

Provision of Dermatologic Care in a Universal Health Care System: A 17-Year Review

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Abstract

Background: Limited data is available on the burden of dermatologic disease including disease distribution and providers of care. Research is needed to facilitate health care planning and improve patient care.

Objectives: To investigate the demographics and economics of the provision of dermatologic care in a universal health care system from fiscal year 2000 to 2016.

Methods: A retrospective population-based analysis was performed on physician billing claims for dermatologic conditions from April 1, 2000 to March 31, 2017. Data came from the province of Ontario's universal health care plan claims records accessed through IntelliHealth.

Results: Dermatologic claims made up 3.6% of all physician claims, with a 20% increase seen over time. The cost of dermatologic claims increased by 70% between fiscal 2000 and 2016, with the average cost per claim increasing by 41%. However, the cost of dermatologic claims as a percentage of all health care claims experienced a decline from 3.5% in fiscal 2000 to 2.8% in fiscal 2016. Over the study period, family physicians submitted 56% to 62% of dermatologic claims, dermatologists 24% to 29%, pediatricians 3% to 4%, and internists 1%. Overall, internists billed the highest average cost per dermatologic claim ranging from \$39 in 2000 to \$60 in 2016, followed by pediatricians at \$33 to \$58, dermatologists at \$28 to \$39, and family physicians at \$23 to \$30.

Conclusions: The demographic and economic burden of dermatologic disease is changing over time, with implications for health care planning, advancing medical education, and patient care.

Keywords

dermatology, epidemiology, costs and cost analysis, health services research, demographics

Introduction

Worldwide, skin diseases continue to be the 4th leading cause of nonfatal disease burden.¹ The burden of skin disease is increasing in Canada, with half of Canada's population suffering from some form of skin condition, disease, or trauma.²⁻⁴ In 2017, skin and subcutaneous diseases had an incidence of 37,898 cases per 100,000 and prevalence of 28,409 cases per 100,000, an increase of 4% and 7%, respectively, from 1990.⁴

Given the variation in delivery models of care between different health care systems, we investigated the demographic and economic burden of dermatologic disease in the context of a universal health care system using data from Ontario, Canada. The information collected in this study will facilitate health care planning and help tailor medical education development for nondermatologists.

Material & Methods

Data Source

Ontario is the most populous province in Canada with approximately 14.7 million inhabitants.⁵ The Ontario government provides its citizens with universal health care

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through the Ontario Health Insurance Plan (OHIP), and physicians receive fee-for-service payment. Access to OHIP data were obtained through IntelliHealth, a database operated by the Ontario Ministry of Health and Long-Term Care, which has been utilized in prior population-based studies on physician billing and practices.⁶⁻¹¹ Information for this study is from the Medical Services database, which includes detailed patient, physician, and medical service information. Data obtained through IntelliHealth is anonymized and publicly available. Therefore, research ethics board approval was not required.

Study Population

This study analyzed billing information from physicians licensed to practice in Ontario from April 1, 2000 to March 31, 2017, with a focus on those who submitted claims for common dermatologic conditions. Specific specialties analyzed in addition to dermatology included general and family practice, internal medicine, and pediatrics. These specialties were selected as they have been shown to have high rates of dermatologic encounters compared to other specialties.^{12,13}

Study Design

Common dermatologic conditions were defined as the top 20 ICD (*International Classification of Diseases*) diagnostic codes billed by dermatologists, accounting for 91.2% of all claims made by dermatologists. Claims with the diagnostic codes “diagnosis not required/not stated” and “other ill-defined conditions” were excluded due to diagnostic ambiguity. Dermatologic procedures were also analyzed for the final year of study and included biopsies, excision of premalignant and malignant lesions, cryotherapy, and curettage and electrodesiccation.

Data Analysis

Data were exported from IntelliHealth’s online system and analyzed using Microsoft Excel version 16.43. Analysis was undertaken on the distribution of dermatologic disease by patient and physician characteristics. Patient characteristics analyzed included sex, age, and geographic location. Physician characteristics analyzed included medical specialty and geographic location. Physician specialty was defined as the specialty most frequently billed. Geographic locations were determined based on the reported Local Health Integration Network (LHIN). As there exist 14 LHINs in Ontario, each LHIN was further classified as rural or urban, with a population of 1,000,000 used to distinguish between the two.^{6,9,10} Further analysis included procedures billed for dermatologic conditions, as well as the total economic burden of dermatologic conditions. To estimate costs, the number of claims submitted per fiscal year was multiplied by the assigned fee schedule code taken from the

corresponding version of the Ontario Schedule of Benefits for Physician Services.¹⁴⁻⁴⁶ Costs for add-on percentage premiums, including age premiums, as well as fees under independent consideration and accompanying assistant and anesthetist claims were unavailable and hence not included in the analysis.

Results

A total of 57,853 physicians who submitted claims for dermatologic diseases were included in the study. The top ICD diagnostic codes billed by dermatologists, family physicians, internists, and pediatricians are presented in Table 1. OHIP claims for dermatologic conditions increased by 20% across the study period. Of the conditions billed by dermatologists, “benign neoplasm of the skin, mole, pigmented naevus, dermatofibroma, seborrheic wart (216)” was billed most frequently, compared to “eczema, rash, allergic/atopic dermatitis, neurodermatitis (691)” which was the most common condition billed by family physicians, internists, and pediatricians. The top dermatologic conditions billed by dermatologists overlapped the most with the top 10 billed by family physicians (8/10), followed by pediatricians (6/10), and internists (5/10). Of total OHIP claims, dermatologic conditions comprised 5.3% of pediatricians’ claims, compared to 4.5% for family physicians and 0.5% for internists.

Patient demographics including sex and age are shown in Figure 1(a) and (b), respectively. In regard to patient sex, there was a slightly higher female to male ratio (54-56%:44-46%).

Family physicians submitted the most claims for dermatologic conditions across all years compared to dermatologists, internists, and pediatricians (Figure 2(a)). The percentage of claim distribution among the specialties remained relatively constant, with 56-62% of claims submitted by family physicians, 24-29% by dermatologists, 3-4% by pediatricians, and 1% by internists. However, dermatologists submitted significantly more dermatologic claims per physician across all fiscal years at 8,355-9,405, followed by 275-362 by family physicians, 160-254 by internists, and only 32-54 by pediatricians. Across the study period, out of total dermatologist claims, 16.6% were for cryotherapy, 3.4% for biopsies, 1.7% for curettage and electrodesiccation, and 0.7% for excisions of premalignant and malignant lesions, for a total of 22.5% of their claims. In comparison, for family physicians, out of dermatologic claims, 9.0% were for cryotherapy, 0.7% for biopsies, 0.3% for excisions of premalignant and malignant lesions, and 0.1% for curettage and electrodesiccation, for a total of 10.0%. Only 6.6% of dermatologic claims by internists were for the procedures studied, followed by 1.7% for pediatricians.

Claim distribution between dermatologists, family physicians, internists, and pediatricians varied by location of practice

Table 1. Top Dermatologic Diagnoses Billed by Specialty.

Physician specialty	Most billed dermatologic diseases ranked in order	No. (%) of claims submitted by specialty	% of total diagnosis claims
Dermatology	1. Other disorders of skin & subcutaneous tissue, hirsutism, scar (709)	5,147,341 (15.8%)	32.4%
	2. Benign neoplasm of the skin, mole, pigmented naevus, dermatofibroma, seborrheic wart (216)	4,601,357 (14.1%)	50.8%
	3. Carcinoma in situ of the skin (232)	3,132,088 (9.6%)	77.5%
	4. Warts, verruca (078)	2,775,157 (8.5%)	19.7%
	5. Eczema, rash, allergic/atopic dermatitis, neurodermatitis (691)	2,497,478 (7.7%)	11.9%
	6. Other skin malignancies, basal cell carcinoma (173)	2,429,112 (7.4%)	39.4%
	7. Psoriasis (696)	2,420,710 (7.4%)	66.8%
	8. Acne, acne vulgaris, sebaceous cyst (706)	2,270,768 (7.0%)	24.7%
	9. Hyperkeratosis, localized scleroderma, keloid, dry skin (701)	1,304,665 (4.0%)	46.9%
	10. Alopecia (704)	823,379 (2.5%)	59.7%
	11. Erythema multiforme, erythema nodosum, acne, rosacea, intertrigo, lupus erythematosus (695)	482,039 (1.5%)	42.1%
	12. Contact dermatitis (692)	347,154 (1.1%)	7.7%
	13. Other viral diseases, condylomata accuminata, rabies (079)	316,472 (1.0%)	3.7%
	14. Athlete's foot, ringworm of scalp, beard or foot (110)	218,215 (0.7%)	29.0%
	15. Melanoma of skin (172)	207,523 (0.6%)	16.5%
	16. Mycoses, other ringworm (117)	177,582 (0.5%)	16.1%
	17. Seborrheic dermatitis (690)	162,255 (0.5%)	18.5%
	18. Pruritus ani, other itchy conditions (698)	156,097 (0.5%)	17.5%
	19. Varicose veins of lower extremities, stasis ulcer (454)	148,697 (0.5%)	3.8%
	20. Haemangioma, lymphangioma, dermoid cyst (228)	136,781 (0.4%)	30.8%
General and Family Practice	1. Eczema, rash, allergic/atopic dermatitis, neurodermatitis (691)	16,564,053 (1.1%)	78.9%
	2. Warts, verruca (078)	10,780,247 (0.7%)	76.6%
	3. Other disorders of skin & subcutaneous tissue, hirsutism, scar (709)	8,645,764 (0.6%)	54.4%
	4. Other viral diseases, condylomata accuminata, rabies (079)	6,413,968 (0.4%)	76.0%
	5. Acne, acne vulgaris, sebaceous cyst (706)	5,704,215 (0.4%)	61.9%
	6. Contact dermatitis (692)	3,749,953 (0.3%)	83.2%
	7. Benign neoplasm of the skin, mole, pigmented naevus, dermatofibroma, seborrheic wart (216)	2,981,881 (0.2%)	32.9%
	8. Varicose veins of lower extremities, stasis ulcer (454)	2,269,390 (0.2%)	58.5%
	9. Hyperkeratosis, localized scleroderma, keloid, dry skin (701)	1,189,885 (0.1%)	42.8%
	10. Other skin malignancies, basal cell carcinoma (173)	1,170,105 (0.1%)	19.0%
Internal	1. Eczema, rash, allergic/atopic dermatitis, neurodermatitis (691)	209,554 (0.1%)	1.0%
	2. Melanoma of skin (172)	174,261 (0.1%)	13.8%
	3. Other disorders of skin & subcutaneous tissue, hirsutism, scar (709)	170,289 (0.1%)	1.1%
	4. Other viral diseases, condylomata accuminata, rabies (079)	102,661 (0.0%)	1.2%
	5. Pruritus ani, other itchy conditions (698)	95,827 (0.0%)	10.7%
	6. Contact dermatitis (692)	76,996 (0.0%)	1.7%
	7. Warts, verruca (078)	74,816 (0.0%)	0.5%
	8. Psoriasis (696)	74,743 (0.0%)	2.1%
	9. Varicose veins of lower extremities, stasis ulcer (454)	56,740 (0.0%)	1.5%
	10. Erythema multiforme, erythema nodosum, acne, rosacea, intertrigo, lupus erythematosus (695)	54,448 (0.0%)	4.8%

(Continued)

Table I. Continued

Physician specialty	Most billed dermatologic diseases ranked in order	No. (%) of claims submitted by specialty	% of total diagnosis claims
Pediatrics	1. Eczema, rash, allergic/atopic dermatitis, neurodermatitis (691)	1,482,696 (1.8%)	7.1%
	2. Other viral diseases, condylomata accuminata, rabies (079)	1,384,778 (1.7%)	16.4%
	3. Other disorders of skin & subcutaneous tissue, hirsutism, scar (709)	336,174 (0.4%)	2.1%
	4. Contact dermatitis (692)	277,857 (0.3%)	6.2%
	5. Warts, verruca (078)	239,792 (0.3%)	1.7%
	6. Acne, acne vulgaris, sebaceous cyst (706)	227,262 (0.3%)	2.5%
	7. Seborrheic dermatitis (690)	87,117 (0.1%)	9.9%
	8. Benign neoplasm of the skin, mole, pigmented naevus, dermatofibroma, seborrheic wart (216)	46,420 (0.1%)	0.5%
	9. Haemangioma, lymphangioma, dermoid cyst (228)	37,854 (0.1%)	8.5%
	10. Pruritus ani, other itchy conditions (698)	28,300 (0.0%)	3.2%

The table shows the number and percentage of total dermatologic claims submitted by each specialty, as well as the percentage of total diagnosis claims submitted by each specialty across the study period.

(Figure 2(b) and (c)). In urban settings, family physicians submitted 54-58% of dermatologic claims, while dermatologists submitted 28-32%. In comparison, in rural settings, family physicians submitted 63-71% of dermatologic claims, while dermatologists submitted 17-21%. Urban pediatricians and internists billed slightly more (4-5% and 1-2%, respectively) than rural ones (2-3% and 1-2%, respectively).

Geographically, 68-70% of claims were made by physicians in urban areas, while 30-32% were in rural areas (Figure 3). Overall, there was a greater rise in the number of dermatologic claims submitted in urban settings based on both patient and physician location. The number of claims submitted by physicians in urban settings exceeded the number of urban patients, while the number submitted by rural

physicians fell short of the number of rural patients, reflecting that rural patients are receiving care in urban settings.

The total cost of dermatologic claims submitted by physicians increased by 70% from \$161,325,818 in 2000 to \$273,683,203 in 2016 (Figure 4(a)). However, the cost of dermatologic claims as a percentage of all claims submitted by physicians experienced a decline from 3.5% in 2000 to 2.8% in 2016 (Figure 4(a)). Dermatologists, family physicians, internists, and pediatricians all experienced a rise in the average submitted cost per dermatologic claim (Figure 4(b)), with pediatricians experiencing a 75% increase per claim followed by internists at 52%, dermatologists at 43%, and family physicians at 35%. Overall, internists billed the highest average yearly cost per

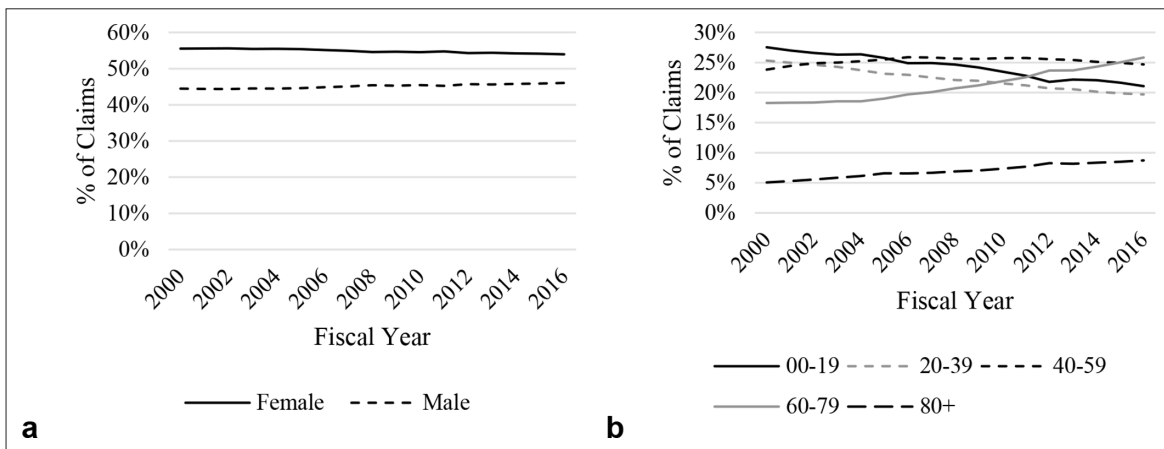


Figure 1. (a) Sex distribution of the most common dermatologic diagnoses by fiscal year. (b) Age-stratified breakdown of the most common dermatologic diagnoses by fiscal year.

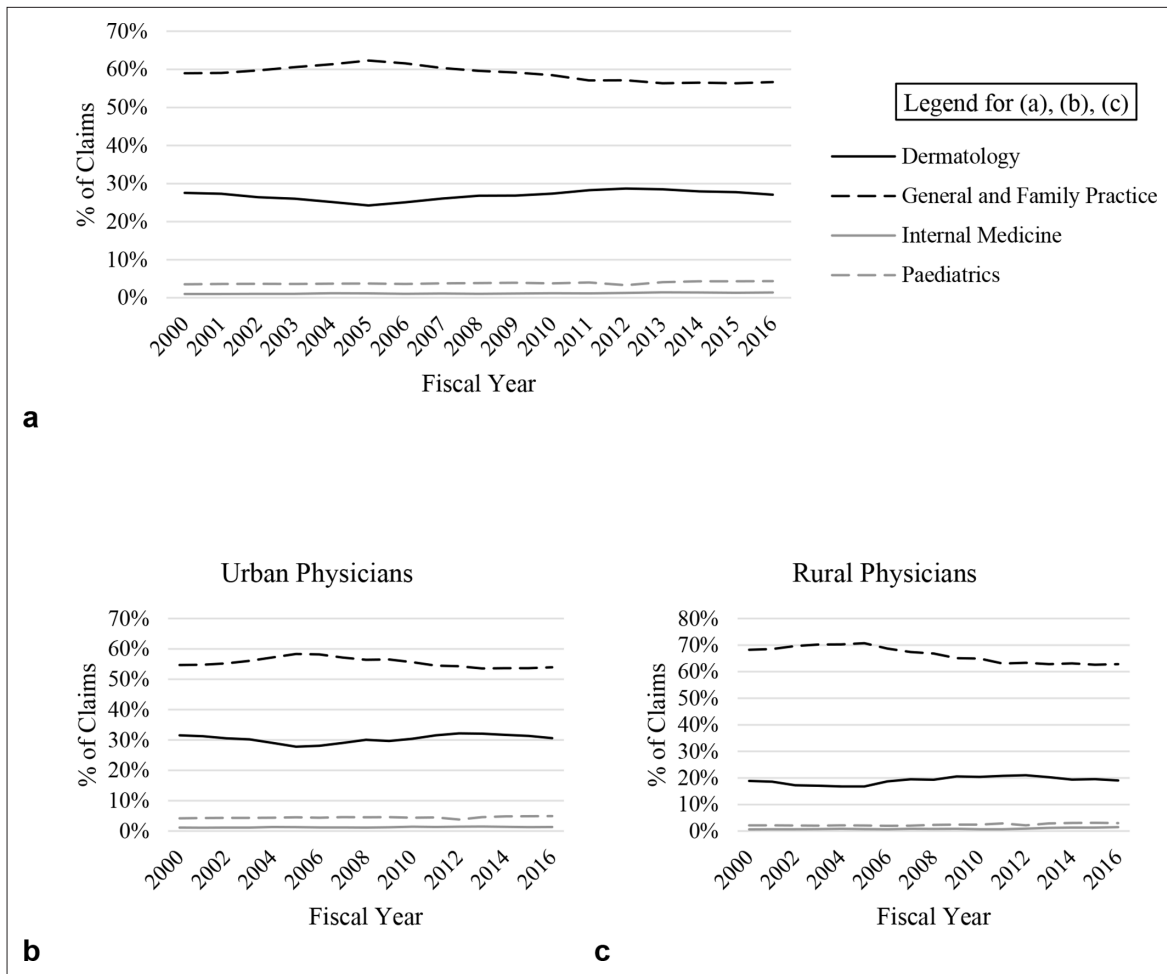


Figure 2. Percentage of dermatologic claim distribution among dermatologists, family physicians, internists and pediatricians by fiscal year for (a) all physicians, (b) urban physicians, and (c) rural physicians.

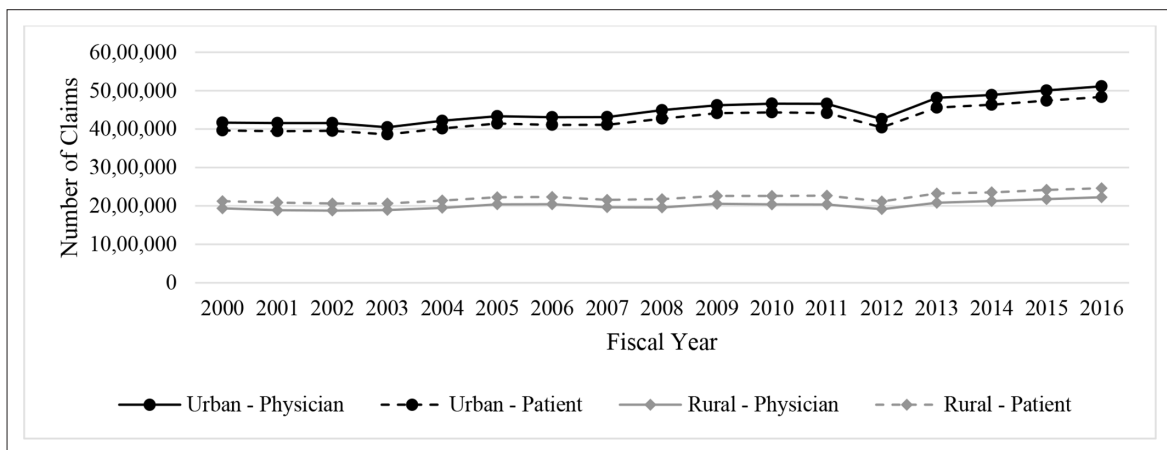


Figure 3. Geographic distribution of claims submitted for dermatologic diagnoses by patient and physician location by fiscal year.

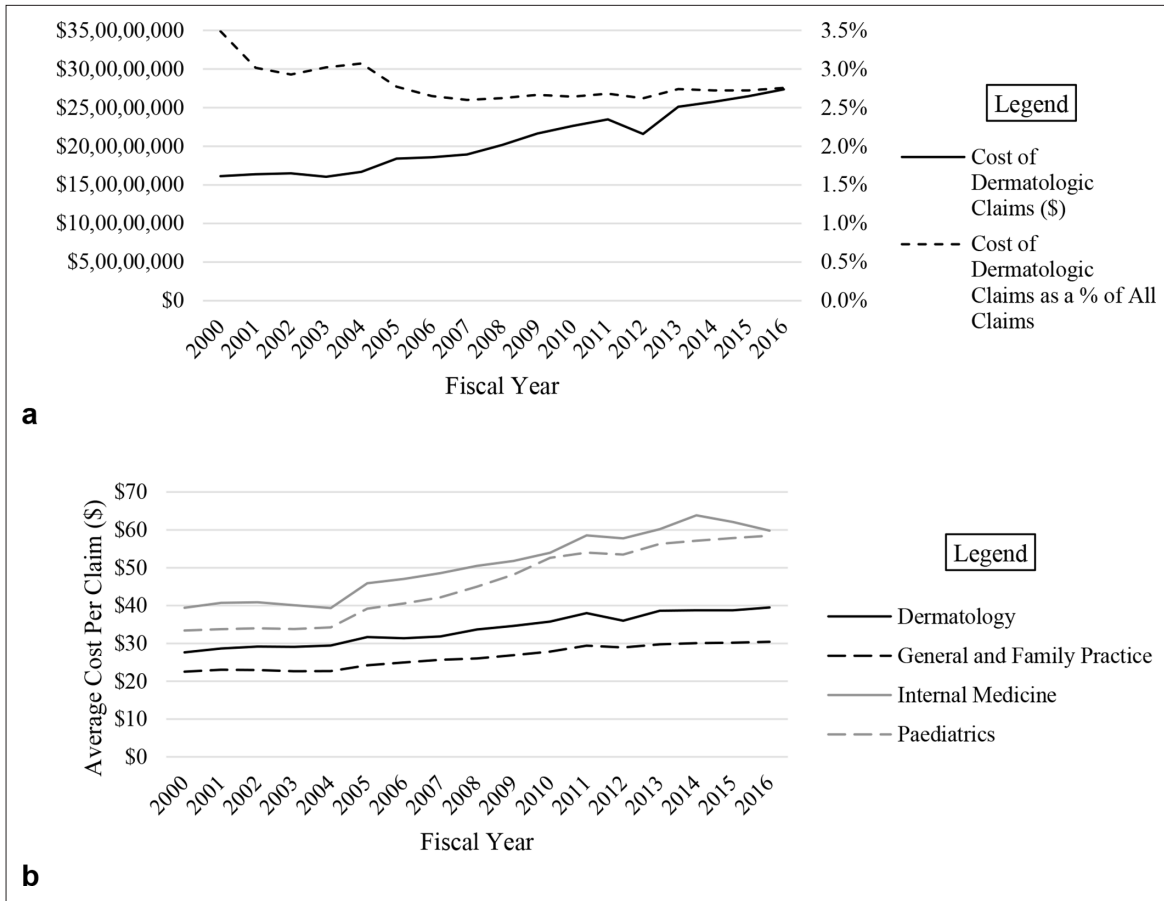


Figure 4. (a) Total cost of all dermatologic claims made by physicians by fiscal year compared to cost of dermatologic claims as a percentage of all claims submitted by physicians by fiscal year. (b) Average cost per dermatologic claim submitted by dermatologists, family physicians, internists, and pediatricians by fiscal year.

dermatologic claim ranging from \$39 in 2000 to \$60 in 2016, followed by pediatricians at \$33 to \$58, dermatologists at \$28 to \$39, and family physicians at \$23 to \$30.

Discussion

Burden of Dermatologic Disease

Dermatologic claims made up 3.6% of all physician billings in Ontario across 17 years, with a 20% increase seen in dermatologic claims across the study period. This is most likely explained by an 18% increase in Ontario’s population between 2000 and 2016,⁴⁷ along with a 19% rise in dermatologists practicing in Ontario over the study period (186 in 2000 to 221 in 2016) calculated using dermatologists who submitted at least one claim during the fiscal year.

Patient Demographics

The sex distribution of patients seen for dermatologic diseases remained relatively constant across the study period, comparable to the Canadian results from the 2017 Global Burden of Disease data where the incidence and prevalence

rates were similarly increased among males (4% and 8%, respectively) and females (5% and 7%, respectively) from 1990 to 2017.⁴ However, the average age of dermatologic patients increased. This is likely a reflection of Ontario’s aging population, with an increasing percentage of elderly compared to young individuals.⁴⁷ An aging population carries important implications for workforce planning and planning for increased geriatric dermatology.

Providers of Dermatologic Care

Our study showed that nondermatologists see the majority of dermatologic conditions, with the diagnostic profile of skin conditions presenting to dermatologists differing from that seen by nondermatologists; a finding reproduced from previous studies.^{12,13,48-52} In the United States, which lacks a universal health care system, 50% of skin-related visits were to nondermatologists,¹² with only 1 in 3 people with skin disease receiving care from a dermatologist.^{53,54} In the Netherlands, which possesses a universal health care system, 65.1% of patients with a skin disease were treated solely by their family physician.⁴⁸ In Ontario’s universal

health care system, dermatologists submitted 24-29% of dermatologic claims. However, when comparing the average number of dermatologic cases per physician, dermatologists saw approximately 38 times more cases per physician than all nondermatologists. Across the study period, dermatologic conditions comprised 4.5% of claims made by family physicians. In comparison to other universal health care systems, in Scotland 8.4% of all claims made by general practitioners were for dermatologic disorders,⁵² while in the Netherlands, skin diseases accounted for 12.4% of diseases seen by family physicians,⁴⁸ compared to only 6.8% in the United States where there is no universal health care.¹² Furthermore, in our study dermatologic conditions comprised 5.3% of claims made by pediatricians and 0.5% by internists, while in the United States 6.8% of pediatrician visits and 4.6% of internist visits were skin-related.¹² However, in the United States internists do non-referred primary care, and as they do not have a universal health care system, the true burden of skin disease data can be confounded when looked at through the lens of providers of care.

Among dermatologic conditions, eczema was billed most frequently by family physicians, internists, and pediatricians. This is in keeping with a review from the United States that found that dermatitis was the most common dermatologic problem diagnosed by internists, family physicians, and pediatricians.¹³ In addition, in our study eczema accounted for 25.4% of skin-related visits to family physicians, which is in line with a study in Scotland that found that eczema accounted for 22.5% of general practitioner dermatologic consultations.⁵² In comparison, benign neoplasms of the skin were billed most frequently by dermatologists. A study from the United States found that primary care physicians performed a limited number of diagnostic procedures, as the number one reason (26.1%) for referral to a dermatologist was for biopsy or excision of a suspicious skin lesion.⁵¹ This is reinforced by our finding that proportionally dermatologists performed a higher percentage of procedures for dermatologic conditions (22.5%) compared to their overall number of claims than family physicians (10.0%), internists (6.6%), and pediatricians (1.7%). These results emphasize the need for improved training for nondermatologists, particularly family physicians, in distinguishing between benign and malignant skin lesions, as well as further training in simple diagnostic procedures.

Overall, of the top 20 ICD diagnostic codes billed by dermatologists, dermatologists only submitted the majority of total claims for four of them. These included carcinoma in situ of the skin (77.5%), psoriasis (66.8%), alopecia (59.7%), and benign neoplasms of the skin (50.8%). In contrast, family physicians submitted the majority of total claims for contact dermatitis (83.2%), eczema (78.9%), warts (76.6%), other viral diseases

(76.0%), acne (61.9%), and varicose veins and stasis ulcers (58.5%). This highlights how a large proportion of dermatologic care that family physicians provide is composed of more minor skin infections, whereas patients more often seek dermatologist care for more complex conditions requiring systemic therapies or office-based procedures. This has likely only been magnified over time with the addition of the complex dermatology assessment code effective September 1, 2011.³⁶ Unsurprisingly, when comparing wart claims submitted by dermatologists to those by family physicians at the beginning of the study period in 2000 (23.7% and 72.0%, respectively) compared to the end of the study period in 2016 (17.1% and 78.6%, respectively) it was clear that wart care, likely along with other minor skin infections, was increasingly being provided by family physicians, reflecting a shift in complexity seen by dermatologists. Conversely, this also reflects that family doctors are increasingly tending to minor skin infections without the need for referral to dermatologists, reflecting an improvement in family doctors' practices in regard to dermatologic care. In addition, although primary care physicians make a wide range of dermatologic diagnoses, they have been shown to be concordant with those made by a dermatologist only 57% of the time.⁵¹ Therefore, part of this is likely due to misdiagnosis.

Geographic Burden of Dermatologic Disease

Family physicians in rural areas submitted significantly more claims for dermatologic diseases than dermatologists in comparison to an urban setting. This is likely due to the fact that there is a lack of specialist care in rural areas, with rural dermatology practices having a higher patient volume than urban ones.⁶ Rural family physicians likely have to take on more dermatologic cases, which is supported by data showing that rural family physicians have a broader scope of practice and perform a broader range of clinical procedures.⁵⁵ These results further emphasize the need for appropriate dermatologic training for family physicians, and in particular rural ones.

The greater percentage of dermatologic claims by dermatologists in urban areas is most likely due to specialists being more concentrated in urban areas compared to the general population.⁵⁵ As specialists, dermatologists require a large population base to support their practice, with an optimal dermatologist-to-population ratio of 1:62,650 as recommended by The Royal College of Physicians and Surgeons,⁵⁶ as many patients may only be seen once. Many rural areas with smaller populations would then naturally not have a local dermatologist. This has likely resulted in a percentage of rural patients traveling to urban areas to be treated. In addition, there has been an increase in the use of e-assessments by dermatologists,⁶ which have most likely been

performed by urban physicians with better access to technology and resources, thus increasing their billing.

Economic Burden of Dermatologic Disease

The cost of dermatologic claims made by physicians in Ontario increased by 70% across 17 years. Over the same time period, there was an average annual rate of inflation of 1.79%, resulting in 32.78% inflation.²³ Furthermore, the average yearly cost per dermatologic claim, although it increased overall, varied greatly between specialties. Reimbursement for internists and pediatricians were significantly higher than dermatologists and family physicians. Dermatologists, experts in skin disease, were thus paid less per visit than other physicians (namely internists and pediatricians), who naturally have less expertise in managing skin diseases and who in many cases will subsequently refer to dermatologists. This reflects a faulty remuneration structure which should be based on expertise in the disease. This is further reflected in the cost of consultations for each specialty. In the earliest Schedule of Benefits analyzed for fiscal 2000,¹⁵ internal medicine and pediatric consultations were billed at \$109.05, compared to dermatology consultations at \$51.85. In comparison, in the Schedule of Benefits for fiscal 2016,¹⁴ costs rose with pediatric consultations billed at \$167.00, internal medicine at \$157.00, and dermatology at \$72.15. Over the study period, this represents a consultation cost increase of 53.1% for pediatrics and 44.0% for internal medicine, compared to 39.2% for dermatology. This stresses the cost-saving implications, along with clinical expertise, of dermatologists providing dermatologic care over internists and pediatricians. Furthermore, the cost of dermatologic claims as a percentage of all claims experienced a decline from 3.5% in 2000 to 2.8% in 2016. Therefore, even though costs are rising in Ontario in regard to the treatment of dermatologic disease, they proportionally cost the health care system less compared to all other claims. In comparison, in the United States, it was found that the costs and prevalence of skin disease are comparable with, or exceed, other diseases with significant public health concerns including cardiovascular disease, diabetes, and end-stage renal disease.^{53,54}

A limitation of this study was the reliance on physician reporting of the diagnosis. The diagnostic codes that each physician chooses to bill under may vary, especially between dermatologists and nondermatologists, with the potential for misdiagnosis. In addition, many patients present with more than one complaint or condition, however claims are associated with single diagnoses, introducing some inaccuracy. The number of providers of dermatologic care most likely also included part-time physicians, those who commenced practice or retired partway through the fiscal year, as well as dermatologists who may

subspecialize, therefore not providing an exact image of the number of providers.

Another limitation of the study is that it only included 91.2% of all claims made by dermatologists, so a small subset of dermatologic conditions may not be included. In addition, data were missing for a small subset of claims, with 0.3% of patients and 0.1% of physicians having an unknown location, as well as 2.8% of dermatologic claims and 5.6% of total health care claims having an unknown cost. Not all costs were available as mentioned earlier, including add-on percentage premiums such as age premiums, primarily affecting claims made by pediatricians, new patient fees, fees under independent consideration, and accompanying assistant and anesthetist claims. This made it difficult to accurately present the economic burden of dermatologic disease and other health care claims over time, likely resulting in a slightly inaccurate depiction of costs. Lastly, since our data source contains only fee-for-service provider activity, physicians at some community health centers, health service organizations, and academic institutions may be excluded, as these providers are salaried or paid through alternative payment programs.⁵⁷

This study provides new insight into the demographic and economic burden of dermatologic disease, with important implications for health care planning, resource allocation, medical education development for nondermatologists, and improving patient care, including the expertise and cost-saving implications of dermatologists providing dermatologic care. Future investigations should focus on the specific burden of each major dermatologic condition, including more detailed information on the primary caregivers of each condition.

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