URBAN & RURAL DIFFERENCES IN THE MANAGEMENT OF ASTHMA AMONGST PRIMARY CARE PHYSICIANS IN ALBERTA

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ABSTRACT

Background
Inconsistencies in rural and urban health care exist; however, little has been done to evaluate the potential differences in asthma management.

Objective
To compare asthma management in rural versus urban primary care physician practices.

Methods
Forty-two of 136 consenting primary care physicians were randomly selected for chart review. The charts of 3072 patients diagnosed with asthma based on the ICD-9 Classification of Diseases were reviewed.

Results
Standards of asthma care were compared between rural and urban primary care physicians. 2671 patients (87%) were cared for by urban physicians and 401 patients (13%) by rural physicians. Greater proportions of male and pediatric patients were found in the rural group. Rural patients made more emergency department or hospital visits than urban patients. Rural physicians performed more pulmonary function tests and made more referrals to other healthcare specialists. Urban patients had more asthma symptoms and triggers documented and used peak flow monitoring more often. Urban physicians provided more asthma education and prescribed more oral corticosteroids and antibiotics. Overall, rates of referral, use of spirometry and use of written action plans were low globally.

Conclusions
Our study indicates that the management of asthma in the rural settings is comparable to that of urban settings. Improvements in the areas of pulmonary function testing, asthma education and use of written action plans are necessary in both settings.

Keywords: *Asthma, community health, primary medicine, rural medicine*

The discrepancies in health care between urban and rural areas have long been recognized.[1-3] However, there are few studies published that assess and compare the management of chronic illnesses, such as asthma, in these two settings.[4,5] Rural and remote areas occupy over 90% of the land mass and contain 22 to 38% of the total population in Canada, depending on the definition of rural applied.[6-8] According to the Canadian Medical Association, approximately 17% of family physicians and only 5% of specialists practice in rural areas.[8] Although the population of rural Canada continues to grow at a rate of 0.5% per year, recruitment and retention of health care professionals into these areas has been at a standstill.[9] Rural hospital closures and

centralization of health services into larger cities will result in greater difficulties for rural patients in accessing health care. Other differences that may impact asthma management are socioeconomic status and level of education. In rural Alberta, both median personal income and educational attainment are lower. Reduced income, however, is offset by lower housing costs.[10] These types of barriers to rural health have been documented in the United States, where approximately 75% of American rural counties have been designated as "medically underserved areas".[11,12]

Asthma is a significant cause of morbidity and mortality in Canada and worldwide.[13-15] It is a major burden on the Canadian healthcare system, where direct and indirect costs have been estimated to be $648 million per year.[16] Several consensus guidelines have been published worldwide to help guide practitioners manage this prevalent disease. The most recent Canadian asthma consensus report focuses on optimal management, including recommendations on diagnosis and evaluation; avoidance of provocative factors; education and monitoring; and pharmacotherapy.[17,18]

The Alberta Strategy to Help Manage Asthma (ASTHMA) project has evaluated the patterns of practice in asthma management among primary care physicians in Alberta.[19-21] In this first phase of the study, patterns of practice of urban and rural primary care physicians were compared, focusing on diagnosis, treatment, and management, to determine whether geographic barriers to healthcare access adversely affect practice patterns. This comparison was conducted to determine whether there are differences in the care provided to patients with asthma based upon their geographic location.

METHODS

Alberta Strategy to Help Manage Asthma (ASTHMA)

The ASTHMA Project is a three-phase study designed to improve the care and outcomes of Albertans with asthma.[19-21] The three phases of the project include assessment of baseline patterns of practice, formulation, and implementation of interventions to overcome identified challenges and to close any identified gaps in asthma care, and re-assessment to measure the impact of the interventions. In this first phase, current patterns of practice in asthma care were assessed through chart reviews of patients diagnosed with asthma in the offices of primary care physicians (PCPs).[19-21]

Study Sample

Physicians in Alberta were mailed packages including study information with a self-addressed stamped postcard for interested individuals to reply.[19] When postcards were returned, the sending physicians were contacted to arrange a meeting in person or by teleconference to further discuss study details and recruitment. The current study sample of 42 physicians was drawn randomly from 136 primary care physicians who volunteered to have their patient records reviewed from over 2000 physicians in the province.[19-21] Almost all patient visits to physicians in Alberta are billed to the Alberta Provincial government. Patients with at least two asthma-related visits between 1996 and 2001 were identified from the Provincial database using the attached diagnostic code (International Classification of Diseases, 9th Revision, Clinical Modification code 493.xx). Lists of these patients, aged 5 years or older, seen between 1996 and 2001, were sent to their family physician and used to identify patient charts from which asthma-related information was extracted by a trained and certified health record analyst. Details of data collection have been published previously.[19-21] Ethical approval to conduct this study was received from both the Health Research Ethics Board of the University of Alberta, and the Conjoint Health Research Ethics Board of the University of Calgary. Collated data was compared to the standards outlined in the Canadian Consensus Guidelines for Asthma Care, which was utilized as the reference for optimal management.[17]

Definitions

For the purpose of this analysis, **rural** patients were defined as those cared for by family doctors residing outside the urban centres of Edmonton or Calgary and their immediate suburbs.[22] Patients with **severe asthma** were defined as those who had hospital or emergency department visits, as it was not possible to identify control parameters from chart reviews. **Medication use** was documented as current use or non-use. **Current use** was defined as having a prescription written

for a particular medication within the last 6 months of the final visit.

Statistical Analysis

The analysis was performed by comparing symptoms/triggers, diagnosis (testing), referral, asthma education, and drug therapy, reported as individual dichotomous variables, between the rural and urban PCPs using Fisher's exact test. T-test was used for continuous data such as age and mean number of visits. Statistical significance was based on the 0.05 level. All analyses were performed using SAS 8.2 (Cary, N.C.).

RESULTS

The charts of 3,072 unique patients were reviewed; 401 (13%) were in a rural setting (from nine physicians) and 2671 (87%) in an urban setting (from 33 physicians). Their demographic characteristics are presented in Table 1. The average age for the urban and rural population was similar, however, there were a larger proportion of paediatric patients (age 5 to 17 years) within the rural group (36%) compared to the urban group (28%; p<0.001). More patients in the urban population were female (55%) compared to the rural group (42%; p < 0.001). Urban patients were more likely to have smoked than rural patients (25% vs. 20%; p < 0.001). The most frequent comorbidities observed were depression, anxiety, hypertension, chronic obstructive pulmonary disease (COPD) and arthritis. On average, patients made 6.6 ± 6.4 (standard deviation, SD) asthma-related visits during the study period. There was no difference in the number of visits made by patients in either group to their primary care physician; however, rural patients (38%) visited emergency departments or were admitted to hospital more often than urban patients (17%; p=<0.001).

TABLE 1 Baseline Patient Characteristics

	Urban (n=2671) # (%)	Rural (n=401) # (%)	P value
Age in years (mean ± SD)	33 ± 20	31 ± 22	NS
Age 5 – 17	758 (28)	145 (36)	0.0018
Ages ≥ 18	1913 (72)	256 (64)	
Females	1480 (55)	170 (42)	< 0.001
Smokers	673 (25)	82 (20)	< 0.001
Comorbidities:			
Depression	371 (14)	35 (9)	0.0034
Hypertension	208 (8)	30 (8)	NS
Arthritis	148 (6)	22 (6)	NS
Other*	148 (6)	20 (5)	NS
Thyroid	78 (3)	10 (3)	NS
DM	86 (3)	12 (3)	NS
CAD	61 (2)	8 (2)	NS
Cancer	49 (2)	9 (2)	NS
Peptic Ulcer	36 (1)	3 (1)	NS
Physician asthma visits (1996-2001)			
Asthma visits (mean ± SD)	6.6 ±6.5	6.6 ± 5.9	NS
Patients with 1-3 visits to PCP since 1996	947 (35)	139 (35)	NS
Patients with ≥ 4 visits to PCP since 1996	1724 (65)	262 (65)	NS
Asthma Severity:			
Mild to moderate	2217 (83)	250 (62)	<0.0001
Severe	454 (17)	151 (38)	

*Other = other psychiatric, kidney, liver or peripheral vascular diseases

Abbreviations: CAD - Coronary Artery Disease; CHF - Congestive Heart Failure; COPD - Chronic Obstructive Pulmonary Disease; DM - Diabetes Mellitus; GERD - Gastroesophageal Reflux Disease; PCP - Primary Care Physician; NS - Not Significant

Aeroallergens, respiratory tract infections, and occupational triggers were more commonly documented for urban patients and smoking more commonly for rural patients. Symptoms that were more frequently documented for urban patients included chest tightness, cough, allergies, and occupation-related respiratory symptoms. Rural patients were more likely to be symptom free and to have no documentation concerning symptoms. This data is not presented in the tables provided. Few patients in either group had documentation of diagnostic or monitoring tests (Table 2). More rural patients had pulmonary function tests but fewer had peak expiratory flow monitoring or chest x-rays compared to urban patients. No documentation of diagnostic or monitoring tests was observed in 212 rural patients (53%) and in 1124 urban patients (42%; $p < 0.001$).

TABLE 2 Pulmonary Tests in Primary Care

	Urban (n=2671) # (%)	**Rural (n=401) # (%)**	**P value**
Pulmonary function tests	632 (24)	127 (32)	< 0.001
Airway hyper-responsiveness test	29 (1)	1 (0.2)	NS
Peak expiratory flow monitoring	1306 (49)	105 (26)	< 0.001
No tests documented*	1124 (42)	212 (53)	< 0.001
Chest x-ray	741 (28)	67 (17)	< 0.001

*No Pulmonary Function Test, no Peak Expiratory Flow monitoring, no airway hyperresponsiveness test

TABLE 3 Referrals

	Urban (n=2671) # (%)	**Rural (n=401) # (%)**	**P value**
Respirologist	168 (6)	65 (16)	< 0.001
Allergist	438 (16)	63 (16)	NS
Internal medicine	40 (2)	6 (2)	NS
Pediatrician	41 (2)	35 (9)	< 0.001
Asthma clinic	149 (6)	19 (5)	NS
Other	80 (3)	0	< 0.001
No referral documented	1830 (69)	251 (63)	0.0189

TABLE 4 Asthma Education

	Urban (n=2671) # (%)	**Rural (n=401) # (%)**	**P value**
Environmental factors	603 (23)	74 (19)	NS
Inhaler use	546 (20)	66 (17)	NS
Home PEF*	268 (10)	42 (11)	NS
Asthma teaching clinic	130 (5)	19 (5)	NS
Smoking cessation	363 (14)	34 (9)	0.0039
Written action plan	44 (2)	7 (2)	NS
No education documented	1443 (54)	244 (61)	0.0114

*PEF-Peak Expiratory Flow

Referral for specialist opinion was documented for 46% of urban and 39% of rural patients (p= 0.02). Overall, most referrals were made to allergists (16%) and respirologists (8%) (Table 3). Asthma education was provided equally and infrequently in the two groups. There was no documentation of any asthma education in 61% of the rural and 54% of the urban patient records (p = 0.01) (Table 4). The most commonly prescribed asthma medications were short acting β_2 agonists (80%) and inhaled corticosteroids (68%) (Table 5). Prescribing patterns were generally similar between groups; however, urban physicians had greater documented use of oral corticosteroids (12% vs. 8%; p=0.02) and antibiotics (16% vs. 11%; p=0.008) in their patients. Rural physicians tended to use more leukotriene receptor antagonists (10 % vs. 6 %; p=0.01) and combination products (8 % vs. 3 %; p< 0.001) compared to their urban counterparts.

TABLE 5 Medication Use within Past 6 Months

	Urban (n=2671) # (%)	**Rural (n=401) # (%)**	**P value**
Short-acting β_2 agonists	2146 (80)	311 (78)	NS
Inhaled corticosteroids	1822 (68)	279 (70)	NS
Oral corticosteroids	315 (12)	31 (8)	0.0174
Theophylline	77 (3)	15 (4)	NS
Long-acting β_2 agonists	222 (8)	31 (8)	NS
Leukotriene antagonists	171 (6)	10 (10)	0.0109
Antibiotics	437 (16)	45 (11)	0.0079
Combination	89 (3)	33 (8)	< 0.001
Other*	266 (10)	74 (19)	< 0.001
No medications documented	116 (4)	24 (6)	NS

Other* = ipratropium, ketotifen, nedocromil, combinations

DISCUSSION

We sought to evaluate the differences in management of asthma care in urban and rural patients and found that the standard of asthma care was comparable, which parallels the findings of a similar study comparing diabetes care in rural and urban Alberta.[23] Nevertheless, some differences in the management and diagnosis of asthma between the two groups were observed and areas for improvement were identified. Even though we defined severe asthma as having to visit the emergency department or hospital, the higher utilization of these facilities in the rural group might actually reflect their use by physicians for "off-hours" patient visits, rather than increased disease severity.

The Canadian Consensus Guidelines state that all patients with asthma should receive asthma education and that an asthma action plan is an integral part of care.[17] In the current study, there was infrequent documentation of asthma education. This was especially true for action or self-management plans, contrary to recommendations set by the Canadian Consensus Guidelines.[17] The rate of documentation of action plans was similar between the two groups and overall, was lower than those recorded in national patient surveys performed in Canada[18,24] and in the United States.[25]

However, the rates in these studies[18,24,25] were obtained from patient surveys, not chart reviews. In a patient survey conducted in Alberta, the rate of patients acknowledging action plans was 11%[26], similar to that in the TRAC study.[27] This difference between chart documentation and patient surveys might suggest that action plans were being given without documentation, that patients had received action plans from other sources including a pharmacy or the world wide

web, or that patients might not have understood the true nature of an action plan and thus responded incorrectly. Objective lung function measurement is crucial for accurate diagnosis.

Overall, documentation of pulmonary function testing, and other forms of diagnostic testing was low, which again is inconsistent with the standard of care outlined by the Guidelines. Therefore, it is possible that improper diagnosis may have occurred among this population. Chest x-rays were requested more often in the urban setting; however, their usefulness in asthma is limited, unless they are being used to rule out an alternative diagnosis or a complication during an acute asthma exacerbation. Asthma education was infrequently documented. Despite having more asthma teaching clinics in urban areas such as Calgary and Edmonton, there was still no difference in the proportion of rural and urban patients being referred for education. These findings reinforce the need to make education more widely available and also, the need to promote the use of pre-existing services and resources to physicians to ensure they are well utilized. These resources may include asthma education clinics, specialized pharmacy services, and electronic media.[28-30] Prescribing patterns were similar, apart from more frequent use of oral corticosteroids and antibiotics in urban patients and more frequent use of leukotriene receptor antagonists and combination therapy (inhaled corticosteroid and long acting beta agonists) in rural patients. The relevance of these findings is uncertain and the value of antibiotic therapy in asthma has not been established.

In other studies, rural patients have been shown to have more severe disease.[4,31] In our study, even though rural patients had a higher rate of emergency department and hospital visits, the apparent lack of associated prescription of oral corticosteroid might reflect the convenience of out-of-hour use of the emergency department rather than increased disease severity. There were several potential limitations to our study. Firstly, our data was limited by accuracy and comprehensiveness of chart documentation. Poor documentation was quite prevalent, especially in the records of rural patients. It was impossible to distinguish between absence of a feature and absence of documentation but this was a comparative study and we believe that the constraints in documentation were likely to be similar in the two groups. Secondly, the physician participants were selected based on their willingness to participate, resulting in potential volunteer bias. Their eagerness to participate might reflect a greater interest and enthusiasm in asthma care than that of their peers, and therefore, our results may represent a higher than average standard of practice and documentation. Another limitation is the generalizability of our data to other rural areas as none of our rural practices were located in truly remote areas and many were situated in small towns with modern facilities.[32]

The interpretation of these data is also complicated by the absence of standard or universally accepted definition of ‘rural’. Lastly, our results may also have been affected by differences between the two patient populations; the urban group was significantly larger and certain patient demographics were imbalanced such as a gender and proportion of adults and children.

CONCLUSION

In this review of 3072 patients and 42 primary care practices, both expected and unexpected differences were observed. Deficiencies in asthma care compared with those outlined in the Canadian Asthma Consensus Report that were common to both rural and urban practices were identified such as lack of documentation of asthma action plans and objective measurements of lung function. Rural patients were more likely to seek emergent medical attention for asthma, and medication-prescribing practices varied between the two groups. In conclusion, there remains the need to identify and rectify the barriers to optimal asthma management in both rural and urban settings, as it is evident that asthma is not being adequately managed in Alberta despite the introduction of national guidelines to improve practice.

Acknowledgements

The Alberta Strategy to Help Manage Asthma (ASTHMA) is supported by an unrestricted research grant from Merck Frosst Canada Ltd. The Epidemiology Coordinating and Research (EPICORE) Centre, University of Alberta (www.epicore.ualberta.ca) provided the data management.

REFERENCES

1. Conte SJ, Imershein AW, Magill MK. Rural community and physician perspectives on resource factors affecting physician retention. J Rural Health 1992;8:185-196.
2. Humphreys J, Hegney D, Lipscombe J, et al. Whither rural health? Reviewing a decade of progress in rural health. Aust J Rural Health 2002;10:2-14.
3. Pampalon R. Health discrepancies in rural areas in Quebec. Soc Sci Med 1991;33:355-360.
4. Watts RW. Asthma management in rural Australia. Aust J Rural Health 1999;7:249-252.
5. Yawn BP, Mainous AG, Love MM, et al. Do rural and urban children have comparable asthma care utilization? J Rural Health 2001; 17:32-39.
6. Mitura V, Bollman RD. The health of rural Canadians: a rural-urban comparison of health indicators. Rural and Small Town Canada Analysis Bulletin 2003;4:1-23.
7. McIlwraith RD, Dyck KG. Strengthening rural health: the contribution of the science and practice of psychology. Ottawa, ON: Can Psychol Assocn 2002;1-9.
8. Society of Rural Physicians of Canada. The SRPC state of rural healthcare page. http://www.srpc.ca/librarydocs/Kirby_SRPC.htm (February 12, 2005).
9. Beshiri R, Bollman RD. Population structure and change in predominantly rural regions. The Daily [serial online]. January 2001: Catalogue 21-006 XIE. http://www.statcan.ca/english/freepub/21-006-XIE/21-006-XIE00002.pdf (Accessed February 12, 2005).
10. Sorenson M, de Peteur J. Rural Alberta Profile: A Ten Year Census Analysis. Rural Research and Analysis Unit, Rural Secretariat, Agriculture and Agri-Food Canada 2005.
11. Ryan-Nicholls KD. Health and sustainability of rural communities. Rural and Remote Health [serial online] 2004; 4 (1). http://rrh.deakin.edu.au/articles/showarticlenew.asp?ArticleID=242 (Accessed February 12, 2005).
12. Kaiser Commission on Medicaid and the Uninsured. The uninsured in rural America. Key Facts [serial online]. April 2001. http://www.kff.org/uninsured/loader.cfm?url=/commonspot/security/getfile.cfm&PageID=13764 (Accessed February 12, 2005).
13. Statistics Canada. The Statistics Canada persons with asthma by age and sex page. http://www.statcan.ca/english/Pgdb/health49a.htm (Accessed February 12, 2005).
14. The National Asthma Control Task Force. The Prevention and management of asthma in Canada: a major challenge now and in the future, 2000. Available at: http://www.phac-aspc.gc.ca/publicat/pma-pca00/pdf/asthma00e.pdf (February 12, 2005).
15. Statistics Canada. The Statistics Canada persons with asthma by sex, provinces page. http://www.statcan.ca/english/Pgdb/health50a.htm (Accessed February 12, 2005).
16. Krahn MD, Berka C, Langlois P, et al. Direct and indirect costs of asthma in Canada, 1990. CMAJ 1996;154: 821-831.
17. Canadian Asthma Consensus Group. Canadian asthma consensus report, 1999. CMAJ 1999;161(11Suppl):S1-62.
18. Lemiere C, Bai T, Balter M, et al. Adult asthma consensus guidelines update 2003. Can Respir J 2004; Suppl A; 9A-18A.
19. Tsuyuki R, Sin D, Sharpe H, et al. Management of asthma among community-based primary care physicians. J Asthma 2005;42(3):163-7.
20. Sharpe H, Sin D, Andrews E, et al. Alberta Strategy to Help Manage Asthma (ASTHMA): A provincial initiative to improve outcomes for individuals with asthma. Healthcare Quarterly 2004;7:55-60.
21. Sin D, Man P, Cowie R, et al. Recruitment of network and non-network primary care physicians to participate in a provincial asthma study. Can Family Physician 2004;50:1251-4.
22. Du Plessis V, Beshiri R, Bollman RD, et al. Definitions of "Rural". Agriculture and Rural Working Paper Series 2002; Working Paper No. 61. Ottawa, Ontario: Statistics Canada, Agricultural Division. http://www.statcan.ca/english/research/21-601-MIE/21-601-MIE2002061.htm (Accessed February 12, 2005).
23. Toth EL, Majumdar SR, Guirguis LM, et al. Compliance with clinical practice guidelines for type 2 diabetes in rural patients: Treatment gaps and opportunities for improvement. Pharmacotherapy 2003;23(5):659-65.
24. Chapman KR, Ernst P, Grenville A, et al. Control of asthma in Canada: Failure to achieve guidelines targets. Can Respir J 2001;8 Suppl A:35A-40A.
25. Asthma in America. Asthma in America survey news release page. Available at: http://www.asthmainamerica.com/newsrelease.htm (February 12, 2005).

26. Cowie RL, Underwood MF, Sin DD, Sharpe HM, Bell NR, Man SFP. Asthma Control and Management in the Community: 1997 compared with 2002. Can Fam Physician 2006;52:750-51. http://www.cfpc.ca/cfp/2006/jun/vol52-jun-res-cowe.asp
27. FitzGerald JM, Boulet LP, McIvor RA, Zimmerman S, Chapman KR. Asthma control in Canada remains suboptimal: The Reality of Asthma Control (TRAC) study. Can Respir J 2006;13:253-9.
28. Barbanel D, Eldridge S, Griffiths C. Can a self-management programme delivered by a community pharmacist improve asthma control? A randomised trial. Thorax 2003;58:851-854.
29. Chan DS, Callahan CW, Sheets SJ, et al. An internet-based store-and-forward video home telehealth system for improving asthma outcomes in children. Am J Health Syst Pharm 2003;60(19):1976-1981.
30. Lozano P, Finkelstein JA, Carey VJ, et al. A multisite randomized trial of the effects of physical education and organization change in chronic asthma chronic-asthma care: health outcomes of the Pediatric Asthma Care Patient Outcomes Research Team II Study. Arch Pediatr Adolesc Med 2004;158(9):875-883.
31. Tong S, Drake P. Hospital admission and mortality differentials of asthma between urban and rural populations in New South Wales. Aust J Rural Health 1999;7:18-22.
32. Health Canada. Health Canada definitions of "rural" summary page. http://www.hc-sc.gc.ca/english/pdf/rural_health/Rural_Executive_Summary.pdf (Accessed February 12, 2005).