

Research

Cost effectiveness and outcomes of a nurse practitioner–paramedic–family physician model of care: the Long and Brier Islands study

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Aim: This longitudinal study was designed to address four research questions and the hypothesis; that adults living in a rural community receiving primary health care and emergency services from a team that included an on-site nurse practitioner (NP) and paramedics and an off-site family physician would, over time, demonstrate evidence of improved psychosocial adjustment and less expenditure of health care resources.

Background: In Canada, there is a growing awareness and commitment to addressing the challenges of providing primary health care services in rural areas. A literature review supported the role of NPs in primary health care and a potential role for paramedics. No studies were found that evaluated the combination of NPs, paramedics and physicians as providers of primary health care. **Methods:** Structured questionnaires, individual and group interviews with patients, health and social service care providers and administrators and community members were used to describe and evaluate the impact of the model of care over the three years of the study. **Findings:** The innovative model of care resulted in decreased cost, increased access, a high level of acceptance and satisfaction and effective collaboration among care providers. Organizational structures to support the innovative model of primary health care were identified.

Keywords: collaboration; evaluation; family physician; innovation; nurse practitioner; paramedics; primary health care; rural health care

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Background

In Canada there is a growing awareness of and commitment to finding effective and efficient strategies that address the health needs of rural communities (Romanow, 2002). To be sustainable, new approaches must maximize access to health services that emphasize health promotion

and address local health needs with ‘minimum leakage’ (Humphreys *et al.*, 2006: p. 35). Such innovations must also be acceptable to users of these services. This paper discusses the results of a longitudinal three-year study that evaluated an innovative model of rural primary health and emergency care involving collaboration among a nurse practitioner (NP), paramedics and family physicians.

The study was conducted on Long and Brier Islands, a geographically remote area in Nova Scotia on the east coast of Canada. Getting there

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requires a 45 min drive from the nearest town, a short ferry ride to Long Island, the larger of the two and home to three of the Islands' four villages, and another to Brier Island. Collectively the Islands are populated by approximately 1240 residents, half of whom are older adults. The Islands had been without resident physician services for many years and, apart from paramedics, the only other resident health care professional was a registered nurse offering foot care services.

Concerned community leaders lobbied for improved access to primary health care services. In response, Emergency Health Services (EHS) decided better use could be made of paramedics who, though stationed on the Islands around the clock, were responding to only one emergency call every third day. Following an education program, paramedics began to assess and manage simple wounds, administer tetanus injections and flu immunizations and perform home assessments. Resident response was positive; nevertheless, they continued their advocacy efforts for a broader range of services (Murray *et al.*, 2002). Thus EHS introduced the NP-paramedic-physician model of care and commissioned an independent evaluation.

Legislation authorizing the role of NPs now exists nation-wide but in 2003 NPs had just been newly implemented in Nova Scotia (Hass, 2006; DiCenso *et al.*, 2007). The safety and effectiveness of NPs in primary care has been established in a systematic review (Horrocks *et al.*, 2002) and it has been shown NPs increase health promotion (Nova Scotia Department of Health, 2004) and access to care by practicing in rural areas designated as under-serviced by physicians (Centre for Rural and Northern Health Research, 2006). In Nova Scotia, rural health board chairs and health professionals identified that NPs could address many of the gaps in rural primary health care services (Martin-Misener, 2006).

The few studies evaluating the role of paramedics in primary health care have been limited to observational, descriptive or retrospective designs. They describe a role for paramedics in screening for domestic violence (American College of Emergency Physicians, 1996; Husni *et al.*, 2000), providing care in sexual assault calls (Greenwood, 2003), managing wounds (Hale and Sipprell, 2000), providing primary injury prevention (Garrison *et al.*, 1997; Kinnane *et al.*, 1997), conducting

geriatric assessments (Salinas and Calhoun, 2002; Mason *et al.*, 2003; Shah *et al.*, 2004), assessing children (Foltin *et al.*, 2002) and providing flu immunizations (Mosesso *et al.*, 2003). No studies have evaluated a model of rural primary health care involving NPs, paramedics and physicians.

Methods

This study hypothesized that adults living in a rural community receiving primary health care and emergency services from an on-site NP and paramedics and off-site family physician would demonstrate evidence of improved psychosocial adjustment and less expenditure of health care resources. Four research questions were addressed:

1. What is the impact of this rural health services model on the accessibility and acceptability of health promotion and illness prevention programs/services?
2. What is the impact of this rural health services model on resident satisfaction with the health care services they receive?
3. What are the organizational structures that can be used or developed to enable this triad of health care providers to deliver integrated and coordinated health care services?
4. What is the nature of collaboration between the NP, paramedic and family physician, and with other providers in the existing health care system?

Data collection

Following approval by research ethics review boards at Dalhousie University and Southwest Nova District Health Authority, an invitation for residents to participate in the study was published in the local newspaper and posted in various public locations. Potential participants were asked to telephone the project coordinator who explained the purpose of the study identified their eligibility for inclusion, and arranged a mutually convenient time to obtain written consent and baseline data. Potential participants who visited the health clinic were informed of the study by staff. In the first year, the project coordinator telephoned participants to review the questionnaires and explained how to complete them. In subsequent years, questionnaires were mailed unless participants previously indicated

a preference for telephone assistance from the project coordinator. To increase response rates, participants were contacted by telephone and mail with two reminders and provided with self-addressed return envelopes (Edwards *et al.*, 2002). Questionnaires included the psychosocial adjustment to illness (PAIS-SR), health and social service utilization (HSSUSQ) and demographic scales.

The PAIS-SR is a self-report scale consisting of 46 questions divided into seven domains of psychosocial adjustment including health care orientation, vocational environment, domestic environment, sexual relationships, extended family relationships, social environment and psychological distress (Derogatis, 1983). Respondents rated their responses to questions on a four-point Likert scale. Scores were summed for the 46 items, reflecting overall adjustment, and each of the seven domains. Internal consistency reliability from previous studies ranged from 0.91 to 0.81, inter-rater reliability was 0.86 (total scale) and construct validity using factor analysis was moderate to good. Both the convergent and predictive validity of the PAIS have been well supported with samples of chronically ill individuals (Derogatis and Lopez, 1983; Derogatis and Flemming, 1996).

The HSSUSQ was used to measure the outcome variable of expenditures for health and social service use. Direct health service categories included primary care, emergency department and specialist visits, days of hospitalization irrespective of episode, hospital episodes irrespective of days, use of seven types of health and social services professionals, and laboratory services. Inquiries were restricted to a reliable recall span: six months for hospitalization, two weeks for a physician visit and two days for medication intake. Out-of-pocket expenditures such as medication costs, travel, parking, childcare expenses and other social services were also included. To calculate annual utilization measures, time spans were extended to yield an annual rate of utilization per category and multiplied times the dollar value of the service. Additional questions addressed out-of-pocket indirect costs including lost individual and or family income related to health care and cash transfers such as costs to private insurance, workers compensation, disability payments and other costs to government. This instrument has been tested for reliability and validity with high levels of observed agreement

(0.72 to 0.99) between the patient's report and their clinic record (Browne *et al.*, 1990). It has detected economically important differences in expenditures resulting from interventions with vulnerable populations, and takes approximately 15 min to complete.

Emergency department and family physician utilization was calculated using postal codes to identify the Long and Brier Islands population. Medical insurance numbers of Islands' residents were then matched with emergency room and doctor visitation records contained in the physician billings data. Residents seen by the same doctor in the same county on the same day multiple times were recorded as having made a single visitation. Data were stratified into three data sets based on the date of service: 18 months prior to implementation of the NP-paramedic-physician model, midpoint and end of the project. Average monthly visits to emergency departments and family physicians were calculated.

Researchers conducted annual semi-structured interviews of 45–60 min, by telephone or in person, with health care providers, health care administrators, and community residents to explore the experiences, satisfaction, and perceptions of persons and groups involved in and affected by the project. In the first year of the project, participants were asked to identify their relationship, involvement or experience with the project, health services available on the Islands, health needs being met or not, resources the project had, what they hoped the project would achieve, and any concerns they had about the new services. At the second and third interviews, they were also asked to reflect on their satisfaction with the health services on the Islands, whether the project was working collaboratively with stakeholders, and what the project had done best and least well. Individual interviews were conducted with Islands' core health care team members, health care administrators, and community leaders. Group interviews were conducted with multidisciplinary service providers in the local health authority (two groups) and community residents (two groups) (Table 1). Group interviews were conducted by two researchers (Ruth Martin Misener and Barbara Downe-Wamboldt), one facilitating and the other recording notes and observing group dynamics (Krueger, 1994). Interviews were audiotaped and transcribed.

Table 1 Summary of individual and group interview participants

Year 1	Year 2	Year 3
Core health team members <i>n</i> = 8 individuals	Core health team members <i>n</i> = 4 individuals	Core health team members <i>n</i> = 7 individuals
Administrators and community leaders <i>n</i> = 7 individuals	Administrators and community leaders <i>n</i> = 9 individuals	Administrators and community leaders <i>n</i> = 9 individuals
Community resident groups <i>n</i> = 2 groups of six to seven individuals	Community resident groups <i>n</i> = 2 groups of four to five individuals	Community resident groups <i>n</i> = 2 groups of four to seven individuals
Multidisciplinary service provider groups <i>n</i> = 2 groups of six to seven individuals	Multidisciplinary service provider groups <i>n</i> = 2 groups of four to five individuals	Multidisciplinary service provider groups <i>n</i> = 2 groups of two to seven individuals
Total number of individual (<i>n</i> = 15) and group (<i>n</i> = 4) interviews	Total number of individual (<i>n</i> = 13) and group (<i>n</i> = 4) interviews	Total number of individual (<i>n</i> = 16) and group (<i>n</i> = 4) interviews

Sample

Adult English-speaking permanent residents of the Islands, age 40 years or more with a diagnosis of at least one chronic illness, aware of their diagnosis and able to provide informed written consent were eligible for inclusion. Sample size was calculated based on a population size of approximately 1200 permanent residents. For this heterogeneous sample, an improvement of 5–10 on the PAIS scale over 36 months was considered clinically significant. Using an alpha level of 0.05, a power level of 0.85, and a standard deviation of 14.9 (PAIS) giving an effect size of 0.54, the required sample size was 82 (Cohen, 1988). Estimating a 75% consent rate from eligible participants and an attrition rate of 15%, 152 participants were needed at baseline to retain 97 in year 2 and 82 in year 3.

For interviews, purposive sampling was used to select health care providers, administrators and community leaders and a snowball technique to identify community residents (Patton, 1990).

Data analysis

Descriptive statistics were used to describe the demographic characteristics of the study participants. Chi-square and Fisher's exact tests for categorical variables and independent *t*-tests for continuous variables were used to determine the comparability of the 50 participants, for whom there was a complete data set throughout the

study, to the 36 participants with missing data over the three time periods.

To test the impact hypothesis, univariate analysis of variance was used to determine differences for the total PAIS scores at the three time points. Pearson product-moment correlation analysis indicated that the PAIS subscale scores were correlated; thus a multivariate analysis variance was computed to determine whether PAIS subscale scores changed significantly over time. The data for HSSUQ cost subcategories had a skewed distribution with few data points; thus the Kruskal-Wallis non-parametric test, analogous to analysis of variance, was used to test for differences over time in specific cost categories; significance was set at $P = 0.05$. Internal consistency reliability of the PAIS questionnaire, with the study sample, was assessed using Cronbach's alpha.

Content analysis and descriptive statistics were used to analyze interview data (Krippendorff, 1980; Downe-Wamboldt, 1991). The analysis process involved development of category and subcategory classifications reflecting the research questions (R.M.M. and B.D.W.). Transcripts were divided into units of analysis defined as words, phrases, sentences, or paragraphs describing any aspect related to the broad content areas of health services accessibility and acceptability, patient satisfaction, organizational factors, and collaboration. Categories were developed through a continuous interactive process. Two researchers

independently coded the interview data achieving an inter-rater reliability rate of 87% agreement.

Results

Sample characteristics and comparability

The resident sample included 86 Caucasian participants at year 1, 85 at year 2, and 50 at year 3. Known reasons for attrition were death ($n = 6$), moved off Island ($n = 1$), and unable to complete ($n = 1$). Differences in participant characteristics were compared over the three time periods using Chi-square and Fisher's exact test for categorical variables (Table 2) and independent t -tests for continuous data. There were no significant differences in age, gender, number of children, or family members living with participants, education level, location of family doctor, the identification of someone they could talk to about their illness, or the category of person they did talk to about their illness. Results indicated significant differences in the number of illnesses and medications used over the three time periods ($P = 0.0001$). There were more participants who rarely or never used medications in year 3 compared to years 1 and 2. More participants reported four illnesses at year 3 and more were living alone compared to years 1 and 2.

Characteristics of the 50 participants, for whom there was a complete data (CD) set, at year 1 (baseline) were compared to the 36 participants with missing data (MD). Independent sample t -tests indicated that the two groups were similar with respect to the continuous variables of age (CD Group $M = 64.8$; MD Group $M = 66.5$), number of children (CD Group $M = 2.7$; MD Group $M = 2.1$), number of people living with them (CD Group $M = 1.06$; MD Group $M = 1.11$) and number of chronic illnesses (CD Group $M = 1.9$; MD Group $M = 1.94$). Chi-square analysis and Fisher's exact test indicated the two groups were similar in terms of gender, level of education, transportation used, location of family doctor, frequency of medication use, and the availability of someone to talk to and category of person actually talked to. Chi-square analysis ($\chi^2 = 4.62$, $P = 0.03$) indicated that the group with missing data was more likely to live with someone (83%) compared to 62% of the participants in the complete data group.

Impact on costs, psychosocial adjustment, and health services utilization

Using the HSSUQ data for the 50 participants with complete data at all three time points, Table 3 describes the mean and median direct costs (year 1 $M = 8967.86$; year 2 $M = 8454.08$; and year 3 $M = 3938.21$), cash transfer costs (year 1 $M = 2377.75$; year 2 $M = 2067.05$; and year 3 $M = 768.08$), and total costs (year 1 $M = 11\,345.61$; year 2 $M = 10\,521.14$; and year 3 $M = 4706.29$) from the HSSUQ. Analysis indicated that the health care costs of two participants (outliers) were much higher than the majority of the participants. The pattern of cost for these outliers remained consistent over the three years. Three of the four overall cost categories were less at years 2 and 3 compared to year 1 (baseline). All three costs categories diminished over the three years of the project. Using the data from the participants with complete data for all three years, Table 4 indicates that significant differences were found in prescription medications ($\chi^2 = 7.55$, $P = 0.02$) and costs of travel for health care ($\chi^2 = 7.09$, $P = 0.02$). Both of these cost categories were less at years 2 and 3 compared to year 1 (baseline) and both costs diminished over the time of the project.

Internal consistency reliability of the PAIS questionnaire, with this study ($n = 221$) using Cronbach's alpha, yielded an alpha of $a = 0.87$ for the total raw scores. The subscale alphas ranged from 0.56 to 0.80 as follows: health care orientation, $a = 0.71$; vocational environment, $a = 0.56$; domestic environment, $a = 0.58$; sexual relationships, $a = 0.62$; extended family relationships, $a = 0.56$; social environments, $a = 0.83$; and psychological distresses, $a = 0.80$. The specific subscales of vocational environment, domestic environment, and extended family relationships were not included in further analysis as the alphas were too low. A univariate analysis of variance computed to determine whether total PAIS raw scores changed over the three years of the project indicated no statistically significant differences over time in total PAIS scores (Table 5). Pearson product-moment correlation analysis indicated that many of the PAIS subscale scores were correlated; thus, a multivariate analysis variance was used to determine whether subscale raw scores changed over the three years. Again, no statistically significant changes were found in the PAIS subscale scores of health care orientation, sexual

Table 2 Comparison of participant characteristics at years 1, 2, and 3

Variable	Levels	Year 1 (n = 86) n (%)	Year 2 (n = 85) n (%)	Year 3 (n = 50) n (%)	Statistic	Value	P
Living arrangement	Live alone	25 (29)	26 (31)	23 (46)	χ^2 , 2 df	4.59	0.10*
	Live with someone	61 (71)	59 (69)	27 (54)			
Children	No	12 (14)	12 (14)	4 (8)	χ^2 , 2 df	1.27	0.53
	Yes	74 (86)	73 (86)	46 (92)			
Gender	Female	54 (63)	54 (64)	32 (64)	χ^2 , 2 df	0.02	0.99
	Male	32 (37)	31 (36)	18 (36)			
Number of family members living with	0	16 (19)	16 (19)	18 (36)	χ^2 , 6 df	7.29	0.29
	1	52 (60)	51 (61)	25 (50)			
	2	13 (15)	13 (15)	4 (8)			
	3	5 (6)	5 (6)	3 (6)			
Education	Junior or partial High School	42 (49)	41 (48)	22 (44)	χ^2 , 4 df	0.33	0.99
	High or Vocational/Trade School	25 (29)	25 (29)	16 (35)			
	University or Professional School	19 (22)	19 (22)	12 (24)			
Number of illnesses	0	1 (1)	1 (1)	3 (3)	χ^2 , 8 df	56.56	<0.0001*
	1	37 (43)	36 (42)	12 (14)			
	2	24 (28)	29 (34)	25 (29)			
	3	16 (19)	13 (15)	7 (8)			
	4	8 (9)	7 (8)	39 (45)			
Medication use	Everyday	71 (83)	70 (81)	41 (48)	χ^2 , 4 df	48.87	<0.0001*
	Only when needed	9 (8)	9 (8)	6 (5)			
	Rarely or never	7 (8)	8 (9)	40 (47)			

*Significance set at $P \leq 0.10$.

Table 3 Summary of health and social utilization costs $n = 50$

Variable	Year 1		Year 2		Year 3	
	Mean \pm SE	Median	Mean \pm SE	Median	Mean \pm SE	Median
Direct cost	8967.86 \pm 4383.39	2379.67	8454.08 \pm 4390.19	2246.80	3938.21 \pm 886.86	1374.54
Cash transfer	2377.75 \pm 1160.85	0.00	2067.05 \pm 1145.96	0.00	768.08 \pm 382.79	0.00
Total cost	11 345.61 \pm 4506.97	3085.75	10 521.14 \pm 4514.86	3221.44	4706.29 \pm 1098.36	1918.54

Table 4 Comparison of prescription medication and travel cost over time $n = 50$

Cost of	Year 1			Year 2			Year 3			χ^2 , 2 df	P
	Mean	SE	Median	Mean	SE	Median	Mean	SE	Median		
Prescription medication	94.82	15.57	67.05	84.58	13.10	67.05	67.01	15.22	24.17	7.55	0.023*
Travel for health care	263.88	75.14	0.00	200.18	68.91	0.00	30.73	25.77	0.00	7.90	0.02*

*Significance set at $P \leq 0.05$

Table 5 Analysis of variance of PAIS subscale and total scores over time $n = 50$

Variable	Year 1 ($n = 50$)			Year 2 ($n = 50$)			Year 3 ($n = 50$)			Test statistic	P
	Mean \pm SE										
Health care orientation	6.16 \pm 0.56			6.16 \pm 0.54			7.34 \pm 0.67			$F_{14, 282}^a = 0.62$ $F_{2, 147}^b = 0.38$	0.85
Sexual relationships	5.88 \pm 0.53			5.88 \pm 0.55			6.20 \pm 0.57				
Social environment	3.62 \pm 0.58			3.48 \pm 0.59			3.40 \pm 0.55				
Psychological distress	3.96 \pm 0.52			3.56 \pm 0.44			3.58 \pm 0.46				
Total PAIS score	31.86 \pm 2.35			31.46 \pm 2.34			34.22 \pm 2.60				

^aMANOVA.

^bANOVA.

Table 6 Emergency department (ED) and family physician utilization by residents by time

Type of visit	Year 1*	Year 2	Year 3	% Change
Total GP visits	5214	5720	3759	28 ↓
Mean GP visits/month	290	249	221	24 ↓
Total ED visits	85	96	51	40 ↓
Mean ED visits/month	5	4	3	40 ↓
Total GP and ED visits	5299	5816	3810	28 ↓
Mean GP and ED visits/month	294	253	224	24 ↓

GP = general practitioners.

*18 months prior to implementation of NP, paramedic, physician model of primary health care.

relationships, social environment, and psychological distress.

To further address the impact of this rural health services model on the accessibility and acceptability of health promotion and illness prevention programs/services, existing health

services administrative data were used to determine the number of emergency and family physician visits made by residents. As Table 6 illustrates, the number of family physician office visits and emergency department visits by residents decreased. Over the duration of the study,

Table 7 Content analysis category system

<p>Accessibility to health services</p> <ul style="list-style-type: none"> Health promotion Illness and injury prevention Managing episodic illness and injury Monitoring chronic illness Community development and advocacy Travel times Pre-existing services <p>Acceptability of health services</p> <ul style="list-style-type: none"> Continuum of acceptance Sense of comfort and safety People stay on the Islands Changes in service patterns 	<p>Resident satisfaction</p> <ul style="list-style-type: none"> Access Clinical/technical management Interpersonal management <p>Organizational structures</p> <ul style="list-style-type: none"> Context Accountability and governance Role clarity Structure <p>Collaboration among providers</p> <ul style="list-style-type: none"> Spectrum of collaboration Communication
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visits made to family physicians decreased from 5720 at year 2 to 3759 at year 3 and visits to emergency departments decreased by 40%.

Content analysis of the interview data yielded the categories of accessibility to health services, acceptability of health services, patient satisfaction, organizational structures, and collaboration among providers. Category and subcategory results are summarized in Table 7.

Impact on accessibility to health services

Participants reported an overall increase in accessibility to a range of health services for residents as well as an increase in utilization of NP and paramedic services. In year 3, participants commented that health promotion services initiated in the early years of the project continued to be available on the Islands. Examples included personalized lifestyle counseling aimed at smoking cessation and weight loss; seniors' fitness classes; wellness services for children, women, seniors, and teens; and an organized home visitation service to reduce the isolation of elderly residents. Early detection, screening, and illness and injury prevention services were reported to be accessible throughout the project. Examples of preventive services included cervical, breast, bone density, and depression screening; falls prevention, bicycle and child car seat safety programs; and immunization. Participants also attributed the acquisition of several new services such as child development services, a family violence prevention program, and on-island visits from a dental hygienist to advocacy efforts of the NP and

paramedics. In addition, they stated the NP and paramedics were improving health by providing opportunities for Islands' residents to acquire new skills of benefit to the community. For example, an NP obtained funding for several community members to become fitness instructors and paramedics offered regular training sessions for medical first responders.

Participants reported that the NP and paramedics treated common acute illnesses and injuries and chronic illnesses such as hypertension, diabetes, and asthma. Services were provided at the clinic and in residents' homes. According to participants, this reduced health-related travel and the convenient access to health services enhanced adherence to follow-up. Access to emergency health services continued to be excellent.

It's certainly more local, it saves on travel; it seems a little more personal I guess. I think it's just better for the community, the health of the citizens and the health of the community.

Impact on acceptability of health services

Participants reported that acceptance of the new model of care by residents and health care providers increased substantially over the three years. There was some initial resistance and fear that adoption of the new model of care would result in there never being a physician on the Islands. Over time, this perspective changed; residents stated their current services were better than any they had previously experienced, even

when there was a fulltime physician on the Islands.

The people, I think, really believe that we probably have a better health system here on the islands than a lot of citizens do in the rest of the province.

Resident satisfaction

Community residents expressed many general statements of satisfaction with the NP and paramedics such as ‘they are excellent’ and ‘I think we are very well off here with what we have now.’ Other comments demonstrated their satisfaction with the quality of clinical care and the interpersonal communication and dynamics.

I really believe that there is less of a clinical and more the relationship kind of scenario which allows the people, I think, to get more out, and answer more things and [be] persuaded to share or discuss things that they’re worried or concerned about.

Organizational structures

Participants stated the NP–paramedic–physician model of care was well suited for rural settings with small populations and though some confusion regarding the respective responsibilities and accountabilities of the NP and paramedics persisted at year 3, it was better than it had been in the past. As one participant commented: ‘*compared to when I came on board three years ago and things were a little bit chaotic and roles weren’t very clear for the nurse practitioner or paramedics, who reported to who, that type of thing; I think in the last three years that has been cleared up.*’

These positive changes were attributed to organizational structures that had facilitated implementation of the new model of care. According to participants, had EHS not taken the leadership to fund and employ the NP and actively support implementation of the new model of care, the change would never have been realized. At the beginning, there was substantial resistance to the project from health care professional groups, requiring the assistance of senior levels of government. In addition to strong political support, leadership from a core group of community members was ‘*key to influencing the opinion of*

the community.’ Participants advised while it was important to build broad support for the model of care as much as possible, it was important to realize ‘*you’re not going to get a hundred percent and have the courage, the stamina to pursue it.*’

To coordinate activities and ensure communication among all parties, EHS organized a management committee composed of representatives from the core health team, district health authority, and community leaders. One of the roles of this committee was to develop a plan to transition employment of the NP from EHS to the district health authority. At the ground level, EHS hired a project coordinator to facilitate communication between the NP and paramedics and assist with program development. Participants stated the project coordinator was an essential ‘point person’ responsible for facilitating the execution of the new model of care. They commented the coordinator was needed until implementation became ‘*day to day operations.*’ Once the transition plan was accomplished, the district health authority re-evaluated the supporting structures for the project and decided regular monthly meetings between managers responsible for the NP and those responsible for paramedics was what was needed to support the project. These structures were reported to have enabled a smooth transition, improved communication between the NP and paramedics, resolved local issues as they emerged, and enabled planning to occur proactively.

Collaboration among providers

Participants reported positive collaboration among the core health team as well as with the rest of the multidisciplinary health care team in the district. Challenges related to collaboration between the NP and paramedics identified in earlier years were not mentioned in interviews conducted at the conclusion of the project. Rather, participants reported effective collaboration and cooperation between NPs and paramedics. Collaboration between the NP and physicians in the core health team was excellent throughout the project and collaboration between the NP and other district physicians improved over time. As one NP said:

The physicians are professionals and I not only ask for referrals or consultations, but I get them from their patients. So you know,

with some of these doctors seeing 40, 50 patients in a day, they get a blood test back that's high for cholesterol, they say right out to their patients, you know what, make an appointment with [the NP]; she will go through it all with you.

Discussion

This innovative model of rural primary health care services increased access to a broad range of health services with high levels of resident acceptance and satisfaction. Health promotion, early detection, screening, and disease management services were increased. Had it been possible to collect clinical indicators to evaluate the process and outcomes of chronic disease management, this would have enabled triangulation of qualitative with quantitative data.

Cost reductions were attributable to reduced travel and medication costs. Decreasing the distances of rural dwellers to early detection and screening services is an important goal for improving the health status of rural populations (DesMeules and Pong, 2006). Furthermore, since rural residents of Nova Scotia have higher rates of poverty, unemployment, and chronic disease (Canadian Institute for Health Information, 2004), reducing the out-of-pocket expense of travel to health services is a significant achievement. Interview data suggest reductions in prescription medication use and cost were attributable to the closer supervision of residents afforded through clinic and in-home services offered through the new model of care. Quantitative data about the numbers of visits made by the NP and paramedics were not collected.

Concomitant with the decline in medication use, this study found an increase in the number of reported illnesses at year 3. Reductions in physician and emergency room use suggest that the increase in the number of reported illnesses was not associated with a decline in the health status of residents. It is possible that the new model of care resulted in improvements in the early diagnosis of illness not necessarily requiring medication. Alternatively, the increase in reported illnesses may have occurred as a result of residents' increased awareness of preexisting illnesses, not necessarily new illnesses.

No significant differences in total PAIS scores were found over the three years of the study. It is possible that the new model of care did not result in a change in psychosocial health. However, the qualitative data suggest that residents found it easier to communicate with the NP and paramedics and were more likely to disclose relevant health information. This suggests the model of care could have demonstrated improvements in psychosocial health. Other instruments to measure psychosocial adjustment possibly may have been more sensitive to measure psychosocial adjustment in an older population, which typically includes many retired persons. Also, the instrument's sensitivity with rural populations is not known; since health beliefs of rural and urban populations may differ, this could have been a factor (Johnson *et al.*, 1995). Lastly, attrition in the third year of the study may have affected the power of the study to detect differences with this instrument. Face to face or telephone interviews with all participants may have resulted in less missing data and provided opportunities for participants to ask for clarification of the meaning of any of the items.

Like others, the magnitude of effort required to implement change in this project was enormous (Nova Scotia Department of Health, 2004; Reay *et al.*, 2006). A key learning from this study is the importance of organizational structures to support the implementation of a new model of care. Community leadership is essential for both advocating the need for a new model of care and facilitating acceptance of the model within the community. Senior levels of government may need to be actively involved when a new model of care is initiated until resistance to change diminishes and transfer to another level of government is feasible. At the local level, ongoing investment in supportive structures to facilitate role clarity and communication is essential when introducing a new model of care that disrupts the usual roles, responsibilities, and patterns of interaction between health care providers (DiCenso *et al.*, 2003; Bryant-Lukosius *et al.*, 2004). It is not reasonable for health administrators to expect health care providers facing the challenges of implementing new roles and relationships to have the time or necessarily even the skills to navigate these complexities. At the same time, it is important to recognize that the type of supporting structures needed may change over time as

collaboration improves (Way *et al.*, 2001) and the model of care matures.

This longitudinal study provides clear direction for policy and practice. The NP-paramedic-physician model of primary health care services increases access to health care services and is a cost-effective model of health care for rural communities with low emergency call volumes. Cost savings at the provincial level could be used to support the development of innovative models of health care. Finally it is important to acknowledge had the study not extended over a three-year time period, the results would not have been discovered, demonstrating that implementation of a new model of care requires sufficient time to elapse before results will be evident.

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