



Original Investigation

Performance Obligations to Improve Delivery of Hospital-Initiated Smoking Cessation Interventions: A Before-and-After Evaluation

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Abstract

Introduction: This study evaluated whether introducing performance obligations (a policy intervention) to service agreements between hospitals ($n = 15$) and their local health authority: (1) improved provision of an evidence-based tobacco cessation intervention (the “Ottawa Model” for Smoking Cessation) and (2) changed the quality of the cessation intervention being delivered.

Methods: Interrupted time series analysis was used to evaluate the change in the proportion of smoker patients provided the Ottawa Model 3 years before and 3 years after introducing the performance obligations. Changes in secondary outcomes related to program quality were described using mean differences, risk differences, and risk ratios, as appropriate.

Results: The proportion and number of patients provided the Ottawa Model doubled in the 3-year period following introduction of the new policy—from 3453 patients (33.7%) in the year before to 6840 patients (62.8%) in the final assessment year. This resulted in a significant slope change (+9.2%; 95% confidence interval [CI] 4.5%, 13.9%; $p = .01$) between the pre- and post-obligation assessment periods, signifying the policy had a positive impact on performance. Quality and effectiveness of the in-hospital intervention remained steady.

Conclusions: Implementation of performance obligations by a healthcare funder increased delivery of an evidence-based smoking cessation intervention across multiple hospitals. Given the known health and economic impacts of smoking cessation interventions, health authorities and hospitals should consider pairing adoption of systematic interventions, like the Ottawa Model, with policy to enhance reach and impact.

Implications: • The hospital-based Ottawa Model for Smoking Cessation (OMSC) intervention has been shown to increase smoking abstinence, while reducing mortality and healthcare utilization.

- The uptake of systematic, evidence-based interventions, like the OMSC, by hospitals has been relatively low despite the known positive impacts.
- The introduction of smoking cessation performance obligations by a healthcare funder resulted in more patients receiving an OMSC intervention while in hospital, with no corresponding change in intervention quality or effectiveness.

- Healthcare funders and hospitals should consider pairing the adoption of effective, systematic interventions, like the OMSC, with policy to enhance reach and impact.

Introduction

Smokers average twice as many hospital days as never smokers and have poorer health outcomes, producing increased health care costs.^{1,2} Hospitalization is a valuable opportunity to initiate tobacco treatment interventions as smokers are commonly forced to abstain from smoking while admitted and are highly motivated to quit during such admissions.³ Intensive smoking cessation interventions that begin in hospital and include pharmacotherapy, counseling, and post-discharge support for ≥ 1 month, increase the likelihood of smoking abstinence (risk ratio 1.37, 95% confidence interval [CI] 1.27–1.48; 25 studies) compared to hospital only interventions with no follow-up.⁴

The Ottawa Model for Smoking Cessation (OMSC) is an evidence-based approach to systematically identifying, treating, and following hospitalized smokers that has been implemented in over 120 Canadian hospitals and has been shown to increase long-term quit rates by an absolute 15% (from 29% to 44%) among patients with cardiovascular diseases,⁵ and by 11% (from 18% to 29%) among general hospital populations, compared to usual care.⁶

A recent 14-site, before-and-after study of nearly 1400 hospitalized smokers found that, compared to usual care, patients who received the OMSC were less likely to be readmitted to hospital within 30 days (absolute risk reduction 6.1%; hazard ratio 0.50, 95% CI 0.34–0.72) and 2 years (absolute risk reduction 11.6%, hazard ratio 0.79, 95% CI 0.68–0.92) and less likely to die over 2 years (absolute risk reduction 7.2%, hazard ratio 0.60, 95% CI 0.42–0.85).⁷

Despite an abundance of evidence supporting the efficacy and cost-effectiveness of hospital-based cessation interventions, many Canadian hospitals fail to systematically offer support to patients who smoke.⁸ Misperceptions regarding lack of time or resources, competing priorities, and a mistaken view that such treatment is irrelevant in an acute care setting have all contributed to this oversight.⁹ Performance measurement is critical for health system improvement and hospital performance indicators have been shown to positively influence the implementation of important clinical interventions.^{10,11}

The objectives of this multi-center study were to evaluate whether introducing performance obligations to service agreements between hospitals and their local health authority (a policy intervention): (1) improved the provision of an evidence-based tobacco cessation intervention (ie, increased the proportion of smokers reached); and (2) changed the quality of the tobacco cessation intervention being delivered.

Methods

Context

During the evaluation period (from 2007 to 2016), the province of Ontario was divided into 14 regional health authorities (Local Health Integration Networks, LHIN); the role of LHINs is to plan, integrate, and fund local health services.¹² This evaluation involved the Champlain LHIN, serving a population of over 1.2 million residents. The Champlain LHIN enters into annual Hospital Service Accountability Agreements (HSAA) with each hospital in its jurisdiction. In signing the HSAA, hospitals agree to meet specified

performance obligations, which are ultimately tied to funding. In 2008, the Ontario government began to implement a new payment model whereby hospitals receive a base budget and are eligible to receive additional funds from their LHIN by achieving “pay for results” performance targets.

In 2006, 19 Champlain LHIN hospitals began to voluntarily implement the OMSC program in partnership with the University of Ottawa Heart Institute (UOHI). Beginning in 2010, the LHIN sought to improve the performance of hospital-initiated tobacco treatment support by introducing an OMSC performance indicator to the HSAs. Signatory hospitals agreed to “ensure provision of the OMSC to patients with the expectation that the intervention would be provided to 80% of inpatient smokers by March 31, 2013”. The LHIN decided to prioritize the OMSC because of: the strong evidence of smoking as a risk factor for many chronic diseases and hospitalizations; the demonstrated effectiveness of the OMSC program in increasing quit rates; and, the LHIN’s key strategic priorities at the time of supporting prevention efforts and chronic disease management (Personal Communication, Karen Patzer, June 13, 2016).

Settings

This evaluation was conducted at 15 hospitals in the Champlain LHIN, each of whom had signed the HSAA containing the OMSC performance obligation. Four additional Champlain LHIN hospitals were excluded from the evaluation as, at the time, their HSAA obligations differed due to the nature of their institution (eg, pediatric hospital, long-term care hospitals, mental health hospital). Table 1 summarizes the characteristics of participating hospitals.

The OMSC Program

OMSC implementation involves introducing a specified standard of care with regard to tobacco use treatment at each hospital supported by appropriately tailored policies and procedures.^{5,6} Each hospital forms a multi-disciplinary task force and works with OMSC implementation specialists from UOHI to implement a six-phase workplan that includes: (1) baseline assessment; (2) development of a clinical tobacco treatment protocol; (3) adaptation of clinical management systems and tools; (4) staff training; (5) program launch; and (6) ongoing, quality improvement and education.⁶

Once the OMSC has been implemented, it is expected that: (1) all admitted patients are asked about tobacco use on admission using a standard question (“Have you used any form of tobacco in the past 6 months? And the past 7 days?”) and their responses documented; (2) a standardized tobacco treatment consultation form is completed for all smokers, which documents smoking history and guides staff in providing brief advice, recommending cessation pharmacotherapies, and enrolling patients in a follow-up support program; (3) cessation pharmacotherapies are ordered through the hospital pharmacy using preprinted order forms; (4) consultation form data are entered into the OMSC database for follow-up enrollment and evaluation purposes; and (5) smokers who agree to follow-up receive \leq eight automated telephone calls over 6 months (TelASK Technologies Inc. Ottawa, ON).¹³ Nurse specialists monitor responses to the calls and

Table 1. Hospital Characteristics

Site	Annual patient volumes	Number of inpatient units	Smoking prevalence	Teaching site	Urban/ rural	Staff responsible for completing the smoking cessation intervention
A	<1000	1	10%	No	Rural	Tobacco Treatment Specialists
B	<1000	1	15%	No	Rural	Tobacco Treatment Specialists
C	<1000	1	15%	No	Rural	Frontline Nurses
D	>5000	6	15%	No	Urban	Frontline Nurses
E	<1000	1	16%	No	Rural	Frontline Nurses
F	1000–5000	3	17%	No	Rural	Frontline Nurses
G	<1000	1	21%	No	Rural	Frontline Nurses
H	>5000	8	21%	Yes	Urban	Frontline Nurses
I	1000–5000	5	23%	Yes	Rural	Tobacco Treatment Specialists
J	1000–5000	6	23%	Yes	Rural	Registered Respiratory Therapists
K	>5000	7	23%	Yes	Urban	Tobacco Treatment Specialists
L	1000–5000	5	25%	Yes	Rural	Frontline Nurses
M	>5000	6	26%	Yes	Rural	Registered Respiratory Therapists
N	<1000	1	28%	No	Rural	Frontline Nurses
O	1000–5000	2	31%	No	Rural	Frontline Nurses

contact patients who have relapsed to smoking or have low confidence in remaining smoke-free to provide additional counseling.

For the majority ($n = 9$) of participating hospitals, frontline nurses completed the in-hospital OMSC tobacco treatment consultation. At these sites, nurses were trained to: identify and document the smoking status of patients; complete a tobacco treatment consultation form and preprinted pharmacotherapy orders (authorized by attending physicians); and, offer the follow-up support program. Administrative clerks entered the consultation data into the OMSC database. Four hospitals employed part- or full-time tobacco treatment specialists (TTS) and two used their team of registered respiratory therapists (RRT) to complete the intervention. At these sites: frontline nurses identified patient smoking status on intake and requested a smoking cessation consultation from the TTS or RRT by paging them or leaving a consultation form stamped with the patient's information in a consult folder; a TTS or RRT visited identified smokers to complete the consultation form; the TTS or RRT recommended cessation pharmacotherapy on preprinted order forms; and, an administrative clerk entered consultation data into the OMSC database. In all cases, telephone follow-up counseling was completed by nurse specialists at the UOHI.

Outcome Measures

The RE-AIM framework, an approach to measuring the impact of health promotion interventions, was used for this evaluation, comparing framework indicators (*reach, effectiveness, adoption, implementation, and maintenance*) before and after introduction of the performance obligations.¹⁴

Primary Outcome

To determine the impact of the policy on delivery of the OMSC, the primary outcome measured was *reach*—the proportion of expected smokers admitted to hospital that received the OMSC intervention before and after introduction of the performance obligations. To calculate the proportion of smokers reached: (1) the actual number of smokers who received the OMSC intervention was determined by the number of tobacco treatment consultation forms completed (numerator) and (2) the expected number of smokers admitted (denominator) was calculated by multiplying annual patient volumes by hospital smoking prevalence (determined by screening a consecutive series of patients admitted over a 1-month period).

Secondary Outcomes

To assess whether variables associated with program quality changed following introduction of the performance obligations, secondary outcomes related to program effectiveness, adoption, implementation fidelity, and maintenance were assessed.

Effectiveness, evaluated as patient-level indicator of smoking abstinence, was not used to measure site performance; however, it was included in the evaluation to ensure that the effect of the program did not decrease as reach increased. Intention-to-treat 7-day point prevalence smoking abstinence rates, measured 6 months after hospital discharge, were collected on a subsample of hospitalized smokers who agreed to a 6-month follow-up call. The Russell Standard was used, assuming non-responders had resumed smoking and removing patients who were deceased, readmitted to hospital at the time of follow-up, or became untraceable.¹⁵

Adoption was measured as the proportion of the total inpatient units that had implemented and were offering the OMSC program in 2009 and 2013.

Implementation fidelity was assessed by measuring: the completeness of smoking cessation consultation forms (proportion of a total of 11 fields completed); the proportion of patients for whom cessation medications were ordered in hospital; and, the proportion of patients that were enrolled in telephone follow-up support.

The Champlain LHIN upheld the OMSC performance obligation in its hospital agreements beyond 2013. We assessed program *maintenance* by tracking to what extent the proportion of smokers being reached was maintained over the 3 years (from 2014–2016) following the initial target date of March 31, 2013. Implementation support from the UOHI (eg, quality improvement, training and education, reporting) continued to be offered to participating hospitals throughout this period.

Statistical Analysis

For the primary outcome, interrupted time series analysis was used to evaluate the change in the proportion of smokers reached (ie, provided a tobacco treatment consultation) in the 3 years before (2007–2009) and 3 years after (2011–2013) implementation of the new performance obligation. Interrupted time series is a robust and appropriate design to use when a randomized controlled trial is not possible; for example, in this case, to retrospectively compare outcomes before

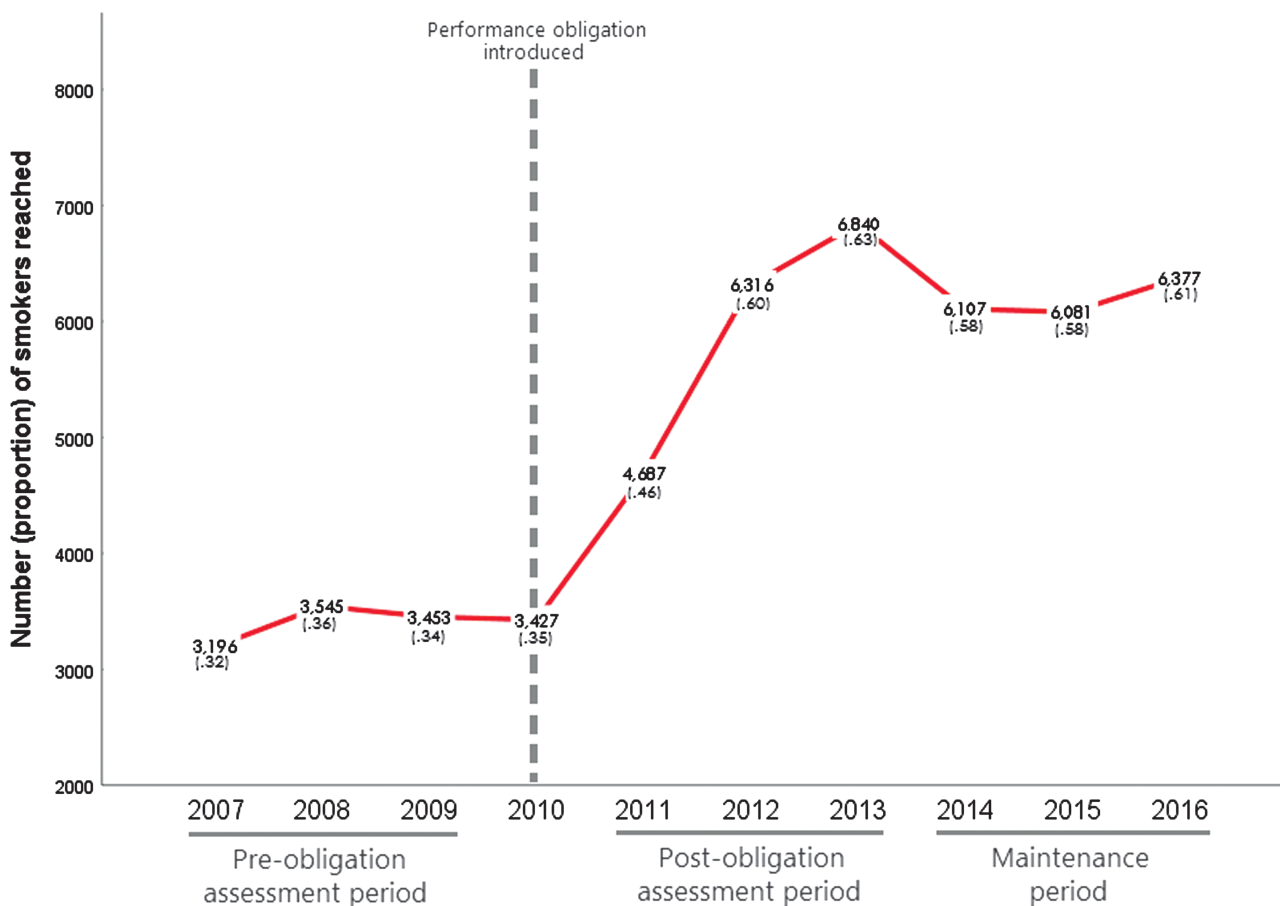


Figure 1. Number (% expected*) of tobacco treatment interventions completed annually by all hospitals ($n = 15$) between 2007 and 2016. *% expected based on annual inpatient admissions multiplied by smoking prevalence.

and after a policy intervention.¹⁶ Figure 1 summarizes the assessment periods and data used in the analysis. It was hypothesized that there would be a temporary change in slope during the post-implementation assessment period (2011–2013), compared to the pre-obligation assessment period (2007–2009), as hospitals would gradually increase the proportion of smokers reached following introduction of the new policy in 2010. A segmented regression model was used to compare the slope related to the proportion of annual smokers reached during the pre-obligation assessment period to the slope during the post-obligation assessment period.¹⁷ Linear regression model assumptions were met (ie, linearity, normality, and homoscedasticity of residuals). First-order autocorrelation was tested using the Durbin-Watson statistic. A positive autocorrelation was detected (value of 1.075);¹⁸ therefore, first-order autocorrelation was adjusted for in the model. Data was inspected (plotting time by number of admissions and time by outcome) and no evidence of seasonality was detected; therefore, we did not control for seasonality. The data included in the model were year, period (pre-obligation assessment = 0; post-obligation assessment = 1), and proportion of smokers reached (the outcome). A least squares regression line was fit to each segment (year) of the independent variable (period). Performance *maintenance* was assessed by analyzing the slope related to the annual proportion of smokers reached during the maintenance period; it was hypothesized there would be no slope change from 2013 until the end of the maintenance period (2016).

To evaluate changes in the secondary outcomes related to program quality—abstinence rates, consultation completeness, medication-use, and follow-up enrollment—risk ratios, risk differences, and mean differences were calculated, as appropriate.¹⁹ Abstinence rates measured before (2009) and after (2013) the policy were compared using logistic regression, adjusting for patient characteristics and stratified by hospital. Results for consultation completeness, medication-use, and follow-up enrollment were displayed in forest plots (generated using Review Manager 5.3). Due to heterogeneity between sites, results were not combined. Analyses were completed using IBM SPSS Statistics 24.

Power

For the primary outcome, a change in slope of 14.7% between the pre- and post-obligation assessment periods would be required to achieve the 80% target in proportion of smokers reached by 2013. We would have >90% power to detect this 14.7% slope change, with sample sizes of 10 194 (based on actual smokers) and 19 500 (based on total expected smokers) in the pre- and post-obligation assessment periods, respectively. Tests for the difference between two linear regression slopes was used, assuming a standard deviation of the residuals of 0.2, population standard deviations of 0.62 and 2.1 for the pre and post groups, respectively, and an alpha level of 0.05.

Ethics

The evaluation activities reported herein were reviewed by the Ottawa Hospital Research Ethics Board and were “deemed not to be related to research,” but rather considered as quality improvement processes.

Results

Primary Outcome

Reach

Figure 1 shows the proportions and absolute numbers of tobacco treatment interventions that were completed by participating hospitals between 2007 and 2016, and demonstrates a distinct increase in performance after the policy was introduced in 2010. During the 3-year pre-obligation assessment period (2007–2009), the average proportion of expected smokers reached annually across the 15 participating hospitals was stable at 33.7% (average $n = 3398$ per year; slope = 0.7%; 95% CI -4.8, 6.3; $p = .66$). There was a near doubling in the proportion and number of patients reached in the 3-year period (2011–2013) following introduction of the new policy. This resulted in a significant slope change (+9.2%; 95% CI 4.5%, 13.9%; $p = .01$) between the pre- and post-obligation assessment periods, signifying the policy had a positive impact on performance. In the final year of the post-obligation assessment period (2013), 6840 annual smokers were reached, representing 62.8% of expected smokers. Five (33%) participating hospitals were reaching $\geq 80\%$ of expected smokers by March 2013. All hospitals that had TTS provide the intervention and one hospital that used their RRT team reached the 80% target. None of the hospitals that incorporated the intervention into the duties of point-of-care nurses achieved the target; these sites’ average reach was 53.3% of smokers.

Secondary Outcomes

Effectiveness

Patient characteristics and the participant flow description for evaluation calls are available online in [Supplementary Tables 1 and 2](#). All patient characteristics were used as covariates in the adjusted regression analyses. Six-month abstinence rates were evaluated in 13 of 15 hospitals and 545 and 974 patients from the 2009 and 2013 cohorts, respectively. Two hospitals were excluded from the evaluation of effectiveness; one hospital had no 2009 data and the other did not refer any patients to participate in the collection of abstinence data in 2009. Figure 2 displays the results of the self-reported 6-month, 7-day point prevalence quit rates. There was no significant difference between 2009 and 2013 cohorts (36.3% vs. 38.3%, respectively; risk ratio, 1.00; 95% CI, 0.86–1.15; $Z = 0.05$; $I^2 = 0\%$; $p = .96$).

Adoption

In 2009, an average of 75.9% of possible hospital units had implemented the OMSC. By March 31, 2013, the overall adoption rate had increased to 96.4%, with 14 hospitals having implemented the OMSC in 100% of their inpatient units.

Implementation

Figure 3A–C summarizes the results of implementation fidelity. One hospital had no 2009 data. Completeness of the patient intervention improved in all hospitals after the performance obligations were in place, with consultation form completeness ranging from 48.9% to 63.5% in 2009, compared to 63.3% to 96.0% in 2013. The documented use of in-hospital pharmacotherapy improved or stayed the same at nine hospitals (64.3%) in 2013 compared to 2009, five of which were the TTS or RRT hospitals. Post-hospitalization follow-up enrollment decreased in seven (57%) sites and remained the same or increased in six (43%) sites in 2013 compared to 2009.

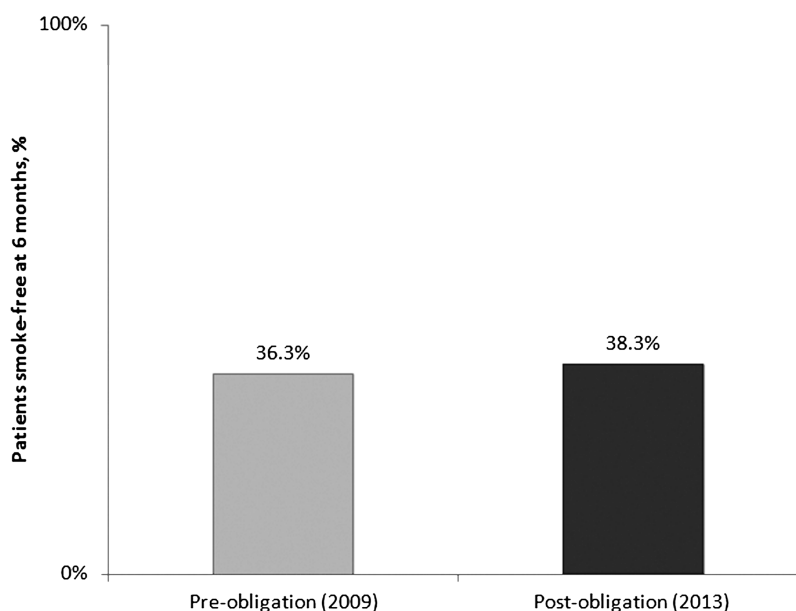
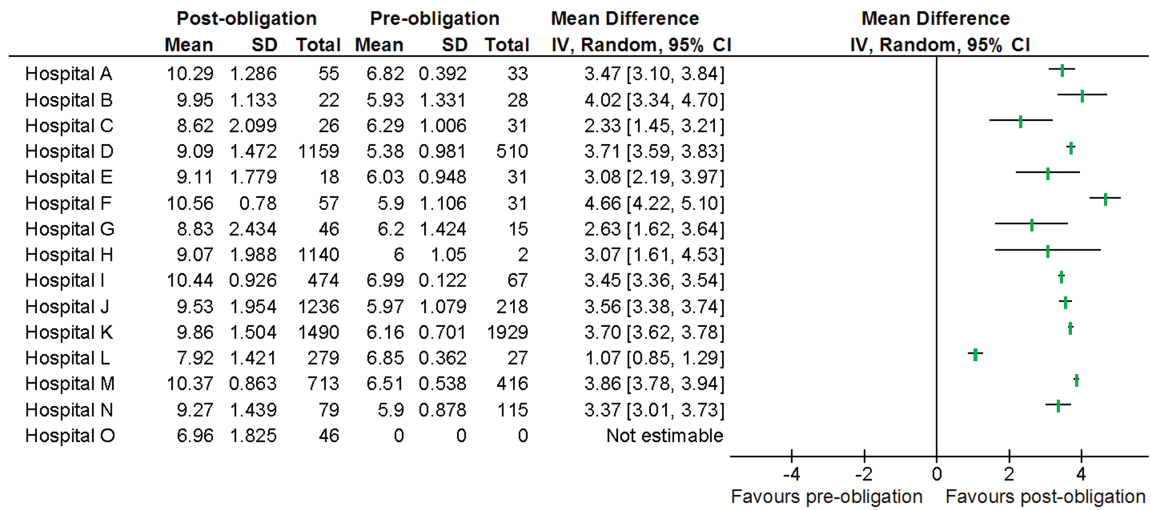
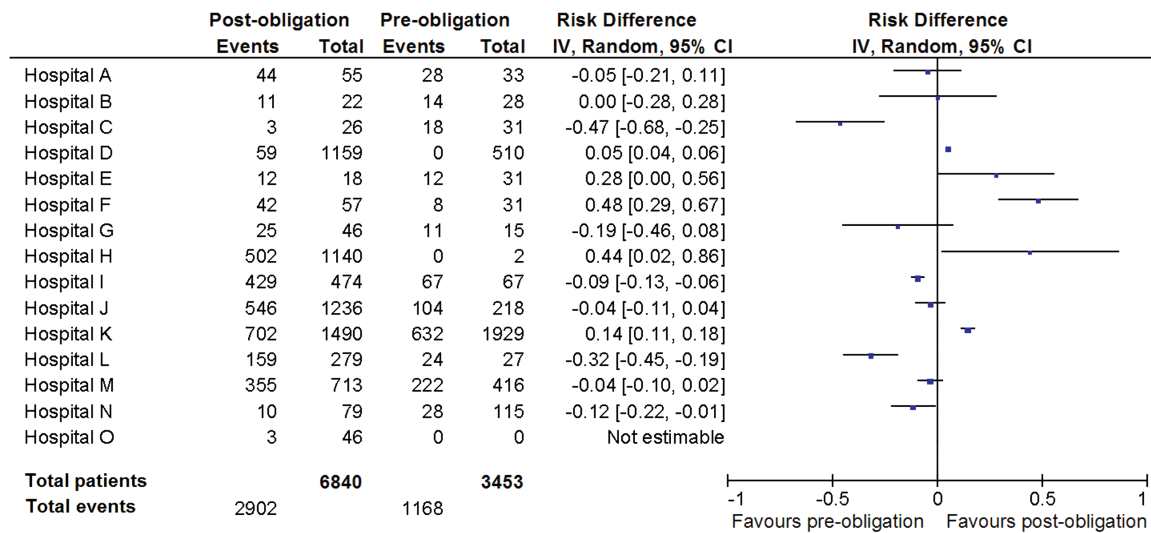


Figure 2. Percentage of patients reporting smoking abstinence at 6 months, before ($n = 545$ surveyed) and after ($n = 974$ surveyed) introducing tobacco treatment performance obligations; 13 hospitals.

A. Completion of tobacco treatment consultation forms (mean number of fields complete of a possible 11)



B. Documented use of in-hospital smoking cessation medications



C. Enrolment in post-hospitalization follow-up support

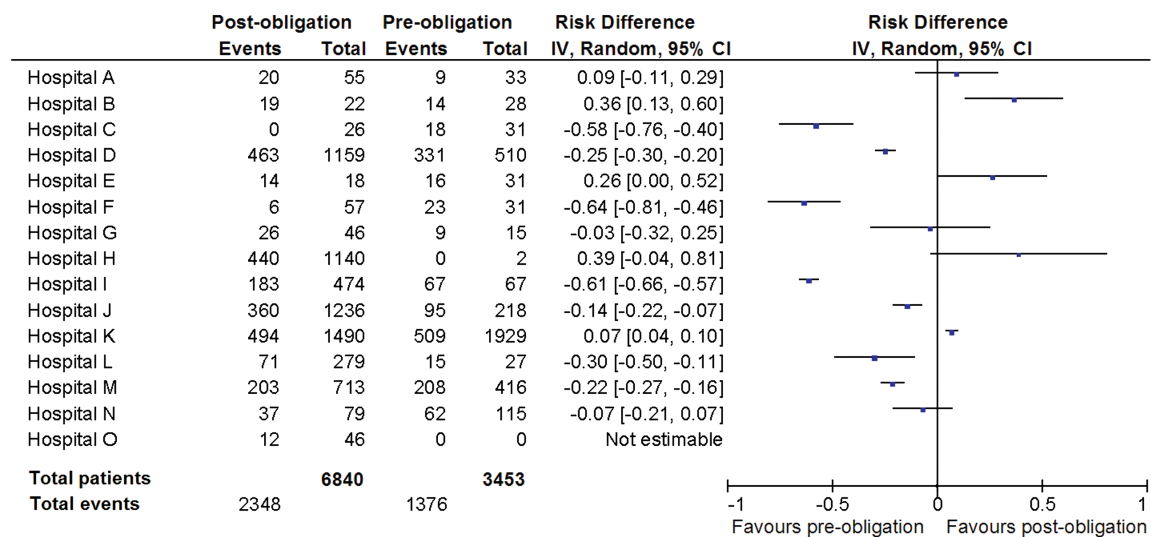


Figure 3. Measures of implementation fidelity, before and after introduction of performance obligations.

Maintenance

The average proportion of smokers reached annually in the 3 years following the 2013 target year was 58.9%. Performance remained relatively constant during the maintenance period (slope = -0.3% , 95% CI -6.3% to 5.7% ; $p = .87$), as shown in Figure 1. The number of consultations completed annually in the maintenance period remained nearly 80% higher compared to before implementation of the policy. A cumulative 18 565 smokers were provided intervention during the maintenance period (2014–2016), versus 10 194 reached during the pre-policy period.

Discussion

Introduction of performance obligations to service agreements for 15 hospitals in Ontario resulted in a doubling of patients who received an evidence-based tobacco treatment intervention (the OMSC), from 3453 (33.7%) in 2009 to 6840 (62.8%) in 2013. Improvements in performance were achieved by 11 (73.3%) hospitals, five (33.3%) of which achieved the performance target of reaching 80% of smokers annually.

There were nearly 8000 more smokers provided the intervention over the 3-year period post-obligation (2011–2013) compared to the 3 years pre-obligation (2007–2009). Encouragingly, program performance remained relatively stable in the three maintenance years, following the initial target year. The overall impact of a health intervention can be defined by its reach (ie, number of smokers provided the intervention) multiplied by its effectiveness (eg, smoking cessation rate, survival rate, cost savings).¹⁴ There was no significant difference in the proportion of patients that quit smoking following the policy intervention, suggesting that, encouragingly, the increase in reach did not correspond with a decrease in program quality. Applying the pre- and post-obligation cessation rates to the absolute number of smokers reached suggests there were an estimated 1000 more quitters per year following the new policy. The numbers needed to treat to prevent one annual death or re-hospitalization following the OMSC intervention are 17 and 9, respectively.⁷ The potential population health impact of this type of policy intervention is very large.

The Champlain LHIN is the first health governing body in Ontario to make the delivery of tobacco dependence interventions a mandatory performance measure for hospitals, making this evaluation unique. Our findings are consistent with a 2013 systematic review looking at the impact of pay for performance schemes on systematic use of tobacco cessation interventions by healthcare professionals in primary care and community health settings in the United Kingdom, Germany, Taiwan, and United States ($n = 18$ studies).²⁰ Generally, this review found financial incentives to be effective at improving the recording of smoking status (from 7.3% to 52% absolute improvements) and the provision of advice and referral of patients to smoking cessation follow-up support (from 2.5% to 16.4% absolute improvements).

While the majority (73%) of hospitals had performance improvements, none of the hospitals in this evaluation that incorporated the intervention within the duties of frontline nurses reached the 80% performance target. Previous studies have found that nurses in hospital settings experience a high level of job dissatisfaction and burnout compared to nurses in other settings, suggesting that workload may have affected performance.^{21,22} OMSC sites using a TTS model or RRT model achieved the performance target suggesting that these two models of delivery may be preferred when implementing the OMSC.

Depending on a hospital's funding model, the financial incentive or projected cost savings related to reduced hospital admissions could be used to offset the cost of a TTS. The percentage of patients enrolled in follow-up support decreased in nearly half of the hospitals after introduction of the policy intervention. As program reach increased, it is possible that clinicians were more likely to engage with smokers at different stages (eg, not ready/less motivated to quit; highly motivated or already quit) and correspondingly less likely to engage in follow-up support.²³ Furthermore, with changes in patterns of telephone-use in the late 2000 and more people using mobile phones, texting and on-line forms of follow-up were gaining popularity and were not, at the time, being offered as part of OMSC follow-up.

This study had a number of strengths, namely the robust evaluation and data collection processes built into OMSC implementation that enabled this assessment. While a randomized controlled trial is ideal for evaluating the effect of clinical interventions, it is not always possible to conduct a randomized controlled trial of policy interventions in a real world setting. Interrupted time series design is a robust, quasi-experimental analysis that is increasingly being used to evaluate policy and quality improvement interventions when randomized controlled trials are not possible.¹⁶ This study also had limitations. The study took place in one health authority in Ontario and lacked a control group. Data were gathered in the OMSC database and based on the completion of consultation forms. It is possible that some data were not entered; therefore, performance may have been under-reported. Performance targets were based on estimates of smoking prevalence for each hospital completed during a screening of consecutive series of patients over 1 month. This is one reason that an 80%, not 100%, performance target was established, recognizing there may be slight annual variations in the proportion of inpatient smokers.

Our findings support evidence demonstrating that the establishment of policy and performance targets by governing bodies, and holding hospitals accountable for reaching these targets, can lead to improved delivery of evidence-based interventions. Given the known benefits of cessation, healthcare authorities should consider adopting policies related to the provision of tobacco cessation interventions.

Supplementary Material

Supplementary data are available at *Nicotine and Tobacco Research* online.

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Declaration of Interests

KAM, RR, AP, and DA are named inventors of the Ottawa Model for Smoking Cessation, a registered trademark of the University of Ottawa Heart Institute. KAM has received speaking fees from Pfizer Inc. within the past 2 years. AP has received consulting fees from Pfizer Inc., Johnson & Johnson, and Glaxo Smith Klein, speaking fees from Johnson and Johnson and Pfizer Inc.; he has received research funding from Pfizer Inc. RR has received speaking fees from Johnson & Johnson and Pfizer Inc. The other authors declare no competing interests.

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