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A Cost-Effectiveness Model to Determine Ostomy-Related Costs of Care and Health Outcomes Among People With an Ostomy in Canada Using a Ceramide-Infused Skin Barrier

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ABSTRACT

PURPOSE: The aim of this study was to determine whether a difference exists in the financial impact of the use of a 2-piece ceramide-infused skin barrier (CIB) versus standard of care barrier (SOC) in Ontario and Alberta using a cost-effectiveness model over a 1-year period for people with a fecal or urinary ostomy.

DESIGN: A cost-effectiveness model adapted from a previously published work.

SUBJECTS AND SETTING: The model was populated with data inputs from a hypothetical cohort of 1000 individuals in Ontario and 4000 in Alberta. Model results were assessed for robustness via the use of deterministic and probabilistic sensitivity analyses. The provinces of Ontario and Alberta were chosen because cost data were readily accessible. The combined population of these provinces accounts for 50% of Canada's population.

RESULTS: An expected cost savings of Can$443.13 (US $322.60) and Can$243.84 (US $177.52) per user for the hypothetical cohort of 1000 individuals in Ontario and 4000 in Alberta per year was obtained for those using a CIB versus a non-infused skin barrier in Ontario and Alberta, respectively. The incremental cost effectiveness ratio (ICER) of CIB to SOC per peristomal skin complication (PSC) avoided and per quality-adjusted life day (QALD) gained was approximately Can$2702 (US $1967)/PSC and Can$1266 (US $922)/QALD for Ontario and approximately Can$1487 (US $1083)/PSC and Can$697 (US $507)/QALD for Alberta. Analysis indicated CIBs remained cost-effective across all sensitivity analyses performed.

CONCLUSIONS: Finding suggest that a CIB is cost-effective when compared to a barrier not infused with ceramide when applied to persons with an ostomy and residing in the provinces of Alberta and Ontario.

KEY WORDS: Ceramide, Colostomy, Cost-effectiveness, Ileal conduit, Ileostomy, NSWOC, Ostomy, Ostomy pouching systems, Skin barrier, Stoma, Urostomy.

INTRODUCTION

Approximately 13,000 new ostomy surgical procedures are performed annually in Canada and 70,000 Canadians are living with an ostomy; these rates are 120,000 and 800,00 when the population of Canada and the United States is combined.[1,2] The creation of a permanent or temporary ostomy is both a lifesaving and life-altering event; those living with an ostomy face physical, financial, and psychological challenges.[3] LeBlanc and colleagues[3] conducted a pan-Canadian cross-sectional survey on the impact of living with an ostomy. They reported that 15% of Canadians living with an ostomy frequently experience peristomal skin complications (PSCs; $P < .001$, $\chi^2 = 257.746$), and 19% ($P < .001$, $\chi^2 = 88.749$) indicated that living with an ostomy impacted their ability to work.

While living with an ostomy may have an effect on one's well-being, the geographical location of these individuals may

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have a significant impact on the availability of resources.[3] There are considerable differences in funding for ostomy supplies among provinces, such as flat rate funding, funding based on a percentage of costs, income-based funding, or no government funding. Despite different funding bundles, the reported out-of-pocket expenses are the same throughout Canada with 58% of individuals reporting that they pay for at least part of their supplies out of pocket. More than half of these individuals (62%) reported paying more than Can$500 (US $364) annually out of pocket and 75% indicated being forced to decide between buying ostomy supplies and paying for other daily costs such as food or prescription drugs. Study findings also revealed that individuals who sought assistance from a Nurse Specialized in Wound, Ostomy and Continence (NSWOC) spent less per year on ostomy supplies ($P < .001$, $\chi^2 = 231.267$) than those who did not seek assistance from an NSWOC. Given the financial impact living with an ostomy has on Canadians, it is imperative for NSWOCs and all WOC nurses to be cognizant of cost-effective health care solutions and services and to ensure this knowledge is transferred to individuals, care givers, and other health care professionals.

A ceramide-infused ostomy skin barrier is an example of a novel technology for ostomy products created with a focus on skin health.[4] Ceramides are extracellular lipids that are found in the stratum corneum. They play a key role in multiple functions of the skin including barrier function, renewal of skin layers, and immune functions.[5] Impaired ceramide levels in the skin have been linked to increased transepidermal water loss and inflammation, resulting in an increased likelihood of atopic dermatitis, acne, and pruritus. Pruritus or itching is a prevalent concern for people living with an ostomy.[1,6]

This study was undertaken to examine potential cost savings for individuals with an ostomy when using a ceramide-infused ostomy barrier (CIB) compared with a standard ostomy barrier (SOB) without ceramide. A hypothetical cost-effectiveness model was used to compare outcomes for individuals living in Ontario (flat rate funding) and Alberta (income-based funding), as examples of different Canadian funding models. Half of the hypothetical individuals were assumed to use the CIB and the other half the SOB. In order to meet this goal, we posed the following research questions. What is the difference in financial impact of the use of a CIB versus standard of care barrier (SOC) using a cost-effectiveness model over a 1-year period in the province of Alberta using the hypothetical cost-effectiveness model? What is the difference in financial impact of the use of a CIB versus SOC using the cost-effectiveness model over a 1-year period in the province of Ontario? What are the costs of care, PSCs, and quality-adjusted life days (QALDs) in a 1-year period for the provinces of Alberta and Ontario using the hypothetical cost-effectiveness model?

METHODS

We adapted a previous cost-effectiveness model that was developed to determine the ostomy-related cost of care and outcomes among persons with a new ostomy assumed to use a CIB versus SOC.[1,4] The ADVOCATE trial investigated ostomy-related health care costs over 12 weeks post-ostomy surgery in a group of 153 patients from 25 sites located in Canada, Europe, and the United States. Participants were randomly allocated using a block randomization and adaptive design. A second study used a hypothetical cohort of 1000 patients who recently underwent fecal ostomy, over a 1-year period. Half (n = 500) were assumed to use CIB and the remaining 500 were assumed to use SOC (flat barrier). Inputs to this cost-effectiveness model allow customization to a specific location of interest. Therefore, since ostomy care delivery differs between the province of Ontario and that of Alberta, we ran the model twice with inputs specific to both provinces. Ontario and Alberta were chosen as the provinces have different funding models, with Ontario having a flat rate funding and Alberta an income-based model.

The cost-effectiveness model analysis was based on 2 hypothetical cohorts of individuals post-ostomy surgery over a 1-year period. Half the individuals were assumed to use CIB and half were assumed to use SOC. Since funding for ostomy supplies is managed by a different budget than clinical care or medications, the model only includes the funded ostomy supplies in each province. The mix of users on each type of pouching system is based on historic database information from Hollister Incorporated and is clearly defined in Table 1.

Individuals living with an ostomy in Ontario are assumed to access their pouching supplies through a recognized retailer in the province (this example is modeled using ALBA Medical). The objective of this model is to demonstrate that, through the use of a CIB barrier, the consumer can potentially manage their health care expenditures more cautiously. Pouch changes are assumed to be as conservative as sensible, given this population is trying to manage supply purchase to a set amount funded by Ontario Health Services (Table 1).

TABLE 1.
Ontario—Distribution of Pouching Systems Assumed in Model

Type of Pouching System	Users	Pouching System Changes/wk
Standard of care cohort		
1-pc flat, extended wear barrier, drainable pouch	4%	1.1
1-pc convex, extended wear barrier, drainable pouch	3%	1.1
1-pc flat, standard wear barrier, drainable pouch	3%	2
2-pc flat, extended wear barrier with drainable pouch	27%	1.1 barrier 1.1 pouch
2-pc convex, extended wear barrier with drainable pouch	20%	1.1 barrier 1.1 Pouch
2-pc flat, standard wear barrier with drainable pouch	23%	2 barrier 2 pouch
2-pc convex, standard wear barrier with drainable pouch	20%	2 barrier 2 pouch
CIB cohort		
1-pc flat, CIB barrier, drainable	5%	1.1
1-pc convex, CIB barrier, drainable	5%	1.1
2-pc flat, CIB barrier with drainable pouch	52%	1.1 barrier 1.1 pouch
2-pc convex, CIB barrier with drainable pouch	38%	1.1 barrier 1.1 pouch

Abbreviations: CIB, ceramide-infused barrier; pc, piece.

TABLE 2.
Alberta—Distribution of Pouching Systems Assumed in Model

Type of Pouching Supplies	Users	Pouching System Changes/wk
Standard of care cohort		
1-pc flat, extended wear barrier, drainable pouch	7%	2.5
1-pc convex, extended wear barrier, drainable pouch	7%	2.5
1-pc flat, standard wear barrier, drainable pouch	4%	3.75
2-pc flat, extended wear barrier with drainable pouch	31%	2.5 barrier 3.75 pouch
2-pc convex, extended wear barrier with drainable pouch	31%	2.5 barrier 3.75 pouch
2-pc flat, standard wear barrier with drainable pouch	10%	3.75 barrier 3.75 pouch
2-pc convex, standard wear barrier with drainable pouch	10%	3.75 barrier 3.75 pouch
CIB cohort		
1-pc flat, CIB barrier, drainable	9%	2.5
1-pc convex, CIB barrier, drainable	9%	2.5
2-pc flat, CIB barrier with drainable pouch	41%	2.5 barrier 3.75 pouch
2-pc convex, CIB barrier with drainable pouch	41%	2.5 barrier 3.75 pouch

Abbreviations: CIB, ceramide-infused barrier; pc, piece.

Individuals in Alberta are assumed to access their supplies through the Alberta Aids to Daily Living (AADL). Pouch changes and supply costs are determined by the benchmark set by the AADL. The objective of the model is to quantify the economic impact to the Alberta Health Services (Table 2).

DATA ANALYSIS

Study outcomes were PSCs (the model allowed for up to 2 PSCs during the 1-year period of interest) and QALDs. Quality-adjusted life days represent participants' daily quality of life; a value of 1 refers to 1 day in optimal health, and a value of 0 refers to death. As described by Berger and colleagues,[4] individuals accrue 1 of 4 possible QALD values daily, as follows: uncomplicated ostomy, mild PSC, moderate PSC, or severe PSC. The model assigns one QALD estimate for each day spent without PSC (defined herein as "uncomplicated ostomy") and a separate QALD estimate for each day spent with PSC (1 of 3 estimates, based on severity of the PSC). The sum of QALDs during the days spent with or without a PSC (ie, uncomplicated ostomy) was calculated to derive the total expected QALDs per patient over a 360-day period. Costs (in Can$) included those related to skin barriers, ostomy accessories, and care of PSCs. The incremental cost-effectiveness of CIB versus SOC was estimated as the incremental cost per PSC averted and QALD gained, respectively; net monetary benefit of CIB was also estimated. Analyses were run using the perspective of an ostomy end user/patient in Ontario, Canada, and the Alberta Health Service–AADL in Alberta, Canada.[7]

Due to the inherent uncertainty of cost-effectiveness analyses, the model uses a deterministic sensitivity analysis (DSA) and probabilistic sensitivity analysis (PSA) to assess the uncertainty of input parameters and their corresponding consequences on decision-making. Each model input has an associated distribution based on its mean, standard deviation, and sample size.

RESULTS

Details regarding the cost-effectiveness model adopted for this study are informed by the findings of the original ADVOCATE trial, and the cost-effectiveness model we adapted is described in detail in the study by Berger and colleagues.[4] The cost-effectiveness model was populated with inputs from a hypothetical cohort of 1000 individuals accessing care in Ontario (Table 3). All dollar amounts are in Canadian dollars (Can$); values in US dollars (US $) are provided in parenthesis (exchange rate: Can$1 = US $0.728). This cohort size was chosen for expository reasons given that the actual number of people who utilize the Ontario health service is unknown and this Health System provides a per-annum payment to the person living with an ostomy. The model found a potential ostomy-related cost savings of $443.13 (US $322.60) per user per year (see Table 3 for full results) for those using a CIB versus a non-infused skin barrier. The incremental cost-effectiveness ratio (ICER) of CIB to SOC per PSC avoided and per QALD gained is approximately $2702 (US $1967)/PSC and $1266 (US $922)/QALD, respectively. Assuming a willingness-to-pay (WTP) threshold of $137 (US $100)/QALD—based on a generally accepted $50,000 (US $36,400)/QALD—the net monetary benefit is approximately $491(US $357) for CIBs.

In the Alberta care setting, the model was populated with approximately 4000 hypothetical individuals (Table 4). This cohort size was based on numbers accessed through AADL of those who live with a stoma and access care through the Alberta Aids for Daily Living. The result in Alberta was a potential ostomy-related cost savings of $243.84 (US $177.52) per user per year for those using a CIB versus a noninfused skin barrier. The ICER of CIB to SOC per PSC avoided and per QALD gained is approximately $1487(US $1083)/PSC and $697(US $507)/QALD, respectively. Assuming a willingness-to-pay (WTP) threshold of $137(US $100)/QALD—based on a generally accepted $50,000 (US $36,400)/QALD—the net monetary benefit is approximately $292 (US $213) for CIBs.

Deterministic and Probability Sensitivity Analyses

The goal of the DSA is to assess the impact of each parameter (study variable) separately on model results. Each parameter is sequentially set to a user-specified low and high value (eg, ±20% of the base case value, the lower and upper 95% confidence interval). The outcome of the DSA is a "tornado plot," which provides a range of likely results depending on the parameter that is changed. The DSA on costs for each province is illustrated in Figures 1 and 2.

Probabilistic sensitivity analysis assesses the robustness of model results to underlying uncertainty of its input parameters. All model inputs are varied simultaneously using the associated distributions across several simulation runs. For each simulation run with a newly varied set of inputs, incremental cost, incremental QALD, and ICER results are calculated. The resulting distribution of results can be depicted graphically on

TABLE 3.
Ontario Model Ostomy Results

	Standard of Care	Ceramide-Infused
Groups	500	500
PSCs		
Individuals experiencing only 1 PSC	253	195
Individuals experiencing 2 PSCs	22	10
Patient experiencing no PSC	225	295
Total PSC events	297	215
QALD		
Total QALD (cohort)	135,189	135,363
Per-patient average	270.38	270.73
Usual care pouching supply cost	Can$781,956 (US $569,264)	Can$581,540 (US $423,361)
PSC-related pouching supply and accessory costs	Can$821,912 (US $598,35)	Can$600,345 (US $437,051)
Per-patient average resource use	Can$1,644 (US $1,197)	Can$1,201 (US $874)
Incremental savings per patient per year		*− Can$443.13 (− US $322.60)*

Abbreviations: PSC, peristomal skin complication; QALD, quality-adjusted life days.

the cost-effectiveness plane (CEP), which shows the expected incremental cost of CIB against its corresponding expected incremental QALDs, both values versus SOC, recorded for each simulation run. The base case value is plotted as the deterministic result as a basis of comparison. The CEP can be divided into 4 quadrants comparing CIB relative to SOC: the lower right quadrant indicates that CIB costs less to use and has a higher QALD for the patient (CIB dominates SOC); the upper left quadrant indicates that CIB costs more to use and has lower QALD (CIB is dominated by SOC); the upper right quadrant indicates CIB costs more to use but has a higher QALD; and the lower left quadrant indicates CIB costs less to use but has a lower QALD. Probabilistic sensitivity analyses based on 1000 runs for each province are illustrated in Figures 3 and 4.

Figure 1 displays the top 20 model inputs examined in the DSA for the Ontario analysis. The 3 primary cost drivers of the cost savings realized in the Ontario model are (1) the percentage of SOC individuals using a 2-piece flat ostomy pouching system, (2) the proportion of SOC individuals using flat ostomy rings, and (3) the proportion of CIB individuals using a flat ostomy ring. For instance, when the percentage of SOC individuals using 2-piece flat skin barriers is increased to an upper bound of 38% (relative to base per case value of 27%), the yearly cost-savings of CIB decreases to $379 (US $276), relative to base per case value of $443 (US $323). Conversely, when the percentage of individuals using 2-piece flat skin barriers is decreased to an 18% (lower bound value), the yearly cost-savings of CIB increases to $500 (US $364). This can be seen in Figure 1, as shown by

TABLE 4.
Alberta Model Ostomy Results

Alberta	Standard of Care	Ceramide-Infused
Groups	2031	2031
PSCs		
Individuals experiencing only 1 PSC	1,026	791
Individuals experiencing 2 PSCs	91	42
Patient experiencing no PSC	914	1,198
Total PSC events	1,208	875
QALD		
Total QALD (cohort)	549,138	549,843
Per-patient average	270.38	270.73
Usual care pouching supply cost	Can$7,010,184 (US $5,103,414)	Can$6,636,489 (US $4,831,364)
PSC-related pouching supply and accessory costs	Can$7,288,497 (US $5,306,026)	Can$6,793,264 (US $4,945,496)
Per-patient average resource use	Can$3,589 (US $2,613)	Can$3,345 (US $2,435)
Incremental savings per-patient per year		*− Can$243.84 (− US $177.52)*

Abbreviations: PSC, peristomal skin complication; QALD, quality-adjusted life days.

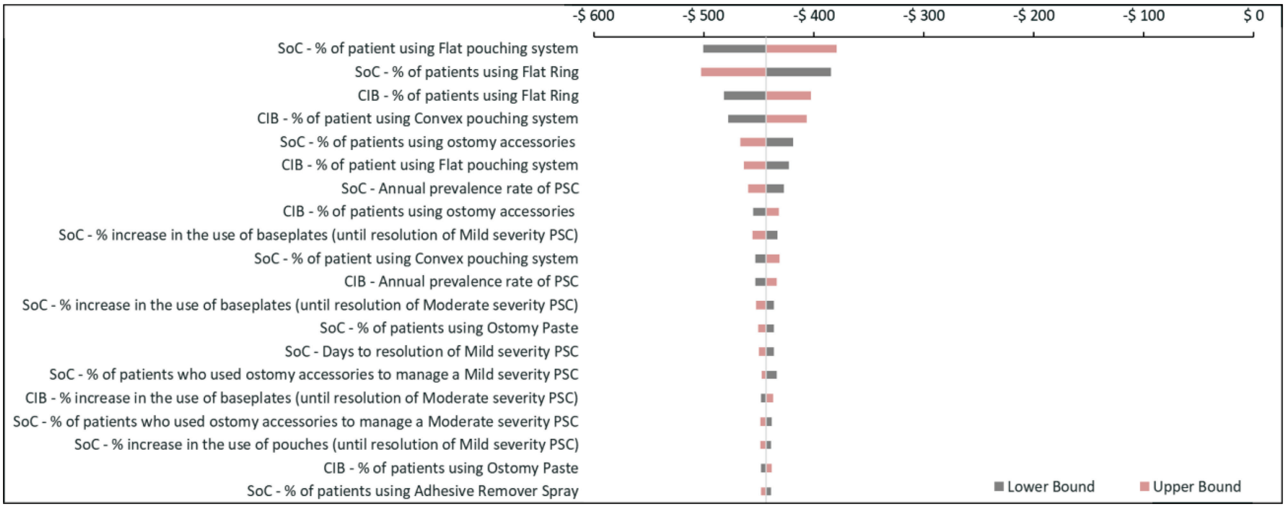

Figure 1. Ontario DSA cost. The vertical center line represents the base case yearly savings of Can$433 (US $323). The lower and upper bound values represent the yearly cost savings when each model parameter is changed to its respective lower and upper bound values. CIB indicates ceramide-infused barrier; DSA, deterministic sensitivity analysis; PSC, peristomal skin complication; SoC, standard of care.

the upper bound value of $367 (US $267) and the lower bound value of $500 (US $364). Table 5 presents the DSA results for the 3 primary cost drivers in detail. These 3 drivers vary the costs savings by at most ±$60 (US $44). Although the cost savings of CIB are less in some instances, it is important to consider that CIB remains cost-effective across all DSA parameters.

Figure 2 displays the top 20 model inputs examined in the DSA for the analysis of hypothetical individuals living in Alberta. The 3 primary cost drivers of the cost savings in this model were: (1) the percentage of SOC individuals using a flat ostomy ring; (2) the percentage of CIB individuals using a flat ostomy ring; and (3) the percentage of individuals on SOC initially using an ostomy accessory (at the onset of the modeling period). For instance, when the percentage of SOC individuals using a flat ring is increased to 61% (relative to the base case value of 47%), the cost-savings of CIB increases to $364 (US $265), as compared to the base case value of $244 (US $178). Table 6 summarizes the DSA results in detail for the 3 primary cost drivers. These 3 drivers vary the costs savings by at most ±$150 (US $109). Although the cost savings of CIB is decreased in some instances, it is important to consider that CIB remains dominant across all DSA parameters.

Figure 3 displays the PSA results of the Ontario model based on 1000 simulation runs. The red diamond represents the base case value of $443 (US $323) and 0.35 QALD. Seventy-one percent of the simulation results indicate that CIB is less costly and provides improved QALD relative to SOC (CIB dominates SOC; lower right quadrant). The remaining 29% of simulations indicate that CIB is less costly but results in less QALDs relative to SOC (lower left quadrant). Assuming

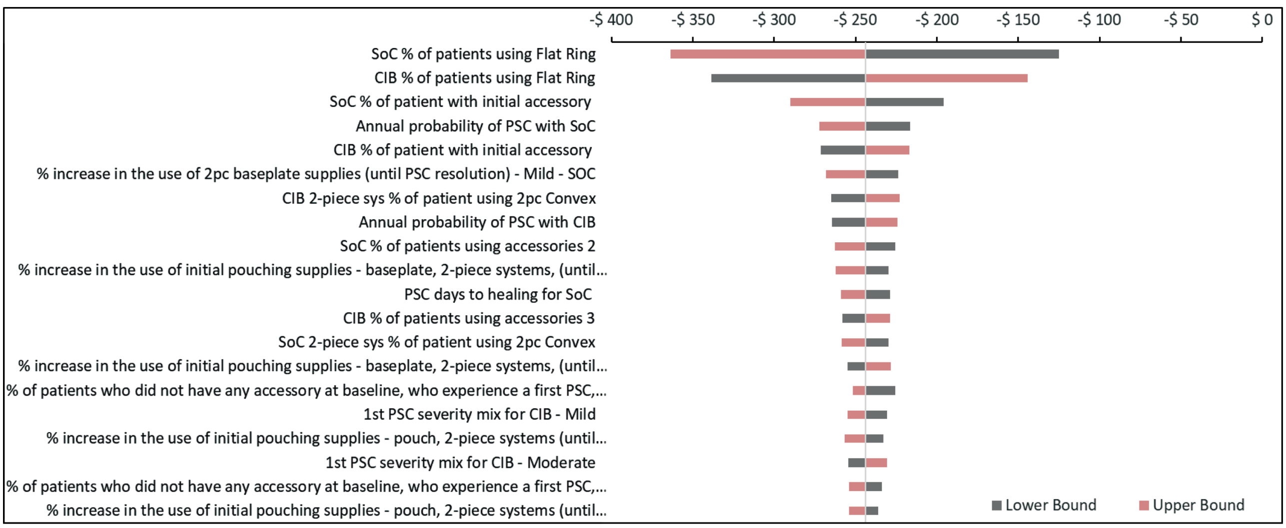

Figure 2. Alberta DSA cost. The vertical center line represents the base case yearly savings of Can$244 (US $178). The lower and upper bound values represent the yearly cost savings when each model parameter is changed to its respective lower and upper bound values. CIB indicates ceramide-infused barrier; DSA, deterministic sensitivity analysis; PSC, peristomal skin complication; SoC, standard of care.

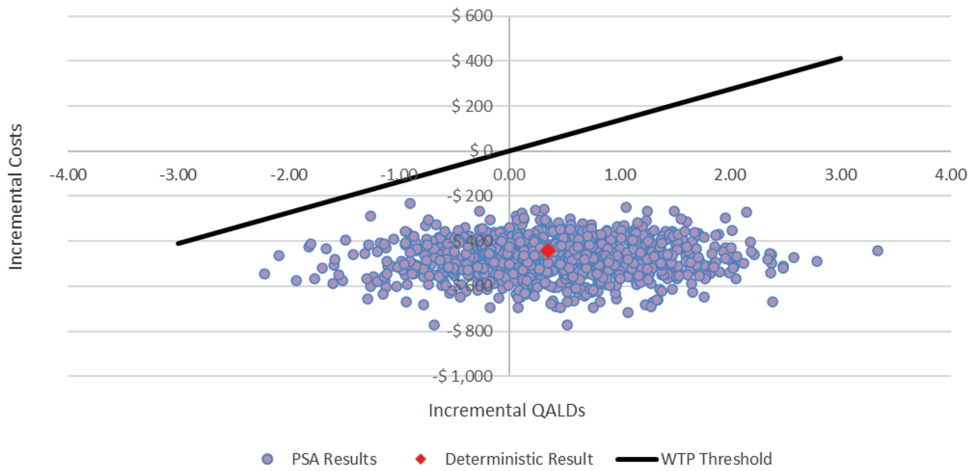

Figure 3. Ontario PSA. Use of CIB was found to be cost-effective in 100% of the simulations. The red diamond represents the base case value of −Can$433 (−US $323) and 0.35 QALDs. Negative incremental costs signify a reduction in costs associated with the use of CIB (ie, cost savings); positive incremental QALDs signify an increase in QALDs associated with the use of CIB (ie, gains in QALDs). The diagonal black line represents a WTP threshold of Can$137 (US $100)/QALD. CIB indicates ceramide-infused barrier; PSA, probabilistic sensitivity analysis; QALDs, quality-adjusted life days; WTP, willingness-to-pay.

a WTP threshold of $137 (US $100)/QALD (indicated by the diagonal line), CIB use was found to be cost-effective in 100% of the simulations. Although use of CIB may not lead to improved QALD, 100% of simulations indicate CIB results in cost savings compared to SOC.

Figure 4 displays the PSA results of the Alberta model based on 1000 simulation runs. The red diamond represents the base case value of $244 (US $178) and 0.35 QALD. Seventy-one percent of the simulation results indicate that CIB is less costly and provides improved QALD relative to SOC (indicating CIB dominates SOC; lower right quadrant). In 28.9% of the simulations, CIB was less costly but resulted in decreased QALDs relative to SOC. In 1/1000 (0.1%) of the simulations, CIB was more costly yet more effective than SOC. Assuming a WTP threshold of $137 (US $100)/QALD (indicated by the diagonal line), CIB was found to be cost-effective in 98.9% of the simulations.

DISCUSSION

The findings from this study demonstrate a significant difference in the financial impact of the use of a CIB versus SOC using a cost-effectiveness model over a 1-year period in both Alberta and Ontario. In Alberta, use of CIB was found to result in a cost savings of $244 (US $178) per patient per year. In Ontario, use of CIB resulted in a greater cost savings of $443 (US $323). Use of a CIB remained cost-effective across all parameters assessed in the deterministic sensitivity analyses. Furthermore, probabilistic sensitivity analyses indicate CIB was cost-effective in 100% of the Ontario simulations and 98.9% of the Alberta simulations. Combined, the sensitivity analyses demonstrate these cost savings are robust. Due to the difference in available funding between the provinces, the results are varied. The cost-effectiveness of ostomy products is of significance for both persons living with an ostomy and the Canadian health care system, including hospitals, community

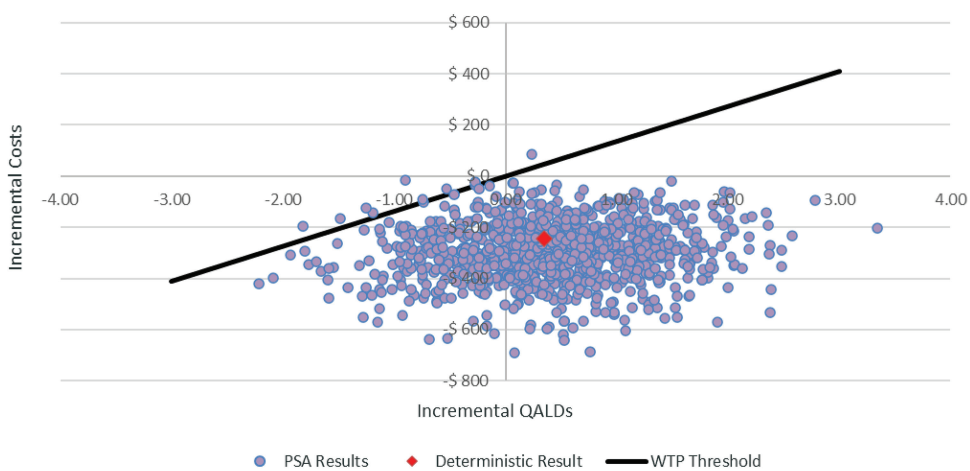

Figure 4. Alberta PSA. Use of CIB was found to be cost-effective in 98.9% of the simulations. The red diamond represents the base case value of −Can$244 (−US $178) and 0.35 QALDs. Negative incremental costs signify a reduction in costs associated with the use of CIB (ie, cost savings); positive incremental QALDs signify an increase in QALDs associated with the use of CIB (ie, gains in QALDs). The diagonal black line represents a WTP threshold of Can$137 (US $100)/QALD. CIB indicates ceramide-infused barrier; PSA, probabilistic sensitivity analysis; QALDs, quality-adjusted life days; WTP, willingness-to-pay.

TABLE 5.
Ontario DSA Cost Drivers

	Base Case		Lower Bound		Upper Bound	
Parameter	**Value**	**Cost[a]**	**Value**	**Cost[a]**	**Value**	**Cost[a]**
SOC individuals using 2-pc flat barriers, %	27%	−Can$443 (−US $232)	18%	−Can$500 (−US $364)	38%	−Can$379 (−US $276)
SOC individuals using a flat ring, %	47%	−Can$443 (−US $232)	33%	−Can$384 (−US $280)	61%	−Can$503 (−US $366)
CIB individuals using a flat ring, %	33%	−Can$443 (−US $232)	21%	−Can$481 (−US $350)	45%	−Can$403 (−US $293)

Abbreviations: CIB, ceramide-infused barrier; DSA, deterministic sensitivity analysis; pc, piece; SOC, standard of care.
[a]Negative costs indicate cost savings of CIB.

care, and long-term care. Within Canada, funding models for the ostomy products required for persons with a urinary or fecal diversion vary significantly between provinces. A recent study suggests that over 69% of Canadians pay for either a portion or the entire amount of their ostomy products out of pocket.[3]

In Alberta, those with a taxable income exceeding $20,970 (US $15,266) for a single person, $33,240 (US $24199) for a childless couple, or $39,250 (US $28,574) for a couple with children will receive 75% coverage through the AADL program, provided that they are assessed by an NSWOC and purchase supplies from an approved vendor. Within this program, the client is responsible for 25% of the cost of program benefits up to a maximum of $500 (US $364) per family per benefit year.[7] In Ontario, a fixed grant of $975 (US $710) per ostomy per year will be paid directly to the client in 2 installments. If a client is receiving social assistance benefits from either Ontario Works, Ontario Disability Support Program, or Assistance to Children with Severe Disabilities, they will receive a grant of $1300 (US $946) per ostomy per year in 2 installments.[8]

The difference in financial impact between CIB and SOC is directly correlated with the available funding provided by benefit programs in each province. Because the available funding is significantly higher in the province of Alberta, the relative cost savings for the client using CIB is less than that in Ontario.[7,8]

According to the cost-effectiveness model for Ontario, the resource used per client averages between $1201 (US $874) and $1644 (US $1197). In contrast, when the cost-effectiveness model was applied to Alberta, it fell between $3345 (US $2435) and $3589 (US $2613). Therefore, the difference in financial impact between the use of CIB and SOC is higher for someone living with an ostomy in Ontario as compared to someone living with an ostomy in Alberta. It is important to note that the use of CIB has a potential positive financial impact in both provinces.

These findings are supported by research conducted by LeBlanc and colleagues,[3] how reported costs associated with living with an ostomy are not exclusively related to the direct costs, such as purchasing ostomy products, but also to indirect costs, such as time away from work and hospital admissions, possibly related to PSCs. Wick and coworkers[9] suggest that individuals with an ostomy are 3 times more likely to be readmitted to the hospital for complications including PSCs than colorectal surgery individuals without an ostomy. Therefore, the use of CIB cannot only impact the direct cost of ostomy products, it can also help decrease indirect costs by preventing PSCs.[3]

Research indicates that the majority of people living with an ostomy report challenges managing their stoma and peristomal skin.[3,10] Bulkley and colleagues[10] found leakage or PSCs and subsequent frequent pouching system changes a predominant concern. Peristomal skin complications and leakage increase the cost of supplies via decreased wear time and added accessory products. Therefore, ostomy products, which have shown to be cost-effective related to the decrease of PSCs and leakage, such as CIBs, would be of significant benefit.[1,4] LeBlanc and colleagues[3] reported that individuals who sought assistance from an NSWOC reported lower skin complications and lower costs associated with product usage. It is noteworthy that in the province of Alberta, individuals must be assessed by an NSWOC in order to receive provincial funding. Therefore, it is unknown whether the difference in cost savings between Ontario and Alberta may be impacted by access to an NSWOC to assist with pouch selection.

Krouse and colleagues[11] reported that living with an ostomy negatively impacted a person's sense of peace, and their health-related quality of life (HRQoL) as related to social well-being. Since PSCs are associated with decreased HRQoL, the increased financial cost of products, the potential increase in anxiety related to the uncertainty of product wear time, and decrease in engagement in both work and social activities

TABLE 6.
Alberta DSA Cost Drivers

	Base Case		Lower Bound		Upper Bound	
Parameter	**Value**	**Cost[a]**	**Value**	**Cost[a]**	**Value**	**Cost[a]**
SOC individuals using a Flat ring, %	47%	−Can$244 (−US $178)	33%	−Can$125 (−US $91)	61%	−Can$364 (−US $265)
CIB individuals using a Flat ring, %	33%	−Can$244 (−US $178)	21%	−Can$338 (−US $246)	45%	−Can$144 (−US $105)
SOC individuals initially using accessories, %	66%	−Can$244 (−US $178)	55%	−Can$196 (−US $143)	77%	−Can$290 (−US $211)

Abbreviations: CIB, ceramide-infused barrier; DSA, deterministic sensitivity analysis; pc, piece; SOC, standard of care.
[a]Negative costs indicate cost savings of CIB.

outside of the home, CIBs facilitate reduced PSCs and costs along with increased HRQoL.[12]

Coons and coworkers[13] also found that difficulty paying for ostomy products was correlated with decreased HRQoL. For many Canadians, particularly those living on a limited, fixed income, the additional financial burden of purchasing ostomy products is substantial. A recent survey of Canadians living with an ostomy found that approximately 75% of respondents reported having to choose purchasing ostomy supplies versus other staples such as food, medications, leisure, or travel related costs.[3]

Hospitals, long-term care facilities, and community care providers are also impacted by the cost-effectiveness of ostomy products. Hospitals are experiencing increased demands on capacity and complexity of patients. Protocols such as enhanced recovery after surgery have been successful in optimizing individuals to reduce postoperative length of stay (LOS) and hospital readmissions.[14] Peristomal skin complications could lead to increased postoperative LOS, emergency department visits, or readmission to hospital, undermining these gains.[10] Cost-effective ostomy products that reduce PSCs will improve patient comfort and confidence when transitioning to home with their new ostomy.

LIMITATIONS

This study used a hypothetical cost-effectiveness model over a 1-year period for people with a fecal or urinary ostomy. Modeling studies have limitations such as a risk of incomplete data and, in the case of the current study, we were unable to track usage in Ontario. As a result, we estimated usage. Furthermore, the cost-effectiveness model assumes a patient will experience up to 2 PSCs per year—this estimate is not based on strong evidence of the true PSC rate in this population.

CONCLUSIONS

Findings from this study suggest that differences in financial impact of use of a CIB versus SOC using a cost-effectiveness model over a 1-year period in both Alberta and Ontario is significant. Further research is needed to determine whether these findings can be applied to individuals living throughout Canada with different funding sources.

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