(1):206;1-6. doi:10.1186/s13643-018-0868-5

Author Roles and Contributions

SL and CV contributed to the concept and study design and drafting the manuscript. PK, VT and GW contributed to the revision of the study design and to critically revising the manuscript. All authors have read and approved the final manuscript.

Related Thesis Appendices

None

The Safety and Efficacy of On-Site Paramedic and Allied Health Treatment Interventions
Targeting the Reduction of Emergency Department Visits by Long-Term Care Patients:
Systematic Review Protocol

Shannon Leduc MSc(c)^{1,2}, ACP, Peter Kelly ACP¹, Venkatesh Thiruganasambandamoorthy
MBBS, MSc^{2,4,5}, George Wells PhD^{2,3}, Christian Vaillancourt, MD, MSc^{2,4,5}

¹Ottawa Paramedic Service, Ottawa, Ontario;

²School of Epidemiology and Public Health, University of Ottawa, Ottawa, Ontario;

³Cardiovascular Research Methods Centre, University of Ottawa Heart Institute

⁴Department of Emergency Medicine, University of Ottawa, Ottawa, Ontario;

⁵Ottawa Hospital Research Institute, Ottawa, Ontario

Word Count: 2,721

Abstract: 277

Abstract

Background: Older adults are more likely to access the ED, which suffers from overcrowding and congestion, for conditions that could potentially be treated in other settings. Older adults living in LTC centers have access to health care resources in their residence, and several programs have been created with the intent of treating medical conditions onsite. The aim of this study is to identify and systematically review programs and interventions at LTC centers that aim to treat patients onsite, avoiding unscheduled transportation to the ED.

Methods: We will follow the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. We will perform a comprehensive search of Embase, Medline, CINAHL, clinicaltrials.gov, PROSPERO and the Cochrane Central Registry of Controlled Trials using a broad search strategy. Two independent reviewers will assess titles and abstracts against inclusion criteria, and we will further evaluate relevant full text articles for inclusion. We will assess the risk of bias using the Newcastle-Ottawa scale for included non-randomized studies and the Cochrane Risk of Bias tool for randomized trials. We will present a narrative synthesis of results and complete a meta-analysis only if enough homogeneity is found. We will create funnel plots to evaluate possible reporting bias and use The Grading of Recommendations Assessment Development and Evaluation (GRADE) methodology to assess the confidence in cumulative evidence.

Discussion: As pressure on the healthcare system continues to rise, many areas are looking for alternative models of care. Several programs have been put in place in LTC centers that seek to

avoid transportation to the ED by providing enhanced care on-site. These programs are quite variable, and, to date, there is no standardized program or model of care.

Systematic review registration

PROSPERO (CRD42018091636)

Keywords:

Prehospital, paramedic, long-term care, alternative care, treat-on-site, treat and release, community paramedic, nursing home

Background

The population of Canada is aging, living longer, and utilizing more healthcare resources than previous generations.(1) These factors add to the challenges faced by an already overwhelmed health care system, that is struggling to cope with high demand and limited resources. In particular, EDs are crowded, resulting in long waits for care, and negative patient outcomes. (2,3) This congestion has a ripple effect which impacts paramedic services and patients waiting for emergency care in the community. ED congestion contributes to long waits for paramedics to transfer the care of their patients to the ED staff, referred to as offload delay, which in turn delays paramedic response to the next emergency call. At times, offload delays have put so much pressure on emergency services that there have been no ambulances available in the community to respond to the next emergency call.(4-9) It is in this context that different factions of the healthcare community have been investigating alternative models of patient care to relieve the pressure on paramedics, EDs, and the healthcare system.

Older adults use hospital services more than other age groups and are more likely to access the ED for conditions that could potentially be treated in other settings.(1) Although only a small proportion of emergency visits are from LTC patients, this group is more vulnerable to adverse events from the transfer of their care to the ED.(10) They also have access to health care resources in the LTC center, making them a group of interest for interventions that provide care in the place of residence avoiding ED visits. Community Paramedic programs, where paramedics augment the care of individuals in the community, are one example of these programs. Several such programs have been put in place with models of care that can vary

significantly from program to program.(11-15) There has been no systematic evaluation of these programs to date.

The aim of this systematic review is to identify programs and interventions that avoid transporting LTC patients to the ED by providing care on-site and to evaluate the safety and efficacy of these programs.

Methods

General Methods

We will complete a systematic review and report a narrative synthesis. We will conduct a meta-analysis only if appropriate. This systematic review is registered with the International prospective register of systematic reviews PROSPERO (CRD42018091636). We have adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 statement and the completed checklist is included as an additional file.(16)

Objective

Specifically, the systematic review will answer the following questions:

Among patients living in LTC facilities, what is the safety and efficacy of interventions that treat patients on-site, avoiding unscheduled transportation to the ED?

Among patients living in LTC facilities, what are the additional patient and system impacts of implementing treat on-site interventions beyond safety and efficacy?

Eligibility Criteria

We will use the following inclusion criteria to select studies for this systematic review:

P – Patients living in LTC facilities, which we define below.

I – Any intervention or program provided by a non-physician that aims to reduce unscheduled patient transports to the ED

C – Standard care or transportation to the ED

O – All reported patient and system effects of any kind

Participants

We will include studies that contain patients 18 years of age and older, living in LTC facilities primarily meant for the elderly. These facilities must be LTC and not retirement residences or assisted living facilities, as the medical care available to residents is different between these facilities as are the patterns of ED use. We will include a LTC facility also caring for younger patients with chronic disease in addition to the main population of older adults, providing they are not a facility that specializes in the care of these younger adults. We will include studies that encompass any patient condition. We will exclude hospitals that specialize in chronic care.

Interventions

We will include any intervention or program aimed at reducing the transport of patients to the ED. Programs where reducing transportation to the ED is a secondary goal will be considered, if the number of ED transports is measured. These programs can be preventative or for acute conditions. The intervention or program must have been completed by a care provider other than

a physician, for example, a paramedic or a nurse. We may consider for inclusion programs where physicians are part of a multi-disciplinary care team on an individual basis, providing allied health providers play a significant role in the intervention. We will include programs or interventions for any conditions.

Comparators

Usual care or transportation to the ED will be the comparator.

Outcomes

We will collect outcomes taking a broad perspective. Outcomes will be collected as they are reported and surrogate outcomes will be included if appropriate. In the event outcomes are reported as composite measures, we will extract the composite and individual outcomes. Pre-defined outcomes of interest include:

Patient outcomes: the proportion of hospital admission, length of stay, death, condition-specific morbidity or adverse events, health-related quality of life, frailty measures, functional status, and patient impacts and perspectives. Quality of life, frailty measures, and functional status will only be collected if a validated tool was used.

System outcomes: the proportion or number of ED transports averted, repeat 911 or ED access, health care resource utilization, paramedic system response times, offload delays and ED crowding or congestion measures, and measures of overall system function (for example, end of shift overtime rates). We will consider other outcomes depending on what is available in the literature.

Study Designs

Study designs will be included taking a broad perspective. Experimental, quasi-experimental, and observational study designs will be included. We will exclude case reports, case series, and review articles, although we intend to review the reference list of review articles if any are found. Abstracts will be excluded unless a full-text article can be found.

Timing

There will be no restriction based on length of patient follow up time.

Language

Articles reported in the English or French language will be included. If articles are found that appear relevant but full text is not available in English or French, we will include them in an appendix.

Exclusion Criteria

We will exclude studies that: relate to patients who live in dwellings other than LTC centers, involve an intervention that is primarily led by a physician or does not have a significant involvement by allied healthcare providers and does not have the goal of caring for patients in place or reducing unscheduled transports to the ED.

Information Sources

We will search Excerpta Medica Database (Embase), Medline, Cumulative Index to Nursing and Allied Health Literature (CINAHL), clinicaltrials.gov, PROSPERO and the Cochrane Central Registry of Controlled Trials with no date restrictions (SL). The reference lists of included studies, as well as any systematic reviews found, will be searched for other relevant articles (SL). We will search the primary authors of included articles to ensure all related research has been found. Grey literature will be searched using the pertinent areas of the Canadian Agency for Drugs and Technologies in Health (CADTH) Grey Matters Checklist (SL).(17) We will present a list of included articles to subject matter experts and ask them to identify any additional documents that are not on the list. If clarification is required regarding study details, two attempts will be made to contact study authors. These attempts will be made three weeks apart.

Search Strategy

Medical subject headings and text words related to LTC and hospital transfers have been used to create a search strategy. Our search strategy has been reviewed by Lindsey Sikora, Health Sciences Librarian at the University of Ottawa. A Medline search strategy is included in Appendix 1. We will adapt this strategy for Embase and CINAHL and test it to see if it yields a high proportion of known studies.

Citation Management

We will use Endnote software (version X7.5.3) to import references and abstracts from electronic databases. We will then use Covidence software to remove duplicates and facilitate the screening and tracking of articles. Full-text articles will be uploaded to Covidence for second stage screening and we will document the reason for exclusion for any articles excluded at this stage.

Selection Process

Stage 1 - Two independent trained reviewers will assess the title and abstract of each article identified by our search strategy (SL and second reviewer to be recruited). Articles thought to be relevant by both reviewers will proceed to stage 2 and we will report a measure of agreement.

Stage 2 - We will assess the full text of articles thought to be potentially relevant by both trained reviewers in stage 1, against the inclusion and exclusion criteria. Disagreements about inclusion decisions at either stage will be resolved by discussion and, if consensus cannot be reached, a third senior co-investigator will adjudicate (CV). If multiple articles are found that appear to be about the same work, we will assess these publications by examining author names, study locations, and intervention details to determine if they are duplicates.

Data Collection

One reviewer will collect data from included studies using a piloted standardized form (SL). If multiple articles are found that refer to the same study, we will link articles together. Data from

each linked study may be collected onto its own extraction form and later combined, or one extraction form may be used for all linked studies depending on what types of duplicate publications are found.

Data Items

We will extract data on patient characteristics (age, gender, level of dependence, cognitive impairment), system characteristics (healthcare system payer information, type of prehospital system, levels of care providers in prehospital system), intervention characteristics (presenting patient condition, severity of illness, intervention details), LTC center characteristics (number of beds, location, skilled care services, funding model), and study characteristics (study designs, methodologies and outcomes, funding). If LTC center characteristics are not reported in the article but are publicly available, we will collect them.

Outcomes and Prioritization

The primary outcome will focus on the proportion of ED transports averted, defined as those patients who were treated at the LTC center within the respective program, but not subsequently conveyed to the ED unless the transport to the ED was a scheduled visit. If patients were transported to an alternative destination, such as a clinic or family physician, we will collect that information but still consider it an avoided ED transport.

Secondary outcomes will include:

The safety of interventions in LTC homes, and will include the proportion of patients who suffer adverse events. Adverse events will include return visits to the ED, hospital admission, death, or condition-specific adverse events. Given the potential for a broad range of patient conditions in the literature, we will not restrict the length of follow-up for adverse events that are reported as being associated with the patient's episode of illness or treatment. Hospital admission, death, and condition-specific adverse events will be analyzed together as well as individually.

Hospital length of stay

Health-related Quality of Life as measured by general or disease-specific validated instruments

Frailty measures as measured by the Clinical Frailty Scale or another validated scale

Functional status as measured by a validated scale that is assessed by interview or observation but not self-reported measures

Patient perspectives as reported

The number of repeat 911 calls or ED access while under the care of the respective program, or within 7 days of completing the treatment program

Paramedic system response times, defined as the number of minutes it takes a paramedic or emergency medical worker to arrive on the scene of an emergency from the time the call for assistance is placed

The mean time in minutes that paramedics spend in offload delay, defined as the time waiting to transfer a patient to a hospital bed and hand over patient care after giving a report to the hospital staff

Measures of ED crowding or congestion as reported in the literature

Measures of overall emergency system function as reported. Examples may include the number of times a paramedic service has no available resource for the next emergency call (level zero) or

are at critical levels of responder availability, end of shift overtime, response time standard compliance or the number of offload nursing hours required in the ED

The primary outcome will remain the same irrespective of the significance found in the included studies, or whether it has been reported as a priority in the literature. The definitions of individual outcome measurements may be altered depending on what is found in the literature. For example, if offload delay is more commonly reported in a measure other than mean time, the definition may be altered to reflect this. If there is an outcome reported in the literature that we have not considered and find important, we will collect it and state in the manuscript that it was not part of our initial list of outcomes. If standard errors are not reported in included studies, we will reconstruct them from confidence intervals and point estimates.

Risk of Bias

We will evaluate all included studies for risk of bias using a tool appropriate to study type. Randomized control trials will be assessed using The Cochrane Risk of Bias tool.(18) Risk of bias will be identified as low, high, or unclear in a table format for each domain. Each section in the Risk of Bias tool will be considered independently, and there will be no overall score calculated. If the risk of bias cannot be determined in a specific category because there is not enough information, the risk of bias in that category will be designated as unclear. The Cochrane Handbook instructions will be used to make a judgment on low and high risk bias ratings.(19) Non-randomized studies will be assessed using the Newcastle-Ottawa Scale.(20) The strengths and limitations of each study as well as the potential impacts they may have had on the outcome

will be presented. Risk of Bias will be determined independently by two reviewers and then compared for agreement. We will resolve any disagreement by discussion or third party arbitration if required.

Data Synthesis

We will summarize the characteristics and findings of all included studies, regardless of the risk of bias, in a narrative synthesis. We will present the results in table form as well as text. Any relevant subgroups that are discovered will be reported, and, when appropriate, similarities and differences between studies will be examined.

If included studies or a subgroup of included studies are homogeneous in patient conditions and study design, they will be meta-analyzed using a random or fixed effects model as appropriate. Studies will be assessed by two reviewers to determine if enough methodological and clinical homogeneity exists to warrant a meta-analysis. Dichotomous outcomes will be determined using odds ratios (OR's) and 95% confidence intervals. Standardized mean differences with 95% confidence intervals will be used to analyze continuous outcomes. The standardized mean differences will be weighted by the precision of the estimates of each study. Study characteristics will be examined using descriptive characteristics. In the event of small sample sizes or skewed data, we will use non-parametric tests for analysis or the data will be presented descriptively. We will examine forest plots for statistical heterogeneity and factor in clinical relevance. The I^2 statistic will also be considered with a value of 40% or greater considered moderate heterogeneity. A sensitivity analysis or subgroup analysis will be undertaken if

heterogeneity is visible on the forest plots. Risk of bias, type of healthcare system, and funding models of the LTC centers are potential variables for subgroup analysis. Subgroup analysis will also be completed for young patients with chronic diseases providing the study reports this group separately.

Meta-bias assessment

To assess reporting bias, we will compare published protocols and trial registries with publications. We will evaluate if selective outcome reporting has occurred by comparing the outcomes that were planned and those that were published to see if there are differences. If greater than 10 studies are included in the review, funnel plots will be used to examine possible reporting bias.

Confidence in Cumulative Evidence

We will use The GRADE methodology to assess the quality of evidence and will report the results in an evidence table.(21-25) Quality of evidence will be assessed independently for each patient outcome and will be rated as very low, low, moderate, or high according to the GRADE scale.

Acknowledgements

Lindsey Sikora, Health Sciences Librarian, University of Ottawa

References

1. Canadian Institute for Health Information. *Health Care in Canada, 2011; A Focus on Seniors and Aging*. Ottawa, ON: CIHI; 2011.
2. Hoot NR, Aronsky D. Systematic review of emergency department crowding: causes, effects, and solutions. *Annals of emergency medicine*. 2008;52(2):126-36. e1.
3. Ospina MB, Bond K, Schull M, Innes G, Blitz S, Friesen C, Rowe BH. Measuring overcrowding in emergency departments: a call for standardization [Technology report no 67.1]. Ottawa: Canadian Agency for Drugs and Technologies in Health; 2006.
4. Cooney, Derek R., et al. "Ambulance diversion and emergency department offload delay: resource document for the National Association of EMS Physicians position statement." *Prehospital Emergency Care* 15.4 (2011): 555-561.
5. Porter, Kate. "Ottawa Exposed to Lawsuits over Failure to Meet Ambulance Response Targets: Report." *CBCnews*. CBC/Radio Canada, 14, Oct. 2016. Web. 14 July 2017.
6. Gorman, Michael. "Why Paramedics Must Spend Hours Waiting Outside Hospital ERs." *CBCnews*, CBC/Radio Canada, 10 Oct. 2017, www.cbc.ca/news/canada/nova-scotia/health-care-ambulance-offload-delays-paramedics-hospitals-1.4345855
7. News, CBC. "AHS Tackles ER 'Offload Delays' for Paramedics." *CBCnews*, CBC/Radio Canada, 5 Nov. 2010, www.cbc.ca/news/canada/calgary/ahs-tackles-er-offload-delays-for-paramedics-1.904420.
8. Citizen, David Reevely Ottawa. "David Reevely: Ottawa Ran out of Ambulances 22 Times in the Past Two Weeks, City Admits." *National Post*, 11 Dec. 2016,

nationalpost.com/news/politics/david-reevely-ottawa-ran-out-of-ambulances-22-times-in-the-past-two-weeks-city-admits.

9. Carter, Adam. "Patients Will Literally Die': Times When No Ambulances Available on the Rise." CBCnews, CBC/Radio Canada, 2 Aug. 2017, www.cbc.ca/news/canada/hamilton/code-zero-1.4231984.
10. Canadian Institute for Health Information. *Sources of Potentially Avoidable Emergency Department Visits; Report*. Ottawa, ON: CIHI; 2014.
11. Kane, Robert L., Peter Huckfeldt, Ruth Tappen, Gabriella Engstrom, Carolina Rojido, David Newman, Zhiyou Yang, and Joseph G. Ouslander. "Effects of an intervention to reduce hospitalizations from nursing homes: A randomized implementation trial of the INTERACT program." *JAMA Internal Medicine* 177, no. 9 (2017): 1257-1264.
12. Loeb, Mark, Soo Chan Carusone, Ron Goeree, Stephen D. Walter, Kevin Brazil, Paul Krueger, Andrew Simor, Lorraine Moss, and Thomas Marrie. "Effect of a clinical pathway to reduce hospitalizations in nursing home residents with pneumonia: a randomized controlled trial." *Jama* 295, no. 21 (2006): 2503-2510.
13. Ouslander, Joseph G., Mary Perloe, JoVonn H. Givens, Linda Kluge, Tracy Rutland, and Gerri Lamb. "Reducing potentially avoidable hospitalizations of nursing home residents: Results of a pilot quality improvement project." *Journal of the American Medical Directors Association* 10, no. 9 (2009): 644-652.
14. Bandurchin, A., M. J. McNally, and M. Ferguson-Paré. "Bringing back the house call: how an emergency mobile nursing service is reducing avoidable emergency department visits for residents in long-term care homes." *Nursing leadership (Toronto, Ont.)* 24, no. 1 (2011): 59-71

15. Marshall EG, Clarke B, Peddle S, Jensen J. Care By Design; New model of coordinated on-site primary and acute care in long-term care facilities. *Canadian Family Physician*. 2015;61:e129 – 34
16. Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev*. 2015;4:1.
17. Grey Matters: a practical tool for searching health-related grey literature.(2015, December 1). Retrieved March 12, 2018, from <https://www.cadth.ca/resources/finding-evidence/grey-matters>
18. Higgins, J. P., Altman, D. G., Gøtzsche, P. C., Jüni, P., Moher, D., Oxman, A. D., ... & Sterne, J. A.(2011). The Cochrane Collaboration’s tool for assessing risk of bias in randomised trials. *Bmj*, 343, d5928.
19. Higgins JPT, Altman DG, Sterne JAC (editors). Chapter 8: Assessing risk of bias in included studies. In: Higgins JPT, Green S (editors). *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 (updated March 2011). The Cochrane Collaboration, 2011. Available from www.handbook.cochrane.org.
20. Wells, G. A., Shea, B., O’connell, D., Peterson, J., Welch, V., Losos, M., & Tugwell, P. (2011). The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Ottawa: Ottawa Hospital Research Institute; 2011.
21. Guyatt, G., Oxman, A. D., Akl, E. A., Kunz, R., Vist, G., Brozek, J., ... & Rind, D. (2011). GRADE guidelines: 1. Introduction—GRADE evidence profiles and summary of findings tables. *Journal of clinical epidemiology*, 64(4), 383-394.

22. Guyatt, G. H., Oxman, A. D., Kunz, R., Atkins, D., Brozek, J., Vist, G., ... & Schünemann, H. J. (2011). GRADE guidelines: 2. Framing the question and deciding on important outcomes. *Journal of clinical epidemiology*, 64(4), 395-400.
23. Balshem, H., Helfand, M., Schünemann, H. J., Oxman, A. D., Kunz, R., Brozek, J., ... & Guyatt, G. H. (2011). GRADE guidelines: 3. Rating the quality of evidence. *Journal of clinical epidemiology*, 64(4), 401-406.
24. Guyatt, G. H., Oxman, A. D., Vist, G., Kunz, R., Brozek, J., Alonso-Coello, P., ... & Norris, S. L. (2011). GRADE guidelines: 4. Rating the quality of evidence—study limitations (risk of bias). *Journal of clinical epidemiology*, 64(4), 407-415.
25. Guyatt, G. H., Oxman, A. D., Montori, V., Vist, G., Kunz, R., Brozek, J., ... & Williams, J. W. (2011). GRADE guidelines: 5. Rating the quality of evidence—publication bias. *Journal of clinical epidemiology*, 64(12), 1277-1282.

Appendix 1 - Search Strategy Medline

1. Long-Term Care/
2. Homes for the Aged/
3. Nursing Homes/
4. Emergency Service, Hospital/
5. Emergency Medical Services/
6. (nursing adj2 home).tw.
7. 1 or 2 or 3 or 6
8. on-site treatment*.tw.
9. (emergenc* adj3 (respond* or aid* or technician*)).tw.
10. (emergenc* adj3 service*).tw.
11. paramed*.tw.
12. ambula*.tw.
13. Emergency Medical Services/ or "Transportation of Patients"/
14. exp "Transportation of Patients"/
15. (hospital adj2 transfer).tw.
16. (patient adj2 trans*).tw.
17. Allied Health Personnel/
18. Hospitalization/
19. 4 or 5 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18
20. 7 and 19
21. limit 20 to "all adult (19 plus years)"

3.2 The Safety and Effectiveness of On-site Paramedic and Allied Health Treatment Interventions Targeting the Reduction of Emergency Department Visits by Long-term Care Patients: Systematic Review

Section Overview

This section presents the results of a systematic review identifying programs led by allied health providers targeting the reduction of ED visits by treating patients on-site.

Manuscript Status

This Manuscript has been published:

Leduc S, Cantor Z, Kelly P, Thiruganasambandamoorthy V, Wells G, Vaillancourt C. The Safety and Effectiveness of On-Site Paramedic and Allied Health Treatment Interventions Targeting the Reduction of Emergency Department Visits by Long-Term Care Patients: Systematic Review. *Prehospital Emergency Care.* 2020:1-10.

doi:10.1080/10903127.2020.1794084

Author Roles and Contributions

SL and CV contributed to the study concept and SL, CV, VT contributed to the study design. SL and ZC screened studies for inclusion and completed data extraction. SL drafted the manuscript and CV, PK, VT, ZC and GW critically revised the manuscript.

Related Thesis Appendices

None

The Safety and Effectiveness of On-site Paramedic and Allied Health Treatment Interventions
Targeting the Reduction of Emergency Department Visits by Long-term Care Patients:
Systematic Review

Shannon Leduc MSc(c)^{1,2}, ACP, Zach Cantor PCP¹, Peter Kelly ACP¹, Venkatesh
Thiruganasambandamoorthy MBBS, MSc^{3,4}, George Wells PhD⁵, Christian Vaillancourt, MD,
MSc^{3,4}

¹Ottawa Paramedic Service, Ottawa, Ontario;

²School of Epidemiology and Public Health, University of Ottawa, Ottawa, Ontario;

³Department of Emergency Medicine, University of Ottawa, Ottawa, Ontario;

⁴Ottawa Hospital Research Institute, Ottawa, Ontario

⁵Cardiovascular Research Methods Centre, University of Ottawa Heart Institute

Abstract 235 words

Manuscript 4,300 words

Abstract

Introduction

Programs that seek to avoid ED visits from patients residing in LTC care facilities are increasing. We sought to identify existing programs where allied healthcare personnel are the primary providers of the intervention and, to evaluate their effectiveness and safety.

Methods

We systematically searched Medline, CINAHL and EMBASE with terms relating to LTC, emergency services, hospitalization and allied health personnel. We reviewed 11,176 abstracts and included 22 studies in our narrative synthesis, which we grouped by intervention category.

Results

We found five categories of interventions including: 1) use of advanced practice nursing; 2) a program called Interventions to Reduce Acute Care Transfers (INTERACT); 3) end-of-life care; 4) condition specific interventions; and 5) use of extended care paramedics. Among studies measuring that outcome, 13/13 reported a decrease in ED visits, and 16/17 reported a decrease hospitalization in the intervention groups. Patient adverse events such as functional status and relapse were seldom reported (6/22) as were measures of emergency system function such as crowding/inability of paramedics to transfer care to the ED (1/22). Only 4/22 studies evaluated patient mortality and 3/4 found a non-statistically significant worsening.

Conclusion

We found five types of programs/interventions which all demonstrated a decrease in ED visits or hospitalization. However, most studies were observational and few assessed patient safety. Many identified programs focused on increased primary care for patients, and interventions addressing acute care issues, such as community paramedics, deserve more study.

Keywords

long-term care, emergency medical services, allied health personnel, paramedics, transfer of patients, hospitalization

Introduction

Healthcare systems are suffering from scarcity of resources and are struggling to meet the demands of a population that is ageing, living longer, and making more intense use of services than in the past.(1)This strain is felt acutely in the ED, a gateway to the healthcare system, and has upstream effects on the prehospital system. EDs are suffering from crowding and often have long wait times for care.(2, 3) This leads to offload delay, a situation where paramedics regularly have to wait hours before they can transfer patients onto an ED bed and transfer their care to ED staff. This depletes paramedic resources in the community, impacts the number of paramedics available to respond to the next emergency call and can cause delays in care for sick or injured patients in the community.(4-9)

An increasing number of frail older adults reside in LTC centers, which are facilities for people who need a high level of medical and personal care including assistance with activities of daily living and access to round the clock nursing care.(10) Patients from these LTC centers are frequently transferred to the ED to receive acute care.(1, 11) Many of these ED visits are considered potentially avoidable and could possibly have been treated within their LTC center.(12, 13) LTC patients are at greater risk of adverse events when transferred to the ED such as delirium, functional decline and acquiring a new infection, and many suffer from dementia which can make these transfers more distressing.(1, 12-15) To address these issues, many organizations have begun implementing programs targeting the reduction of ED visits by LTC patients and their hospitalization in acute care hospitals.(16) These programs are quite diverse in nature and often leverage care by allied health providers such as community paramedics. Community paramedics provide assessment, diagnostics and treatment beyond the traditional prehospital emergency care and transport model, integrate with other healthcare

providers, and frequently provide care to vulnerable populations.(17) The effectiveness and safety of these programs has yet to be determined.

We conducted a systematic review of the literature to determine, among LTC patients, what is the effectiveness and safety of interventions that evaluate and treat patients on site, avoiding unscheduled transport to the ED. A secondary objective was to determine what additional patient and system impacts occurred when these interventions were implemented, such as changes to health-related quality of life, frailty measures or functional status, paramedic response times and hospital offload delay measures.

Methods

This systematic review was registered on PROSPERO (CRD42018091636).(45) We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement when completing this review which was based on a protocol we published a priori.(19, 20)

Search Strategy and Information sources

In collaboration with a health services librarian with expertise in systematic reviews, we created a search strategy in Medline with no date or language restrictions (Appendix 1). We used Medical Subject Headings and text words relating to LTC patients and transportation to the ED, then adapted that search to Medline, Embase and CINAHL. The initial search was run on April 27, 2018, and was updated on February 26, 2019. We searched clinicaltrials.gov, PROSPERO, the Central Registry of Controlled Trials as well as the reference lists of included studies. We followed the Canadian Agency for Drugs and Technologies in Health (CADTH) Grey Matters Checklist to guide us in our grey literature search.(21) We presented our article list to two researchers with experience in the field of LTC and they did not suggest any additional articles for inclusion. When required, we contacted the study authors for clarification.

Inclusion Criteria

Eligible studies included adult patients living in LTC centers who received an intervention performed primarily by a care provider other than a physician, targeting the reduction of patient transports to the ED by treating the patient on-site. The intervention could be for any condition and we compared this to standard care or transportation to the ED. We collected all reported patient and system outcomes. We excluded case reports, case series, review articles and abstracts that did not have full text available. Given the variety of possible patient conditions, we did not place any restriction on length of follow up.

Study Selection

Titles and abstracts identified in our search strategy were imported into the Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia) and duplicates were electronically removed. Two independent reviewers (SL, ZC) screened all titles and abstracts against our pre-specified inclusion criteria and those for which both reviewers agreed proceeded to second stage screening. At this point, we excluded articles that were not available in French or English. In the second stage, two independent reviewers (SL, ZC) assessed the full text of each article and those for which both reviewers agreed met our inclusion criteria were included in this review. In both stages, we resolved cases where reviewers disagreed by discussion and consensus.

Data Collection

Information was extracted from each included study using a piloted standardized data collection tool by one reviewer (SL). We collected information on patient characteristics, system characteristics, LTC center characteristics, and intervention characteristics. We also collected

information on study characteristics such as the design, methodology, outcomes and source of funding.

Risk of Bias

Two reviewers (SL, ZC) independently assessed risk of bias for each individual study using tools appropriate to study design. We assessed randomized control trials using The Cochrane Risk of Bias tool.(22, 23) We assessed each domain separately and identified the risk of bias as low, high or unclear. Non-randomized studies were evaluated using the Newcastle-Ottawa Scale.(51)

Results

Literature Search Results

Our search strategy yielded 11,176 potentially relevant studies. (Figure 1) After removing duplicates, two authors (SL, ZC) independently reviewed the titles and abstracts of 9,479 articles and the full text of 87 articles. Twenty-two studies were included in our review. No additional study was found through our grey literature search. In five cases where it was unclear if an article met our inclusion criteria we contacted authors for further information. We compared study protocols and trial registries with published results to identify selective reporting. and found no evidence of selective outcome reporting.

Study Characteristics

Characteristics of the 22 studies included are presented in Table 1. Twelve studies (55%) were published in 2016 or after, 91% were conducted in North America and all studies were multicenter. Four studies (18%) were randomized controlled trials and 19 (86%) studies were observational. One manuscript reported seven different interventions in seven states which were part of a government initiative to reduce avoidable hospitalizations.(25, 26) One of these interventions was also published in a separate paper documenting their portion of the same

study.(27) We found the results most thoroughly reported in the studies project report, (26) but utilized all papers in assessing outcomes.(25-28)

Risk of Bias

Risk of Bias assessment is reported in Table 2 and 3. Two of the four randomized control studies in our review had an overall high risk of bias, one had a low risk of bias, and one had some concerns (Table 2). The overall quality assessment scores of our observational studies ranged between 2 and 9 with a median of 6.5 (Table 3).

Intervention Categorization and Reporting

The 22 included studies differed in terms of patient conditions, interventions and study designs making meta-analysis inappropriate. Instead, we have organized interventions into five categories by way of consensus and present our results using a narrative review. Intervention summaries and main findings are also presented in a supplemental table.

First, there were interventions focused on providing some form of advanced nursing care such as nurse practitioners or advanced practice nurses.(25-27, 29-33) Second, there were programs that used a set of tools called Interventions to Reduce Acute Care Transfers (INTERACT). Four studies focused primarily on INTERACT (34-37) and an additional three studies, representing eight interventions, included INTERACT as an addition to their primary intervention.(25-27, 31) Third, we found five programs addressed end-of-life issues.(38-41) Fourth, we found two studies focused on condition-specific interventions which treated acute infections and dehydration.(42, 43) Fifth, one program utilized Extended Care Paramedics (ECP) to respond to acute illnesses in residents.(44, 45) Extended Care Paramedics have additional training and use an expanded scope of practice to provide care beyond the traditional emergency response model.

Primary Outcome of ED Transports and Hospital Admission

These five categories of interventions reported on the effectiveness of their programs in terms of decreasing the proportion of ED transports or hospital admissions.

Thirteen studies representing 16 interventions reported on measures of ED visit rates.(26, 27, 29-34, 38, 40, 42, 44, 45) Seventeen studies representing 21 interventions reported hospital admission rates.(26, 27, 29, 32-43, 45, 46) All studies measuring ED visits and all but two interventions found a decrease in transferring patients to the hospital which ranged from decreases of 5% (29) to 69%.(31) Only seven of these interventions demonstrated statistical significance.

In the 17 studies measuring hospitalization, all but one of the 21 interventions (41) reported a decrease. Effects ranged from a decrease as small as 3% in hospital admissions for patients who received palliative care consults (46) to almost half as many hospitalizations in a group using a program called Evercare.(32) However, only 12 interventions demonstrated statistical significance.(26, 32, 36, 38, 40, 42, 43, 45, 46)

Secondary Outcomes

Patient Specific

Few studies evaluated measures of adverse events in patients. Main adverse event results are presented in a supplemental table. Two studies examined patient relapse rates which were defined as repeat encounters with paramedics (44, 45), four studies assessed mortality (26, 28, 33, 42, 43) and one study reported antibiotic treatment adverse reactions.(42) Two studies measured depressive symptoms and pain (26, 41) and one study included other quality of care measures such as antipsychotic medication use, the number of falls, pressure ulcers and urinary tract infections.(26) Two studies measured functional status (26, 42) and four studies measured

hospital length of stay (32, 39, 42, 43) We found no studies that measured Health-related Quality of Life, frailty or patient perspectives.

Relapse

The two studies measuring relapse rates both used Extended Care Paramedics as their intervention.(44, 45) In the first study, six patients (2.8%) required unexpected emergency care within 48 hours and they were all in the intervention group. In the second study, patients treated by Extended Care Paramedics had 11% fewer relapses than those treated by emergency paramedics.

Mortality

In the studies that measured mortality (26, 28, 33, 42, 43), most studies trended towards a slight but insignificant increase in mortality in the intervention groups, with the exception of one intervention that had a slight but insignificant decrease in mortality.(27)

Length of Stay

All studies that measured length of stay reported a decrease, ranging from 0.2 days fewer (43) to 1.2 days fewer (32) in the intervention groups. One study focusing on palliative care reported length of stay in terms of what they defined as clinically inappropriate days spent in the hospital in the last two months of life and found a 38% decrease after the intervention was in place.(39)

System Specific

Only one study evaluated out-of-hospital system impacts, measuring the average time paramedics spent in the ED as well as the average time they spent on scene with patients as well as the average time it took from initiation of an emergency call until a paramedic arrived on scene (response time).(45) Five studies evaluated potential cost savings.(26, 29, 38, 40, 42) No

study evaluated ED crowding or measures of overall out-of-hospital system function such as paramedic end-of-shift overtime.

Out-of-hospital Impacts

The study measuring out-of-hospital impacts reported there was no difference in offload delay between the intervention (Extended Care Paramedic) and control group (Emergency Paramedic). They also found the intervention group spent more time with patients, with an average call with ECP's lasting 1 hour and 35 minutes and an average call with Emergency Paramedics lasting 30 minutes and 45 seconds. When transported to hospital, patients spent less time in the ED before being admitted or discharged if they were in the ECP group compared to those treated by emergency paramedics.(45)

Cost Impacts

Three studies representing seven interventions found cost savings.(26, 38, 42) One study, found that across all five of their intervention groups, an average savings in Medicare expenditures for hospitalizations was \$512 per patient.(26) Another study reported savings of \$1,517 per resident for patients with respiratory infections treated at the LTC center (42) and another study reported savings of \$3,000 in the last week of life for patients who received palliative care consults.(38) One study found the intervention group had \$1,101 higher costs per patient in the intervention group (non statistically significant) (29) and one study found higher hospice and overall costs for the intervention group, but lower expenditures on hospitalization and skilled nursing facility days.(40)

Findings by Intervention Category:

Advanced Nursing

Programs utilizing advanced nursing included registered nurses with experience in acute interventions, advanced practice registered nurses or nurse practitioners. Advanced practice nurses are registered nurses with additional training and enhanced skillset.(47, 48) In all programs, nursing care supplemented that provided by primary care physicians. All studies except one (31) had nursing staff provide scheduled visits to patients to manage chronic diseases, complete assessments and monitor changes in health status. In four studies nursing were involved with patients being discharged from hospital by assisting in discharge planning or providing nursing care.(26, 30, 32, 33) In two studies the advanced nurses provided education to LTC staff but not direct clinical care to patients.(26) Seven interventions included nurses that provided acute care. In one study, registered nurses reported that 78% of patients they treated for acute issues were treated in the LTC center, avoiding an ED visit.(30) Another study reported 43% of acute issues managed by a nurse practitioner avoided transport to the ED.(33) Both of these studies used self-reported measures where the nurse reported if they felt an ED visit (30), or hospitalization (33) was avoided. In a study utilizing nurse practitioners to provide care through a program called Evercare, patients in the Evercare program had an average of 2.4 hospital admissions per 100 enrollees per month compared to 4.6 admissions in the control group (p=.001). Two programs utilized telemedicine in conjunction with care from nurse practitioners and other allied health personnel.(26, 31) One pilot program had nurse practitioners and physician assistants assess patients through telemedicine and determine if they required transfer to the ED or if they could be treated on site. They reported that 69% of cases that would previously have been sent to the ED, were treated at the LTC center.(31)

INTERACT

The INTERACT program consists of a set of seven tools aimed at preventing hospital admissions by identifying and treating changes in condition early, managing conditions in the LTC center when possible, and improving advanced care planning (Figure 2). These studies included as few as three LTC centers (35) to as many as 264.(34) There was wide variability in how INTERACT was implemented in each study. In one study, some sites implemented as few as two of the seven tools or as many as five (26), one study modified the tools (28) and in the largest study almost a quarter of the included sites had incomplete data on tool usage.(34) There were no data to indicate if the use of specific tools or the usage of a certain number of tools impacted outcomes more. Two studies categorized LTC centers by their level of engagement finding in both cases that reductions in hospitalization were higher in those that were more engaged with a 14-24% reduction in hospitalization in centers considered engaged compared to a 0-6% reduction in those considered non-engaged.(36, 37) Although not significant, one low-engagement group saw an increase in hospitalizations of 31.9% ($p=.073$) Two observational studies found significant reductions in hospitalizations with one pilot program finding an overall reduction of 50% in hospitalizations per 1000 resident days and a relative reduction of 36% in potentially avoidable hospital admissions.(35) That pilot was followed up by a multi-centered study including 30 nursing homes. This study found a 17% reduction in hospitalization rates (95% confidence interval -0.08 to -1.30).(36) When INTERACT was applied in a 264 center randomized controlled trial. However, there was no significant difference in hospitalizations or ED visits. Similarly, to the previous studies showing greater effects of the intervention with greater engagement, a subgroup analysis of this study found that LTC centers who reported increased use of the tools had greater reductions in hospitalization. They report a relative

reduction of 11.2% in all cause hospitalizations and of 18.9% in potentially avoidable hospitalizations (both $p < .001$).⁽²¹⁾ The most successful program using INTERACT tools also included an advanced practice nurse providing direct care to patients. This study reported a 54.1% marginal decrease in ED visits ($p < .001$) and a 65.3% marginal decrease in potentially preventable ED visits ($p < .001$).⁽²⁶⁾

End-of-Life

End-of life care was addressed in three different ways between five studies. One study implemented a palliative care framework and set of tools in addition to a palliative care nurse providing and modeling good palliative care. They report a 7% reduction in hospital admission in the last eight weeks of life.⁽³⁹⁾ One author contributed three retrospective cohort studies to this review, one of which was a subgroup analysis of patients with moderate to severe advanced dementia.⁽⁴⁰⁾ These studies evaluate palliative care consults provided by nurse practitioners that address goals of care and symptom management. All three studies showed a reduction in hospital admission in patients with palliative care consults, and both studies measuring ED visits found a reduction in these as well.^(38, 40) In one of these studies, ED visits in patients who had palliative consults between 31 and 60 days before death was almost half of that as those that did not.⁽³⁸⁾ The same study found patients who had earlier consults had a hospital admission rate that was 13.2% less than those without consults ($p = .003$).

Condition Specific

Two studies focused on the acute treatment of specific conditions. The first study focused on treating pneumonia and other lower respiratory tract infections in the LTC center with a specific clinical pathway that included obtaining chest x-rays and administering subcutaneous normal saline and oral Levofloxacin.⁽⁴²⁾ They found that 12% fewer patients in the intervention group

were admitted to the hospital compared to those in the usual care group (weighted mean difference of 12% 95%CI 5% to 18%). They found this difference was higher in patients who had pneumonia confirmed by radiograph (19% less hospitalizations (weighted mean difference 95%CI 7% to 32%) ($p = .005$). The second study provided training to LTC nursing staff on the treatment of dehydration and infections with intravenous fluids and antibiotics.(43) They report an overall decrease of 44% in hospitalizations for dehydration or infection with 37% of patients treated at the LTC center in the before period (28-47%) and 81% of patients treated at onsite after the intervention (76% -86%) ($p < .05$). There was a decrease in hospitalization for dehydration of 39% with the number of patients being treated onsite increasing from 53% (35-71%) before the intervention to 92% (87-97%) after ($p < .001$) and a decrease in patients being transferred for infection with 29% (18-41%) being treated onsite before the intervention and 71% (63-79%) after ($p < .001$). To address difficulties with placing intravenous lines, the LTC centers arranged for the paramedic service to assist them when required.

Extended Care Paramedics

Two studies, representing one program, utilized extended care paramedics who responded to calls for acute issues in LTC centers, such as abdominal pain, diabetic problems and traumatic injuries.(44, 45) They found a 29.3% decrease in overall ED transfers after the program was implemented ($p < .001$) and that patients treated by an extended care paramedic were less likely to visit the ED than those treated by an emergency paramedic (45.3% vs 92.7%, $p < .001$). The second paper found patients seen by the extended care paramedic were less likely to be admitted (16.8%) compared to those seen by an emergency paramedic (39.8%) ($p < .001$). However, there were some differences in the Canadian Triage and Acuity Scores (CTAS) of patients seen by each type of paramedic, with extended care paramedics seeing fewer patients assigned a CTAS

score of 1 (resuscitation), 2 (emergent) or 3 (urgent) and were more likely to see patients with a CTAS score of 4 (less urgent) or 5 (non urgent).

Discussion

As the pressures on hospital resources continue to rise and as healthcare becomes more patient oriented, several programs have been created that attempt to avoid ED visits and treat patients on-site. In this review, we found that interventions targeting reduced ED visits or hospital admission by LTC patients could be classified into five categories: 1) advanced practice nursing; 2) INTERACT; 3) end of life or palliative care; 4) condition specific interventions; and 5) extended care paramedics. With one exception (40), all interventions trended towards a reduction in ED visits or hospitalization. When measured, studies reported decreased length of stay, more time spent with patients, cost savings, and no change in paramedic offload delay. Few studies tracked adverse events such as repeat emergency or hospital care, mortality or other quality measures. The studies that did measure mortality found a small but statistically insignificant increase.

Our study found a number of good initiatives to treat LTC patients on-site however, many of them were pilot projects or quality improvement projects and very few evaluated their interventions against a comparator group. Research in this area could benefit from the use of more standardized interventional designs with a specific focus on patient- oriented outcomes. Although many programs had a mechanism to respond to acute issues in residents, three programs focused specifically on these.(6,7,10,18) Programs that utilized advanced practice nurses responded to acute conditions in patients but most often that was in addition to providing enhanced primary care. Acute conditions such as fall-related injuries, pneumonia and other infections are among the top sources of potentially avoidable ED visits.(12) In a population-

based study that tracked LTC residents in the province of Ontario, 36.5% of the residents had an ED visit within the year and 56.5% of those patients were immediately discharged back to the LTC center. This suggests that some of these patients could have received care in a place other than the hospital ED.(11)

Paramedics have experience providing acute care in an out-of-hospital environment as well as palliative and end-of-life care, and may be able to provide some key treatments that could allow residents to remain in their LTC home. Paramedics have a unique skill set that may be able to compliment the current care being provided by advanced practice nurses and primary care physicians. In a community paramedic model, paramedics could respond to acute issues in LTC patients working in collaboration with existing care teams. If paramedics could treat even a portion of patients on site, it could reduce the burden on the ED's, hospitals and most importantly on patients. Although a standard exists which provides a framework for community paramedicine, (17) there are many questions that still need to be answered regarding community paramedicine in the LTC setting. These questions include what the best model of care is, what additional training would be required, what scope enhancements are needed and how best paramedics can integrate within care structures ensuring that the care they provide compliments but does not duplicate existing care models.

Our study has several strengths. We followed a rigorous methodology which we published *a priori*, utilized the assistance of a Health Sciences Librarian and used two reviewers to perform screening and risk of bias assessments in duplicate. As we were expecting diversity in interventions, we created a broad search strategy. This resulted in the need to screen a high volume of citations but hopefully reduced the chances we missed any relevant intervention.

Our systematic review also has its limitations. Despite our broad search strategy, it is still possible we missed eligible studies. Included languages were limited to English and French and we were unable to meta-analyze due to heterogeneity. Included studies were quite diverse, making it difficult to report outcomes in a uniformed manner or to make comparisons. Many programs included multiple interventions, making it difficult to determine what contributions individual interventions made to the outcomes. We found several interventions of interest from Australasia. However, they occurred in Residential Aged Care Facilities which are a combination of several levels of care and not specific to LTC patients. It is possible we missed important information by excluding these studies. Although our primary outcome of interest was ED visits, many studies only measured hospitalizations. As it would be uncommon for a patient to be admitted to hospital without first being assessed in the ED, we suspect that hospitalization rates would underestimate ED visits. Most studies were observational, many without comparator groups, several were of concern for risk of bias and, there were few randomized controlled trials. No study evaluated patient preferences or experiences and very few reported on adverse events.

Conclusion

Although many interventions found in our study trended towards successfully reducing ED visits or hospitalizations, most studies were observational, and evaluations of patient safety were lacking. Our study found several types of interventions that target the reduction of ED visits in LTC patients. Despite efforts to reduce ED visits by providing better primary care, residents will always be at risk of acute issues. Further investigation into interventions that respond to acute issues, such as community paramedics, may be beneficial. Ideally, more research is needed to evaluate the safety of interventions and should also consider outcomes such as patient preferences and quality of life indicators.

Acknowledgements

Lindsey Sikora, Health Sciences Librarian, University of Ottawa.

References

1. Canadian Institute for Health Information. Health Care in Canada, 2011. A Focus on Seniors and Aging. Ottawa, Ont.; 2011.
2. Hoot NR, Aronsky D. Systematic review of emergency department crowding: causes, effects, and solutions. *Annals of emergency medicine*. 2008;52(2):126-36. e1.
3. Ospina M, Bond K, Schull M, Innes G, Blitz S, Friesen C, Rowe BH.. Measuring overcrowding in emergency departments: a call for standardization. *Technology report*. 2006(67.1).
4. Cooney DR, Millin MG, Carter A, Lawner BJ, Nable JV, Wallus HJ. Ambulance diversion and emergency department offload delay: resource document for the National Association of EMS Physicians position statement. *Prehospital Emergency Care*. 2011;15(4):555-61.
5. Porter K. Ottawa Exposed to Lawsuits over Failure to Meet Ambulance Response Targets: Report. *CBCnews CBC/Radio Canada*. 2016 14, Oct. 2016.
6. Gorman M. Strain of balancing ER demand with capacity leads to ambulance offload delays. *CBC News*. 2017 Oct 10, 2017.
7. AHS tackles ER 'offload delays' for paramedics. *CBC News, Calgary*. 2010 November 5, 2010.
8. Reevely D. Ottawa ran out of ambulances 22 times in the past two weeks, city admits. *National Post*. 2016 December 11, 2016.
9. Carter A. Patients will literally die': Times when no ambulances available on the rise. *CBC News*. 2017 Aug 02, 2017.

10. Canada Go. Long-term facilities-based care [Website]. Home and continuing health care: Canada.ca; 2004 [Available from: <https://www.canada.ca/en/health-canada/services/home-continuing-care/long-term-facilities-based-care.html>].
11. Gruneir A, Bell CM, Bronskill SE, Schull M, Anderson GM, Rochon PA. Frequency and pattern of emergency department visits by long-term care residents—a population-based study. *Journal of the American Geriatrics Society*. 2010;58(3):510-7.
12. Canadian Institute for Health Information. Sources of Potentially Avoidable Emergency Department Visits; Report. Ottawa, Ont.: CIHI; 2014.
13. Ministry of Health and Long-Term Care. Hallway Health Care: A System Under Strain; First Interim Report from the Premier’s Council on Improving Healthcare and Ending Hallway Medicine.
14. Creditor MC. Hazards of hospitalization of the elderly. *Annals of internal medicine*. 1993;118(3):219-23.
15. Quach C, McArthur M, McGeer A, Li L, Simor A, Dionne M, Levesque E, Tremblay L.. Risk of infection following a visit to the emergency department: a cohort study. *CMAJ*. 2012;184(4):E232-E9.
16. Canadian, Medical, Association. A Policy Framework to Guide a National Seniors Strategy for Canada.
17. Group C. Community paramedicine: Framework for program development. 2017(Z1630-17).
18. Leduc S, Vaillancourt C, Thiruganasambandamoorthy V, Wells G, Kelly P. The safety and efficacy of on-site treatment interventions targeting the reduction of emergency

- department visits by long-term care patients: a systematic review. PROSPERO 2018 CRD42018091636.
19. Moher D, Liberati A, Tetzlaff J, Altman DG, The PG. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLOS Medicine*. 2009;6(7):e1000097.
 20. Leduc S, Kelly P, Thiruganasambandamoorthy V, Wells G, Vaillancourt C. The safety and efficacy of on-site paramedic and allied health treatment interventions targeting the reduction of emergency department visits by long-term care patients: systematic review protocol. *Systematic reviews*. 2018;7(1):206.
 21. Canadian Agency for Drugs Technologies in Health. Grey matters: a practical tool for searching health-related grey literature. Ottawa, ON. 2015.
 22. Higgins JP, Altman DG, Gøtzsche PC, Jüni P, Moher D, Oxman AD, Savovic J, Schulz K, Weeks L, Sterne JAC. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *Bmj*. 2011;343:d5928.
 23. Green S. Chapter 8: Assessing risk of bias in included studies. *Cochrane handbook for systematic reviews of interventions version 5.1. 0 [updated March 2011]*2011.
 24. Wells G, Shea B, O'Connell D, Peterson J, Welch V, Losos M, Tugwell P. Newcastle-Ottawa quality assessment scale cohort studies. 2014.
 25. Ingber MJ, Feng Z, Khatutsky G, Wang JM, Bercaw LE, Zheng NT, Vadnais A, Coomer NM, Segelman M. Initiative To Reduce Avoidable Hospitalizations Among Nursing Facility Residents Shows Promising Results. *Health Aff (Millwood)*. 2017;36(3):441-50.
 26. RTI International. Evaluation of the Initiative to Reduce Avoidable Hospitalizations among Nursing Facility Residents: Final Report. Waltham, MA; 2017 September 2017.

27. Rantz MJ, Popejoy L, Vogelsmeier A, Galambos C, Alexander G, Flesner M, Crecelius C, Ge B, Petroski G. Successfully Reducing Hospitalizations of Nursing Home Residents: Results of the Missouri Quality Initiative. *J Am Med Dir Assoc.* 2017;18(11):960-6.
28. Feng Z, Ingber MJ, Segelman M, Zheng NT, Wang JM, Vadnais A, Coomer NM, Khatutsky G. Nursing Facilities Can Reduce Avoidable Hospitalizations Without Increasing Mortality Risk For Residents. *Health Aff (Millwood).* 2018;37(10):1640-6.
29. Aigner MJ, Drew S, Phipps J. A comparative study of nursing home resident outcomes between care provided by nurse practitioners/physicians versus physicians only. *Journal of the American Medical Directors Association.* 2004;5(1):16-23.
30. Bandurchin A, McNally M, Ferguson-Paré M. Bringing back the house call: how an emergency mobile nursing service is reducing avoidable emergency department visits for residents in long-term care homes. *Nursing leadership (Toronto, Ont).* 2011;24(1):59-71.
31. Hofmeyer J, Leider JP, Satorius J, Tanenbaum E, Basel D, Knudson A. Implementation of Telemedicine Consultation to Assess Unplanned Transfers in Rural Long-Term Care Facilities, 2012-2015: A Pilot Study. *J Am Med Dir Assoc.* 2016;17(11):1006-10.
32. Kane RL, Keckhafer G, Flood S, Bershadsky B, Siadaty MS. The effect of Evercare on hospital use. *Journal of the American Geriatrics Society.* 2003;51(10):1427-34.
33. McAiney CA, Haughton D, Jennings J, Farr D, Hillier L, Morden P. A unique practice model for Nurse Practitioners in long-term care homes. *J Adv Nurs.* 2008;62(5):562-71.
34. Kane RL, Huckfeldt P, Tappen R, Engstrom G, Rojido C, Newman D, Yang Z, Ouslander JG. Effects of an Intervention to Reduce Hospitalizations From Nursing

- Homes: A Randomized Implementation Trial of the INTERACT Program. *JAMA Intern Med.* 2017;177(9):1257-64.
35. Ouslander JG, Perloe M, Givens JH, Kluge L, Rutland T, Lamb G. Reducing potentially avoidable hospitalizations of nursing home residents: results of a pilot quality improvement project. *J Am Med Dir Assoc.* 2009;10(9):644-52.
 36. Ouslander JG, Lamb G, Tappen R, Herndon L, Diaz S, Roos BA, Grabowski DC, Bonner A. Interventions to reduce hospitalizations from nursing homes: evaluation of the INTERACT II collaborative quality improvement project. *J Am Geriatr Soc.* 2011;59(4):745-53.
 37. Tena-Nelson R, Santos K, Weingast E, Amrhein S, Ouslander J, Boockvar K. Reducing potentially preventable hospital transfers: results from a thirty nursing home collaborative. *J Am Med Dir Assoc.* 2012;13(7):651-6.
 38. Miller SC, Dahal R, Lima JC, Intrator O, Martin E, Bull J, Hanson LC. Palliative Care Consultations in Nursing Homes and End-of-Life Hospitalizations. *J Pain Symptom Manage.* 2016;52(6):878-83.
 39. Hockley J, Watson J, Oxenham D, Murray SA. The integrated implementation of two end-of-life care tools in nursing care homes in the UK: an in-depth evaluation. *Palliat Med.* 2010;24(8):828-38.
 40. Miller SC, Lima JC, Intrator O, Martin E, Bull J, Hanson LC. Specialty Palliative Care Consultations for Nursing Home Residents With Dementia. *J Pain Symptom Manage.* 2017;54(1):9-16 e5.

41. Temkin-Greener H, Mukamel DB, Ladd H, Ladwig S, Caprio TV, Norton SA, Quill TE, Olsan TH, Cai X. Impact of Nursing Home Palliative Care Teams on End-of-Life Outcomes. *Medical care*. 2018;56(1):11-18.
42. Loeb M, Carusone SC, Goeree R, Walter SD, Brazil K, Krueger P, Simor A, Moss L, Marrie T. Effect of a clinical pathway to reduce hospitalizations in nursing home residents with pneumonia: a randomized controlled trial. *Jama*. 2006;295(21):2503-10.
43. Romoren M, Gjelstad S, Lindbaek M. A structured training program for health workers in intravenous treatment with fluids and antibiotics in nursing homes: A modified stepped-wedge cluster-randomised trial to reduce hospital admissions. *PLoS One*. 2017;12(9):e0182619.
44. Jensen JL, Travers AH, Bardua DJ, Dobson T, Cox B, McVey J, Cain E, Merchant R, Carter AJE. Transport outcomes and dispatch determinants in a paramedic long-term care program: a pilot study. *Canadian Journal of Emergency Medicine*. 2013;15(4):206-13.
45. Jensen JL, Marshall EG, Carter AJ, Boudreau M, Burge F, Travers AH. Impact of a Novel Collaborative Long-Term Care -EMS Model: A Before-and-After Cohort Analysis of an Extended Care Paramedic Program. *Prehosp Emerg Care*. 2016;20(1):111-6.
46. Miller SC, Lima JC, Intrator O, Martin E, Bull J, Hanson LC. Palliative Care Consultations in Nursing Homes and Reductions in Acute Care Use and Potentially Burdensome End-of-Life Transitions. *J Am Geriatr Soc*. 2016;64(11):2280-7.
47. Canadian Nurses Association. *Advanced Practice Nursing; A Pan-Canadian Framework*. Ottawa, Ont.; 2019.

48. APRN Consensus Work Group & the National Council of State Boards of Nursing APRN Advisory Committee. Consensus Model for APRN Regulation: Licensure, Accreditation, Certification & Education. 2008 July 7, 2008.

Table 1. Characteristics of Included Studies

Systematic Review	No. and % of papers; n = 22
Median year of publication and range	2016 [2013-2018]
Country of Publication	
United States	15 (68)
Canada	5 (25)
Scotland	1 (5)
Norway	1 (5)
Language of publication	
English	22
Research Methodology	
Observational	19 (86)
RCT	4 (18)
Quality Improvement Projects	2 (9)
Quasi-experimental	1 (5)
Intervention Type	
Nurse Practitioner/Advanced Practice Nursing	6 (30)
Paramedics	2 (10)
Palliative Care	5 (25)
INTERACT	6 (27)
Condition Specific	
Pneumonia	1 (5)
Dehydration/Infection	1 (5)
Combination of Advanced Nursing and INTERACT	2 (9)
Intervention Provider	
Paramedics	2 (9)
Physicians Assistants	4 (18)
Nurse Practitioners	13 (59)
Advanced Practice Nurses	3 (14)
Registered Nurses	6 (27)
Other Nursing*	9 (41)

*Other nursing included palliative care nurses, certified nursing assistants and nurses whose level of care was not specified. RCT = randomized controlled trial, INTERACT = Interventions to Reduce Acute Care Transfers

Table 2. Risk of Bias for Randomized Control Trials as Assessed by The Cochrane Risk of Bias Tool

	Risk of bias arising from the	Risk of bias due to deviations	Missing outcome data	Risk of bias in measurement of	Risk of bias in selection of the	Overall risk of bias
Kane 2017	Low	High	Low	Low	Low	High*
Loeb 2006	Low	Low	Low	Low	Low	Low
Romoren 2017	High	Low	Low	Low	SC	High
Temkin-Greener 2018	Low	SC	SC	Low	Low	SC

*Note: Direction of bias in deviation from intended interventions is towards the null (the control group took on the intervention) SC=Some Concerns

Table 3 Risk of Bias for Observational Studies as Assessed by the Newcastle-Ottawa Scale

	Newcastle-Ottawa Quality Assessment Scale Cohort Studies			
	Selection (****)	Comparability (**)	Outcome (***)	Total (/9)
Aigner 2004	***		**	5
Bandurchin 2011	**			2
Feng 2018	****	**	**	8
Hockley 2010	****		***	7
Hofmeyer 2016	**			2
Ingber 2017	****	**	**	8
Jensen 2013	****		**	6
Jensen 2016	****		***	7
Kane 2003	****	**	***	9
McAiney 2008	**		*	3
Miller 2016	***	**	***	8
Miller 2016-2	****	**	***	9
Miller 2017	****	**	***	9
Ouslander 2009	****		**	6
Ouslander 2011	***		**	5
Rantz 2017	**		*	3
Tappen 2018	****	**	***	9
Tena-Nelson 2012	***		*	4

Scores are calculated out of a total of 9 points, represented by stars. A study may be awarded up to 4 stars for the selection category, up to 2 stars for comparability and up to 3 for the outcome category.

Table 4. Main Findings

1 st author, year	# of patients	Study Design	Funding	Type of intervention	Main findings	Additional Information
Advanced Nursing						
Aigner et. Al 2004 (56)	203 pts, 8 LTC's	Retrospective health record review	Not stated	Nurse practitioners, partnered with physicians, provided regular and acute care to patients	Fewer patients in the NP group had at least 1 ED visits (p=0.60) and fewer hospital admissions (p value .99) compared to those cared for by physician only.	There were significantly more visits made for acute issues by the NP group than patients cared for by physician only (3.0 visits per year (±2.4) vs 1.2 (±2.1)
Bandurchin et. al. 2011 (57)	12 LTC's with 2, 298 beds	Pilot Project - cohort	Nursing Secretariat of the Ontario Ministry of Health and Long-Term Care	Regular and acute care by mobile registered nurses	ED transports decreased by 10% in the 3 months prior to the program and in the same time period measured after. 5/7 LTC's had a decrease in ED transfers ranging from 7-24%. 2 LTC's had an increase in transfers ranging from 3-67%	

Hofmeyer et. al. 2016 (58)	34 LTC's with 5000 residents	Pilot Project - cohort	Health Resources and Services Administration of the US Department of Health	NP or PA assessed patient via telemedicine and determined if required transfer to ED or would guide treatment in LTC	ED visits were avoided in 69% of telemedicine consults. (511/736)	Previously all patients assessed by telemedicine would have been transferred to the ED
Kane et. al. 2003 (59)	44 LTC's	Quasi-experimental	Centers for Medicare and Medicaid Services (CMS)	Regular and acute care from nurse practitioners	There was an average of 3.3 ED visits per 100 patients / month in the intervention group compared to 6.3 ED visits per 100 patients/month in the control group (p<.001) The average number of hospital admissions for intervention patients was 2.4 per 100 patients per month, vs 4.6 control (p=<.001)	NP care was in addition to physician care Hospitalization rate after receiving acute care in the LTC was similar to rates of re-hospitalization for patients treated in hospital
McAiney et. al 2008 (60)	22 LTC's with 2900 residents	Prospective cohort	Ontario Ministry of Health and Long-Term Care & The Hamilton Emergency Services Network	NPs provided care when requested by LTC, hospital or physician	Care by NP prevented hospital visits in 43% of cases, NPs report that hospital admission was not avoided in 55% of cases. NPs assessed patients eventual outcome and found 2% of patients seen by the NP had died.	NPs determined if their care resulted in an avoided admission or hospital visit all self-reported outcomes

Rantz et. al 2017 (54)	16 LTC's with 3160 beds	Intervention study, no control	Centers for Medicare and Medicaid Services (CMS) Innovations Center and Medicare- Medicaid Coordinatio n Office	Advanced practice nurse (NP or nurse specialist) provided clinical care to patients as well as education to LTC staff	There was an overall reduction in all cause hospitalizations of 30% from the start of the study until the end.	Subgroup of Ingber – reported further there
INTERACT						
Kane et. al 2017 (61)	85 LTC's, 36, 717 residents	Cluster randomized clinical trial	National Institute for Nursing Research & Medline Industries	A project champion facilitated INTERACT training via eLearning and webinars. Project champion was supported by study team	Decrease in ED visits of 0.02 per 1000 resident days 95%CI (-.17 to 0.22) p=.83 All-cause admissions decreased by 0.13 per 1000 resident days, 95%CI (-.36 to .10) p=.25 There was a decrease of 0.18 potentially avoidable hospitalizations per 1000 resident days 95%CI (-.31 to -.04) p=.01 but this was no longer significant when Bonferroni adjustment was applied	Authors reported evidence that the comparison group adopted the intervention due to a policy change penalizing LTC's for hospital admissions They found a reduction in potentially avoidable hospitalizations (-.18 per 1000 resident days; 95%Ci -.31 to -.04) (p=.01) but it was not significant with Bonferroni correction applied.

Ouslander et. al. 2009 (62)	3 LTC's, 289 beds	Prospective quality improvement project	Centers for Medicare and Medicaid Services (CMS)	A panel assessed hospital admissions to determine if avoidable and what factors may have prevented the admission. INTERACT tools were developed based on this and applied.	There was a 28% absolute reduction in potentially avoidable hospitalizations after the intervention was implemented. There was an overall reduction in hospitalizations of 50% per 1000 resident days	
Ouslander et. al. 2011 (63)	30 LTC's	Quality improvement project	The Commonwealth Fund	INTERACT tools were evaluated and improved upon based on feedback to create INTERACT 2, A gerontological NP supported facilities as they implemented the tools.	There was a 17% reduction in hospitalization rates (95% confidence interval -0.08 to -1.30) The highest reductions were seen in "engaged" nursing homes 24% 95% confidence interval 0.23 to -1.56) p=.01	Hospitalizations tracked by LTC staff. Participating LTCs had the highest rate of hospitalizations in the state
Tappen et al. 2018	85 LTC's, 36, 717 residents	Quality improvement Project	National Institute of Nursing Research		There was no statistically significant difference in safety measures between the intervention and control groups in the pre-intervention or intervention years.	This is the safety evaluation of Kane 2017.
Tena-Nelson et. al 2012 (64)	30 LTC's	Quality improvement project	New York State Workforce Training	Implemented INTERACT tools.	There was a non-significant overall reduction in hospital admissions of 10.6%	

			Grant, one author was supported by the Greenwall Foundation	Additional education during implementation included hands on training with a patient simulator and measures were taken to engage LTC executives, hospital staff and unions.	(p=.332) between the before and after period. The effect was higher in highly engaged LTCs with a reduction of 14.3% (p=.213) LTCs with low engagement saw a non-significant increase in hospitalization rates of 31.9% (p=.073)	
INTERACT and Advanced Nursing						
Feng et. al 2018 (55)	143 LTC's	Mixed methods	Centers for Medicare and Medicaid Services	Interventions as stated in Ingber	In pooled analysis the program was associated with a small nonsignificant reduction in mortality. 6 states had a small non-significant increase in mortality (0.3-1.5 percentage points) and New York had a small reduction in mortality (nonsignificant)	This is a mortality analysis of Ingber reported above
Ingber et. al 2017 (52, 53)		Mixed methods	Centers for Medicare and	Enhanced Care and Coordination Provider Organizations in 7	Combined intervention results:	The authors presented results in a variety of ways including relative and absolute measures.

			Medicaid Services	states. They chose which interventions to implement to reduce potentially avoidable hospitalizations following basic guidelines of the funding agency (Centers for Medicare and Medicaid Services)	<p>There was a 2.6 percentage point decrease in probability of having at least one all cause hospitalizations 90%CI (-3.7 to -1.6) (p<.001)</p> <p>Potentially avoidable hospitalizations -2.0 percentage points (90%CI -2.7 to -1.3) (p<.001)</p> <p>All cause ED visits -1.5 percentage points (90%CI -2.6 to -.4 (p=.029)</p> <p>Potentially Avoidable ED visits -.9 percentage points (-1.5 to -.3 (p=.012)</p>	This study is reported in this article, in a report (53), Rantz and Feng
Alabama	23 LTC's			This was an education only model where RN's gave training and support to staff at the LTC's	<p>4.6 percentage point reduction in all cause ED visits (relative reduction of 19.1%) 90%CI (-7.0 to -2.2) (p= 0.002)</p> <p>1.5 percentage point decrease in potentially avoidable hospitalizations (relative effect of 10%) 90%CI (-2.7 to -0.2) (p= 0.061)</p>	
Indiana	19 LTC's			RN's provided direct clinical care as well as	5.1 percentage point lower probability of all cause	

				education and support to LTC staff. RN's were supported by NPs.	hospitalization 90% CI (-8.2 to -2.0) (p=.007) 0.8 percentage point lower probability of all cause ED visit 90%CI (-4.6 to 3.0) (p=.728)	
Missouri	16 LTC's			Advanced practice registered nurses provided direct care to patients as well as education to LTC staff.	7.9 percentage point lower probability of all cause hospitalization 90%CI (-10.0 to -5.7) (P<.001) Probability of all cause ED visits decreased by 6.8 percentage points 90%CI (-9.4 to -4.1) (p<.001)	
Nebraska	14 LTC's			NPs provided clinical care and were on call for acute conditions. Dental hygiene, medication management and education for LTC staff were also part of the program.	2.3 percentage point lower probability of an all cause hospitalization 90%CI (-4.9 to 0.3) (p=.144) 1.3 higher probability of an all cause ED visit 90%CI (-2.3 to 4.8) (p=.559)	
Nevada	24 LTC's			Advanced practice nurses, RN's and physician assistants rotated through facilities to provide clinical care to patients and training to LTC staff.	All cause hospitalizations 5.7 percentage point lower probability 90%CI (-9.1 to -2.3)(p=.007) 0.8 percentage point higher probability of an all	

					cause ED visit 90%CI (-2.1 to 3.6) (p=.654)	
New York	29 LTC's			RN's educated LTC staff, identified causes of hospitalization and provided reports. No direct clinical care provided to patients.	2.8 percentage point lower probability of all cause hospitalization 90%CI (-4.8 to -.7) (p=.027) 0.8 percentage point lower probability of an all cause ED visit 90%CI (-2.6 to 1.1) (p=.513)	
Pennsylvania	18 LTC's			NPs and an enhanced care RN provided direct clinical care to patients.	3.1 percentage points lower probability of an all cause hospitalization 90%CI (-5.9 to -.2) (p=.075) 1.0 percentage point decrease in probability of having at least one 90%CI (-4.2 to 2.3) (p=.618) 2.0 percentage points decrease probability of having at least one potentially avoidable ED visit 90%CI (-3.2 to -.7) (p.013)	
End of Life						

Hockley et. al 2010 (66)	7 LTC's, 228 pts	Retrospective cohort	The Robertson Trust, Lothian Health Board, St. Columba's Hospice, Macmillan Cancer Support	Palliative care nurse modeled care in homes that implemented two end of life tools: the Gold Standards Framework for Care homes and an adapted Liverpool Care Pathway for Care Homes	31% of patients were hospitalized in the last 8 weeks of life before the intervention and 24% were hospitalized after. Clinically inappropriate days send in hospital fell from 82% before the intervention and 44% after	
Miller et. al. 2016 (72)	286 LTC's	Retrospective cohort	National Institute on Aging Grant	Palliative care consultations with NPs that address symptom management, goals of care and advanced directives	1.6 percentage point rate reduction in hospitalizations in the last 30 days of life after PC consults were introduced (p<.01) Before PC consults 29% (SD 0.109) patients hospitalized in last 30 days of life and 26% (SD 0.106) after	An increased number of palliative care visits was not associated with reduced hospitalization
Miller et. al 2016 (65)	46 LTC's, 477 pts	Retrospective cohort	National Institute on Aging Grant	Palliative care consultations with NPs that address symptom management, goals of care and advanced directives	Hospital admission was significantly less all patients who had consultations compared to those who didn't. Hospitalization in the last 60 days of life for those with early PC Consultation (between 61-180 days before death) rate of 26.9	The earlier the palliative care consultation occurred (the further from death) the higher the reduction in hospitalization

					<p>95%CI (23.0-30.9) and those without consultation 40.1 (37.0-43.3) p=.003,</p> <p>The rate of ED visits in the last 30 days of life was 8.3 95%CI (5.4-11.2), in the group that had palliative care consults between 31-60 days before death vs 15.9 95%CI (13.4-18.4) p=.02 in those without consults,</p>	
Miller et. al 2017 (67)	31 LTC's, 217 pts	Retrospective cohort	National Institute on Aging Grant	Palliative care consultations with NPs that address symptom management, goals of care and advanced directives	<p>Risk of hospitalization with early consult 13.2% points lower than without consult 95% CI (-21.8 to -4.7%)</p> <p>Hospitalizations in last 30 days of life were 18.4 percentage points lower in patients who had early consultation vs those who had none 95%CI (-28.5, -8.4%)</p> <p>Patients with PC consultations had an average individual risk difference of -11.9% 95%CI (-20.7 to -3.1%) of having an ED visit</p>	This is a subgroup of Miller 2016-2

Temkin-Greener et. al 2018 (68)	25 LTC's, 5, 830	Randomized controlled trial	The Patient Centered Outcomes Research Institute (PCORI)	Implementation of LTC based palliative care teams	Incident rate ratio for number of hospital stays in the last 90 days of life was 1.068 in treatment facilities compared to the preintervention period and 1.035 in control facilities compared to the preintervention period nonsignificant	
Condition Specific Interventions						
Loeb et. al 2006 (69)	22 LTC's, 680 pts	Cluster randomized controlled trial	Canadian Institutes of Health Research Interdisciplinary Health Research Team grant and The Physicians' Services Incorporated Foundation of Ontario	Clinical treatment path including fluids and antibiotics for patients with lower respiratory tract infections	No significant difference in ED visits 12% fewer patients in the clinical pathway were admitted than the usual care (weighted mean difference 12%) 95%CI 5% to 18%) P=.001 In patients with radiographically confirmed pneumonia weighted mean difference of 19% fewer hospitalizations for clinical pathway group 95%CI (7%-32%) p=.005	This study reported a weighted mean difference in mortality rate of 2.9% (95%CI, -2.0% to 7.9%) with a weighted mean mortality of 3.1% in the group who received treatment at the LTC and 6.0% in the group who received usual care.

Romoren et. al 2017 (70)	30 LTC's, 330 cases	Modified stepped-wedge cluster-randomized trial	The South-Eastern Norway Regional Health Authority and the University of Oslo, Norway	LTC staff received training on administering fluids and antibiotics to treat dehydration and infections	<p>Overall 37% decrease in hospitalizations for dehydration or infection (81% control period (76 - 86%) and 37% in after (28-47%) $p < .05$.</p> <p>There was a decrease in hospitalization for IV fluids of 39% from 92% (87-97%) to 53% (35-71%) $p < .001$) and a decrease in patients being treated by antibiotics from 71% (63-79%) to 29% (18-41%) $p < .001$)</p> <p>45% (95%CI, 36-55%) of patients who received IV antibiotics at the LTC died within 30 days compared to 36% (95%CI, 25-46%) who were treated at the hospital ($p=0.17$)</p> <p>19% (95%CI, 11 to 26%) of patients who received IV fluids at the LTC died within 30 days compared to 8% (95%CI, 0-20%) patients treated at hospital ($p=0.22$)</p>	Authors performed a multilevel logistic regression to further assess mortality and found that the location of treatment (LTC vs hospital) was not associated with mortality but that reduced level of consciousness, treatment with antibiotics instead of fluids, age less than 70 and elevated CRP levels were.
--------------------------	---------------------	---	---	---	--	---

Extended Care Paramedics						
Jensen et. al 2013 (71)	15 LTC's, 238 pts	Observational pilot	Canadian Institutes of Health Research grant	Extended care paramedics responded to acute issues in LTC patients	<p>70% of patients treated by Extended Care Paramedic (ECP) remained at the LTC (No ED visit) vs 21.4% of patients treated by Emergency paramedics.</p> <p>Within 48 hours, 4.3% of patients (6/140) treated by ECPs had a subsequent 911 call related to the initial call problem. There were no repeat calls in the group treated by emergency paramedics</p>	
Jensen et al 2016 (30)	Unknown # LTC's, 360 patients	Retrospective cohort	Not stated	Extended care paramedics responded to acute issues in LTC patients	<p>Significant difference in overall ED transfers in the before (no ECPs) and after groups 94.9% transported in before vs 65.6% transported in after (p=<.001)</p> <p>Patients seen by ECP less likely to be admitted 16.8% admitted with ECP vs 39.8% admitted with Emergency paramedic (p=<.001)</p>	<p>Patient CTAS levels differed between ECP and Emergency Paramedic groups</p> <p>Extended Care Paramedics saw fewer high acuity patients</p>

					2.8% of patients (2/70) treated by ECPs and not transported had repeat calls to paramedics within 48 hours compared to 14.3% (1/7) patients who were treated by emergency paramedics and not transported.	
--	--	--	--	--	---	--

Pts = patients, LTC's = long-term care centers, ED = Emergency Department, NP=Nurse Practitioner, APRN = Advanced Practice Nurse, ECP = Extended Care Paramedic, CTAS = Canadian Triage and Acuity Scale, IV = intravenous, CRP = c-reactive protein

Figure 1. Study Flow Diagram

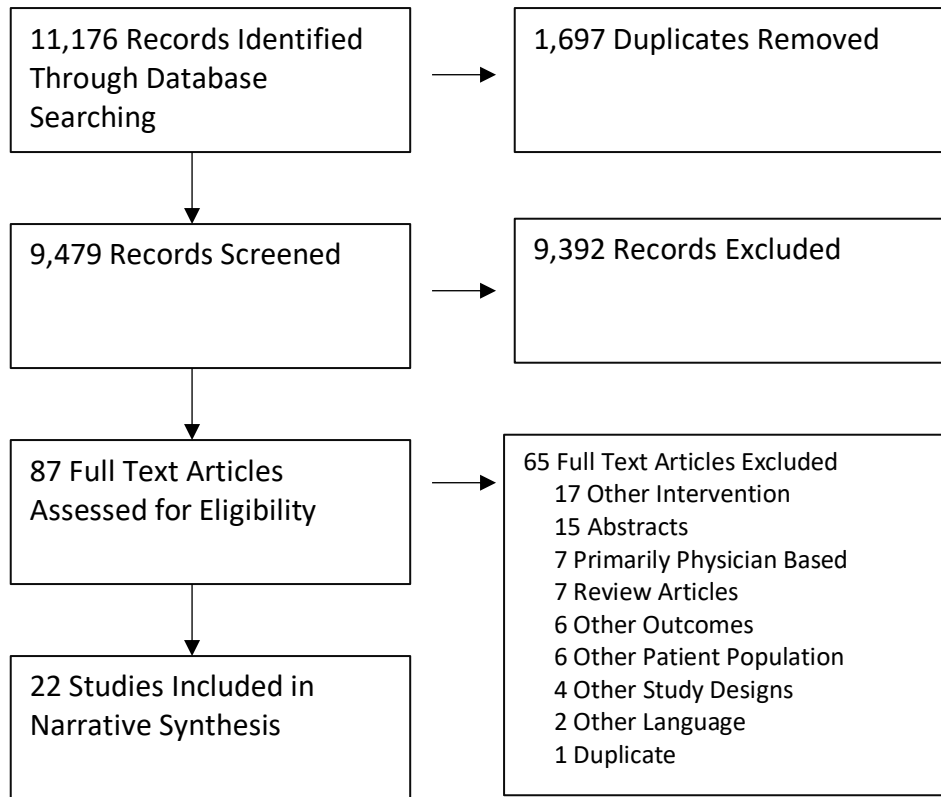


Figure 2. Summary of INTERACT Tools

INTERACT Tools (23)
Stop and Watch Early Warning Tool
SBAR Communication Form and Progress Note
Hospitalization Tracking Tool
Root Cause Analysis Quality Improvement Review Tool
Hospital Transfer Form
Decision Support Tools (Care Paths, Change in Condition File Cards)
Advanced Care Planning Tools

*SBAR = Situation, Background, Assessment, Recommendation

Appendix – Medline Search Strategy

1. Long-Term Care/
2. Homes for the Aged/
3. Nursing Homes/
4. Emergency Service, Hospital/
5. Emergency Medical Services/
6. (nursing adj2 home).tw.
7. 1 or 2 or 3 or 6
8. on-site treatment*.tw.
9. (emergenc* adj3 (respond* or aid* or technician*)).tw.
10. (emergenc* adj3 service*).tw.
11. paramed*.tw.
12. ambula*.tw.
13. Emergency Medical Services/ or "Transportation of Patients"/
14. exp "Transportation of Patients"/
15. (hospital adj2 transfer).tw.
16. (patient adj2 trans*).tw.
17. Allied Health Personnel/
18. Hospitalization/
19. 4 or 5 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18
20. 7 and 19
21. limit 20 to "all adult (19 plus years)"

Chapter 4 – NATIONAL SURVEY OF CANADIAN PARAMEDIC SERVICES

Chapter 4 addresses the research questions: *What programs exist across Canada where paramedics are providing alternative models of care to patients living in LTC, what are the outcomes of those programs on a patient and health care system level, what are the needs for future programs, and what barriers exist to implementing future programs?*

Paramedic services across Canada face systemic barriers to engaging in research and publishing evaluations of initiatives they implement. We expected there were more paramedic led programs treating LTC patients on-site than we would find in the published or grey literature during our systematic review. As such, the objective of this chapter was to determine what community paramedic programs treating LTC patients exist across Canada and what paramedic services thought their priorities, need, feasibility and barriers are to implementing such programs.

Chapter 4 contains one manuscript which is in preparation for submission to Prehospital Emergency Care. The manuscript is described below.

Chapter Contents

Section 4.1 presents the results of a national survey of paramedic services surrounding community paramedics in LTC . This manuscript is in preparation for submission.

4.1 Alternative Care Models for Paramedic Patients From Long-term Care Centers; a National Survey of Canadian Paramedic Services

Section Overview

This section presents the results of our survey of Canadian paramedic services, describing the priorities, needs, feasibility and barriers to implementing community paramedic programs in LTC.

Manuscript Status

This manuscript is in preparation for submission to Prehospital Emergency Care

Author Roles and Contributions

SL, CV and PK contributed to study design. SL and PK contributed to survey design and piloting. SL drafted the manuscript and PK, CV, VT and GW critically revised it.

Related Thesis Appendices

Appendix 1: Waiver of Ethics Review – Survey

Appendix 2: Letter to Paramedic Chiefs Introducing Survey

Appendix 3: Direct Email to Introduce Survey

Appendix 4: Survey of Canadian Paramedic Services

Alternative Care Models for Paramedic Patients From Long-term Care Centers; a National Survey of Canadian Paramedic Services

Shannon Leduc MSc(c)^{1,2}, ACP, George Wells PhD^{2,3}, Venkatesh Thiruganasambandamoorthy MBBS, MSc^{2,4,5}, Peter Kelly ACP¹, Christian Vaillancourt, MD, MSc^{2,4,5}

¹Ottawa Paramedic Service, Ottawa, Ontario;

²School of Epidemiology and Public Health, University of Ottawa, Ottawa, Ontario;

³Cardiovascular Research Methods Centre, University of Ottawa Heart Institute

⁴Department of Emergency Medicine, University of Ottawa, Ottawa, Ontario;

⁵Ottawa Hospital Research Institute, Ottawa, Ontario

Conflicts of Interest: None

Keywords

Paramedic, EMS, long-term care, ED crowding, community paramedicine

Abstract:339

Manuscript: 2,509

Abstract

Introduction

Long-term care (LTC) patients do poorly when transported to the emergency department (ED) for care. Community paramedic programs can deliver enhanced care in their place of residence, yet few such programs are reported in the literature. We conducted a national cross sectional survey of land ambulance services to understand if such programs exist in Canada, and what the perceived needs and priorities are for future programs.

Methods

We emailed a 46-question electronic survey to paramedic services across Canada. We asked services about their characteristics, current ED diversion programs, existing diversion programs specific to LTC patients, priorities for future programs, the potential impact of such programs, and what the feasibility and barriers are to implementing programs that treat LTC patients on-site, avoiding an ED visit.

Results

We received responses from 50 services across Canada, providing services to 73.5% of the total population. Almost half of responding services were municipally run (48.0%), 68.0 percent covered a mix of low and high population density, and 28.0% employed self-regulated paramedics. Almost a third (30.0%) had existing treat-and-refer programs, and 65.5% of services reported transporting to destinations other than an ED. Almost all respondents (98.0%) felt the need for programs to treat LTC patients on site, avoiding an ED visit, and 36.0% had such existing programs. The top priorities for future programs were support for patients being discharged (30.6%), extended care paramedics (24.5%), and respiratory illness treat-in-place program (20.4%). The highest potential impact was expected from support for patients being

discharged (62.0%) and respiratory illness treat-in-place programs (54.0%). Required changes in legislation (36.0%) and required changes to the current system of medical oversight (34.0%) were identified as the top barriers to implementing such programs.

Conclusion

The number of current community paramedic programs treating LTC patients on site does not match the identified need for such programs, and little scientific evidence exists that evaluates existing programs. There are several program models believed to have high impact, but significant barriers to broad adoption exist including required changes to legislation and existing structures of medical oversight.

Introduction

Community paramedic program initiatives are growing across Canada and around the world. In a healthcare system that is under-resourced and struggling to provide quality care to an ageing population, community paramedic programs are being designed and implemented to supplement existing healthcare, provide care delivery options in the community rather than in hospital, and to improve patient outcomes and relieve pressure on the healthcare system, reducing hallway healthcare.(1) Community paramedic programs are often designed to address gaps in the healthcare system and are designed specifically to meet a community's unique needs.(2) This results in programs being highly variable from place to place.(3)

As a method to mitigate healthcare resource issues, community paramedic programs often target vulnerable populations or high users of paramedic and ED services. One such group is patients living in long-term care (LTC) centers. These patients are older than seniors living in the community, have more comorbidities and higher prevalence of frailty and dementia.(4, 5) LTC patients also have higher levels of emergency department (ED) use, spend more time in the ED when they are there, are more likely to be admitted, and have longer lengths of stay compared to seniors in the community.(6) These factors make LTC patients an ideal target for community paramedic programs. However, a recent systematic review found only one program that served this population.(7) It is possible there are fewer programs in LTC as this population has access to healthcare resources in their place of residence and might be perceived as having less needs. It is also possible more community paramedic programs exist but are not published in the scientific literature as there have been several barriers identified to conducting research in paramedic services.(8)

We completed a national cross-sectional survey to determine what community paramedic programs exist across Canada, and what the perceived needs and barriers are for future programs in LTC.

Methods

Design and Setting

We completed an electronic cross-sectional survey of land paramedic services across Canada.

Population

Paramedic services are delivered in various models across the country and are under the jurisdiction of the city, province, territory or region they are located in or, in some cases, may be operated by a private company. We worked with the Paramedic Chiefs of Canada (PCC) to identify paramedic services across the country using their membership list as a base, then searched Government websites for additional services. We directly contacted 91 paramedic service leaders from these lists. The PCC and the Paramedic Association of Canada (PAC) sent a recruitment email to their email list servers introducing our study and its goals and asking for participation in the survey. (Appendix 2) We asked that each service leader identify the most appropriate person to fill out the survey on behalf of their service. We directly contacted leaders of services who did not reply to the call from the PCC and PAC and those we identified who were not on the membership list by email. The survey did not ask for personal or patient information and only asked questions about the service as an organization. We received a waiver of ethics review from Ottawa Health Science Network Research Ethics Board (OHSN-REB)

Survey Instrument

We designed a six-part, 43-question electronic survey (available in appendix 4) informed by the findings of our completed systematic review examining programs in LTC centers targeting the treatment on-site of residents and the reduction of ED visits.(9) We presented a draft of initial questions to members of the Eastern Ontario Paramedic Chiefs who provided feedback on question relevance and made suggestions for further questions. After two rounds of feedback, we presented the questions to a Paramedic Chief with experience in research for further feedback. We worked with members of the Ontario Association of Paramedic Chiefs to test our survey for face and content validity and piloted our survey with two paramedic services. We asked respondents questions about the following six topics: 1) Service characteristics including existing ED diversion programs, also known as treat and release or refer programs; 2) Programs specific to treating LTC patients on-site, avoiding an ED visits; 3) Services perceived needs for alternative models of care outside the traditional paramedic response that results in an ED visit; 4) The priorities of future potential programs; 5) The potential impact of these programs and the feasibility and barriers to implementing them; and 6) Additional information the services wanted to share. The survey was distributed in English and French.

Survey Distribution

We used a modified Dillman method to deliver our survey to the individuals identified by service leadership as the most appropriate people to complete the survey and up to three reminders were sent.(10) We followed up with services who did not identify a specific individual and, in cases where we had difficulty identifying respondents, used networking strategies to increase our response rate. We did not offer any incentives or compensation for completion of the survey.

Data Collection & Analysis

We collected data using Google Forms and exported it into Microsoft Excel for Mac (version 15.28). To ensure we didn't miss any key programs; we included a survey question asking if the respondent was aware of any other service with a program in place to decrease the number of emergency responses or transports from LTC centers. We analyzed demographic data and Likert scales with descriptive statistics, using frequencies and proportions and present medians with interquartile ranges. We present ranked data for program priorities.

Results

We received 50 responses to our survey from services representing 73.5% of the Canadian population, and from all provinces and territories exception of Nunavut and the North West Territories (Table 1). Of the 91 services we contacted, 86 identified a most appropriate person to complete the survey resulting in a response rate of 58%. As we do not know the number of individuals on the list servers of the PCC and PAC, it is impossible to know the total number of people who received the survey invitation. Of the people who responded to our survey, 24 (48.0%) self-identified as representing municipally run services, 10 as representing provincial services (20.0%), 9 as private services (18.0%), and we received one response from a First Nations service. Respondents were primarily from services that covered a mix of high and low population density areas (n=34, 68.0%) and mostly staffed with Primary Care Paramedics 71.0% [52, 96]. Fourteen services (28.0%) were self-regulated. Surveys were frequently filled out by

the Chief, Director, or a senior leader (n=22, 44.0%). We received 14 surveys (28.0%) where the respondent did not identify their position in the organization and one survey that did not indicate which service or location it was from.

Characteristics of responding services are reported in Table 2. Almost a third of services had dispatch protocols in place through the 9-1-1 system, where a paramedic may not be dispatched to an emergency call (n=13, 26.0%), or had treat and release/refer protocols in place (n=15, 30.0%) where a patient received treatment on scene and may be referred to follow up care but is not transported to the ED. Nineteen services (65.5%) indicated they transport patients to places other than an ED, including 18 to hospital areas other than the ED (62.1%), nine to mental health services (31.0%), nine to detox centers (31.0%), and seven to urgent care centers or walk in clinics (24.1%). Of the 35 services who did not have treat and refer protocols, 31 wished to implement them (88.6%). (Table 3)

Current Programs in long-term care centers

In our sample, 49 services (98.0%) felt there was a need for programs in place to reduce ED visits from LTC patients, and 18 services (36.0%) had existing programs in place. (Table 4). When asked if they had knowledge of existing programs at other services, no respondent indicated knowing of a program that we were not aware of, or was not already captured through our survey responses. Existing programs included different versions of community paramedics or a mobile integrated health team, remote patient monitoring, and influenza treat in place programs. Those with community paramedic programs described them as paramedics with additional training in patient assessment, ageing and geriatric care, medication reviews, falls prevention, and screening for diseases such as diabetes and hypertension. Respondents described

paramedics in these programs as having an expanded scope compared to emergency response paramedics, including the ability to draw blood work and the administration of antibiotics, as well as integrating with the patients' primary care health team. Fifteen services (83.3%) with programs to treat on-site in LTC indicated they were measuring outcomes including 13 measuring repeat calls for the same patient (26.0%), 12 measuring patient transport volumes (80.0%) and eight measuring patient specific outcomes (53.3). Half of the programs were funded as part of the services regular operating budget (n=9, 50.0%) and half were funded by other sources (n=9, 50.0%). Among those offering such a program, none planned to end their programs, and all planned to either continue, expand, and/or create new programs with different patient populations.

Priorities, Impact and Feasibility

Impacts and Feasibility are reported in Table 5. When asked to rank what program types would be priorities for their communities, 15 services identified support for patients being discharged as the top priority (30.6%), 12 chose extended care paramedics who are paramedics with an expanded scope of practice (24.5%), and ten chose programs to treat respiratory illnesses in place (20.4%) (Figure 1). We asked services to rank potential programs in terms of the impact they may have. Nine services identified extended care paramedics as having the most impact (18.0%), eight services identified support programs for patients being discharged (16.0%), and six services selected respiratory illness treat in place programs (12.0%). Thirty-one services listed support programs for patients being discharged (62%) as having either high impact or the most impact and 27 services identified respiratory illness treat in place programs (54.0%). Extended care paramedics were listed as having high or the most impact by 24 services (48.0%) and were rated as being somewhat or very easy to implement by 24 services (48.0%). Fall

prevention programs were listed as having a high or the most impact by 25 services (50.0%) but were also listed as being not feasible or somewhat difficult to implement by 30 services (60.0%). Services ranked ‘other’ programs (n=20, 40.0%) followed by extended care paramedics (n=6, 12.0%) as the easiest to implement and most frequently ranked a fall prevention program as not feasible to implement (n=10, 20.0%) followed by an influenza management program (n=7, 14.0%).

Barriers

Barriers to implementing these programs were most frequently cited as required changes in legislation (n=18, 36.0%), required changes to the current system of medical oversight (n=17, 34.0%), and cost (n=15, 30.0%) (Table 6). We found over a third of respondents reported required changes to medical oversight was an extreme barrier to implementing a program, a proportion that was similar in the self-regulated (n=5, 35.7%) and non-self-regulated (n=12, 33.3%) groups. Few services described required changes in legislation or required changes to medical oversight as not a barrier (n=7, 14.0% for each).

Discussion

Our survey found that, despite 98.0% of services believing there was a need for community paramedic programs to treat LTC patients on-site, only 36.0% of services had programs in place. Most programs were described as using community paramedics with additional training and expanded scopes of practice to deliver care to LTC patients in their place of residence. Several programs described an integrated care model with the patient’s primary health care team. Most programs indicated they were measuring outcomes, with 86.7% of them monitoring repeat

emergency calls for the same patient, a variable often considered a measure of safety. Just over half of the services measuring outcomes were measuring patient specific outcomes.

Our findings are consistent with that of others who found little scientific research to support the rapidly growing area of community paramedicine.(3, 11) Despite the gap between the paramedic services' perceived need for programs and the number of programs in place, we have found many more community paramedic programs exist in LTC than programs with peer reviewed evaluations. This may be attributed in part to a multitude of barriers that have been identified to conducting prehospital research. These barriers include lack of formal training, few research positions and little funding, as well as few opportunities for mentorship.(8) With all these existing barriers, it is possible that many services put programs in place to address the needs of their communities but do not complete a thorough quality assurance evaluation that includes publication in the literature. In our survey, services clearly indicated a need for programs in LTC centers as well as a need for alternative models of care in general, such as treat and refer programs or the ability to transport patients to locations other than the ED. Community paramedics programs can benefit from having evidence to support these initiatives, as well as standardized ways to evaluate them.

Surprisingly, lack of evidence was most frequently not categorized as a barrier to the implementation of future programs. Required changes in legislation and required changes to the current system of medical oversight were selected frequently as moderate or extreme barriers. Paramedic systems were designed to provide treatment and transport to people experience life threatening emergencies, and were not designed to provide care to lower acuity patients in the community. While paramedic services have adapted their models of service delivery to address

the growing needs for out-of-hospital low acuity care, legislation and system design have been slow to catch-up with these new programs.(12) Our results could be influenced by the number of respondents from Ontario, a province where paramedics are not regulated health professionals and are bound by an Ambulance Act and a restrictive medical direction system targeted towards the treatment and transport of acute emergencies, leaving little flexibility to implement alternative programs.(13)

Limitations

Our study has several limitations. We utilized the PCC membership list as a starting point to identify paramedic services. Membership in the PCC is not mandatory, and, although we attempted to identify all services across Canada, it is likely that we missed some. We attempted to mitigate this by asking services if they were aware of existing programs at other services. No program was identified that we were unaware of or not already identified in our survey. Despite having respondents from most parts of the country, we only had one response from Newfoundland and no response from the North West Territories or Nunavut, providing little insights from those areas of the country. Understanding that existing programs would be variable, we asked respondents to free text a description of their community paramedic program rather than giving them pre-defined program categories to choose from. A number of respondents left that response blank, leaving us without detail of their programs.

Conclusions

There is a gap between the need for community paramedic programs in LTC centers as identified by paramedic services and the number of programs in place, suggesting this is an area where

more programs are needed. Outcome measures in existing programs are variable, seldom measure patient specific outcomes, and there is little peer-reviewed evidence to guide the creation of future programs. Although there are several program models believed to have high impact, significant barriers exist to implementing them, including the need for change to legislation and medical oversight. More evidence is needed to determine what program types are the safest, most effective, and yield the best patient-oriented outcomes in the LTC population.

References

1. Ministry of Health and Long-Term Care. Community Paramedicine. Framework for Planning, Implementation and Evaluation. In: Home and Community Care Branch, editor. Toronto 2017. p. 2.
2. CSA Group. Community paramedicine: Framework for program development. 2017(Z1630-17).
3. Thurman WA, Moczygemba LR, Tormey K, Hudzik A, Welton-Arndt L, Okoh C. A scoping review of community paramedicine: evidence and implications for interprofessional practice. *Journal of Interprofessional Care*. 2020:1-11.
4. Canadian Medical Association. A Policy Framework to Guide a National Seniors Strategy for Canada.
5. Gruneir A. " Avoidable" Emergency Department Transfers from Long-Term Care Homes: A Brief Review. *Healthcare Quarterly*. 2013;16(2).
6. Canadian Institute for Health Information. Health Care in Canada, 2011: A Focus on Seniors and Aging. 2011.
7. Leduc S, Cantor Z, Kelly P, Thiruganasambandamoorthy V, Wells G, Vaillancourt C. The Safety and Effectiveness of On-Site Paramedic and Allied Health Treatment Interventions Targeting the Reduction of Emergency Department Visits by Long-Term Care Patients: Systematic Review. *Prehospital Emergency Care*. 2020:1-10.
8. Jensen JL, Bigham BL, Blanchard IE, Dainty KN, Socha D, Carter A, et al. The Canadian National EMS Research Agenda: a mixed methods consensus study. *Canadian Journal of Emergency Medicine*. 2013;15(2):73-82.
9. Leduc S, Kelly P, Thiruganasambandamoorthy V, Wells G, Vaillancourt C. The safety and efficacy of on-site paramedic and allied health treatment interventions targeting the

- reduction of emergency department visits by long-term care patients: systematic review protocol. *Systematic reviews*. 2018;7(1):206.
10. Hoddinott SN, Bass MJ. The dillman total design survey method. *Can Fam Physician*. 1986;32:2366-8.
 11. Bigham BL, Kennedy SM, Drennan I, Morrison LJ. Expanding paramedic scope of practice in the community: a systematic review of the literature. *Prehospital Emergency Care*. 2013;17(3):361-72.
 12. Ontario's Regulatory Registry. Enabling New Models of Care for Select 9-1-1 Patients Toronto, Ontario2019 [Available from: <https://www.ontariocanada.com/registry/view.do?postingId=30268&language=en>].
 13. Ambulance Act, R.S.O. 1990, c. A.19., (2020).

Figure 1. Program Priority Ranking

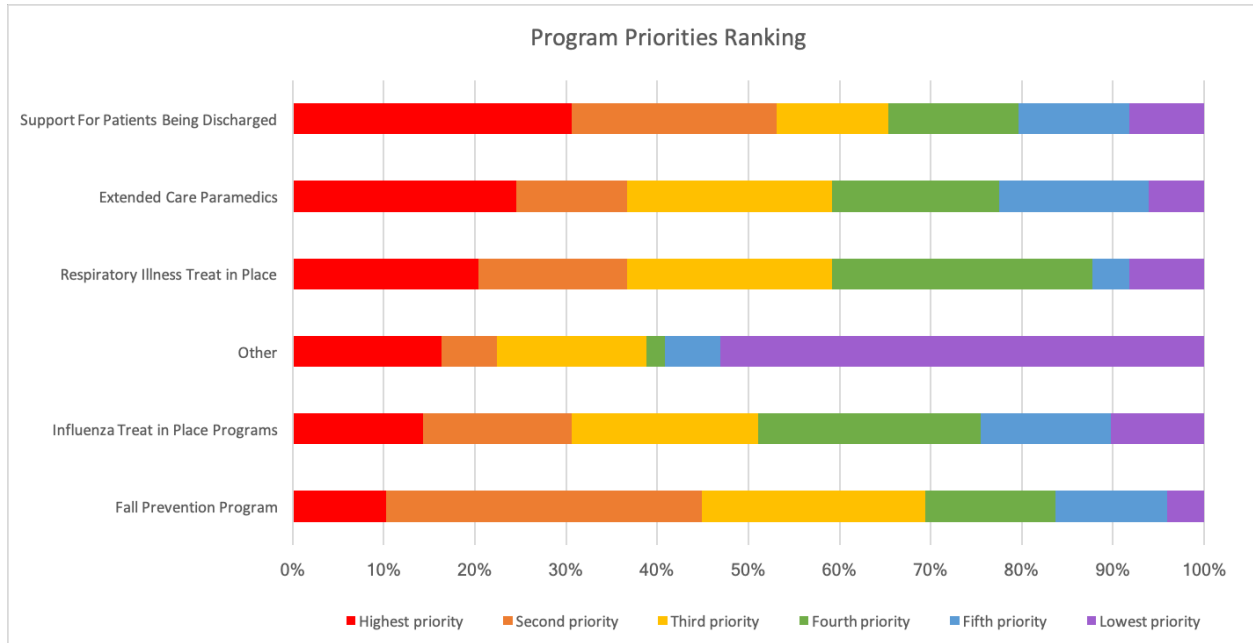


Table 1. Population Represented by Respondents

Province	Population	Number of paramedic services who replied	Population Served by Responding Services	Population Served (%)
British Columbia	4,648,055	3/1†	4,648,055	100.0
Alberta	4,067,175	3/1†	4,067,175	100.0
Saskatchewan	1,098,352	4/105	290,194	26.4
Manitoba	1,278,365	3/5*	995,074	77.8
Ontario	13,448,494	22/55**	7,830,431	58.2
Quebec	8,164,361	9/200	4,971,542	60.9
New Brunswick	747,101	1/1	747,101	100.0
PEI	142,907	1/1	142,907	100.0
Nova Scotia	923,598	1/1	923,598	100.0
Newfoundland	519,716	1/61	2,310	0.4
Yukon	35,874	1/1	35,874	100.0
NWT	41,786	0	0	0.0
Nunavut	35,944	0	0	0.0
TOTAL	35,151,728	50	25,822,045	73.5

† Provincial services who had multiple respondents

*Manitoba has 5 Health Authorities

** Excluding ORNGE, a large aeromedical and land critical care interfacility transfer service provider.

Table 2. Demographics of Responding Services N=50

Characteristics	No (%)
Service Type	
Municipal	24 (48.0)
Provincial	10 (20.0)
Private	9 (18.0)
Contracted	2 (4.0)
First Nations	1 (2.0)
Other	4 (8.0)
Type of Area Covered by service	
Mixed	34 (68.0)
Primarily Rural**	12 (24.0)
Primarily a Population center*	4 (8.0)
Median Sq. Km services provide emergency coverage for (IQR)	3,921 [1,865, 22,500]
Median number of LTC centers in service coverage area (IQR)	8 [2, 25]
Position of Respondent	
Chief or Director	16 (32.0)
Senior Leader	6 (12.0)
Community Paramedic Lead	6 (12.0)
Supervisor	2 (4.0)
Public Relations	2 (4.0)
Paramedic (unspecified)	4 (8.0)
Unknown	14 (28.0)
Call Volume in 2017	
Median total call volume (IQR)	25,000 [6,000, 72,478]
Median call volume at LTC centers (IQR)	469.5 [29, 1,054]
Median emergency calls at LTC centers (IQR)	300 [10, 2,349]

*Population center = most coverage areas have a population of at least 1, 000 and a density of 400 or more people per sq km

** Rural = most coverage areas have a population less than 1, 000 and a density of less than 400 people per square kilometer

Sq. Km = square kilometers

LTC = long-term care

Table 3. Alternative Models of Care No. (%)

Services with dispatch protocols in place where a paramedic would not be dispatched to a call for assistance	13 (26.0)
Call types paramedics may not be sent to	
Non-urgent, low acuity	4 (30.8)
OMEGA calls	4 (30.8)
Lift assist	2 (15.4)
Community paramedic	2 (15.4)
Unsafe scenes	1 (7.7)
Services that have treat and release protocols in place for 9-1-1 responses	15 (30.0)
Patient conditions with treat and release protocols	
Hypoglycemia	10 (20.0)
Falls	8 (16.0)
Mental Health	3 (6.0)
Influenza	2 (4.0)
Other	3 (6.0)
SVT	2 (4.0)
Palliative patients	2 (4.0)
Syncope	1 (2.0)
Other*	3 (6.0)
Services who do not have treat and release protocols but would like to implement them	31 (62.0)
Conditions services would like to implement treat and release protocols for	
Hypoglycemia	31 (79.5)
Mental Health	31 (79.5)
Falls	29 (74.4)
Seizures	22 (56.4)
Other	8 (20.5)
Services that transport patients to a place other than an emergency room	29 (58.0)
Services are transporting to:	
Hospital department other than the ED	18 (62.1)
Detox center	9 (31.0)
Mental health service	9 (31.0)
Urgent care center or walk-in clinic	6 (20.7)
Doctors office	6 (20.7)
Other	10 (34.5)
Services that would like to transport to a place other than the emergency room but currently do not	21 (42.0)
Alternative location services would like to transport to	

Urgent care center or walk-in clinic	20 (95.2)
Mental health service	19 (90.5)
Detox center	16 (76.2)
Hospital department other than the ED	15 (71.4)
Doctors office	12 (57.1)
Other	1 (0.5)

OMEGA is a call priority assigned by dispatch to low acuity calls that may not need transport and may be referred elsewhere for care

*Other treat and release programs included seizures, minor motor vehicle collisions, urinary tract infections, congestive heart failure, nausea and vomiting and analgesia

** Services transported to x-ray and ultrasound clinics, catheterization labs and stroke labs, palliative care centers, centers affiliated with hospitals and a medical clinic specifically for the homeless population (the Targeted Engagement Diversion program)

SVT = supraventricular tachycardia

ED = emergency department

Table 4. Programs in Long-term Care Centers to Treat Patients On-site and Reduce Transfers to the ED No (%)

Services who have programs in place to reduce ED visits in LTC patients	18 (36.0)
Types of Programs*n=13	
Community Paramedicine	7 (38.9)
Remote Patient Monitoring	1 (5.6)
Influenza Treat in Place	2 (11.1)
Illness screening clinics	2 (11.1)
Services who are measuring outcomes of the program	15 (83.3)
Repeat calls for the same patient	13 (86.7)
Measuring patient transport volume	12 (80.0)
Measuring patient specific outcomes	8 (53.3)
Measuring system response time	4 (26.7)
High priority response time	4 (26.7)
Offload delay	3 (20.0)
Measuring scene time	2 (13.3)
Other	5 (33.3)
Program funding type	
Part of regular operating budget	9(50.0)
Funded from source outside of regular operating budget	9 (50.0)
Service intentions for the future of the program	
Plan to expand the program	9 (60.0)
Plan to continue with the program	3 (20.0)
Plan to create new programs with other patient populations	2 (13.3)
Plan to continue if funding is maintained	1 (6.7)
Combo of continue, expand and create new programs	1 (6.7)
Unknown	1 (6.7)
Plan to end the program	0 (0.0)

*Five respondents did not describe details of their program

LTC = Long-term Care, ED = Emergency Department

Table 5. The Impact and Feasibility of Implementing Treat on-site Programs in LTC No. (%)

Question	Priority		Impact						Feasibility				
	Ranked First in Order of Priority for Community	Median Rank (IQR)	The Most Impact	High Impact	Moderate Impact	Little Impact	No Impact at All	Mean Impact on 5 point scale (SD)	Very Easy	Somewhat Easy	Neutral	Somewhat Difficult	Not at all feasible
Support program for patients being discharged	15 (30.6)	2 (1,4)	8 (16.0)	23 (46.0)	15 (30.0)	4 (8.0)	0 (0.0)	2.7 (0.84)	3 (6.0)	15 (30.0)	10 (20.0)	17 (34.0)	5 (10.0)
ECP	12 (24.5)	3 (1,4)	9 (18.0)	15 (30.0)	13 (26.0)	10 (20.0)	3 (6.0)	2.3 (1.2)	6 (12.0)	18 (36.0)	14 (28.0)	9 (18.0)	3 (6.0)
Respiratory illness treat in place program	10 (20.4)	3 (2,4)	6 (12.0)	21 (42.0)	17 (34.0)	6 (12.0)	0 (0.0)	2.5 (0.9)	1 (2.0)	15 (30.0)	13 (26.0)	17 (34.0)	4 (8.0)
Influenza management program	7 (14.3)	3 (2,4)	5 (10.0)	20 (40.0)	17 (34.0)	7 (14.0)	1 (2.0)	2.4 (0.9)	1 (2.0)	17 (34.0)	9 (18.0)	16 (32.0)	7 (14.0)
Fall Prevention program	5 (10.2)	3 (2,4)	5 (10.0)	20 (40.0)	19 (38.0)	6 (12.0)	0 (0.0)	2.5 (0.8)	0 (0.0)	7 (14.0)	13 (26.0)	20 (40.0)	10 (20.0)
Other	8 (16.3)	6 (3,6)	2 (4.0)	6 (12.0)	10 (20.0)	5 (10.0)	27 (54.0)	1.0 (1.3)	20 (40.0)	3 (6.0)	17 (34.0)	5 (10.0)	5 (10.0)

ECP = extended care paramedic, IQR = interquartile range, SD = standard deviation

Table 6. Barriers to Implementing Programs to Treat Patients On-site in LTC No (%)

Type of Barrier	Extreme Barrier	Moderate Barrier	Somewhat of a Barrier	Not a Barrier
Required changes in legislation	18 (36.0)	17 (34.0)	8 (16.0)	7 (14.0)
Required changes to the current system of medical oversight	17 (34.0)	16 (32.0)	10 (20.0)	7 (14.0)
Cost	15 (30.0)	21 (42.0)	12 (24.0)	2 (4.0)
A lack of evidence regarding the best model of care to implement	6 (12.0)	14 (28.0)	14 (28.0)	16 (32.0)
Resistance from other medical responders	5 (10.0)	9 (18.0)	18 (36.0)	18 (36.0)
Labor issues with medical responders	3 (6.0)	8 (16.0)	18 (36.0)	21 (42.0)
Labor issues with LTC staff	3 (6.0)	19 (38.0)	16 (32.0)	12 (24.0)
Making changes to medical responder train	0 (0.0)	11 (22.0)	23 (46.0)	16 (32.0)
Other	2 (4.0)	6 (12.0)	8 (16.0)	34 (68.0)

LTC = Long-term Care

Chapter 5 HEALTH RECORDS REVIEW OF LONG-TERM CARE PATIENTS TREATED BY PARAMEDICS

Chapter Overview

Chapter 5 addresses the research question: *What medical and traumatic conditions occurring in patients living in LTC facilities could be treated by paramedics on site, preventing unscheduled transport to the ED.*

Many ED visits by LTC patients are preventable. Having gained an understanding of what ED avoidance programs currently exist in LTC by allied health providers and specifically paramedics, we sought to examine what treatment is provided in the ED to LTC patients who are transported by paramedics. The objective of this chapter is to determine what treatment could have been rendered by paramedics on-site, avoiding that ED visit.

Chapter 5 contains one manuscript (Section 5.1) which is in preparation for submission to the Canadian Medical Association Journal (CMAJ).

Chapter Contents

Section 4.1 presents the results of our health records review examining the hospital care and outcomes of LTC patients who were treated and transported to the ED.

5.1 The Hospital Care and Outcomes of Long-term Care Patients Treated by Paramedics During an Emergency Call: Exploring the Potential Impact of Community Paramedicine

Section Overview

This section presents the results of a health records review describing the care LTC patients received in the ED after being treated and transported by paramedics.

Manuscript Status

This manuscript is in preparation for submission to the Canadian Medical Association Journal (CMAJ)

Author Roles and Contributions

SL, CV, PK, VT and GW contributed to the conception and study and SL, GW and CV contributed to study design. MR assisted with designing search strategies to find prehospital records. SL conducted statistical analysis and SL, GW and CV contributed to data interpretation. SL drafted the manuscript which was critically revised by all authors.

Related Thesis Appendices

Appendix 5: Ethical Approval – Health Records Review

Appendix 6: Data Collection Tool – Health Records Review (Prehospital)

Appendix 7: Data Collection Tool – Health Records Review (In Hospital)

Appendix 8: Sample Size Calculation – Health Records Review

The Hospital Care and Outcomes of Long-term Care Patients Treated by Paramedics During an Emergency Call: Exploring the Potential Impact of Community Paramedicine.

Shannon Leduc MSc(c)^{1,2}, ACP, George Wells PhD^{2,3}, Venkatesh Thiruganasambandamoorthy MBBS, MSc^{2,4,5}, Zach Cantor PCP¹, Peter Kelly ACP¹, Micah Rietschlin PCP¹, Christian Vaillancourt, MD, MSc^{2,4,5}

¹Ottawa Paramedic Service, Ottawa, Ontario;

²School of Epidemiology and Public Health, University of Ottawa, Ottawa, Ontario;

³Cardiovascular Research Methods Centre, University of Ottawa Heart Institute

⁴Department of Emergency Medicine, University of Ottawa, Ottawa, Ontario;

⁵Ottawa Hospital Research Institute, Ottawa, Ontario

Conflicts of Interest: None

Keywords

Paramedic, EMS, long-term care, ED crowding, community paramedicine

Abstract:432

Manuscript: 3,467

Introduction

Adults living in long-term care (LTC) centers are at increased risk of harm when transferred to the emergency department (ED), and programs targeting treatment on-site are increasing. We examined characteristics, clinical course, and disposition of LTC patients transported to the ED to examine the potential impact of community paramedic programs in LTC centers.

Methods

We conducted a health records review of paramedic and ED records between April 1, 2016 and March 1, 2017. We searched ambulance dispatch data for emergency calls originating from LTC centers and patients transported to The Ottawa Hospital ED. We excluded scheduled or deferable transfers to hospital, patients who had absent vital signs, or who had a Canadian Triage Acuity Score of 1. We stratified cases by month and randomly selected cases required to meet our *a priori* sample size. We used a standardized piloted data collection tool to extract data from the health records, and categorized patients into groups based on the care they received in the ED and current paramedic medical directives. We calculated descriptive statistics by groups and standardized differences to examine the differences between groups.

Results

The mean age of the 381 included patients was 82.5 years and 58.5% were female. After arrival to hospital, 57.7% of patients waited on paramedic stretchers for the hospital to take over their care (offload delay) for a median time of 45.0 minutes (IQR 33.5-78.0). We identified 4 groups: 1) patients requiring no treatment or diagnostics in the ED (7.9%); 2) patients receiving ED treatment within current paramedic medical directives and no diagnostics (3.2%); 3) patients requiring diagnostics or ED care outside current paramedic directives (54.9%); and 4) patients

requiring admission (34.1%). Most patients were discharged from the ED (65.6%), and 1.1% died. Patients who required hospital admission were most frequently diagnosed with infection (18.5% vs 4.8%) and seldomly diagnosed with musculoskeletal injury (2.3% vs 25.9%) compared to discharged patients. Musculoskeletal injury was diagnosed more frequently in the group requiring diagnostics or hospital care than in patients who could be treated paramedics (30.1% vs 4.8%). Patients in group 1 or 2, those who received no treatment or diagnostics or who received care within current paramedic directives, were diagnosed more frequently with abdominal or genitourinary issues in the ED (14.3% vs 5.7% and 7.1% vs 1.9%).

Conclusion

This study found that 7.9% of LTC patients transported to the ED did not receive diagnostics, medications, or other treatment, and, overall, 11.1% of patients could have been treated by paramedics within their current medical directives. This group could potentially be expanded utilizing community paramedics with an expanded scope of practice.

Introduction

Adults living in long-term care (LTC) centers are older, have complex healthcare needs and suffer from frailty and high rates of dementia, making them more vulnerable to adverse events when transported or hospitalized. These patients are more likely to suffer from falls, infections, functional decline and delirium when moved from their home to the emergency department (ED), (1-5) yet this group has an important number of preventable visits.(1,6) In one population-based study, a quarter of all LTC patients had at least one preventable ED visit within a year, and almost half of that group experienced at least one subsequent ED visit which was not necessarily related to the first.(7) Preventable transfers to hospital can have negative impacts on the patients as well as the healthcare system. Hospitals are over capacity resulting in what is referred to as “hallway medicine”. Patients are receiving care in hallways or makeshift areas while waiting for a bed, which in turn results in long waits for paramedics to transfer care to hospital staff, a problem known as “offload delay”.(3, 8, 9) When paramedics are delayed in the ED, it impacts their availability to provide out-of-hospital care, putting other patients in the community at risk. These delays can cause long response times to emergency calls, and in some cases a situation known as “level zero”, when there are no paramedics available to respond to 9-1-1 calls in the community.(10-15)

When possible, allowing LTC patients to access care in their own home environment could improve patient safety and satisfaction, and relieve pressure on a strained healthcare system. Several programs have examined ways to reduce transports to the ED by LTC residents many of which utilize allied health providers such as advanced practice nurses.(16-21) However, few programs consider the clinical capabilities of paramedics.(22) In a recent systematic review, we found only one program which used paramedics to reduce these transports.(23) Paramedics,

experienced at providing advanced care in an out-of-hospital setting, may augment existing care at LTC's and provide a bridge between the current care available and the care available at the ED. Paramedic services have recently begun to offer community paramedicine, where paramedics assess patients and treat them in the community without transport to hospital.(24, 25) Compared to traditional paramedics, community paramedics typically have expanded scopes of practice including provision of point of care diagnostics and collaboration with patients' primary care providers to augment existing care.(26) Community paramedicine has rapidly grown in recent years and has a wide variety of program models, ranging from those treating a single condition to more generalized programs encompassing a wider range of patient conditions. Some of these programs occur in LTC.

Despite these programs growing in popularity, little evidence has been published regarding which LTC patients would be best served by paramedics. We conducted a health records review to determine which patients from LTC centers could potentially be treated on-site by paramedics, reducing the need to transport these patients to the ED.

Methods

Study design and setting

We completed a health records review of LTC patients cared for by Ottawa paramedics following an emergency call (9-1-1) who were transported to the Civic or General Campus EDs of The Ottawa Hospital between April 1, 2016 and March 31, 2017. We chose this time frame to avoid potential issues with obtaining prehospital records as, following this period, the prehospital electronic medical record was changing software versions and the impact on our ability to retrieve records during the change over time was unclear. The Ottawa Paramedic Service covers

a mixed urban and rural territory of 2,796 km² and provides out-of-hospital emergency care to over 139,000 9-1-1 calls per year.(27) The Ottawa Paramedic Service also oversees the Ottawa Central Ambulance Communications Centre (OCACC) which receives 9-1-1 calls and dispatches paramedics from four paramedic services within the region of Eastern Ontario. We followed the STROBE statement for the reporting of this study.(28)

Selection of Participants

We identified potential cases by searching the Ambulance Dispatch Reporting System for emergency calls originating from any of the 28 LTC centers in Ottawa. We included LTC patients who were assigned a dispatch priority code of 3 (Prompt) or 4 (Urgent) (29, 30) treated by paramedics as part of an emergency call, and transported to one of two Ottawa Hospital EDs. We excluded cases where the patient had absent vital signs, was assigned a Canadian Triage and Acuity Scale of 1 (resuscitation) by paramedics, and those who were assigned a dispatch priority classified as Deferrable (Code 1) or Scheduled (Code 2).(29, 30) We excluded repeat visits by the same patient during our study period as well as calls where paramedics responded to the LTC center for visitors or staff. We stratified the remaining cases by month and used a random number generator to randomly select enough cases to meet our *a priori* sample size. Using a conservative event rate of 0.5, we calculated the sample size required to estimate the proportion of patients who have conditions manageable by paramedics with a 95% confidence interval and determined we would require 385 patients. (Appendix 8). This study received ethics approval from the Ottawa Health Science Network Research Ethics Board (OHSN-REB) 20180077-01H.

Data sources and data collection

We linked out-of-hospital data to in-hospital records by providing the patients name, date of birth, campus and date of hospital visit to the Ottawa Hospital Data Warehouse (OHDW). The OHDW is a database containing clinical and administrative data from multiple systems across the Ottawa Hospital, and regularly undergoes data quality testing.(31) The Data Warehouse provided us with records of treatments and diagnostics in the ED, patient disposition, and identification of repeat visits to the ED within one week of the initial call. The OHDW provided us with all but two of our required variables, name and dose or amount of medication and fluids administered, which we extracted manually from in-hospital patient records. Once we linked the prehospital and in-hospital data, we removed patient identifiers.

We used a piloted standardized data collection form to record information from prehospital electronic patient call reports (ePCRs). We collected patient characteristics such as age, medical history and prescribed medications as well as details of the presenting condition, paramedic impression, patient vital signs and paramedic treatment. We completed an audit of 5% of cases to assess the accuracy of data extracted by our research assistant, by selecting consecutive cases from the first month included in our sample.

Group Classification

Ontario paramedics practice under the medical direction of a base hospital physician. The Medical Advisory Committee, comprised of base hospital medical directors from across Ontario, creates medical directives for paramedics based on a scope of practice set out by the Ministry of Health. A medical directive must be in place for each individual treatment or procedure in order for paramedics to provide that care. These medical directives are specific to individual medications or procedures in comparison to clinical practice which often provides a range of

treatment options based on current evidence.(32) We used the medical directives in the Advanced Life Support Patient Care Standards to categorize patients into four groups (Figure 1): Group 1 did not receive diagnostics, treatment or medications during their ED visit and were discharged home; Group 2 only received treatment within the current paramedic medical directives, did not receive diagnostics and were discharged home; Group 3 received diagnostics, or treatment or medications outside of current paramedic medical directives and were discharged home; and Group 4 were patients who were admitted to hospital.

Outcome measures

When determining if treatment fell within current paramedic medical directives, we used broad categories of medications rather than individual names. For example, we considered any opioid analgesic to be within paramedic medical directives as opposed to only morphine or fentanyl, the two opioids with existing prehospital medical directives. We measured offload delay as the total time between paramedics' arrival at the hospital and the hospital taking over care of the patient. When this time was greater than 30 minutes it was classified as a delay.(33) In-hospital diagnoses were collected according to the International Statistical Classification of Diseases and Related Health Problems Tenth Ed. Canada (ICD-10-CA) which we organized into broader categories. For example, viral infection, sepsis and bacterial pneumonia, were all categorized as 'infection'.

Data Analysis

We calculated descriptive statistics, means with standard deviations and medians with interquartile ranges for continuous variables, and proportions for discrete variables. We

compared variables between groups using standardized differences. The standardized difference compares the difference in means or proportions in units of the pooled standard deviation. Unlike statistical tests, the standardized difference provides effect sizes between groups, independent of sample size.(35) In alignment with Cohen's d, these effect sizes can be interpreted as small difference <0.2 , medium difference 0.2-0.8 and large difference >0.8 between groups.(90)

Results

Study Flow

There were 2,105 calls meeting our screening criteria during the study period. We selected 33 random charts per month totaling 396 records. We excluded 13 calls because they were for staff or family members of the LTC resident, one because the in-hospital data could not be found and one because it was a duplicate record. We included a total of 381 health records in our study. (Figure 2). We audited a total of 573 unique fields from the ePCRs and found errors in ten fields (1.7%) which we corrected.

Patient characteristics

Overall patient characteristics are summarized in Table 1. The mean age of patients in our sample was 82.5 years, and 223 (58.5%) of them were female. Medical history of the patients included 227 (59.7%) with hypertension, 200 (52.6%) with dementia, and 198 (52.1%) with cardiovascular disease. Medication history included 106 (27.9%) patients taking prescription narcotics, 87 (22.9%) anticoagulants, 83 (21.8%) antipsychotics, and 74 (19.5%) antibiotics.

Paramedic response characteristics

Most patients received care by an Advanced Care Paramedic (n=322, 82.1%).

Paramedics listed the most common primary problems, choosing from the prescribed list in the Ambulance Call Completion Manual (30), as follows: 68 (17.9%) trauma, 46 (12.1%) generally unwell, 43 (11.3%) gastrointestinal complaints, and 36 (9.5%) infections. Emergency 9-1-1 calls are triaged by following the Dispatch Priority Card Index and assigned a response priority. Prior to transporting to hospital, paramedics assign patients a return priority code.(36) Although 60.4% of all calls were dispatched to the LTC centers as urgent (code 4), only 28 (7.4%) returned to hospital with a similar “urgent” priority following patient assessment, and 337 (88.5%) returned with a lower “prompt” return priority (code 3) instead. The most common medication administered by paramedics was dimenhydrinate (n=15, 4.0%). Thirty-one patients (8.1%) in our sample received other paramedic interventions with spinal immobilization being the most common (n=17, 4.5%). Only three cases in our sample (0.8%) required a phone call to a base hospital physician for consultation or extended orders. (Table 2)

ED Management

On arrival to hospital, 220 patients (57.7%) in our sample waited in offload delay for hospital staff to take over care of the patient, a percentage similar among patients ultimately discharged or admitted (57.7% vs 60.8%). Two hundred and fifty-one patients (65.9%) were discharged and a third of all patients were admitted (34.1%). When the hospital took over care of the patients they were triaged as follows: 115 (30.3%) waited with the offload nurse for a bed to become available in the ED; 98 (25.7%) patients were triaged to the observation area; and 71 (18.6%) to

the emergent monitored area. An offload nurse is a nurse funded by the paramedic service who looks after selected patients while waiting for the ED to take over care, allowing paramedics to leave the hospital. The two most commonly made diagnoses in the ED were: 71 infections (18.6%, for which almost 60% were admitted); and 68 musculoskeletal injuries (17.9%, for which 96% were discharged). Diagnostic imaging was performed in 289 patients (75.9%); with 240 (63.0%) being x-rays and 133 (34.9%) being computed tomography (CT). Treatment administered in the ED included intravenous fluids (n=136, 5.7%), and medications (n=150, 39.4%). The medications were antibiotics (n=112, 29.4%), 83 non-opioid (21.8%), and 79 opioids analgesics (20.7%). Thirty-six patients (9.2%) in our sample received an intervention beyond fluids or medications such as skin repair or a fracture reduction. Most patients in our sample were discharged (n=250, 65.6%), 127 patients (33.3%) were admitted and four patients (1.1%) died. Of the patients who were admitted, most were admitted under general internal medicine (n=78, 60.0%) or orthopedics (n=13, 10.0%). (Table 3)

Main results

The distribution of patients among our four predetermined groups was as follow: group 1) 30 patients (7.9%) did not require diagnostics or treatment in the ED; group 2) 12 patients (3.2%) receiving ED treatment within current paramedic medical directives and no diagnostics; group 3) 209 patients (54.9%) requiring diagnostics, or ED care outside of current paramedic medical directives; and group 4) 130 patients (34.1%) requiring admission.

Compared to all other groups combined, patients who were admitted (group 4) had a lower proportion of seizure disorders (2.3% vs 8.0%; Cohen's d (d)= -0.26) and higher rates of chronic obstructive pulmonary disease (COPD) (20%vs 12.4%; d = 0.21), congestive heart failure

(18.5% vs 9.6% $d = 0.26$), and antibiotic prescriptions (29.2% vs 14.4%; $d = 0.37$). Similarly, paramedics frequently categorized the patient's primary problem as infection (18.5% among admitted vs 4.8% for all other patients; $d = 0.44$) which was also the most common ED diagnosis (32.3% vs 11.6%; $d = 0.52$). Trauma was listed as the patient's problem less often (9.2% vs 22.3%; $d = -0.36$) and the ED diagnosis of musculoskeletal injury was far less prevalent in the admitted group (2.3% vs 25.9% than those who were discharged; $d = -0.72$).

When comparing groups one and two (patients only requiring care within current paramedic medical directives) to group three (discharged patients requiring care outside current paramedic medical directives), we found no remarkable differences in past medical history. Patients who did not receive ED treatment or diagnostics or who received treatment within current paramedic medical directives (group 1 and 2) had higher proportions of prescribed antibiotics (21.4% vs 13.0%; $d = 0.23$), insulin (19.1% vs 9.6%; $d = 0.27$), and benzodiazepines (23.8% vs 7.7%; $d = 0.45$) than patients who required ED diagnostics or care. Paramedics most frequently categorized the patient's primary problem in groups 1 and 2 as gastrointestinal complaints (21.4% vs 9.1% group 3; $d = 0.35$), compared to those in group 3 who were more frequently classified as trauma (2.4% groups 1&2 vs 26.3% group 3; $d = 0.73$). There was no difference in the classification of infection between groups by paramedics and only a small difference in the number of patients diagnosed with infection in the ED (9.5% group 1&2 vs 12.0% group 3; $d = 0.08$). Abdominal and genitourinary issues were diagnosed in the ED more frequently in groups one and two (14.3% vs 5.7%; $d = 0.29$ and 7.1% vs 1.9%; $d = 0.25$) and musculoskeletal injury was diagnosed far less frequently than those requiring ED diagnostics or care (4.8% vs 30.1%; $d = -0.71$) (Table 4)

Discussion

In this health records review we found that 7.9% of patients transported to the ED did not receive diagnostics, medications or treatment during their ED visit. In total, 11.1 % of LTC patients transported to the ED did not require care beyond current emergency paramedic capabilities, and could potentially have been treated on-site, avoiding an ED visit. Patients in this group were most frequently categorized as having gastrointestinal complaints by paramedics, and, diagnosed with abdominal or genitourinary issues in the ED. Utilizing community paramedics with an expanded scope of practice could likely increase the number of patients who could be treated on-site.

These findings differ from another cohort study that also categorized patients based on their clinical course in the ED.(37) The study examined clinical records of 3,000 prehospital patients over the age of 18 and found that 3.6% did not receive diagnostics or treatment in the ED. This number rose to 6.3%, when considering only patients over 65 years of age who were assigned a lower acuity CTAS of 4 or 5. As age increases, there are more patients who do not receive treatment or diagnostics when they present to the ED. This suggests older adults, including patients from LTC centers, have a greater need for alternatives to the ED for healthcare. Our findings also differ from a recent systematic review examining programs targeting the reduction of ED visits among LTC patients.(23) The reported ability of these programs to decrease ED visits ranged from 5% to 69%, and where community paramedicine was reported to decrease ED visits by 47% and hospitalizations by 23%.(38) This program, based in Nova Scotia, Canada called their community paramedics ‘extended care paramedics’. These were advanced care paramedics with an expanded scope of practice. Whereas we examined treatment received in the ED to determine which patients could be treated on-site with current medical directives, the

Nova Scotia program used expert consensus to derive a more inclusive list of patient conditions suitable for treatment by paramedics with an expanded scope.(39, 40) Despite treating a broader range of patient conditions, evaluation of this program found it to be safe with only 2.8% of patients generating a subsequent call to paramedics.

Part of the success of the Nova Scotia program may be attributed to the expanded scope held by those paramedics which included, among others, wound closure techniques, point of care testing, and end-of-life care. These community paramedics also worked closely with the patient's healthcare team in an integrated care model.(40) In contrast, the current medical direction system in Ontario is designed to provide traditional emergency responses resulting in transport of all patients to the ED.(41) Paramedics currently provide acute episodic care without integration with a patient's primary health team. Although the scope of practice set out by the Ministry of Health for Ontario paramedics is quite broad, including the ability to administer any medication the medical director deems appropriate, medical directives are targeted towards high acuity patients with emergent issues and are standardized across the province. While standardization has many benefits, it stands in opposition to one of the greatest powers of community paramedicine, which is to deliver programs targeted towards the unique needs of individual communities.

In our study, community paramedics with an expanded scope could possibly have increased the number of patients who may have been treated on site. In our cohort of patients, a large proportion requiring ED care were diagnosed with musculoskeletal injuries and required diagnostic imaging. Allowing paramedics to order radiographic tests, or, in some cases perform point of care ultrasound, could further reduce the need for transport to the ED. We also found that infection was the most frequent ED diagnosis for all patients, almost 60% of whom were

admitted. Although we did not consider patients who were admitted as having conditions amenable to paramedic treatment on-site, previous studies have reduced hospital admission by providing IV antibiotics and fluid rehydration at the LTC center.(42, 43) Adding these treatments to the paramedics' arsenal may allow a subset of patients presenting with infection to be treated without transport to the ED.

Limitations

Our study had several limitations including those inherent to health records reviews such as incomplete records or possible documentation errors. We searched for our study population using LTC center addresses which are entered manually into the Computer Aided Dispatch System and possibly affected by data entry errors. We attempted to mitigate this problem by using both the address and assigned facility number. Our call volume to LTC centers included all calls processed through the dispatch center and may have included calls dispatched to surrounding paramedic services and for which we would not have access to the patients ePCR. We expect this number to be low given there were no such calls among our randomly selected cases. We only included patients who were transported and did not include calls where the patient refused transport to the ED. Patients who refuse transport are more likely to be of lower acuity and their exclusion may have resulted in our underestimating the number of patients who could be treated on site. We also included patients who were transported to The Ottawa Hospital, an academic tertiary care center whose care could differ from the other two community hospitals in the city that we excluded.

Conclusion

LTC patients are often transferred to the ED where, in many cases, they do not receive any diagnostic or therapeutic interventions. Paramedics are an under-utilized group who could provide care to some of these patients on site, decreasing the burden of transfer on both the patient and the healthcare system. Community paramedics specifically may be best suited for this as they have additional training, work with an expanded scope of practice, and have the ability to deliver targeted clinical services unique to specific communities of patients, an adaptability that cannot be matched within the current system of emergency paramedic medical direction in Ontario.

References

1. Canadian Institute for Health Information. Health Care in Canada, 2011: A Focus on Seniors and Aging. 2011.
2. Canadian Institute for Health Information. Sources of Potentially Avoidable Emergency Department Visits; Report. Ottawa: CIHI; 2014.
3. Ministry of Health and Long-Term Care. Hallway Health Care: A System Under Strain; First Interim Report from the Premier's Council on Improving Healthcare and Ending Hallway Medicine. 2019.
4. Creditor MC. Hazards of hospitalization of the elderly. *Annals of internal medicine*. 1993;118(3):219-23.
5. Quach C, McArthur M, McGeer A, Li L, Simor A, Dionne M, et al. Risk of infection following a visit to the emergency department: a cohort study. *CMAJ*. 2012;184(4):E232-E9.
6. Gruneir A, Bell CM, Bronskill SE, Schull M, Anderson GM, Rochon PA. Frequency and pattern of emergency department visits by long-term care residents—a population-based study. *Journal of the American Geriatrics Society*. 2010;58(3):510-7.
7. Gruneir A, Cigsar C, Wang X, Newman A, Bronskill SE, Anderson GM, et al. Repeat emergency department visits by nursing home residents: a cohort study using health administrative data. *BMC Geriatr*. 2018;18(1):157.
8. Hoot NR, Aronsky D. Systematic review of emergency department crowding: causes, effects, and solutions. *Annals of emergency medicine*. 2008;52(2):126-36. e1.
9. Ospina M, Bond K, Schull M, Innes G, Blitz S, Friesen C, et al. Measuring overcrowding in emergency departments: a call for standardization. *Technology report*. 2006(67.1).

10. Cooney DR, Millin MG, Carter A, Lawner BJ, Nable JV, Wallus HJ. Ambulance diversion and emergency department offload delay: resource document for the National Association of EMS Physicians position statement. *Prehospital Emergency Care*. 2011;15(4):555-61.
11. Porter K. Ottawa Exposed to Lawsuits over Failure to Meet Ambulance Response Targets: Report. *CBCnews CBC/Radio Canada*. 2016 14, Oct. 2016.
12. Gorman M. Strain of balancing ER demand with capacity leads to ambulance offload delays. *CBC News*. 2017 Oct 10, 2017.
13. AHS tackles ER 'offload delays' for paramedics. *CBC News, Calgary*. 2010 November 5, 2010.
14. Reevely D. Ottawa ran out of ambulances 22 times in the past two weeks, city admits. *National Post*. 2016 December 11, 2016.
15. Carter A. Patients will literally die': Times when no ambulances available on the rise. *CBC News*. 2017 Aug 02, 2017
16. Aigner MJ, Drew S, Phipps J. A comparative study of nursing home resident outcomes between care provided by nurse practitioners/physicians versus physicians only. *Journal of the American Medical Directors Association*. 2004;5(1):16-23.
17. Bandurchin A, McNally M, Ferguson-Paré M. Bringing back the house call: how an emergency mobile nursing service is reducing avoidable emergency department visits for residents in long-term care homes. *Nursing leadership (Toronto, Ont)*. 2011;24(1):59-71.
18. Hofmeyer J, Leider JP, Satorius J, Tanenbaum E, Basel D, Knudson A. Implementation of Telemedicine Consultation to Assess Unplanned Transfers in Rural Long-Term Care Facilities, 2012-2015: A Pilot Study. *J Am Med Dir Assoc*. 2016;17(11):1006-10.

19. Kane RL, Keckhafer G, Flood S, Bershadsky B, Siadaty MS. The effect of Evercare on hospital use. *Journal of the American Geriatrics Society*. 2003;51(10):1427-34.
20. McAiney CA, Haughton D, Jennings J, Farr D, Hillier L, Morden P. A unique practice model for Nurse Practitioners in long-term care homes. *J Adv Nurs*. 2008;62(5):562-71.
21. Rantz MJ, Popejoy L, Vogelsmeier A, Galambos C, Alexander G, Flesner M, et al. Successfully Reducing Hospitalizations of Nursing Home Residents: Results of the Missouri Quality Initiative. *J Am Med Dir Assoc*. 2017;18(11):960-6.
22. Paramedic Association of Canada. National Occupational Competency Profile Ottawa, ON2011 [updated October 29, 2011. Available from:
<https://www.paramedic.ca/site/nocp?nav=02>.
23. Leduc S, Kelly P, Thiruganasambandamoorthy V, Wells G, Vaillancourt C. The safety and efficacy of on-site paramedic and allied health treatment interventions targeting the reduction of emergency department visits by long-term care patients: systematic review protocol. *Systematic reviews*. 2018;7(1):206.
24. Chan J, Griffith LE, Costa AP, Leyenaar MS, Agarwal G. Community paramedicine: A systematic review of program descriptions and training. *CJEM*. 2019:1-13.
25. Goldstein J, McVey J, Ackroyd-Stolarz S. The role of emergency medical services in geriatrics: bridging the gap between primary and acute care. *Canadian Journal of Emergency Medicine*. 2016;18(1):54-61.
26. CSA Group. Community paramedicine: Framework for program development. 2017(Z1630-17).
27. Ottawa Paramedic Service. Ottawa Paramedic Service 2016 Annual Report. Ottawa, ON: City of Ottawa, Committee CaPS; 2016 September 13, 2017.

28. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Annals of internal medicine*. 2007;147(8):573-7.
29. Beveridge R. Canadian emergency department triage and acuity scale: implementation guidelines. *CJEM*. 1999;1:S2-S28.
30. Ministry of Health and Long-Term Care. *Ambulance Call Report Completion Manual*. In: Branch EHS, editor. 3.0 ed. Toronto, ON: Queen's Printer for Ontario; 2016.
31. Ronksley PE, McKay JA, Kobewka DM, Mulpuru S, Forster AJ. Patterns of health care use in a high-cost inpatient population in Ottawa, Ontario: a retrospective observational study. *CMAJ open*. 2015;3(1):E111.
32. Thomas L. Clinical practice guidelines. *Evidence Based Nursing*. 1999;2(2):38.
33. Schwartz B, Cass P, Michael C, Dundas P, Farr B, LeBlanc L, et al. *Improving Access to Emergency Services: A System Commitment*. 2005:7.
34. Cooper H, Hedges LV, Valentine JC. *The handbook of research synthesis and meta-analysis*: Russell Sage Foundation; 2019.
35. Yang D, Dalton JE, editors. *A unified approach to measuring the effect size between two groups using SAS®*. SAS global forum; 2012.
36. Office of the Auditor General of Ontario. *2013 Annual Report*. Toronto, Ontario 2013. p. 126-7.
37. Tavares W, Drennan I, Van Diepen K, Abanil M, Kedzierski N, Spearen C, et al. *Building Capacity in Healthcare by Re-examining Clinical Services in Paramedicine*. *Prehospital emergency care*. 2017;21(5):652-61.

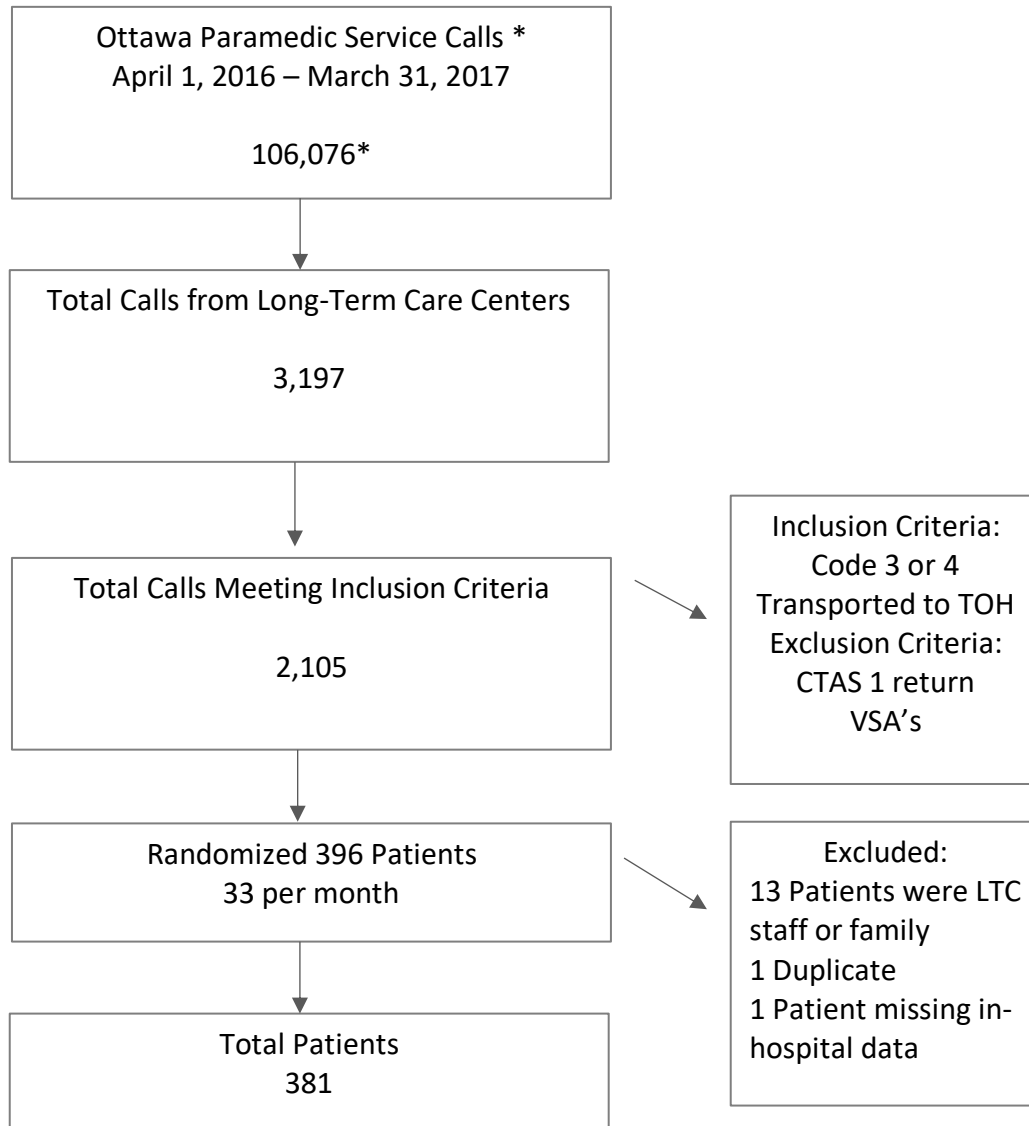
38. Jensen JL, Marshall EG, Carter AJ, Boudreau M, Burge F, Travers AH. Impact of a Novel Collaborative Long-Term Care -EMS Model: A Before-and-After Cohort Analysis of an Extended Care Paramedic Program. *Prehosp Emerg Care*. 2016;20(1):111-6.
39. Jensen JL, Travers AH, Bardua DJ, Dobson T, Cox B, McVey J, et al. Transport outcomes and dispatch determinants in a paramedic long-term care program: a pilot study. *Canadian Journal of Emergency Medicine*. 2013;15(4):206-13.
40. Marshall EG, Clarke B, Peddle S, Jensen J. Care By Design; New model of coordinated on-site primary and acute care in long-term care facilities. *Canadian Family Physician*. 2015;61:e129 - 34.
41. Ministry of Health and Long-Term Care. Advanced Life Support Patient Care Standards. In: Branch EHS, editor. 4.4 ed. Toronto, ON: Queen's Printer for Ontario; 2017.
42. Loeb M, Carusone SC, Goeree R, Walter SD, Brazil K, Krueger P, et al. Effect of a clinical pathway to reduce hospitalizations in nursing home residents with pneumonia: a randomized controlled trial. *Jama*. 2006;295(21):2503-10.
43. Romoren M, Gjelstad S, Lindbaek M. A structured training program for health workers in intravenous treatment with fluids and antibiotics in nursing homes: A modified stepped-wedge cluster-randomised trial to reduce hospital admissions. *PLoS One*. 2017;12(9):e0182619

Figure 1. Categorization of Patients

Group 1 Assessment only	Group 2 Treatment in the ED was within Paramedic directives	Group 3 Treatment in the ED was beyond Paramedic directives/capabilities	Group 4 Admitted to Hospital
<p>Patients were not admitted Patients did not receive diagnostics Patients did not receive treatment Patients did not receive fluids Patients did not receive medications</p>	<p>Patients were not admitted Patients did not receive diagnostics Patients did not receive treatment Patients had either: Crystalloid fluids or Medications that can be administered by a paramedic per the current Ontario ALSPCS medical directives</p>	<p>Patients were not admitted Patients had at least one of the following: Diagnostics (x-ray, MRI, ultrasound) or Treatment (e.g. skin repair, # reduction,) or Medications outside paramedic medical directives</p>	<p>Patients were admitted</p>

ED = Emergency Department, ALSPCS = Advanced Life Support Patient Care Standards, MRI = Medical Resonance Imaging

Figure 2. Study Flow



*106, 076 are unique incidents including the number of events paramedics were called for but does not represent the total number of resources sent.

Table 1. Patient and LTC Intervention Characteristics (N=381)

Patient Characteristics	All (N=381)	Admitted (N=130)	Not Admitted (N=251)
Mean age – years (SD)	82.5 (11.6)	82.6 (12.6)	82.4 (11.1)
Range	[24 -110]*	[24-98]	[44-110]
Female sex – no. (%)	223 (58.5)	70 (53.9)	153 (61.0)
Medical History – no. (%)			
Hypertension	227 (59.7)	70 (53.9)	157 (62.8)
Dementia	200 (52.6)	61 (46.9)	139 (55.6)
Cardiovascular disease	198 (52.1)	72 (55.4)	126 (50.4)
COPD	57 (15)	26 (20.0)	31 (12.4)
Congestive heart failure	48 (12.6)	24 (18.5)	24 (9.6)
Cancer	48 (12.6)	18 (13.9)	30 (12.0)
Seizure disorder	23 (6.1)	3 (2.3)	20 (8.0)
Palliative	1 (0.26)	0 (0.0)	1 (0.4)
Patient Medications – no. (%)			
Narcotics	106 (27.9)	35 (26.9)	71 (28.4)
Anticoagulants	87 (22.9)	35 (26.9)	52 (20.8)
Antipsychotics	83 (21.8)	30 (23.1)	53 (21.2)
Antibiotics	74 (19.5)	38 (29.2)	36 (14.4)
Insulin	43 (11.3)	15 (11.5)	28 (11.2)
Benzodiazepines	37 (9.7)	11 (8.5)	26 (10.4)
Antiplatelets	30 (7.9)	6 (4.6)	24 (9.6)
Corticosteroids	26 (6.8)	11 (8.5)	15 (6.0)
Mean number of medications patients are on (SD)	9.17 (4.6)	9.5 (4.7)	9.0 (4.6)
Vitals Signs			
Initial mean Glasgow Coma Score (SD)	13.9 (1.8)	13.6 (2.3)	14.0 (1.5)
Initial Glasgow Coma Score 15 – no. (%)	165 (44.7)	53 (42.1)	112 (46.1)

Initial mean systolic BP in Millimeters of mercury (SD)	137.5 (26.9)	131.4 (27.9)	140.8 (25.8)
Initial mean heart rate in beats per minute (SD)	86(21)	89.0(21.5)	84.3 (20.9)
Who initiated the call for paramedics - no (%)			
Staff	158 (41.5)	60 (46.15)	98 (39.0)
Unknown	135 (35.4)	41 (31.5)	94 (37.5)
Physician	46 (12.1)	15 (11.5)	31 (12.4)
Family	18 (4.7)	5 (3.9)	13 (5.2)
RN	17 (4.5)	7 (5.4)	10 (4.0)
Patient	7 (1.8)	2 (1.5)	5 (2.0)
Call for a problem previously assessed by a physician – no. (%)			
Unknown	207 (54.3)	76 (58.5)	131 (52.2)
No	91 (23.9)	20 (15.4)	71 (28.3)
Yes – Previously assessed	83 (21.8)	34 (26.2)	49 (19.5)
Median number of days since last seen by physician (IQR)	2.0 (1.6)	2.0 (1.7)	1.5 (1.6)
Assessed by a healthcare professional before 9-1-1 was called – no. (%)			
Unspecified LTC staff	143 (37.5)	56 (14.7)	87 (22.8)
Physician	31 (8.1)	11 (2.9)	20 (5.2)
RN	19 (5.0)	4 (1.0)	15 (3.9)
Nurse practitioner	1 (0.3)	1 (0.3)	0 (0.0)
Treatment administered prior to paramedic arrival – no (%)			
Patient monitoring	53 (13.9)	15 (3.9)	38 (10.0)
Oxygen administration	28 (7.3)	17 (4.5)	11 (2.9)
Acetaminophen administered	18 (4.7)	7 (1.8)	11 (2.9)
Other medication administered	18 (4.7)	6 (1.6)	12 (3.1)
Multiple treatments	9 (2.4)	6 (1.6)	3 (0.8)
X-Ray	2 (0.5)	0 (0.0)	2 (0.5)
Bloodwork	1 (0.3)	0 (0.0)	1 (0.3)
Intravenous inserted	1 (0.3)	0 (0.0)	1 (0.3)
LTC Facility Funding Type no. (%)			
Charitable	201 (52.8)	72 (55.4)	129 (51.4)

Private	147 (38.6)	43 (33.1)	104 (41.4)
Municipal	33 (8.7)	15 (11.5)	18 (7.2)
Median number of beds at individual LTC centers (IQR)	193 (IQR 128-242)	171 (IQR 128-242)	193 (IQR 128-242)
Final Vitals			
Final mean Glasgow Coma Score (SD)	14.0 (1.6)	13.8 (2.0)	14.1 (1.3)
Final Glasgow Coma Score 15 – no. (%)	154 (47.1)	48 (44.4)	106 (48.4)
Final mean systolic blood pressure in millimeters of mercury (SD)	134.7(25.4)	129.1 (28.2)	137.6 (23.3)
Final mean heart rate in beats per minute (SD)	84(19.4)	87.2 (21.5)	81.6 (18.0)

* Our sample included a small number of younger patients who were at the LTC due to chronic conditions that required 24-hour nursing care. SD = standard deviation; COPD = Chronic obstructive pulmonary disease

Table 2. Paramedic Response Characteristics for the 381 Long-Term Care Patients

Paramedic Response Characteristics	All (N=381)	Admitted (130)	Not Admitted (251)
Advanced care paramedic – no. (%)	312 (82.1)	101 (78.3)	211 (84.1)
Paramedic Impression – no. (%)			
Trauma	68 (17.9)	12 (9.2)	56 (22.3)
Generally Unwell	46 (12.1)	24 (18.5)	22 (8.8)
Gastrointestinal Complaints	43 (11.3)	15 (11.5)	28 (11.2)
Infection	36 (9.5)	24 (18.5)	12 (4.8)
Breathing Issues	33 (8.7)	20 (15.4)	13 (5.2)
Pain	29 (7.6)	0 (0.0)	9 (3.6)
Other	63 (16.5)	20 (15.4)	66 (26.3)
Paramedic Dispatch Priority – no. (%)			
Code 4 – Urgent	230 (60.4)	89 (68.5)	141 (56.2)
Code 3 - Prompt	151 (39.6)	41 (31.5)	110 (43.8)
Code 2 – Scheduled	0 (0.0)	0 (0.0)	0 (0.0)
Code 1 – Deferrable	0 (0.0)	0 (0.0)	0 (0.0)
Paramedic Return Priority – no. (%)			
Code 4 – Urgent	28 (7.4)	17 (13.1)	11 (4.4)
Code 3 – Prompt	337 (88.5)	109 (83.9)	228 (90.8)
Code 2 – Scheduled	1 (0.3)	0 (0.0)	1 (0.4)
Code 1 - Deferrable	15 (3.9)	4 (3.1)	11 (4.4)
CTAS on Arrival to Patient – no. (%)			
Resuscitation	1 (0.26)	1 (0.8)	0 (0.0)
Emergent	94 (24.7)	48 (36.9)	46 (18.4)
Urgent	205 (54.0)	67 (51.5)	138 (55.2)
Less Urgent	61 (16.1)	10 (7.7)	51 (20.4)
Non-Urgent	19 (5.0)	4 (3.1)	15 (6.0)
CTAS at Arrival to ED – no. (%)			
Resuscitation	0 (0.0)	0 (0.0)	0 (0.0)

Emergent	91 (24.0)	50 (38.5)	41 (16.5)
Urgent	207 (54.6)	66 (50.8)	141 (56.6)
Less Urgent	63 (16.6)	11 (8.5)	52 (20.9)
Non Urgent	18 (4.8)	3 (2.3)	15 (6.0)
Paramedic interventions – no. (%)			
Oxygen nasal cannula	120 (31.6)	53 (41.1)	67 (26.7)
Intravenous insertion	50 (13.2)	26 (20.2)	24 (9.6)
Oxygen non-rebreather	45 (11.8)	27 (20.9)	18 (7.2)
Dimenhydrinate	15 (4.0)	7 (5.4)	8 (3.2)
Dressing	9 (2.4)	3 (2.3)	6 (2.4)
Fluid Bolus	7 (1.8)	5 (3.9)	2 (0.8)
Morphine	6 (1.6)	3 (2.3)	3 (1.2)
ASA	5 (1.3)	0 (0.0)	5 (2.0)
Splint	5 (1.3)	0 (0.0)	5 (2.0)
Salbutamol	4 (1.1)	4 (3.1)	0 (0.0)
Nitroglycerine	4 (1.05)	1 (0.8)	3 (1.2)
Ketorolac	3 (0.8)	2 (1.6)	1 (0.4)
Other medication	2 (0.5)	1 (0.8)	1 (0.4)
Acetaminophen	1 (0.26)	0 (0.0)	1 (0.4)
Dextrose/Oral glucose/ Diphenhydramine/Ibuprophen	0 (0.0)	0 (0.0)	0 (0.0)
Received Paramedic Intervention	31 (8.1)	6 (1.6)	25 (6.6)
Spinal Immobilization	17 (4.5)	3 (0.8)	14 (3.7)
Other BLS treatment **	12 (3.1)	1 (0.3)	11 (2.9)
Airway Management*	2 (0.5)	2 (0.5)	0 (0.0)
Required Physician Patch	3 (0.8)	2 (1.5)	1 (0.4)

BLS = Basic Life Support, CTAS = Canadian Triage and Acuity Scale, LTC = Long Term Care

*Airway management may include placing an oropharyngeal airway, nasopharyngeal airway, or positioning.

**Other BLS treatment includes an ice pack, direct pressure, padding of a splint, application of gauze or a sling

ASA = Acetylsalicylic acid

Table 3. Emergency Department Management & Outcomes of 381 Long-Term Care Patients

	All (N=381)	Admitted (N=130)	Not Admitted (N=251)
Hospital - no. (%)			
Civic Campus	231 (60.6)	82 (63.1)	149 (59.4)
General Campus	150 (39.4)	48 (36.9)	102 (40.6)
Patient Assignment on Arrival ED-no (%)			
Resuscitation	48 (12.6)	27 (20.8)	21 (8.4)
Emergent	71 (18.6)	34 (26.2)	37 (14.7)
Observation	98 (25.7)	22 (16.9)	76 (30.3)
Offload Nurse	115 (30.2)	31 (23.9)	84 (33.5)
Urgent	1 (0.3)	1 (0.8)	0 (0.0)
Waiting Room	2 (0.52)	0 (0.0)	2 (0.8)
Unknown	40 (10.5)	12 (9.2)	28 (11.2)
Other	6 (1.6)	3 (2.3)	3 (1.2)
Patient waited with paramedics in offload delay	220 (57.7)	79 (60.8)	141 (56.2)
Median offload delay in minutes (IQR)	45 (IQR 33.5-78)	45 (IQR 34-71)	44 (IQR 32.5-80.5)
Emergency Department Diagnostic Tests – no. (%)			
Urinalysis	338 (88.7)	129 (99.2)	209 (83.3)
Bloodwork	337 (88.5)	129 (99.2)	208 (82.9)
Any imaging	289 (75.9)	115 (88.4)	174 (69.3)
X-Ray	240 (63.0)	106 (81.5)	134 (53.4)
Joint, bone, spine, pelvis	323 (84.8)	111 (85.4)	212 (84.5)
Multiple X-ray sites	56 (14.7)	17 (13.1)	39 (15.5)
Thoracic or lung X-ray	2 (0.5)	2 (0.5)	0 (0.0)
CT Scan	133 (34.9)	45 (34.6)	88 (35.1)
Ultrasound	11 (2.9)	3 (2.3)	8 (3.2)
MRI	1 (0.26)	0 (0.0)	1 (0.4)
Emergency Department Categories of Diagnosis– no. (%)			
Infection	71 (18.6)	42 (32.3)	29 (11.6)
Musculoskeletal Injury	68 (17.9)	3 (2.3)	65 (25.9)
Other	61 (16.0)	15 (11.5)	46 (18.3)

Respiratory Complaints	49 (12.9)	25 (19.2)	24 (9.6)
Abdominal	27 (7.1)	9 (6.9)	18 (7.2)
Cardiac	24 (6.3)	10 (7.7)	14 (5.6)
Mental Status Issue	18 (4.7)	7 (5.4)	11 (4.4)
Neuro	17 (4.5)	4 (3.1)	13 (5.2)
Genitourinary	15 (3.9)	8 (6.2)	7 (2.8)
Pneumonitis	12 (3.2)	7 (5.4)	5 (2.0)
Device management	10 (2.6)	0 (0.0)	10 (4.0)
Syncope	9 (2.4)	0 (0.0)	9 (3.6)
Fracture	0 (0.0)	0 (0.0)	0 (0.0)
Emergency Department Management – no. (%)			
Fluids	136 (35.7)	86 (66.2)	50 (19.9)
Normal Saline	113 (29.7)	75 (57.7)	38 (15.1)
Ringers Lactate	25 (6.6)	19 (14.6)	6 (2.4)
D5W	9 (2.4)	6 (4.6)	3 (1.2)
Other fluids	5 (1.3)	3 (2.3)	2 (0.8)
Medication Administered – no. (%)	257 (67.5)	115 (88.5)	142 (56.6)
Medication administered by IV	150 (39.4)	97 (74.6)	53 (21.2)
Antibiotics	112 (29.4)	71 (54.6)	41 (16.3)
Non-opioid analgesics	83 (21.8)	33 (25.4)	50 (19.9)
Narcotics	79 (20.7)	37 (28.5)	42 (16.7)
Other medication	56 (14.7)	32 (24.6)	24 (9.6)
Antidepressants	28 (7.4)	12 (9.2)	16 (6.4)
Diuretics	22 (5.8)	18 (13.9)	4 (1.6)
Benzodiazepines	20 (5.25)	12 (9.2)	8 (3.2)
Bronchodilators	17 (4.5)	10 (7.7)	7 (2.8)
Antipsychotics	15 (3.9)	7 (5.4)	8 (3.2)
Antiarrhythmic (beta blocker, calcium channel)	15 (3.9)	9 (6.9)	6 (2.4)
Anticoagulation	13 (3.4)	7 (5.4)	6 (2.4)
Antiemetic	13 (3.4)	7 (5.4)	6 (2.4)
Steroids	13 (3.4)	9 (6.9)	4 (1.6)
Vaccination	4 (1.1)	0 (0.0)	4 (1.6)
Nitroglycerine	4 (1.1)	3 (2.3)	1 (0.4)
Insulin	3 (0.79)	3 (2.3)	0 (0.0)
Blood Products	13 (3.4)	10 (7.7)	3 (1.2)

ED Procedures no. (%)			
No intervention	346 (90.8)	113 (86.9)	233 (92.8)
Other Intervention	25 (6.6)	12 (9.2)	13 (5.2)
Skin Repair	9 (2.4)	1 (0.8)	8 (3.2)
Fracture Reduction	3 (0.8)	0 (0.0)	3 (1.2)
Consultation			
Medicine	96 (25.2)	79 (60.8)	17 (6.8)
Clinical Decision Unit	48 (12.6)	7 (5.4)	41 (16.3)
Orthopedics	22 (5.8)	13 (10.0)	9 (3.6)
Surgery	13 (3.4)	8 (6.2)	5 (2.0)
Cardiology	9 (2.4)	6 (4.6)	3 (1.2)

SD = Standard Deviation, ED = Emergency Department, IQR = Interquartile Range, CT = Computed Tomography, MRI = Magnetic Resonance Imaging, IV = Intravenous

Table 4. Comparisons Between Groups with Standardized Differences

Patient Characteristics	Group 3 (N=209)	Group 1 and 2 (N=42)	Standardized Differences	Group 4 (N=130)	Group 1, 2, and 3 (N=251)	Standardized Differences
Mean age – years (SD)	82.8 (11.1)	80.5 (11.4)	0.21	82.6 (12.6)	82.4 (11.1)	0.01
Range	[44-110]	[54-100]		[24-98]	[44-110]	
Female sex – no. (%)	127 (60.8)	26 (61.9)	-0.02	70 (53.9)	153 (61.0)	-0.14
Medical History – no. (%)						
Hypertension	128 (61.5)	29 (69.1)	-0.16	70 (53.9)	157 (62.8)	-0.18
Dementia	115 (55.3)	24 (57.1)	-0.04	61 (46.9)	139 (55.6)	-0.17
Cardiovascular disease	106 (51.0)	20 (47.6)	0.07	72 (55.4)	126 (50.4)	0.10
COPD	26 (12.5)	5 (11.9)	0.02	26 (20.0)	31 (12.4)	0.21
Congestive heart failure	20 (9.6)	4 (9.5)	0.00	24 (18.5)	24 (9.6)	0.26
Cancer	25 (12.1)	5 (11.9)	0.00	18 (13.9)	30 (12.0)	0.06
Seizure disorder	16 (7.7)	4 (9.5)	-0.07	3 (2.3)	20 (8.0)	-0.26
Palliative	1 (0.5)	0 (0.0)	0.10	0 (0.0)	1 (0.4)	-0.09
Patient Medications – no. (%)						
Narcotics	57 (27.4)	14 (33.3)	-0.13	35 (26.9)	71 (28.4)	-0.03
Anticoagulants	42 (20.2)	10 (23.8)	-0.09	35 (26.9)	52 (20.8)	0.14
Antipsychotics	42 (20.2)	11 (26.2)	-0.14	30 (23.1)	53 (21.2)	0.05
Antibiotics	27 (13.0)	9 (21.4)	-0.23	38 (29.2)	36 (14.4)	0.37
Insulin	20 (9.6)	8 (19.1)	-0.27	15 (11.5)	28 (11.2)	0.01
Benzodiazepines	16 (7.7)	10 (23.8)	-0.45	11 (8.5)	26 (10.4)	-0.07
Antiplatelets	20(9.6)	4 (9.5)	0.00	6 (4.6)	24 (9.6)	-0.19

Corticosteroids	11 (5.3)	4 (9.5)	-0.16	11 (8.5)	15 (6.0)	0.10
Mean number of medications patients are on (SD)	8.7 (4.0)	10.4 (6.5)	-0.32	9.5 (4.7)	4.7 (4.6)	0.12
Initial Vital Signs						
Initial mean Glasgow Coma Score (SD)	14.0 (1.6)	14.3 (1.1)	-0.24	13.6 (2.3)	14.0 (1.5)	-0.20
Initial mean systolic BP in Millimeters of mercury (SD)	141.4 (25.8)	137.9 (25.9)	0.13	131.4 (27.9)	140.8 (25.8)	-0.35
Initial mean heart rate in beats per minute (SD)	83.3 (18.7)	89.3 (29.3)	-0.24	89.0 (21.5)	84.3 (20.9)	0.22
Final Vital Signs						
Final mean Glasgow Coma Score (SD)	14.1 (1.4)	14.4 (1.1)	-0.21	13.8 (2.0)	14.1 (1.4)	-0.18
Final mean systolic blood pressure in millimeters of mercury (SD)	138.8 (23.2)	132.2 (25.2)	0.28	129.1 (28.2)	137.7 (23.7)	-0.33
Final mean heart rate in beats per minute (SD)	81.7 (18.2)	81.2 (17.1)	0.03	87.2 (21.5)	81.6 (18.0)	0.28
Paramedic Response Characteristics						
Advanced care paramedic – no. (%)	176 (84.2)	35 (83.3)	0.02	101 (78.3)	211 (84.1)	-0.15
Paramedic Impression – no. (%)						
Trauma	55 (26.3)	1 (2.4)	0.73	12 (9.2)	56 (22.3)	-0.36
Generally Unwell/Sick person	17 (8.1)	5 (11.9)	-0.13	24 (18.5)	22 (8.8)	0.29
Gastrointestinal Complaints	19 (9.1)	9 (21.4)	-0.35	15 (11.5)	28 (11.2)	0.01
Pain	9 (4.3)	0 (0.0)	0.30	0 (0.0)	9 (3.6)	-0.27
Infection	10 (4.8)	2 (4.8)	0.00	24 (18.5)	12 (4.8)	0.44

Breathing Issues	12 (5.7)	1 (2.4)	0.17	20 (15.4)	13 (5.2)	0.34
Other	87 (41.6)	24 (57.1)	-0.31	35 (26.9)	111 (44.2)	-0.37
Paramedic Dispatch Priority – no. (%)						
Code 4 – Urgent	121 (57.9)	20 (47.6)	0.21	89 (68.5)	141 (56.2)	0.26
Code 3 - Prompt	88 (42.1)	22 (52.4)	-0.21	41 (31.5)	110 (43.8)	-0.26
Paramedic Return Priority – no. (%)						
Code 4 – Urgent	11 (5.3)	0 (0.0)	0.33	17 (13.1)	11 (4.4)	0.31
Code 3 – Prompt	187 (89.5)	41 (97.6)	-0.34	109 (83.9)	228 (90.8)	-0.21
Code 2 – Scheduled	1 (0.5)	0 (0.0)	0.10	0 (0.0)	1 (0.4)	-0.09
Code 1 - Deferrable	10 (4.8)	1 (2.4)	0.13	4 (3.1)	11 (4.4)	-0.07
CTAS on Arrival – no. (%)						
Resuscitation	0 (0.0)	0 (0.0)	0.00	1 (0.8)	0 (0.0)	0.12
Emergent	43 (20.6)	3 (7.1)	0.40	48 (36.9)	46 (18.3)	0.43
Urgent	110 (52.6)	28 (66.7)	-0.29	67 (51.5)	138 (55.0)	-0.07
Less Urgent	44 (21.1)	7 (16.7)	0.11	10 (7.7)	51 (20.3)	-0.37
Non Urgent	11 (5.3)	4 (9.5)	-0.16	4 (3.1)	15 (6.0)	-0.14
CTAS at Arrival to ED – no. (%)						
Resuscitation	0 (0.0)	0 (0.0)	0.00	0 (0.0)	0 (0.0)	0.00
Emergent	38 (18.2)	3 (7.1)	0.34	50 (38.5)	41 (16.3)	0.51
Urgent	113 (54.1)	28 (66.7)	-0.26	66 (50.8)	141 (56.2)	-0.11
Less Urgent	45 (21.5)	7 (16.7)	0.12	11 (8.5)	52 (20.7)	-0.35
Non Urgent	11 (5.3)	4 (9.5)	-0.16	3 (2.3)	15 (6.0)	-0.18
Paramedic Intervention – no. (%)						
Received medication	140 (67.0)	31 (73.8)	-0.15	107 (82.3)	171 (68.1)	0.33

Oxygen nasal cannula	56 (40.0)	11 (35.5)	0.01	53 (49.5)	67 (39.2)	0.31
Intravenous	21 (15.0)	3 (9.7)	0.10	26 (24.3)	26 (15.2)	0.30
Oxygen non-rebreather	16 (11.4)	2 (6.5)	0.12	27 (25.2)	18 (10.5)	0.40
Dimenhydrinate	6 (4.3)	2 (6.5)	-0.10	7 (6.5)	8 (4.7)	0.11
Dressing	6 (4.3)	0 (0.0)	0.24	3 (2.8)	6 (3.5)	0.00
Fluid Bolus	2 (1.4)	0 (0.0)	0.14	5 (4.7)	2 (1.2)	0.20
Morphine	3 (2.1)	0 (0.0)	0.17	3 (2.8)	3 (1.8)	0.09
ASA	5 (3.6)	0 (0.0)	0.22	0 (0.0)	5 (2.9)	-0.20
Splint	5 (3.6)	0 (0.0)	0.22	0 (0.0)	5 (2.9)	-0.20
Salbutamol	0 (0.0)	0 (0.0)	0.00	4 (3.7)	0 (0.0)	0.25
Nitroglycerine	3 (2.1)	0 (0.0)	0.17	3 (2.8)	1 (0.6)	-0.04
Ketorolac	1 (0.7)	0 (0.0)	0.10	2 (1.9)	1 (0.6)	0.12
Other medication	1 (0.7)	0 (0.0)	0.10	1 (0.9)	1 (0.6)	0.05
Acetaminophen	1 (0.7)	0 (0.0)	0.10	0 (0.0)	1 (0.6)	-0.09
Dextrose/Diphenhydramine/ Oral glucose/ Ibuprophen	0 (0.0)	0 (0.0)	0.00	0 (0.0)	0 (0.0)	0.00
Received Paramedic Intervention	25 (12.0)	0 (0.0)	0.52	6 (4.62)	25 (9.96)	-0.21
Spinal Immobilization	14 (56.0)	0 (0.0)	0.38	3 (50.0)	14 (56.0)	-0.17
Other BLS treatment **	11 (44.0)	0 (0.0)	0.33	1 (16.6)	11 (44.0)	-0.23
Airway Management*	0 (0.0)	0 (0.0)	0.00	2 (33.3)	0 (0.0)	0.18
Required Physician Patch	1 (0.5)	0 (0.0)	0.10	2 (1.5)	1 (0.4)	0.12
Emergency Department Management & Outcomes						
Patient Disposition on Arrival ED						
Resuscitation	20 (9.6)	1 (2.4)	0.31	27 (20.8)	21 (8.4)	0.36
Emergent	28 (13.4)	9 (21.4)	-0.21	34 (26.2)	37 (14.7)	0.29
Observation	60 (28.7)	16 (38.1)	-0.20	22 (16.9)	76 (30.3)	-0.32

Offload Nurse	71 (34.0)	13 (31.0)	0.06	31 (23.9)	84 (33.5)	-0.21
Urgent	0 (0.0)	0 (0.0)	0.00	1 (0.8)	0 (0.0)	0.12
Waiting Room	2 (1.0)	0 (0.0)	0.14	0 (0.0)	2 (0.8)	0.08
Other	3 (1.4)	0 (0.0)	0.17	3 (2.3)	3 (1.2)	0.08
Unknown	25 (12.0)	3 (7.1)	0.16	12 (9.2)	28 (11.2)	-0.06
Patient waited in offload delay	117 (56.0)	24 (57.1)	-0.02	79 (60.8)	141 (56.2)	0.09
Median offload delay in minutes (IQR)	43 [31,83]	51.5 [39,76]	-0.22	45 [34, 71]	44 [32.5, 80.5]	0.05
Emergency Department Diagnostics – no. (%)						
Urinalysis	173 (82.8)	36 (85.7)	-0.08	129 (99.2)	209 (83.3)	0.59
Bloodwork	172 (82.3)	36 (85.7)	-0.09	129 (99.2)	208 (82.9)	0.60
Emergency Department Diagnosis– no. (%)						
Infection	25 (12.0)	4 (9.5)	0.08	42 (32.3)	29 (11.6)	0.52
Musculoskeletal Injury	63 (30.1)	2 (4.8)	0.71	3 (2.3)	65 (25.9)	-0.72
Other	31 (14.8)	15 (35.7)	-0.50	15 (11.5)	46 (18.3)	-0.19
Respiratory Complaints	22 (10.5)	2 (4.8)	0.22	25 (19.2)	24 (9.6)	0.28
Abdominal	12 (5.7)	6 (14.3)	-0.29	9 (6.9)	18 (7.2)	-0.01
Cardiac	13 (6.2)	1 (2.4)	0.19	10 (7.7)	14 (5.6)	0.09
Mental Status Issue	8 (3.8)	3 (7.1)	-0.15	7 (5.4)	11 (4.4)	0.05
Neuro	13 (6.2)	0 (0.0)	0.36	4 (3.1)	13 (5.2)	-0.11
Genitourinary	4 (1.9)	3 (7.1)	-0.25	8 (6.2)	7 (2.8)	0.16
Pneumonitis	3 (1.4)	0 (0.0)	0.17	5 (3.9)	3 (1.2)	0.17
Device management	9 (4.3)	1 (2.4)	0.11	0 (0.0)	10 (4.0)	-0.29
Fracture	0 (0.0)	0 (0.0)	0.00	0 (0.0)	0 (0.0)	0.00
In-hospital Procedures no. (%)						

Consultation						
Medicine	15 (7.2)	2 (4.8)	0.10	79 (60.8)	17 (6.8)	1.39
Clinical Decision Unit	40 (19.1)	1 (2.4)	0.56	7 (5.4)	41 (16.3)	-0.36
Orthopedics	9 (4.3)	0 (0.0)	0.30	13 (10.0)	9 (3.6)	0.26
Surgery	3 (1.4)	2 (4.8)	-0.19	8 (6.2)	5 (2.0)	0.21
Cardiology	3 (1.4)	0 (0.0)	0.17	6 (4.6)	3 (1.2)	0.20
Repeat access to ED - no. (%)	30 (14.4)	2 (4.8)	0.33	7 (5.4)	32 (12.8)	-0.26

SD = Standard Deviation, COPD = Chronic Obstructive Pulmonary Disease, BLS = Basic Life Support, ASA = Acetylsalicylic acid, ED = Emergency Department, IQR = Interquartile Range

Chapter 6. DISCUSSION

This chapter provides a summary of our key research findings and their implications, their strengths and limitations, and discusses the next steps for future research.

6.1 Research Summary

The purpose of this thesis was to explore how paramedics can provide enhanced medical care to LTC patients, allowing them to remain in their place of residence and avoid ED visits. To achieve this, we completed a review of the literature and detail in chapter 2 why LTC patients need alternatives to the ED for acute care, and how legislation and paramedic care are changing to provide alternative models of care to these patients. In chapter 3, we report the results of a systematic review of interventions in LTC centers by allied health providers that target the reduction of ED visits. In chapter 4, we discuss the findings of a national survey of paramedic services and what community paramedics programs are in place across the country in LTC centers. In chapter 5, we report the results of a health records review that examined what diagnostics and therapeutic interventions were provided to LTC patients to determine what conditions could be managed by paramedics on-site. This final chapter aims to provide an overview of the findings of all three studies and how they contribute to answering our research question.

6.2 Key Study Findings

Our three studies contributed to our understanding of what role paramedics could play in providing enhanced care to residents of LTC facilities, avoiding transportation to the ED. In our first study, a systematic review, we found that current interventions targeted towards reducing ED visits by LTC patients can be grouped into 5 categories; 1) the use of advanced practice nursing; 2) a program called Interventions to Reduce Acute Care Transfers (INTERACT); 3) end-of-life care; 4) condition specific interventions; and 5) the use of extended care paramedics. All 13 programs measuring ED visits found they decreased and all but one of the 17 programs measuring hospitalization found reductions. Few studies measured patient adverse events or mortality and only one study measured impacts on the healthcare system such as ED crowding or paramedic offload delay.

Our second study, a national survey of paramedic services, found a gap between the perceived need for community paramedic programs that could treat LTC patients on-site (98.0%) and the 36.0% of services who have such programs in place. We found the top priorities for future programs were for programs that support patients being discharged (30.6%), extended care paramedics (24.5%) and programs that treat respiratory illnesses in place (20.4%). Services identified support for patients being discharged and programs treating respiratory illness as having the highest potential impact (62.0% and 54.0% respectively). We also found that significant barriers exist to wide adoption of these programs, most notably required changes in legislation (36.0%) and required changes to the current system of medical oversight (34.0%).

Finally, our health records review found that 11.1% of patients from LTC could have been treated by paramedics within their current medical directives. We found that 7.9% of LTC patients did not require diagnostics or therapeutic interventions in the ED and an additional 3.2% received treatment in the ED that is part of current medical directives for Ontario paramedics. We found that 54.9% of patients required diagnostics or interventions in the ED that were beyond current paramedic capabilities, and that 34.1% of patients were admitted to hospital. Our comparison of these groups of patients, using standardized differences, identified opportunities where community paramedics could increase the number of patients who could be treated in their place of residence. Some of these opportunities included requisitioning diagnostics or providing point of care testing as well as providing antibiotics and fluid rehydration to some patient with infections.

6.3 Importance of Findings / Implications

This body of research contributes to our knowledge and understanding of programs treating LTC patients on-site and how paramedics can play a complimentary role within existing care systems, providing alternative care options to the ED. Our studies have identified several knowledge gaps including a general lack of peer reviewed evidence evaluating existing programs, and lack of patient safety and patient specific outcomes in existing evaluations. We also identified a need for legislative changes to allow for such models of care. The current structure of medical direction in Ontario is a barrier to implementing community paramedic programs, which, to be successful, rely on being targeted to the specific needs of individual communities rather than amenable to a provincially standardized approach.

6.4 Strengths and Limitations

We have used a mixed methods approach to address our general research question which included a systematic review, a national survey and a health records review. We followed rigorous methodological standards for each study including PRISMA guidelines for our systematic review and the STROBE statement for our health records review.

We have highlighted the limitations of each study within their respective manuscripts which include limitations inherent to each research design. The broad scope we employed in our systematic review led to the inclusion of diverse programs which were difficult to directly compare and precluded meta-analysis. Our survey, while receiving responses from services representing the coverage area for the majority of the population, did not receive responses from all territories, and had several instances where services did not describe their community paramedic programs. Our health records review was retrospective and therefore dependent upon the accuracy of data entered historically. It also had a relatively small sample size.

6.5 Future Research

Alternative models of care for prehospital patients, and specifically community paramedicine, are increasing in importance. Programs are continuing to be developed and implemented in absence of scientific evidence to guide them. To date, most research has been observational and intervention trials are needed to rigorously evaluate outcomes. More work needs to be completed to risk stratify LTC patients and determine which patients are best served by treating them in their place of residence and for which an ED visit is still the best option. Future research

needs to include patient and family preferences as well as quality of life indicators. Future evaluation of community paramedic programs should also focus on patient safety.

6.6 Conclusion

Community paramedics can play an important role in providing treatment to LTC patients in their place of residence allowing them to avoid ED visits. LTC patients experience frequent, burdensome transfers to the ED and often do not receive diagnostics or therapeutic treatment beyond what could be delivered at the LTC. Community paramedics with expanded scopes of practice, working outside the traditional system of medical direction, are already fulfilling roles where they are actively providing treatments to LTC patients and paramedic services across the country have identified the need for more such programs. Significant barriers exist to implementing further community paramedic programs including a need for legislative changes and changes to the current system of medical direction. If these barriers can be overcome, community paramedics in LTC centers could reduce ED transfers and hospitalization, potentially reducing the risks associated with hospitalization and reducing the burden on the healthcare system.

Appendices

Appendix 1. Waiver of Ethics Review – Survey



**Ottawa Health Science Network Research Ethics Board (OHSN-REB) /
Conseil d'éthique de la recherche du réseau de science de la santé d'Ottawa (CER-RSSO)**

February 8, 2018

Dr. Christian Vaillancourt
The Ottawa Hospital- Civic Campus
Department of Emergency Medicine
1053 Carling Avenue, F658
Ottawa, Ontario, K1Y 4E9

Re: Alternative Care Models for Paramedic Patients from Long-Term Care Centers; An Environmental Scan of Paramedic Services

Dear Dr. Vaillancourt,

Thank you for your email dated January 25, 2018 enclosing the above named project.

Our review of the proposal indicates that your project falls within the context of quality initiative, quality improvement, quality assurance, and/or program evaluation. Consequently, as per the Tri-Council Policy Statement 2, Article 2.5, we have determined that the proposal is not 'human subject research'; therefore, review by the OHSN-REB is not required.

Please ensure that there is no mention of 'research' in any telephone/email scripts and/or information consent forms used for the purpose of recruiting participants to your project.

The TOH or UOHI Quality Office will be copied on this letter.

For more information regarding TOH quality improvement projects, please contact the TOH Quality Office at quality@toh.ca.

University of Ottawa Heart Institute quality improvement projects must be **registered**, please contact Bonnie Bowes at the UOHI Quality Office at quality@ottawaheart.ca or 613-798-5555 extension 14322.

The Ottawa Health Science Network Research Ethics Board is constituted in accordance with, and operates in compliance with the requirements of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans; Health Canada Good Clinical Practice: Consolidated Guideline; Part C Division 5 of the Food and Drug Regulations of Health Canada; and the provisions of the Ontario Health Information Protection Act 2004 and its applicable Regulations.

Yours sincerely,

Raphael Saginur, M.D./Francine Sarazin Ph.D., C. Psych or James Robblee MBA, MD as applicable
Chair/Vice-Chair
Ottawa Health Science Network Research Ethics Board

cc. [TOH/UOHI as applicable] Quality Office

Civic Campus, Box 675, 725 Parkdale Avenue, Ottawa, Ontario, K1Y 4E9
613-798-5555 extension 16719 Fax : 613-761-4311 <http://www.ohri.ca/ohsn-reb>

Appendix 2. Letter to Paramedic Chiefs Introducing Survey

Subject: Canadian Survey Conducted by Paramedic

Dear fellow Chiefs,

I would like to introduce Shannon Leduc, who is one of my paramedics at the Ottawa Paramedic Service. Shannon is an Advanced Care Paramedic and clinical educator who is currently completing her Master's of Science in Epidemiology at the University of Ottawa. As part of her studies, Shannon is investigating Community Paramedicine in long-term care. Specifically, she is attempting to identify conditions in long-term care patients, that are manageable by paramedics on site, avoiding transportation to the emergency department.

Adults living in long-term care facilities are more likely to utilize the emergency department (ED), have higher per-person healthcare costs and are more susceptible to adverse events when in the ED. This makes them a group of interest when designing Community Paramedic programs.

There are a small number of known paramedic programs in place across the country that focus on treating long-term care patients in their residence. These innovative programs vary considerably and are not yet being adapted across the country. As part of our larger project, we wish to learn from these programs so that we can understand what is working and use this information to inform potential future models of care.

We are asking you to help with this project by identifying someone in your service to complete a short 15-minute survey.

As we only need one response on behalf of each service, could you please identify the most appropriate person in your service to fill out our survey.

Click below to tell us who will fill out the survey by

June 7, 2018

(The link below is to give us the contact details of the person filling out the survey and should take less **than 5 minutes** to complete)

<https://goo.gl/forms/g12Cj4866mt1711m2>

An email will then be sent to that individual containing a survey link and a PDF copy of the survey. The PDF copy may be of assistance when determining what data needs to be gathered before filling out the electronic survey (call volumes, number of staff etc.).

In this survey, we are asking for systems based information. We are **not** asking for any personal health information or for any individual patient or provider information. This survey and project proposal has been reviewed by the Ottawa Health Science Network Research Ethics

Board. They have determined that it is not 'human subject research' per the Tri-Council Policy Statement 2, Article 2.5., and as such, a waiver of ethics review has been received.

In our survey, we will ask you questions related to the following topics:

Demographics such as call volume and number of long-term care centers in your area

Information on programs you may have in place

What the industry needs are regarding treat and release protocols, alternative destinations and

Community Paramedic programs

Barriers to providing programs

It is important to our profession that we continue to build models of care based on evidence and that we as paramedics are actively leading the exploration for the evidence we require. Completing this survey will support both important objectives and I thank you for your time and assistance with this worthwhile project.

Sincerely,

Myles Cassidy

Chief, Ottawa Paramedic Service

Appendix 3. Direct Email to Introduce Survey

Hello,

My name is Shannon Leduc and I am a paramedic from Ottawa Ontario. I am asking for your help completing a survey on Community Paramedicine in Long-Term Care.

Recently, the Paramedic Chiefs of Canada send out an email with information on the survey and a request for services across the country to participate.

I believe it is extremely important to capture the diverse experience and needs of services across Canada and recognize that not all paramedic services may have received the request to participate. As such, I am also contacting services directly to ask that you assist us in this important project.

Completing this survey will help us create models of care based on evidence and will support a paramedic led initiative.

Please see the messaging below that was distributed by the Paramedic Chiefs of Canada containing information about the survey. Or click here to identify someone to fill the survey out on behalf of your service:

<https://goo.gl/forms/s0UhKe6a6CqNwhgy2>

If you have any questions, please don't hesitate to contact me at XXX or XXX

Thank you,

Shannon Leduc

Email sent via Paramedic Chiefs of Canada:

Subject: Canadian Survey Conducted by Paramedic

Dear fellow Chiefs,

I would like to introduce Shannon Leduc, who is one of my paramedics at the Ottawa Paramedic Service. Shannon is an Advanced Care Paramedic and clinical educator who is currently completing her Master's of Science in Epidemiology at the University of Ottawa. As part of her studies, Shannon is investigating Community Paramedicine in long-term care. Specifically, she is attempting to identify conditions in long-term care patients, that are manageable by paramedics on site, avoiding transportation to the emergency department.

Adults living in long-term care facilities are more likely to utilize the emergency department (ED), have higher per-person healthcare costs and are more susceptible to adverse events when in the ED. This makes them a group of interest when designing Community Paramedic programs.

There are a small number of known paramedic programs in place across the country that focus on treating long-term care patients in their residence. These innovative programs vary considerably and are not yet being adapted across the country. As part of our larger project, we wish to learn from these programs so that we can understand what is working and use this information to inform potential future models of care.

We are asking you to help with this project by identifying someone in your service to complete a short 15-minute survey.

As we only need one response on behalf of each service, could you please identify the most appropriate person in your service to fill out our survey.

Click below to tell us who will fill out the survey by

June 14, 2018

(The link below is to give us the contact details of the person filling out the survey and should take less **than 5 minutes** to complete)

<https://goo.gl/forms/g12Cj4866mt1711m2>

An email will then be sent to that individual containing a survey link and a PDF copy of the survey. The PDF copy may be of assistance when determining what data needs to be gathered before filling out the electronic survey (call volumes, number of staff etc.).

In this survey, we are asking for systems based information. We are **not** asking for any personal health information or for any individual patient or provider information. This survey and project proposal has been reviewed by the Ottawa Health Science Network Research Ethics Board. They have determined that it is not 'human subject research' per the Tri-Council Policy Statement 2, Article 2.5., and as such, a waiver of ethics review has been received.

In our survey, we will ask you questions related to the following topics:

Demographics such as call volume and number of long-term care centers in your area

Information on programs you may have in place

What the industry needs are regarding treat and release protocols, alternative destinations and

Community Paramedic programs

Barriers to providing programs

It is important to our profession that we continue to build models of care based on evidence and that we as paramedics are actively leading the exploration for the evidence we require. Completing this survey will support both important objectives and I thank you for your time and assistance with this worthwhile project.

Sincerely,

Myles Cassidy

Chief, Ottawa Paramedic Service

Community Paramedicine In Long-Term Care

Thank you for helping us with our survey. We appreciate you taking the time to assist us with this important project. It should take no more than 15 minutes to answer the following questions.

This survey is being completed as part of a larger project that aims to identify conditions in long-term care patients that could be managed by paramedics in the field, avoiding transportation to the emergency department.

As the population ages and the pressures on paramedic services increases, many services are looking for alternative models of care that optimize resources while continuing to provide high quality care to patients. There are several services doing innovative things to address these challenges but they are not yet being adopted across the country. It is our goal to understand what programs are in place across Canada, specifically for patients in long-term care centers.

Please answer the following questions to the best of your knowledge. We recognize how valuable your time is and that it may be more convenient for you to send us existing documents regarding programs you have, rather than type out a description. As such, at the end of the survey, we will ask you if you have any documents you wish to share with us to aid in describing any programs or protocols your service may have.

About your service

What is the name of your service?

May we recognize your contribution by listing the name of your service in the acknowledgement section, if we successfully submit the results of this survey to a medical journal? We will only present aggregate data with no reference to your specific answers.

No

Yes

Is your service:

Provincially operated

Municipally operated

Privately operated

Other _____

What is the approximate area, in square kilometers, that you provide emergency coverage for?

Is the area you provide emergency coverage for:

Primarily a population center (most coverage areas have a population of at least 1, 000 and a density of 400 or more people per square kilometer, the former term for this was urban center)

Primarily rural (most coverage areas have a population less than 1, 000 and a density of less than 400 people per square kilometer)

Mixed

How many long-term care centers are in your emergency coverage area. The Center for Disease Control defines long-term care centers as 'skilled nursing facilities that provide medical and personal care to people who are unable to manage independently in the community'. They do not include retirement residences or group homes. If you do not know how many long-term care centers are in your area, please type 'unknown'.

In 2017, what was your total call volume (including calls for emergency response, non-emergency transfers, standby's and all other requests for service)?

In 2017, what was the total volume of calls your service responded to at long-term care centers? This would include emergency responses as well as scheduled inter-facility transfers. If you do not know the total volume of calls your service responded to at long-term care centers, please type 'unknown'.

In 2017, how many emergency responses did your service respond to at long-term care centers? Emergency responses are defined as unscheduled calls for medical assistance (this

may include lift assists but does not include inter-facility transfers). If you do not know how many emergency responses your service responded to at long-term care centers, please type 'unknown'.

Of the people who provide medical care in your service, what approximate percentage of your staff are Emergency medical technicians/attendants/respondents:

Of the people who provide medical care in your service, what approximate percentage of your staff are Primary Care Paramedics:

Of the people who provide medical care in your service, what approximate percentage of your staff are Advanced Care Paramedics:

Of the people who provide medical care in your service, what approximate percentage of your staff are Critical Care Paramedics:

Of the people who provide medical care in your service, what approximate percentage of your staff are Community Paramedics:

Of the people who provide medical care in your service, what approximate percentage of your staff are Other (please describe):

From now on, we will use the term medical responder to refer to all the above providers.

Are the medical responders in your service self-regulated (have a governing body sanctioned by law to regulate the profession; this is sometimes referred to as a college)?

No

Yes

Some of them

Responding to Calls

Do you have any dispatch protocols in place that would provide the option not to send a medical responder to a call for medical assistance?

No

Yes

If yes, what call types might you not send a medical responder to?

Do you have any treat and release programs or protocols in place? 'Treat and release' refers to protocols or programs where medical responders treat a patient on scene and intentionally leave them at the scene rather than transport to the hospital, with or without follow up or referral. This is different than a patient initiated refusal of transport.

No

Yes

If yes, what conditions are the treat and release protocols for? (select all that apply)

Hypoglycemia

Seizures

Mental Health

Falls

Other

If no, what conditions would you be interested in seeing treat and release protocols for?

Hypoglycemia

Seizures

Mental Health

Falls

Other

Are you aware of other services in your province that have treat and release programs or protocols in place?

No

Yes

If yes, what service may have treat and release program or protocol?

Do you ever transport patients to places other than a hospital emergency department?

If Yes, please tell us what destination you transport patients to (check all that apply)

Urgent care centers or walk in clinics

Doctors' offices

Detox centers

Mental health services

Hospital – department other than the emergency department

Other _____

Are you aware of other services in your province that have programs in place to decrease the number of emergency responses or transports from long-term care centers?

No

Yes

If yes, what service may have a program?

Do you have any programs or protocols in place to decrease the number of emergency responses or transports from long-term care centers? Some examples of such programs

include; a fall prevention program, a specialty paramedic that is integrated into the long-term care team or treat and release programs for specific conditions such as hypoglycemia.

No (go to section 3 – service needs)

Yes (go to section 2 – programs related to long term care centers)

Section 2

Programs related to long-term care centers

If yes, please describe your program. Please include the following in your description: name of the program, goal of the program, who is the program staffed with (specialized dedicated providers, modified workers, other) The conditions that are treated in the program, how the medical responders are activated (e.g. dispatch, referrals from another agency etc.), if the medical responders practice under their usual scope of practice or an expanded scope, if the medical responders practice using guidelines and protocols or under online medical control.

Any other relevant information

Please note - you will be asked in a future question

to upload any documents you would like to share to aid in the description of the program.

Are you measuring outcomes to evaluate the program you have in place?

No

Yes

If yes, what outcomes are you measuring? (check all that apply)

Patient transport volume

Scene time

Patient specific outcomes

Repeat calls for the same patient

System response times

High priority call response time

Offload delays

Other _____

If you are measuring patient specific outcomes, please list what those are

If you are measuring outcomes, please describe the results of the program:

Is the funding for your program:

Part of your regular operating budget

Funded form a source outside the regular operating budget

What are your services current plans regarding your program; does your service:

Plan to continue with the program

Plan to expand the program

Plan to create new programs with other patient populations

Plan to end the program

Other _____

Section 3

Service Needs

Does your service feel there is a need for programs that facilitate the treatment of long-term care patients in their place of residence, decreasing transportation to emergency?

No (go to section 5 – impact and barriers)

Yes (go to section 4 – future programs)

Section 4

Future Programs

If your service feels there is a need for future programs, please rank the programs in the list below, in terms of their priority for your community, 1 would be the program with the highest priority, two the next highest priority and so on.

Extended care paramedics in the long-term care center

A Fall prevention program

A Respiratory illness treat in place program

An Influenza management program

A support program for patients discharged from the hospital

Other

Section 5

Impact and Barriers

From the paramedic service perspective, how significant are the following barriers to implementing a program that facilitates the treatment of long-term care patients in their place of residence, decreasing transportation to the emergency department

	Not a Barrier	Somewhat of a Barrier	Moderate Barrier	Extreme Barrier
Cost				
Required changes in legislation				
Required changes to the current system of medical oversight				
Labor issues with medical responders				
Labor issues with long-term care staff				
Resistance from other medical responders				
Making changes to medical responder training				
A lack of evidence regarding the best model of care to implement				

Other _____				
-------------	--	--	--	--

Please rate the programs in the list below, in terms of the potential impact your service feels they may have

	No impact at all	Little impact	Moderate impact	High impact	The most impact
Extended care paramedics in the long-term care center					
Fall prevention program					
Respiratory illness treat in place program					
Influenza management program					
Support programs for patients discharged from the hospital					
Other _____					

From the paramedic service perspective, please indicate how feasible it would be to implement the programs below.

	Not at all Feasible	Somewhat Feasible	Neutral	Somewhat Easy	Very Easy
Extended care paramedics in the long-term care center					
Fall prevention program					
Respiratory illness treat in place program					
Influenza management program					
Support programs for patients discharged from the hospital					
Other _____					

Section 6

Additional Information

Is there anything you would like to expand on or clarify from your answers above, or is there anything else you would like us to know?

Do you have any documents you would be willing to share with us to aid in the description of any programs or protocols you have mentioned? Documents will be kept confidential and any program information will only be described in aggregate form.

No

Yes

If you do have documents to share with us, please enter your email address below so that we can follow up with you.

Thank you for your time and help with this survey! For questions about this survey, please contact Shannon Leduc at XXX or XXX

Appendix 5. Ethical Approval - Health Records Review



Ottawa Health Science Network Research Ethics Board/ Conseil d'éthique de la recherche du Réseau de science de la santé d'Ottawa

Civic Box 411 725 Parkdale Avenue, Ottawa, Ontario K1Y 4E9 613-798-5555 ext. 14902 Fax : 613-761-4311
<http://www.ohri.ca/ohsn-reb>

March 8, 2018

Dr. Christian Vaillancourt
Ottawa Hospital - Civic Campus
Department of Emergency Medicine
1053 Carling Avenue, F658
Ottawa, ON K1Y 4E9

Dear Dr. Vaillancourt:

Re: Protocol # 20180077-01H — Characteristics, management and outcomes of pre-hospital long-term care patients

Protocol approval valid until - March 7, 2019

Thank you for the e-mail of March 06, 2018 from Angela Marcantonio. I am pleased to inform you that your Application for Chart Review underwent expedited review by the Ottawa Health Science Network Research Ethics Board (OHSN-REB), and is approved. No changes, amendments or addenda may be made to the protocol without the OHSN-REB's review and approval.

Date of approval: March 08, 2018.

Approval is for the following:

- Protocol dated February 27, 2018
- Pre-Hospital Case Report Form dated February 28, 2018
- In-Hospital Case Report Form dated February 28, 2018

If the study is to continue beyond the expiry date noted above, a Renewal Form should be submitted to the REB, in hardcopy. All Annual Renewal Reports, regardless of review type (i.e., full board or delegated), must now be submitted according to the full board meeting submission deadlines AND at least 30 days prior to the expiry date of the study to prevent a lapse in approval. If the study is completed by this date, a Termination Report should be submitted.

The OHSN-REB complies with the membership requirements and operates in compliance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans; the International Conference on Harmonization - Good Clinical Practice: Consolidated Guideline and the provisions of the Personal Health Information Protection Act 2004.

Yours sincerely,

A black rectangular box redacting the signature of Raphael Saginur.

Raphael Saginur, M.D.
Chairperson
Ottawa Health Science Network Research Ethics Board

/ag

Community Paramedicine for Long-Term Care Patients Case Report Form - Prehospital

02/28/2018

Prehospital Data

Case Number

Unique ID

ACR Number

Date of Call (mm/dd/yyyy)

Male

Female

Year of Birth

Month of Birth

Pickup Facility Number

Chief Complaint

Medical History:

Dementia

Cancer

COPD

Epilepsy

Palliative

HTN

HTN

Cardiovascular Disease

CHF

Medications:

Insulin

Antipsychotic

Antibiotics

Narcotics

Anticoagulant

Antiplatelet

Corticosteroids

Benzodiazepines

Number of medications the patient is prescribed

Treatment given prior to arrival

Initial pain scale

Treatment Given:

- | | | | | | |
|----------|--------------------------|--------------|--------------------------|----------------|--------------------------|
| IV | <input type="checkbox"/> | Oxygen N/C | <input type="checkbox"/> | Oxygen NRB | <input type="checkbox"/> |
| Bolus | <input type="checkbox"/> | Splint | <input type="checkbox"/> | Dressing | <input type="checkbox"/> |
| ECG | <input type="checkbox"/> | 12-Lead | <input type="checkbox"/> | Nitroglycerine | <input type="checkbox"/> |
| ASA | <input type="checkbox"/> | Oral Glucose | <input type="checkbox"/> | Dextrose | <input type="checkbox"/> |
| Ventolin | <input type="checkbox"/> | Gravol | <input type="checkbox"/> | Benadryl | <input type="checkbox"/> |
| Morphine | <input type="checkbox"/> | Ketorolac | <input type="checkbox"/> | Advil | <input type="checkbox"/> |
| Tylenol | <input type="checkbox"/> | | | | |

Other Medication

Other Treatment

Patch for orders

- Yes
 No

If patch; orders:

Glucose Reading

Initial

Final

Vital Signs

Time of Initial

- | | | | | | | | |
|-------------|----------------------|--------------|--------------------------|------------------|--------------------------|-----|----------------------|
| HR | <input type="text"/> | RR | <input type="text"/> | SPO ₂ | <input type="text"/> | GCS | <input type="text"/> |
| BP Systolic | <input type="text"/> | BP Diastolic | <input type="text"/> | Pain Scale | <input type="text"/> | | |
| Temp | <input type="text"/> | Celsius | <input type="checkbox"/> | Farenheit | <input type="checkbox"/> | | |

02/28/18

Time of Final

HR RR SPO₂ GCS

BP Systolic BP Diastolic Pain Scale

Temp Celsius Fahrenheit

Patient Disposition

Emergent Urgent Observation

Waiting Room Resus

Other

Paramedic Impression

CTAS on Arrival CTAS Final Destination Hospital Number

Dispatch Priority Code Return Priority Code

Times:

Call Received

Time Date (mm/dd/yyyy)

Arrive Scene

Time Date (mm/dd/yyyy)

Patient Contact

Time Date (mm/dd/yyyy)

Depart Scene

Time Date (mm/dd/yyyy)

Arrive Destination

Time Date (mm/dd/yyyy)

Time Date (mm/dd/yyyy)

Triage Alert

TOC

Time Date (mm/dd/yyyy)

Verbal Handover

Time Date (mm/dd/yyyy)

Offload Delay? Yes No Length of Offload Delay ACP on Scene? Yes No

Paramedic Impression:

Who initiated the call?

Is the call a follow up or continuation of a problem the patient has already been assessed for by a physician?

Yes No Not stated

If yes, how long ago was the patient seen by the physician? Not stated

Was the patient assessed by a healthcare provider before 911 call was made?

Yes No Not stated

If so; by whom?

Physician RN Nurse Practitioner

Other

Community Paramedicine for Long-Term Care Patients Case Report Form - In-Hospital

02/28/2018

In-hospital Data Elements:

Case Number Unique ID ACR Number

Receiving Facility:

Diagnostics Completed:

X-ray CT Scan MRI US
 12-Lead Bloodwork Urinalysis

Treatment given:

Fluids Type Amount

Medication Type Dose

Blood Yes No Number of Units

Surgeries:

Procedures:

Consultations (geriatric assessment, social work, other services)

Times:
 Triage In Unit: Discharged

Physically Left Hospital

What service repatriated the patient?

Transfer Service Paramedic Service

Other Not stated

Patient Disposition

Discharged Admitted Died Other

Discharge Date (mm/dd/yyyy)

If admitted, to which service?

Diagnosis - ICD 10

Repeat Visit

Did this patient have repeat access to the emergency department within the next 7 days?

Yes No

Date of repeat access (mm/dd/yyyy)

If so, disposition?

Admitted Discharged Died

Other

If discharged, date? (mm/dd/yyyy)

If admitted, to which service?

Discharge Date (mm/dd/yyyy)

Date CRF Completed (mm/dd/yyyy)

Completed By

Date Audit Completed (mm/dd/yyyy)

Audit Completed By

Appendix 8. Sample Size Calculation - Health Records Review

A sample size calculation has been completed based on estimating the proportion of patients who have conditions manageable by paramedics with a 95% confidence. A conservative event rate of 0.5 was used to calculate the sample size. 385 patients are required to estimate the proportion of patients with a condition manageable by paramedics with a 95% confidence interval.

$$n = p(1-p) \left(Z_{1-(\alpha/2)} / E \right)^2$$
$$n = (1-0.5) \left(1.96 / .05 \right)^2 = \mathbf{385}$$