



Original Research

Impact of a family medicine-based transitional care intervention on readmission and length of stay: a pilot study

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Older patients transitioning from the hospital to home are at risk of having complicated care transitions, with more readmissions, longer stays, and even death (1). These poor health outcomes result from poor coordination and communication during these transitions (2, 3). In response to this situation, transitional care interventions, which are defined as a

“set of actions designed to ensure the coordination and continuity of healthcare as patients transfer between different locations or different levels of care within the same location” have been implemented (1). These interventions may have a positive impact on reducing hospital readmissions (4, 5) and mortality in older

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patients after hospital discharge (6), but some interventions have not shown success.

Multiple hypotheses have been suggested in the literature as to why some transitional care intervention are more effective than others in reducing readmissions, mortality and length of stay (LOS) when readmitted. First, it is not yet known in which settings transitional care interventions could provide better results (7). In fact, a systematic review concluded that there is no evidence to support the implementation of hospital-based transitional care interventions (8). It is possible that a family medicine-based transitional care intervention would be more successful to reduce older patients' service use (9). Indeed, a transitional care intervention based in a primary care team, more specifically led by a Virtual Ward (VW) physician and a VW nurse (acting as a case-manager) from the primary care team where the admitted patient is registered, would ensure that the usual care providers are involved early on and throughout the transition by improving communication between the usual family physician and the hospital. Better communication between the usual family physician and the hospital could help reduce short-term readmissions (10). The usual family physician is equipped with longitudinal and comprehensive understanding of the patients' needs and is trained in managing community-based chronic diseases, offering a significant benefit to the care provided by an unfamiliar hospital internist. Other components for a successful transitional care intervention to reduce short-term readmissions include a home visit within three days after discharge (10) and should begin at the pre-hospital discharge (11).

Therefore, we designed a family medicine-based transitional care intervention, in an attempt to increase and strengthen the engagement of usual care providers working in the same primary care team. The main objective of this pilot study was to evaluate the impact of our family medicine-based transitional care intervention (described in the methods below) on ED visits or hospital readmission rates and LOS of older patients at risk for readmission. A more detailed description of the family medicine-based transitional care intervention is described in our companion paper (12). We hypothesized that patients in the intervention group would have fewer ED visits, fewer hospital readmission rates and shorter LOS than patients in the control group.

Methods

Design and setting

A quasi-experimental pilot study with an independent historical control group was used to determine the impact of the intervention on hospital readmission rates and LOS.

A participatory approach was used to root the primary care practice-based study in action and make it meaningful for clinicians, patients and caregivers (13). Participatory approach is an approach of conducting research by actively involving all relevant stakeholders, in this case clinicians, patients and caregivers, throughout the research project (13). Indeed, patients and caregivers were involved in the development of the clinical intervention and the care process indicators. This study was initiated by a family physician and nurse from the Herzl Family Practice Center, at the Jewish General Hospital (JGH), in Montreal, Canada. The Herzl Family Practice Center is a McGill University-affiliated primary care interdisciplinary team located in Montreal, Quebec. In addition, the clinic is attached to a hospital where patients can be hospitalized in a family medicine ward and cared for by doctors who also work at the primary care clinic. This project was a practice-based initiative (14), in that it was the VW clinicians who contacted the McGill University researchers to evaluate their transitional care intervention. Together, clinicians and researchers served on a "steering committee", who managed the course of the research project, on a weekly basis throughout the study.

Intervention

We built upon the VW model (5, 15-17), in which an interdisciplinary team, usually located in a hospital, coordinates care, meets daily, facilitates communication between the hospital and the usual providers, and offers a single point of contact for the patients. In contrast to basing a team within the hospital setting and the intervention at the primary care setting, our design was expected to strengthen communication with the usual care providers and their involvement. Furthermore, the patients' discharge plan was initiated during hospitalization.

The intervention was divided in three clinical modules to facilitate its potential implementation in other clinics. Module 1 was composed of the selection process and hospital discharge plan. A designated VW nurse (case manager) from the Herzl Family Practice Center visited the family medicine ward daily and selected patients based on their LACE index (18), which identifies patients at risk for readmission or

death within thirty days of discharge. The LACE index was chosen because it is well used and validated (18) and to be in line with the other Canadian Virtual Ward intervention, based in hospital (15). The index is based on four indicators: LOS of the index admission, acuity of the admission, co-morbidity index, and number of ED visits within the last 6 months. LOS of index admission was estimated as the discharge plan was prepared. As per recommended, patients who scored equal or higher than 10 on the LACE index, indicative of a high risk of readmission, during their daily visits to the family medicine ward were approached and the intervention was explained (18). The VW nurse scheduled follow-up appointments with the patients' usual family physicians, residents, and nurses at the Herzl Family Practice Center and elaborated the discharge plan. The caregivers, when available, were involved throughout the period the patients were admitted into the VW. The discharge plan occurred while the patients were still hospitalized.

Module 2 was composed of case management. The VW nurse provided post hospital discharge follow-ups by phone (the initial follow-up was done within 72 hours post hospital discharge), assessed the patients and caregivers' needs and symptoms, shared educational information, reviewed the patients' medications, and confirmed follow-up appointments with patients and caregivers and the usual family physicians, residents, and nurses at the Herzl Family Practice Center. The VW nurse was available to the patients and caregivers by phone five days a week. The VW nurse also initiated communication with community services, such as home care services, and organized home visits by the usual family physicians, residents, and other health professionals if needed.

Module 3 was composed of weekly multidisciplinary rounds. Weekly meetings with the usual family physician, resident, the VW nurse and VW physician, social worker, and pharmacist were organized to review each VW patient's medical history, medication list, and medical and social issues. Adjustments in diagnosis or treatment were made, and patient, caregiver, usual family physician, community pharmacist, and home care services were notified. Finally, a discharge plan from the VW was organized when the situation became stable. These three modules are described in our companion paper (12). The intervention started on July 1st, 2014 with internal funding from the director of the Herzl Family Practice Clinic.

Participants

The VW group consisted of all patients admitted in the family medicine ward at the JGH, between July 1st, 2014 and June 30th, 2015. Inclusion criteria were: having a family physician at the Herzl Family Practice Center, being 65 years old and over, being at risk for readmission (LACE ≥ 10), and being discharged to home or senior residence. All patients admitted to the ward who met the criteria were contacted by the VW nurse and, upon their consent, were offered to be included in the intervention group.

A historical control group consisted of all patients discharged from the same ward between July 1st, 2013 and June 30th, 2014. The same inclusion criteria were used. All patients admitted to the family medicine ward and satisfying the criteria were included in the control group except for patients who participated in the intervention group to ensure independent groups. Consent from the control group was not required.

The study and consent forms were approved by the Research Ethics Office of the JGH.

Data collection and outcomes

A retrospective chart review of the Electronic Medical Records (EMR) of patients in VW and historical control groups was used to measure the primary outcomes: a composite outcome (ED visits and/or hospital readmissions) and LOS. Both outcomes were measured at 30, 60, 90 and 180 days post discharge. For each patient readmitted, LOS was calculated as the cumulative number of days for all hospital readmissions, where an ED visit counted as one day, and any LOS started the day of admission to ED and ended the day of hospital discharge.

Analyses

Descriptive analyses were performed on patients' characteristics and study outcomes. Care process descriptions were examined over the length of stay in the VW program for the intervention group. Unadjusted proportion of patients with at least one readmission and average LOS were calculated. Poisson regressions, controlling for exposure time, were performed for readmission at each time point. Given that at least 12 VW patients (34%) were not readmitted during the study period, zero-inflated Poisson regressions, controlling for exposure time, were performed for LOS at each time point. We were not able to adjust for age, sex, and LACE score given the limited sample size. However, sensitivity analyses were performed adjusting for age, sex, and LACE scores for each outcome. The care processes of the intervention

were refined as the study progressed, therefore the number of care processes performed at the beginning of the intervention were not fully implemented and this could create a “ramp-up” effect, whereby the impact of the intervention would be stronger in patients recruited later on. Therefore, we verified the potential existence of a ramp-up effect, and its impact on our results by performing another set of sensitivity analyses. Ramp-up effect was calculated as the number of days between the start of the intervention and the patient recruitment in the intervention. Finally, to evaluate the potential adverse effect of the intervention on mortality, we performed Kaplan-Meier survival analyses, using Log rank statistics to compare the groups on mortality rates at 90 and 180 days. All analyses were performed with Statistical Package for the Social Sciences (SPSS; IBM Corp. Released 2010. IBM SPSS Statistics for Windows, Version 19.0. Armonk, NY: IBM Corp).

Results

Fifty VW patients and 89 control patients were examined for eligibility. Of these, 15 VW patients and 21 control patients were excluded due to transfer to long-term care or rehabilitation services, or refusal. A total of 35 patients in the VW and 68 in the control group were included in the study (Figure 1).

The demographics for the 35 VW patients and 68 controls are in Table 1. Overall, no clinically meaningful differences at inclusion were observed in terms of age, sex distribution, LACE score, or discharge destination. On average, the LOS in the VW intervention group was 48.1 ± 17.2 days, during which the VW team provided transitional care as described in the intervention. The proportion of patients who were contacted by the VW nurse within 72 hours post discharge was 54.3%; this proportion climbed to 80% if we considered a 4-day timeframe. More details describing the diverse care processes provided to the VW group is given in Table 2.

Over the 180-day of follow-up period, readmissions varied from 23% to 66% in the VW group and from 33% to 60% in the control group. Over the same period, the LOS decreased from 3.9 at 30 days to 1.3 days at 180 days in the VW group and from 9.1 days at 30 days to 2.3 days at 180 days in the control group. Change in ED visits/hospital readmission rates varied from +6% to -10% between the VW and control group. LOS in the VW group was 0.4 days to 1 day per 30 days of post discharge follow-up period shorter than the control group (Table 3).

After adjusting for exposure time and zero-inflation, we found no statistically significant differences in the incidence of readmission rates between VW and the control at 30 days (Incidence Rate Ratio [IRR]=0.66,

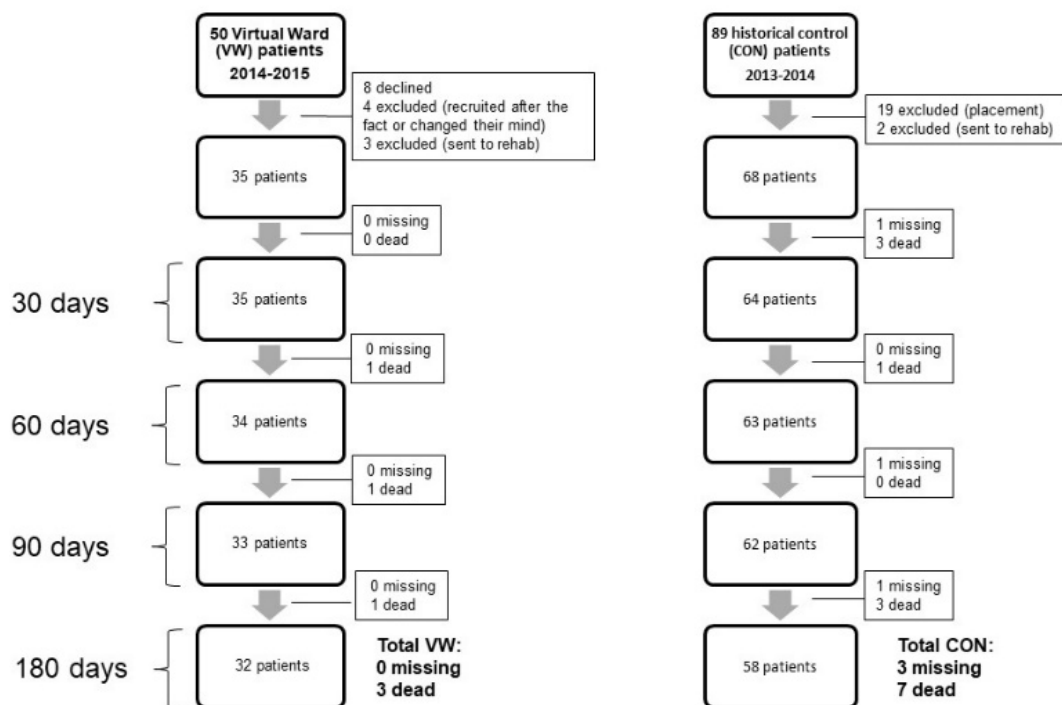


Figure 1.

95% Confidence Interval [95%CI]=0.29-1.47), 60 days (IRR=0.75, 95%CI=0.40-1.44), 90 days (IRR=0.93, 95%CI=0.52-1.66), and at 180 days (IRR=1.07, 95%CI=0.65-1.76) (Figure 2). The LOS was found to be statistically significantly shorter at 90 (IRR=0.66, 95%CI=0.64-0.69) and 180 days (IRR=0.49, 95%CI=0.43-0.55) for VW patients compared to controls. However, no difference in LOS was detected at 30 days (IRR=1.16, 95%CI=0.95-1.42) and 60 days (IRR=1.04, 95%CI=0.89-1.23) (Figure 2). Sensitivity analyses adjusting for age, sex, and LACE found no clinically meaningful differences in the IRRs (Tables 4 and 5).

There was no indication of a ramp-up effect on the rate of readmissions in VW patients at any time point (data not shown). There were statistically significant ramp-up effects on the LOS at 30, 90 and 180 days. The IRR (95% CI) was 0.997 (0.995-0.999) at 30 days, 0.999 (0.997-1.000) at 60 days, 0.997 (0.995-0.998) at 90 days, and 0.998 (0.997-0.999) at 180 days. In other words, for every additional day since the start of intervention, an additional 0.1% to 0.3% reduction in the LOS was found. This was deemed as not clinically meaningful. No difference in mortality was observed between the VW group (3 patients or 8.6%) and the control group (7 patients or 10.3%) at 180 days (Log Rank (Mantel-Cox) Chi-Square=0.10, df=1, p=0.75).

Discussion

Our family medicine-based VW intervention showed a statistically significant effect on reducing LOS at 90 (IRR=0.66, 95%CI=0.64-0.69) and 180 days (IRR=0.49, 95%CI=0.43-0.55) for older patients at risk of readmission, but it did not have an effect on the hospital readmission rates at any time point.

It is likely that the reduction of cumulative LOS was due to the hospital staff becoming aware of the VW team's presence and the hospital staff's increasing confidence in the family medicine-based VW ability to ensure adequate transitional care, thus discharging patients sooner. Indeed, the link between the hospital and the Herzl Family Practice centre, which is based within the hospital, might have been strong enough to warrant earlier discharge.

The lack of impact on reducing readmissions rate, ER visits or hospitalizations, does not seem to be due to a ramp-up effect as it was clinically non-significant. However, it could be due to the lack of an integrated health care network, which has not yet been implemented in Quebec. Indeed, the link between community services and the Family Medicine Groups in Quebec is weak (19-21). Nurses from home care services may not have been aware of the family medicine-based VW intervention and sent patients to

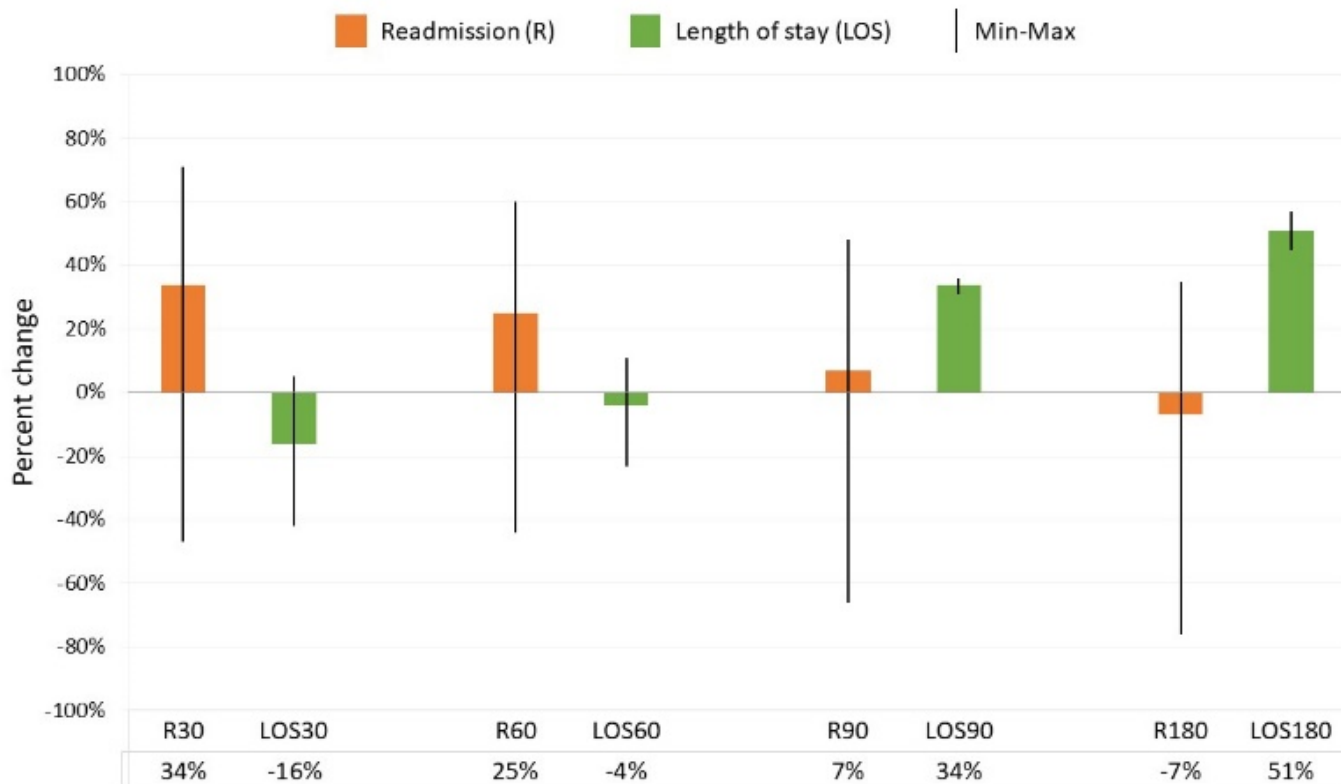


Figure 2.

ED directly, rather than contacting the VW nurse. Unfortunately, we did not assess whether discharge instructions were followed by home care services. Similarly, patients may have preferred to by-pass, or simply forgotten to call the VW nurse when a new symptom appeared. Reinforcing the link between Family Medicine Groups, such as the Herzl Family Practice centre, and home care services in the future of the VW might help decrease readmissions to hospitals. For instance, inviting a home care services representative to the multidisciplinary rounds would be an important step toward increasing this communication.

Despite promising results, our study has some limitations. First, the small sample size limits the generalizability of our results. Indeed, our study was limited by the one-year internal funding from the director of the clinic for a VW nurse and the number of patients admitted during that period. Our historical control group prevented us from considering secular trends. Nonetheless, steps were taken to minimise bias in interpreting our findings by performing multiple sensitivity analyses. While unequal group sizes may have a small effect on the precision of the estimate within each group, this design was preferred over equal group sizes as it allowed us to maximize the overall sample size and therefore power to detect an effect of the intervention in our study outcomes. The care process information collected may have benefitted from some additions, such as the assiduity of usual family physicians to multidisciplinary meetings and number of successful contacts between patients and VW nurse, irrespective of who initiates the call. Additionally, chart data might be incomplete, and we might not have captured readmissions outside of the JGH hospital. This is not likely in our population, as older patients tend to go to the same hospital (22) and hospitals reorient patients when they are already known by another hospital. Finally, due to the lack of power, we could not fully explore the effects of age, sex, and LACE score on hospital readmission rates and LOS, despite having found significant effects of these variables in sensitivity analyses. These variables should be considered in a larger study. Similarly, future studies may benefit into looking at ED visit and hospitalizations separately.

This participatory research project emerged from clinicians who contacted researchers interested in evaluating a transitional care intervention for older patients. Together, they developed the research questions and methods, considering usefulness and feasibility relevant to the practice. This is important, as

practice-based research is thought to bridge the gap between research and practice, and make healthcare innovations more relevant to clinicians and patients (14). This intervention should be applied in more family medicine groups, while allowing adaptations of the intervention to different clinical contexts. The results of this study will be used by the clinical team to further refine the intervention. The results are promising and future studies should use a stronger design, such as a randomised controlled trial, for greater confidence in the effect of this complex intervention.

Table 1: Demographics of the intervention patients and the historical group patients

	VW* (n=35)		CON* (n=68)	
Age at inclusion, in years (mean, SD)	82.3	8.5	83.5	8.2
LACE score (mean, SD)	12.6	2.9	12.7	1.9
L score* (mean, SD)	4.9	1.2	5.0	1.3
A score* (mean, SD)	3.0	0.0	3.0	0.4
C score* (mean, SD)	3.2	1.6	3.8	1.4
E score* (mean, SD)	1.4	1.5	0.9	1.2
Sex (M:F, % of F*)	14:21	60%	24:44	65%
Discharge destination				
Home (n, %)	27	77%	57	84%
Senior residence (n, %)	8	23%	11	16%

*VW = Family medicine-based Virtual Ward intervention; CON = Historical control patients; L = Length of stay; A = Acuity; C = Comorbidity; E = Emergency room visit; M = Male; F = Female

Table 2: Descriptive statistics on the care processes given to the patients registered in the family medicine-based transitional care intervention

Care processes	Statistics
Number of days in the VW*, mean (SD)	48.1 (17.2)
Number of patients for whom a med-reconciliation form was completed, n (%)	35 (100%)
Number of patients contacted by VW nurse within 72 hours post discharge, n (%)	19 (54.3%)
Number of patients contacted by VW nurse within 4 days post discharge, n (%)	28 (80%)
Number of patients for whom the home-based services were contacted by VW nurse at least once, n (%)	28 (80%)
Number of contact with the home-based services per patient, mean (SD)	6.5 (4.8)
Number of prescription adjustments made, mean (SD)	2.5 (1.8)
Number of patients with no adjustment, n (%)	1 (3%)
Number of patients with 1 adjustment, n (%)	11 (31%)
Number of patients with 2 to 8 adjustments, n (%)	23 (66%)

*VW = Family medicine-based Virtual Ward intervention

Table 3: Unadjusted percentages of living patients with at least one readmission and average length of stay

		30 days	60 days	90 days	180 days
Readmissions, n (%)	VW*	8 (23%)	12 (35%)	15 (45%)	21 (66%)
	CON*	20 (33%)	29 (46%)	30 (48%)	35 (60%)
LOS*, mean number of days per 30 days (SD)	VW*	3.9 (9.3)	2.7 (7.2)	1.7 (5.5)	1.3 (6.1)
	CON*	4.2 (9.1)	3.4 (7.3)	3.3 (7.0)	2.3 (4.6)

*Family medicine-based Virtual Ward intervention; CON = Historical control patients; LOS = Length of stay

Table 4: Incidence Rate Ratios for all-cause cumulative Length of stay at 30, 60, 90 and 180 days adjusting for age, sex and LACE score and controlling for exposure time.

	IRR*	95% CI* min	95% CI max
LOS30*			
VW* vs CON*	1.20	0.97	1.48
Age	0.99	0.98	1.00
Women vs men	1.05	0.85	1.30
LACE* score	0.91	0.87	0.96
LOS60*			
VW* vs CON*	0.99	0.84	1.17
Age	1.02	1.01	1.03
Women vs men	1.18	1.00	1.39
LACE* score	0.92	0.88	0.95
LOS90*			
VW* vs CON*	0.66	0.57	0.76
Age	1.03	1.02	1.04
Women vs men	1.31	1.15	1.51
LACE* score	0.98	0.95	1.01
LOS180*			
VW* vs CON*	0.49	0.43	0.55
Age	1.01	1.00	1.01
Women vs men	1.21	1.09	1.35
LACE* score	1.00	0.98	1.03

* VW = Family medicine-based Virtual Ward patients; CON = Historical control patients; IRR = Incidence Rate Ratios; CI = Confidence Intervals; min = minimum; max = maximum; LOS30 = length of stay at 30 days; LACE = Length of stay (L), Acuity (A), Comorbidity (C), Emergency room visit (E); LOS60 = length of stay at 60 days; LOS90 = length of stay at 90 days; LOS180 = length of stay at 180 days.

Table 5: Sensitivity analyses of Incidence Rate Ratios for readmission at 30, 60, 90 and 180 days adjusting for age, sex and LACE score and controlling for exposure time.

	IRR*	95% CI* min	95% CI max
Read30*			
VW* vs CON*	0.679	0.303	1.520
Age	1.034	0.987	1.085
Women vs men	0.990	0.445	2.151
LACE* score	1.077	0.906	1.280
Read60*			
VW vs CON	0.758	0.397	1.446
Age	0.999	0.963	1.037
Women vs men	0.917	0.485	1.735
LACE score	1.101	0.960	1.263
Read90*			
VW vs CON	0.931	0.519	1.671
Age	1.004	0.970	1.039
Women vs men	1.004	0.556	1.815
LACE* score	1.038	0.909	1.186
Read180*			
VW vs CON	1.071	0.647	1.774
Age	1.002	0.972	1.033
Women vs men	1.056	0.630	1.768
LACE score	1.051	0.938	1.177

* VW = Family medicine-based Virtual Ward patients; CON = Historical control patients; IRR = Incidence Rate Ratios; CI = Confidence Intervals; min = minimum; max = maximum; Read30 = readmissions at 30 days; LACE = Length of stay (L), Acuity (A), Comorbidity (C), Emergency room

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