Editor's key points

- In 2004 to 2005, Newfoundland and Labrador introduced reforms to primary health care (PHC), which included establishing interdisciplinary teams, maximizing scope of practice, enhancing patient access, and improving information technology. This study used linked health administrative data and an interrupted time-series design to assess the effects of these provincial PHC reforms on hospitalization rates and mortality from ambulatory care–sensitive (ACS) conditions.
- This study found no effect of PHC reforms on hospitalization rates for ACS conditions, but did find a prominent peak in mortality around the time that reforms were introduced. Because the changes in mortality trend occurred in all the communities studied, they cannot be attributed to the reforms themselves but might be associated with broader health system attention to public health and disease prevention. Overall, there was a decreasing trend in hospitalization rates for ACS conditions in rural areas over the 9-year study period, suggesting improvements in health system performance, increasing effectiveness of primary care, improvements in health, or increased health-seeking behaviour patterns over time.

Effect of primary health care reforms in the province of Newfoundland and Labrador

Interrupted time-series analysis

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Abstract

Objective To examine the effects of primary health care (PHC) reforms in the Canadian province of Newfoundland and Labrador on ambulatory care–sensitive (ACS) hospitalization rates and mortality.

Design Interrupted time-series analysis of administrative data.

Setting All communities in the province of Newfoundland and Labrador were divided into 3 groups: rural reform (n = 69 143), rural nonreform (n = 228 914), and urban nonreform (n = 197 012). No urban communities introduced PHC reforms.

Participants All residents of the province who held a valid health card and did not change their address during the 2001-2009 study period were included. Individuals were assigned to 1 of the 3 study groups based on community of residence.

Main outcome measures Hospitalization rates for ACS conditions, hospitalization rates for control conditions, and ACS-related mortality were compared using interrupted time-series models.

Results Results are reported as rate ratio or odds ratio (OR) (95% CI). In rural reform and rural nonreform communities, there was a decreasing trend in ACS hospitalization rates that preceded reforms (rate ratio of 0.97 [0.94-1.00]) and rate ratio of 0.98 [0.96-1.00], respectively) but no change following reforms. There were no significant changes in the urban group. In all 3 groups, there was a significant increasing trend in ACS-related mortality before reforms (OR of 1.09 [1.02-1.15], OR of 1.10 [1.06-1.13], and OR of 1.09 [1.05-1.14] for rural reform, rural nonreform, and urban communities, respectively), which was reversed after the introduction of reforms ($P < .01$).

Conclusion Primary health care reforms in Newfoundland and Labrador had no observed effect on ACS hospitalization rates, but a potential effect might have been masked by a decreasing trend that preceded the introduction of reforms. The increase in mortality rates that was reversed after the introduction of reforms cannot be attributed to the reforms because it occurred in all studied populations including those that did not introduce reforms.

Les effets des réformes des soins de santé primaires dans la province de Terre-Neuve-et-Labrador

Analyse de séries chronologiques interrompues

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Résumé

Objectif Examiner les effets des réformes dans les soins de santé primaires (SSP) dans la province canadienne de Terre-Neuve-et-Labrador sur les taux d'hospitalisation et de mortalité dues à des conditions propices aux soins ambulatoires (PSA).

Type d'étude Analyse de séries chronologiques interrompues de données administratives.

Contexte Toutes les communautés dans la province de Terre-Neuve-et-Labrador ont été réparties en 3 groupes : communautés rurales avec réformes (n = 69 143), rurales sans réformes (n = 228 914) et urbaines sans réformes (n = 197 012). Aucune communauté urbaine n'avait instauré de réformes dans les SSP.

Participants Tous les résidents de la province détenteurs d'une carte d'assurance maladie valide qui n'avaient pas changé d'adresse durant la période à l'étude, soit de 2001 à 2009, ont été inclus. Les personnes étaient assignées à l'un des 3 groupes étudiés selon leur communauté de résidence.

Principaux paramètres à l'étude Les taux d'hospitalisation pour des conditions PSA, les taux d'hospitalisation pour des conditions de contrôle et la mortalité liée à des conditions PSA ont été analysés à l'aide de modèles de séries chronologiques interrompues.

Résultats Les résultats sont rapportés sous forme de ratio des taux ou de rapports de cotes (RC) (IC à 95 %). Dans les communautés rurales avec et sans réformes, une tendance à la baisse dans les taux d'hospitalisation due à une condition PSA a précédé les réformes (ratio des taux de 0,97 [0,94-1,00]) et ratio de taux de 0,98 [0,96-1,00], respectivement), mais aucun changement n'a été observé à la suite des réformes. Il ne s'est pas produit de changement significatif dans le groupe urbain. Dans les 3 groupes, on a constaté une tendance à la hausse significative de la mortalité due à des conditions PSA avant les réformes (RC de 1,09 [1,02-1,15], RC de 1,10 [1,06-1,13] et RC de 1,09 [1,05-1,14] respectivement dans les communautés avec réformes rurales, sans réformes rurales et urbaines), qui a été inversée après l'instauration des réformes ($p < ,01$).

Conclusion Les réformes dans les soins de santé primaires à Terre-Neuve-et-Labrador n'ont eu aucun effet observé sur les taux d'hospitalisation due à des conditions PSA, mais un effet potentiel pourrait avoir été masqué par une tendance à la baisse précédant la mise en œuvre des réformes. L'augmentation dans les taux de mortalité, qui a été inversée après l'instauration des réformes, ne peut pas être attribuable aux réformes, parce que l'inversion s'est produite dans toutes les populations à l'étude, incluant celles qui n'ont pas adopté ces réformes.

Points de repère du rédacteur

- De 2004 à 2005, la province de Terre-Neuve-et-Labrador a instauré des réformes dans les soins de santé primaires (SSP), notamment la création d'équipes interdisciplinaires, la maximisation du champ de pratique, la facilitation de l'accès par les patients et l'amélioration de la technologie de l'information. Dans cette étude, on s'est servi de données administratives correlées sur la santé, analysées par séries chronologiques interrompues, pour évaluer les répercussions de ces réformes provinciales des SSP sur les taux d'hospitalisation et de mortalité dues à des conditions propices aux soins ambulatoires (PSA).

- Cette étude n'a observé aucun effet des réformes des SSP sur les taux d'hospitalisation due à des problèmes PSA, mais a effectivement cerné une culmination importante de la mortalité durant la période entourant l'instauration des réformes. Parce que les changements dans les tendances sur le plan de la mortalité se sont produits dans toutes les communautés à l'étude, ils ne peuvent pas être attribués aux réformes elles-mêmes, mais pourraient être associés à une attention accrue portée par le système de santé à la santé publique et à la prévention des maladies. Dans l'ensemble, on a observé une tendance à la baisse dans les taux d'hospitalisation due à des conditions PSA dans les régions rurales durant la période de 9 ans qu'a duré l'étude, ce qui porte à croire à des améliorations dans le rendement du système de santé, à une efficacité croissante des soins primaires, à des améliorations dans la santé ou à des habitudes comportementales plus saines avec le temps.

Ecological studies suggest that areas with improved access to primary health care (PHC) demonstrate reduced socioeconomic disparities in health,[1-3] reduced emergency department use,[4-6] reduced health costs,[3,7,8] and improved health outcomes including reduced mortality.[9,10] This information has been used to justify widespread efforts to improve access to and quality of PHC, but reform implementation in Canada has achieved mixed degrees of success.[11-17] One of the mechanisms by which PHC is thought to exert its effect on costs and outcomes is by identifying disease and initiating treatment early to decrease the rate of progression to severe morbidity and hospitalization. Improved access to PHC has been associated with reductions in hospitalizations in some studies,[18-21] but not in others,[22-25] and 1 study actually showed an increase in preventable hospitalizations associated with improved access to PHC.[26]

Using funding from the federal Primary Healthcare Transition Fund,[12] the Canadian province of Newfoundland and Labrador introduced reforms to PHC in 2004 to 2005, which included establishing interdisciplinary teams, maximizing scope of practice, enhancing patient access, and improving information technology. Evaluations of this program thus far are limited primarily to assessments of patient and provider satisfaction. Providers reported that reforms were associated with improved team effectiveness and enhanced scopes of practice, while patients and clients reported shorter wait times, fewer emergency department visits, and improved access and client satisfaction.[27] In this study, we use linked health administrative data and an interrupted time-series design to assess the effects of these provincial PHC reforms on hospitalization rates and mortality from ambulatory care–sensitive (ACS) conditions. Ambulatory care–sensitive conditions are conditions for which effective primary care should prevent or reduce the need for hospitalization.[28]

Methods

The research protocol was approved by the provincial Health Research Ethics Authority. Patient health insurance registry records for the years 2001 to 2009 were linked to provincial hospital abstracts, physician claims, and death records using health insurance numbers. The study cohort consisted of all residents of the province of Newfoundland and Labrador that held a provincial health card between January 1, 2001, and December 31, 2009. Individuals who had an invalid postal code of residence, changed postal code, or left the province between 2001 and 2009 were excluded. The cohort was divided into 3 groups as follows: communities in rural areas undergoing reform (n = 7), rural communities in areas not undergoing reform, and urban communities. Census subdivisions (CSDs) (ie, municipalities) were considered urban if they fell within a census metropolitan area or census agglomeration in the 2006 census and rural otherwise.[29] Although an eighth PHC team was planned in an urban area, implementation did not proceed.[27] Data were divided into prereform (2001-2004) and postreform (2005-2009) periods.

The primary outcome was number of hospitalizations per 1000 people for ACS conditions from provincial hospital abstracts, and the secondary outcome was mortality per 1000 people for which an ACS condition was listed as a cause of death in the death record. We used a previously published list of ACS conditions including chronic, acute, and vaccine-preventable conditions.[30] We also determined number of hospitalizations for 3 "control conditions" for which hospitalization rates were thought to be relatively consistent and independent of primary care access or quality.[28,31] These were appendicitis with appendectomy, bowel obstruction, and hip or femur fracture. Individual-level outcome variables were calculated by year over the 9-year study period. Hospitalization rates for ACS conditions and control conditions were obtained mainly from the ICD-9 or ICD-10-CA[32,33] codes for the most responsible diagnosis of the patient during the hospitalization, except for appendicitis with appendectomy, which was obtained from Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures or Canadian Classification of Health Intervention codes.[34,35] A list of the codes used to define the outcomes can be obtained from the corresponding author (K.A.B.).

Age and sex covariates were obtained for each individual from the patient health insurance registry.

Six-digit postal code of residence was mapped to census dissemination area (ie, neighbourhood) and CSD,[36] and several dissemination area–level sociodemographic control variables were obtained from the 2006 Statistics Canada census.[29]

Charlson comorbidity index (CCI) values were calculated using diagnostic codes contained in physician billing data,[37] and were categorized into 1 of 4 levels (0, 1 to 2, 3 to 4, or ≥5). We used categories instead of a continuous score because the relationship between CCI and outcomes in our data was not linear. Including a greater number of categories did not appreciably increase model predictive ability (negligible change in Akaike information criterion).

The geographic centroid of each CSD was mapped to the closest location on the road network, and CSDs were assigned to the closest acute care hospital by road using ArcGIS, version 10.3, geospatial software (Environmental Systems Research Institute). The mean number of acute care hospital beds per 1000 residents was determined from published hospital bed numbers for acute care[38] and 2006 census catchment populations.

Information on general practitioner supply and retention was obtained from the Physician and Medical Practice Database from Memorial University of Newfoundland. General practitioners and family physicians (hereafter referred to as *GPs*) were assigned to a

community using their office postal code, and the mean number of GPs per 1000 residents for each year of the study period was determined. In addition, CSDs were rolled up into 1 of 20 provincial economic zones (EZs), and physician retention, defined as percentage of GPs practising within each EZ at the start of a given year who were still practising within the same EZ at the start of the next year, was calculated by year for 2001 to 2009.[39] Descriptive statistics were calculated using SPSS, version 23 (IBM Corporation).

We used negative binomial (hospitalization) or logistic (mortality) segmented regression models to assess the statistical significance of preintervention (2001-2004) trends in outcome and the immediate (step change in outcome from expected value based on prereform trend) and gradual (change in slope) effects of reforms, while adjusting for covariates. Negative binomial models are appropriate for count outcomes such as number of hospitalizations, which exhibit excessive overdispersion. Reforms were mostly implemented in 2004, so we considered 2005 to be the first year under the effect of reforms. Generalized estimating equation methods with an autoregressive covariance structure were used to adjust for the repeated measures within patients over time. For simplicity, figures only include results from the adjusted analyses of preintervention effect, step change with reform, and change in trend postreform. Multivariate analyses were conducted using SAS, version 9.4 (SAS Inc.).

Results

We accessed data for 519 267 residents of the province who held a provincial health insurance card at any point in the study period. After excluding patients who changed or had an invalid postal code (n = 24 198), the data set included 495 069 (95.3%) individuals for the final analysis. **Table 1** presents selected characteristics of the study population. We observed 32 155 ACS hospitalizations and 6498 deaths in the prereform period (2001-2004) and 38 189 ACS hospitalizations and 7975 deaths in the postreform period (2005-2009). **Tables 2** and **3** present parameters for individual-level covariates from adjusted negative binomial regression analyses for the ACS hospitalization rates and ACS-related mortality outcomes, respectively.

In rural reform and rural nonreform communities, there was a decreasing trend in ACS hospitalization rates that preceded reforms (rate ratio of 0.97 [0.94-1.00]) and rate ratio of 0.98 [0.96-1.00], respectively). There were no significant changes in the urban group. **Figure 1** presents mean annual hospitalization rates for ACS conditions and control conditions over time. The superimposed lines on the figure show preintervention and postintervention trends. In the reform group, although there is an apparent decreasing trend in hospitalization for ACS conditions prereform and an apparent immediate increase in hospitalization rates postreform, neither the preintervention trend ($P = .076$) nor the immediate effect of reform ($P = .077$) was statistically significant. There was also no significant change in trend after the interventions ($P = .565$). **Figure 2** includes the results for ACS-related mortality during the study period. Both prereform trends and change in trend after the introduction of reforms were statistically significant in all 3 experimental groups (*P* values presented on figure). In all 3 groups, there was a significant increasing trend in ACS-related mortality before reforms (odds ratio [OR] of 1.09 [1.02-1.15], OR = 1.10 [1.06-1.13], and OR = 1.09 [1.05-1.14], for rural reform, rural nonreform, and urban communities respectively), which was reversed after the introduction of reforms ($P < .01$).

Discussion

Reforms to primary care implemented between 2004 and 2005 in Newfoundland and Labrador do not appear to have had a meaningful effect on ACS hospitalization rates; however, we instead observed a prominent peak in mortality around this time. Because a similar magnitude of change in the mortality trend occurred in all 3 groups of communities (2 of which did not implement reforms), this effect cannot be attributed to the reforms themselves. After discussion with several provincial government stakeholders and researchers, the most widely supported explanation is that increased attention to PHC outside of the reform process, as well as to public health and preventive lifestyle interventions both provincially and nationally that preceded the PHC reforms, might have translated into the improvements in mortality that we observed.

Despite the lack of a reform effect, we observed decreasing trends in hospitalizations in both rural reform and nonreform areas over the full study period, despite an aging population. The lack of a reform effect on hospitalization rates was not surprising and is consistent with the mixed effect of reforms documented in the literature.[18-25] While satisfaction with reforms in this province among interviewed and surveyed patients and providers was generally positive, and the limited number of patients surveyed reported increased accessibility to PHC services, the reform process suffered because of the lack of widespread engagement of GPs.[27] In addition, once the funds from the Primary Healthcare Transition Fund were exhausted, attention was diverted from PHC, and programs might have suffered as a result (unpublished observations). Furthermore, reforms both provincially and nationally struggled at some sites because of "turf wars" with GPs who were concerned that a substantial number of their responsibilities were being assumed by other providers.[11,27]

The lack of a measurable effect on hospitalization trends does not necessarily indicate a failure of PHC reforms in improving access to or quality of care, as ACS hospitalization rates might be influenced by a host of other factors including prevalence and severity of illness, lifestyle

Table 1. Selected demographic characteristics of the study population

COVARIATE	RURAL REFORM (N = 69 143)	RURAL NONREFORM (N = 228 914)	URBAN NONREFORM (N = 197 012)	TOTAL (N = 495 069)
Mean (SD) age, y	34.7 (23.7)	35.4 (23.6)	32.1 (24.5)	34.0 (24.0)
Female sex, %	50.7	49.3	50.4	49.9
CCI score (9-y period), %				
• 0	75.5	66.3	63.3	66.4
• 1-2	12.9	18.1	19.8	18.0
• 3-4	6.6	8.6	8.7	8.4
• ≥ 5	5.0	7.1	8.2	7.2
Income quintile, %				
• Q1 (lowest)	23.2	21.5	24.1	22.8
• Q2	28.6	18.1	21.3	20.8
• Q3	12.2	22.1	17.6	18.9
• Q4	20.4	19.1	17.9	18.8
• Q5 (highest)	15.6	19.3	19.0	18.7
Mean (SD) high school completion, %	52.9 (10.5)	59.7 (13.4)	75.1 (12.3)	64.9 (15.3)
Mean (SD) visible minority, %	0.5 (1.7)	0.8 (1.8)	1.8 (3.3)	1.2 (2.6)
Mean (SD) Aboriginal identity, %	15.7 (26.8)	4.3 (9.6)	1.8 (3.2)	5.0 (12.9)
Mean (SD) nearest hospital, km	26.5 (33.9)	31.5 (30.2)	7.3 (11.8)	21.2 (27.7)
Mean (SD) hospital beds per 1000 residents, n	1.8 (1.3)	2.5 (1.3)	3.2 (0.5)	2.7 (1.2)
Mean (SD) GPs per 1000 residents, n	2.2 (0.9)	1.6 (0.4)	1.6 (0.1)	1.7 (0.5)
Mean (SD) years since graduation	16.4 (2.3)	17.8 (1.5)	18.4 (0.8)	17.9 (1.5)
Mean (SD) IMGs, %	61.9 (19.6)	59.2 (16.4)	29.9 (11.9)	47.8 (21.2)
Mean (SD) GP retention, %	86.3 (2.9)	89.2 (2.3)	91.8 (0.4)	89.9 (2.7)

CCI—Charlson comorbidity index, IMG—international medical graduate.

and care-seeking behaviour, and patient compliance with treatment regimens, which might not have been completely accounted for in our analysis. It is also possible that reforms affected other hospital outcomes not measured in the current study. For example, a US study found that improved accessibility to primary care did not improve avoidable hospitalization rates, but did decrease mean length of stay.[25]

Strengths and limitations

A strength of this study is its use of population-based longitudinal administrative databases covering the provincial population, thus avoiding sampling and volunteer biases. Another strength is the use of a time-series analysis, which is the strongest quasi-experimental design to estimate intervention effects in non-randomized studies. We also used 2 levels of study control. First, we controlled for effects of other health system factors by comparing outcomes in communities undergoing reforms with both urban and rural communities that did not undertake reforms. We also compared changes in hospitalization rates for ACS conditions with hospitalization rates for comparator conditions (which should not have been affected by changes in primary care).

The study is limited by its observational design and by its use of secondary data collected for administrative purposes rather than for research. As discussed above, we were unable to adjust for several factors that might have influenced outcomes. However, the time-series design used here effectively compares data from a given year to data from previous years in the same populations. Most of these modifying factors should change very little over time within these populations, and thus, this limitation could have affected between-group comparisons between community groups but should have had minimal effect on our assessment of the effect of reforms (within-group). There are slight differences between the populations of Newfoundland and Labrador, other provinces in Canada,[29] and other countries that might affect generalizability of our findings. For example, the proportion of seniors is higher in Newfoundland and Labrador than in other Canadian provinces but lower than in most other G7 countries.[40] However, many of our results are similar to those from other jurisdictions, suggesting reasonable external validity.

Physician claims in the province include data from fee-for-service physicians only. Data were not available

Table 2. Multivariate individual-level negative binomial regression of hospitalization rates for ACS conditions

PARAMETER	RATE RATIO (95% CI)		
	RURAL REFORM (N = 69 143)	RURAL NONREFORM (N = 228 914)	URBAN NONREFORM (N = 197 012)
Age	1.02 (1.01-1.02)*	1.01 (1.01-1.01)*	1.00 (1.00-1.00)*
Sex			
• Male	1.02 (0.95-1.09)	0.97 (0.94-1.01)	1.07 (1.03-1.11)*
• Female (reference)	1.00	1.00	1.00
CCI score			
• 0	0.07 (0.05-0.09)*	0.05 (0.05-0.06)*	0.04 (0.03-0.04)*
• 1-2	0.40 (0.28-0.56)*	0.36 (0.31-0.42)*	0.24 (0.20-0.28)*
• 3-4	0.78 (0.54-1.12)	0.94 (0.80-1.11)	0.76 (0.64-0.90)*
• ≥ 5 (reference)	1.00	1.00	1.00
Income quintile			
• Q1 (lowest)	1.40 (1.20-1.62)*	1.06 (0.99-1.14)	1.31 (1.22-1.41)*
• Q2	1.37 (1.16-1.61)*	1.08 (1.01-1.15)*	1.22 (1.14-1.31)*
• Q3	1.42 (1.20-1.67)*	1.10 (1.04-1.17)*	1.16 (1.08-1.25)*
• Q4	1.20 (1.06-1.36)*	1.10 (1.04-1.17)*	1.12 (1.05-1.21)*
• Q5 (highest) (reference)	1.00	1.00	1.00
High school completion	0.98 (0.98-0.99)*	0.99 (0.99-0.99)*	0.99 (0.99-0.99)*
Visible minority	1.00 (0.98-1.03)	0.98 (0.97-0.99)*	1.00 (0.99-1.00)
Aboriginal identity	1.02 (1.02-1.03)*	1.00 (0.99-1.00)*	1.00 (0.99-1.00)
Nearest hospital (per 10 km)	1.01 (0.99-1.02)	1.02 (1.01-1.03)*	1.00 (0.99-1.01)
Hospital beds per 1000 residents	1.06 (1.03-1.08)*	1.01 (0.99-1.02)	1.07 (1.01-1.13)*
No. of GPs per 1000 residents	1.07 (1.02-1.12)*	1.18 (1.13-1.22)*	1.15 (0.99-1.34)
Years since graduation	1.02 (1.01-1.03)*	1.00 (0.99-1.01)	1.15 (0.99-1.34)
Percentage IMG (per 10%)	1.07 (1.05-1.09)*	1.03 (1.02-1.04)*	1.03 (1.01-1.06)*
Percentage GP retention (per 10%)	1.03 (1.02-1.04)*	1.02 (1.01-1.03)*	1.02 (1.02-1.03)*

ACS—ambulatory care sensitive, CCI—Charlson comorbidity index, IMG—international medical graduate.
*$P < .05$.

for patients visiting non–fee-for-service physicians who were located largely in rural areas. Thus, the CCI score, which used diagnostic codes from physician claims, was not calculable for these individuals. Again, because of the time-series design and because no changes to physician remuneration were made during the study period, this factor should have had very little effect on our study results.

Conclusion

This study found no effect of PHC reforms on hospitalization rates for ACS conditions, but did find a prominent peak in mortality around the time that reforms were introduced. Because the changes in mortality trend occurred in all communities, they cannot be attributed to the reforms themselves, but might be associated with broader health system attention to public health and disease prevention. Overall, there was a decreasing trend in hospitalization rates for ACS conditions in rural areas over the 9-year study period, suggesting improved health system performance, increasing effectiveness of primary care, improvements in health, or increased health-seeking behaviour patterns over time.

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Contributors

Dr Knight drafted the manuscript, and contributed substantially to study conception and design, as well as to data acquisition, analysis, and interpretation. **Dr Moineddin** contributed substantially to study conceptualization and design, as well as to data analysis and interpretation. **Dr Mathews** contributed substantially to study data analysis and interpretation. **Dr Aubrey-Bassler** was principal investigator and was involved in all aspects of the project, including drafting and revising the manuscript. All authors contributed to editing and revising the article for intellectual content, gave final approval of the version to be published, and agreed to act as guarantors.

Competing interests

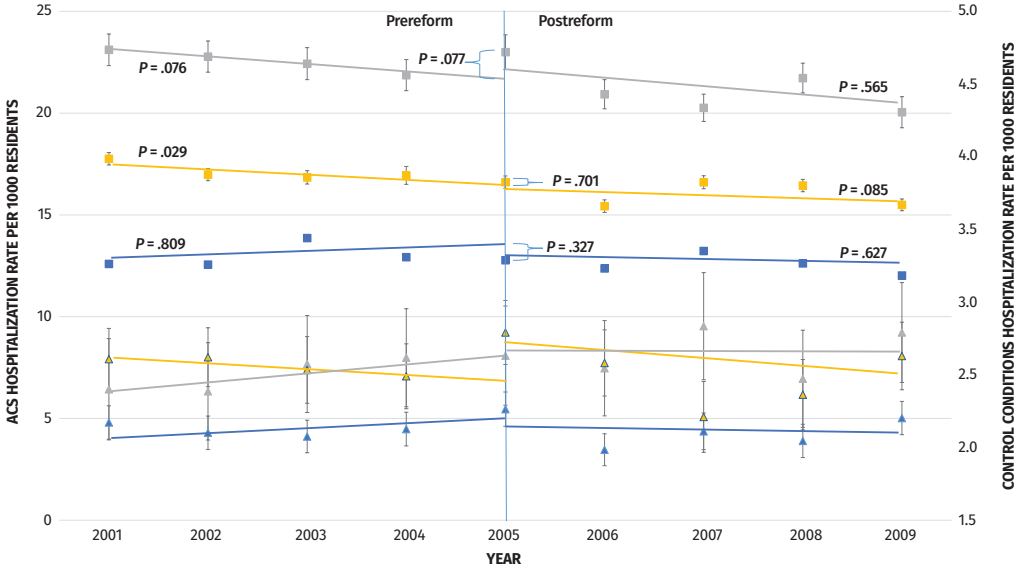
Dr Aubrey-Bassler has received research funding from the Department of Health and Community Services of Newfoundland and Labrador (who was responsible for implementing the reforms studied in this paper), but not for this project. The Department of Health and Community Services of Newfoundland and Labrador had no role in the

Table 3. Multivariate individual-level negative binomial regression of ACS-related mortality

PARAMETER	ODDS RATIO (95% CI)		
	RURAL REFORM (N = 69 143)	RURAL NONREFORM N = 228 914	URBAN NONREFORM N = 197 012
Age	1.10 (1.10-1.11)*	1.10 (1.10-1.10)*	1.10 (1.10-1.10)*
Sex			
• Male	1.16 (1.07-1.26)*	1.19 (1.14-1.25)*	1.29 (1.22-1.36)*
• Female (reference)	1.00	1.00	1.00
Income quintile			
• Q1 (lowest)	1.13 (0.91-1.40)	1.08 (0.99-1.18)	1.17 (1.06-1.28)*
• Q2	0.97 (0.78-1.20)	1.14 (1.05-1.23)*	1.12 (1.02-1.22)*
• Q3	1.06 (0.85-1.34)	1.07 (0.99-1.16)	1.05 (0.96-1.16)
• Q4	1.01 (0.82-1.24)	1.01 (0.93-1.10)	0.97 (0.88-1.06)
• Q5 (highest) (reference)	1.00	1.00	1.00
High school completion	0.99 (0.98-0.99)*	1.00 (0.99-1.00)*	0.99 (0.99-1.00)*
Visible minority	1.01 (0.97-1.04)	1.01 (1.00-1.03)	0.99 (0.98-1.00)*
Aboriginal identity	1.01 (1.00-1.02)*	1.00 (0.99-1.00)	0.99 (0.98-1.00)
Nearest hospital (per 10 km)	1.00 (0.98-1.02)	0.99 (0.98-1.00)	1.00 (0.99-1.01)
Hospital beds per 1000 residents	1.01 (0.97-1.05)	0.99 (0.97-1.01)	0.96 (0.87-1.05)
No. of GPs per 1000 residents	1.03 (0.94-1.12)	1.10 (1.04-1.16)*	1.23 (0.96-1.58)
Years since graduation	1.04 (1.02-1.07)*	0.99 (0.98-1.00)	1.00 (0.96-1.04)
Percentage IMG (per 10%)	1.02 (0.98-1.03)	1.01 (0.99-1.02)	1.00 (0.99-1.00)
Percentage GP retention (per 10%)	1.04 (1.01-1.06)*	1.01 (0.95-1.08)	1.02 (0.99-1.04)

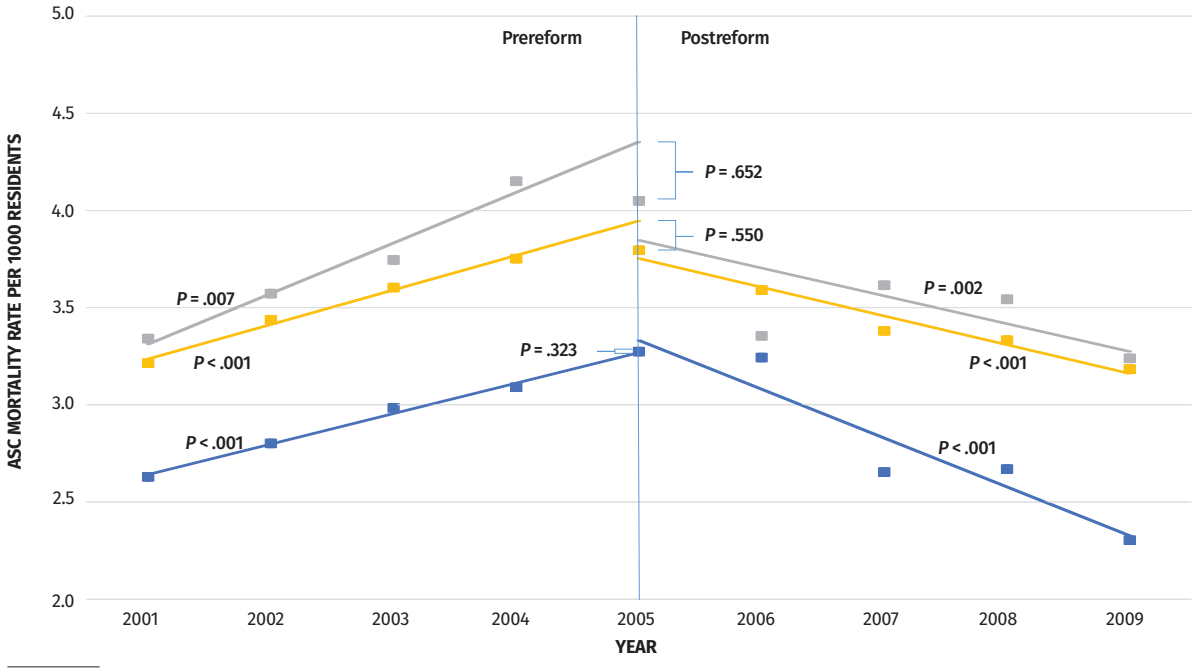
ACS—ambulatory care sensitive, IMG—international medical graduate.
*$P < .05$.

Figure 1. Hospitalization rates for ACS and control conditions in rural reform, rural nonreform, and urban nonreform communities over time: *Hospitalization rates for ACS conditions are indicated by square symbols and the scale is on the left vertical axis. Hospitalization rates for control conditions are indicated by triangles and the scale is on the right vertical axis. Whiskers indicate standard error. Experimental groups are indicated as follows: rural reform (gray), rural nonreform (yellow), and urban (blue). The* P *values to the left of the figure, adjacent to the centre line, and to the right of the figure are for prereform trend, immediate change with reform, and change in trend after reform, respectively. Point estimates are unadjusted but* P *values are obtained from adjusted analyses.*



ACS—ambulatory care sensitive.

Figure 2. Results of ACS mortality in rural reform, rural nonreform, and urban nonreform communities over time: *Standard error whiskers are not visible because of overlap with the point indicators. Experimental groups are indicated as follows: rural reform (gray), rural nonreform (yellow), and urban (blue). The* P *values to the left of the figure, adjacent to the centre line, and to the right of the figure are for prereform trend, immediate change with reform, and change in trend after reform, respectively.*



ACS—ambulatory care sensitive.

design, or acquisition, analysis, or interpretation of data, nor in the writing and submission of the manuscript for this study. The other authors report no conflicts of interest.

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