NURSES SPECIALIZED IN WOUND, OSTOMY AND CONTINENCE CANADA
INFIRMIÈRES SPÉCIALISÉES EN PLAIES, STOMIES ET CONTINENCE CANADA

Canadian Journal of Wound, Ostomy and Continence

Journal canadien en plaies, stomies et continence

DECEMBER 2025 | DÉCEMBRE 2025 VOLUME 1 ISSUE | Nº 3

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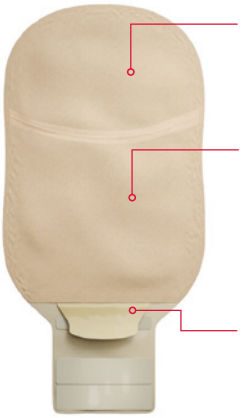

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Canadian Journal of Wound, Ostomy and Continence
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Overview / Aperçu

Canadian Journal of Wound, Ostomy and Continence, the official publication of Nurses Specialized in Wound, Ostomy and Continence Canada (NSWOCC®), is published three times annually. The journal is diamond open access with no publication fees. We accept professional news, research projects, clinical papers, case studies, reports, review articles, clinical questions, and letters to the editor. Feature Articles and Case Studies are peer-reviewed and should be submitted via www.cjwoc.ca.

Le Journal canadien en plaies, stomies et continence (JCPSC) est la publication officielle des Infirmières spécialisées en plaies, stomies et continence Canada (ISPSCC). Il est publié trois fois par année. Nous acceptons des contributions sous forme de nouvelles professionnelles, de revues de la littérature, projets de recherche, d'articles cliniques, d'études de cas, de rapports, de revues d'articles, de questions pour la section clinique et de lettres à l'éditeur. Les articles de fond et les études de cas sont évalués par des pairs et doivent être soumis sur www.cjwoc.ca.

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Message from the Editor-in-Chief • Message de la rédactrice en chef

Lina Martins, MScN, BScN, RN, NSWOC, WOCC(C), FNSWOC
Editor-in-Chief, Canadian Journal of Wound, Ostomy and Continence

Louise Forest-Lalande, inf., M.Ed., NSWOC, FNSWOC
Rédactrice du contenu francophone, Journal canadien en plaies, stomies et continence

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"Success is not measured by the money you make, but by your ability to change people's lives." — Michelle Obama

Every day, the Nurse Specialized in Wound, Ostomy and Continence (NSWOC) encounters individuals whose health is impacted by an ostomy, wound, or continence issue. Our NSWOC education has prepared us to address the many challenges these individuals face and to support them in regaining an optimal quality of life. NSWOC education is the foundation of our specialty, upon which we must continue to build to keep our knowledge current, as it is constantly evolving. Some clinical situations are familiar to us, others less so and reading the *Canadian Journal of Wound, Ostomy and Continence* (CJWOC) is a source of information that can inspire us and contribute to modifying our clinical practice through research and shared clinical experiences.

This publication focuses on pressure injuries (PI) and examines this issue from two different perspectives: research and prevention. Dr. Campbell, on behalf of the late Dr. Teague, shares her research on the physiological and environmental variables associated with complications of stage 4 PI in spinal cord injury patients following surgical repair. In 2024, the Nurses' Association of Ontario released updated recommendations for the assessment, prevention, and treatment of PI across Paediatric, adult, and older-adult populations. These recommendations are intended to support caregivers, patients, and families. Stade et al. have further described the three preventative areas of repositioning frequency, care bundles, and the use of prophylactic dressings for individuals at risk, within this issue of CJWOC.

A reassured, encouraged, and supported patient on his path to recovery is the goal of our specialty. Our work makes a huge difference, often without us realizing it.

We take this opportunity to wish you all the best for 2026! Please reflect on the satisfaction of having made a change in the lives of your patients through your ongoing commitment to increasing your knowledge around wound, ostomy and continence. We also have a small challenge for you for 2026: how about an article in the CJWOC? We would be delighted to support you in this project! •

Message from the Editor-in-Chief • Message de la rédactrice en chef

"La réussite ne se mesure pas à l'argent que vous gagnez mais à votre capacité à changer les vie des gens."
— Michelle Obama

Chaque jour l'infirmière spécialisée en plaies, stomies et continence (ISPSC) rencontre des personnes fragilisées par des soucis de santé liés à une stomie, une plaie ou un problème de continence. Notre formation d'ISPSC nous a préparé à faire face aux nombreux défis auxquels ces personnes sont confrontées, pour leur permettre de retrouver une qualité de vie optimale. La formation d'ISPSC est le fondement de notre spécialité sur laquelle nous devons continuer de bâtir pour tenir nos connaissances à jour, car elle évolue constamment. Certaines situations cliniques nous sont familières, d'autres moins, et la lecture du *Journal canadien plaies, stomies et continence* (JCPSC) est une source d'information qui peut nous inspirer et contribuer à modifier notre pratique clinique grâce aux résultats de recherche et d'expériences cliniques partagées.

Cette publication met l'accent sur les lésions de pression (LP) et examine cette problématique sous deux angles différents, la recherche et la prévention. Dr. Campbell, au nom de la regrettée Dr. Teague partage ses recherches sur les variables physiologiques et environnementales associées aux complications de LP de stade 4 chez des blessés médullaires, suite à une réparation chirurgicale. En 2024, l'Association des infirmières et infirmiers de l'Ontario a publié une mise à jour de ses recommandations concernant l'évaluation, la prévention et le traitement des LP chez les populations pédiatrique, adulte et âgée. Ces recommandations visent à soutenir les soignants, les patients et leurs familles, en fournissant des directives sur la fréquence des repositionnements, la mise en œuvre de programmes de soins préventifs, ainsi que l'utilisation de pansements prophylactiques pour les personnes à risque. Stade et al. ont également décrit plus en détail, dans ce numéro du JCPSC, les trois domaines de prévention que sont la fréquence de repositionnement, les protocoles de soins et l'utilisation de pansements prophylactiques pour les personnes à risque.

Un patient rassuré, encouragé et soutenu tout au long de son rétablissement constitue l'objectif de notre spécialité. Notre travail fait une immense différence, souvent sans que nous en ayons pleinement conscience.

Nous profitons de l'occasion pour vous offrir nos meilleurs vœux pour 2026! Repensez à la satisfaction d'avoir fait un changement dans la vie de vos patients grâce à votre engagement continu à approfondir vos connaissances en matière de plaies, de stomie et de continence. Nous vous proposons aussi un petit défi pour 2026, pourquoi pas un article dans le JCPSC? C'est avec plaisir que nous vous accompagnerons dans ce projet! •

Message from the NSWOCC President • Message du président de l'ISPSCC

Corey Heerschap, PhD, MScCH, RN, NSWOC, WOCC(C), FNSWOC
President, Nurses Specialized in Wound, Ostomy and Continence Canada (NSWOCC)

Président de l'association des Infirmières spécialisées en plaies, stomies et continence Canada (ISPSCC)

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Gratitude and Growth as the Year Ends

Dear Friends and Colleagues,

As winter settles across the country and 2025 ends, I am filled with gratitude and excitement for the remarkable progress NSWOCC has made since my last message.

Since our last Journal issue in September, we have continued to advance our strategic priorities. The board has been diligently seeking out our next Chief Executive Officer and plans to have news to share early in the new year. We have also had several exciting leadership updates to share:

- Troy Curtis, has been promoted to Chief Operating Officer of NSWOCC
- Bruce Millar, with over 30 years of experience in finance and leadership has joined our team as the Chief Financial Officer and Human Resources Manager
- Dr. Kevin Woo has taken on the role of Chief Research Officer, leading a new NSWOCC Research Centre of Excellence
- Jonathan Mancor has taken on the role of Program Coordinator for the Wound, Ostomy and Continence Institute

Please join me in congratulating and welcoming this team of exceptional individuals who will assist with moving the association forward in the years to follow.

The WCET®-NSWOCC® 2026 Joint Congress planning is well underway. I hope that you can join me in beautiful Vancouver, British Columbia April 24th to 28th for this global sharing of wound, ostomy and continence expertise. An outstanding lineup of international and Canadian keynote speakers have been secured.

Our core programs continue to move forward with new best practice recommendations. Work on the next update to the Nurses Specialized in Wound, Ostomy and Continence Standards of Practice is now underway, led by Allison Lachaine, the Core Program leader for Professional Development. This also marks the final issue of Volume 1 of the *Canadian Journal of Wound, Ostomy and Continence* and I would like to commend the team and Editor-in-Chief Lina Martins for the exceptional work developing our journal into an academic success. It is also with great excitement that I share the news that the Ontario Ministry of Long-Term Care has announced funding for 150 Registered Practical nurses to complete the Skin Wellness Associate Nurse Program as well as 600 Personal Support Workers (PSW) to complete the PSW and Caregiver Skin Health Education Course. This significant investment in wound, ostomy and continence within the Long-Term Care sector is set to have a sustained, high impact on the care of Ontario's most vulnerable.

As I write what is my second-to-last President's Message, I'm struck by how quickly these past two years have gone. What felt like so long when I began has turned into just a moment, one filled with challenges, growth, and more shared accomplishments than I could ever imagine. Serving as your President has been a privilege, and I am profoundly grateful for the opportunity. As we move into 2026, let us carry forward this same spirit of innovation, compassion, and collaboration. I look forward to seeing many of you in Vancouver as we write the next chapter of NSWOCC together.•

Message from the NSWOCC President • Message du président de l'ISPSCC

Gratitude et croissance à l'aube de la fin de l'année

Chères amies, chers amis et collègues,

Alors que l'hiver s'installe partout au pays et que l'année 2025 tire à sa fin, je ressens une profonde gratitude et un grand enthousiasme devant les progrès remarquables réalisés par l'ISPSCC depuis mon dernier message.

Depuis la parution de notre dernier numéro du Journal en septembre, nous avons poursuivi l'avancement de nos priorités stratégiques. Le conseil d'administration travaille avec rigueur à la recherche de notre prochaine directrice générale ou de notre prochain directeur général et prévoit pouvoir partager des nouvelles à ce sujet au début de la nouvelle année. Nous avons également plusieurs mises à jour importantes à annoncer au sein de notre équipe de direction :

- Troy Curtis a été promu au poste de chef de l'exploitation de l'ISPSCC
- Bruce Millar, fort de plus de 30 ans d'expérience en finance et en leadership, s'est joint à notre équipe à titre de chef des finances et gestionnaire des ressources humaines
- Le Dr Kevin Woo a assumé le rôle de chef de la recherche, à la tête du nouveau Centre d'excellence en recherche de l'ISPSCC
- Jonathan Mancor a assumé le rôle de coordonnateur de programme pour l'Institut de soins des plaies, des stomies et de la continence

Je vous invite à vous joindre à moi pour féliciter et accueillir cette équipe de personnes exceptionnelles qui contribueront à faire progresser l'association au cours des prochaines années.

La planification du Congrès conjoint WCET®-ISPSCC® 2026 est bien amorcée. J'espère que vous pourrez vous joindre à moi à Vancouver, en Colombie-Britannique, du 24 au 28 avril, pour ce grand rassemblement mondial consacré au partage de l'expertise en soins des plaies, des stomies et de la continence. Une impressionnante programmation de conférenciers principaux internationaux et canadiens a été confirmée.

Nos programmes de base continuent d'évoluer avec de nouvelles recommandations fondées sur les pratiques exemplaires. Les travaux sur la prochaine mise à jour des Normes de pratique des infirmières spécialisées en plaies, stomies et continence sont maintenant en cours, sous la direction d'Allison Lachaine, responsable du programme de base en développement professionnel. Ce numéro marque également la parution finale du volume 1 du Journal canadien des soins des plaies, des stomies et de la continence, et je tiens à souligner le travail exceptionnel de l'équipe et de la rédactrice en chef, Lina Martins, qui ont su faire de notre journal un véritable succès académique. C'est également avec grand enthousiasme que je partage la nouvelle selon laquelle le ministère des Soins de longue durée de l'Ontario a annoncé un financement permettant à 150 infirmières et infirmiers auxiliaires de suivre le programme de formation en bien-être de la peau, ainsi qu'à 600 préposés aux services de soutien à la personne (PSSP) et aux soignants. Cet investissement important dans les soins des plaies, des stomies et de la continence au sein du secteur des soins de longue durée aura un impact durable et significatif sur les soins offerts aux personnes les plus vulnérables de l'Ontario.

En rédigeant ce qui constitue mon avant-dernier message à titre de président, je suis frappé par la rapidité avec laquelle ces deux dernières années se sont écoulées. Ce qui me semblait long au départ est devenu un instant, rempli de défis, de croissance et de réalisations partagées bien au-delà de ce que j'aurais pu imaginer. Ce fut un privilège de vous servir à titre de président, et je vous en suis profondément reconnaissant. À l'aube de 2026, poursuivons dans cet esprit d'innovation, de compassion et de collaboration. J'ai hâte de vous retrouver nombreuses et nombreux à Vancouver afin d'écrire ensemble le prochain chapitre de l'ISPSCC. •

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Canadian Consensus Statement: The management of venous leg ulcers

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Harding et al, 2023


Professor Keith Harding

Leads:


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- *Dr Asem Saleh*
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- *Sheri McPhee*
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- *Maryse Beaumier*
- *Helen Arputhanathan*
- *Shannon Handfield*

Read the VLU consensus here:
https://sites.google.com/view/VLUconsensus
or scan the QR code below

1. Bull R et al. Int Wound J. 2023; 1–9
2. Jones N et al. Br J Nurs 2018; 27(20): S16-S21.

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Message from the Chief Executive Officer • Message de la directrice générale

Catherine Harley, eMBA, RN, IIWCC
Chief Executive Officer,
Nurses Specialized in Wound, Ostomy and Continence Canada (NSWOCC)

Directrice générale de l'Association des infirmières spécialisées en plaies, stomies et continence Canada (ISPSCC)

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The Whole is Greater than the Sum of the Parts – Aristotle

A happy new year to you all! I want to thank you all for your contributions. 2025 was another transformative year for Nurses Specialized in Wound, Ostomy and Continence Canada (NSWOCC®). It was a year in which we strengthened our core programs and the Wound, Ostomy and Continence Institute further, growing our organization by welcoming new members and rolling out important initiatives that will help to guarantee our continued success in the future.

Working together, we made good progress toward our strategic goals and partnered to launch important educational programs such as the Indigenous ECHO Skin and Wound program. We also completed our first Ontario Ministry of Health and Long-Term Care contract for the education of 90 Skin Wellness Associate Nurses (SWAN™) in Ontario Long-Term Care (LTC) facilities. We have now embarked on our second contract for 150 SWANs™ and 600 Personal Support Workers in Ontario LTC facilities.

One of our largest initiatives is the upcoming World Council of Enterostomal Therapy (WCET®) joint Congress with NSWOCC® which will take place at the Vancouver Convention Center April 24-28, 2026. Together, our collective passion for making wound, ostomy and continence care the best that it can be, has been the center of our collaboration with WCET®. We truly appreciate this opportunity to bring nurses who have specialized in wound, ostomy and continence together from around the world to share best practice and learn from each other.

I want to thank you for your continued commitment and effort. Every one of us has an important role to play in the work ahead and I'm confident that together we will achieve great things. I wish you and your loved ones a happy and successful 2026! •

Le tout est plus grand que la somme de ses parties – Aristote

Je vous souhaite à toutes et à tous une bonne et heureuse année ! Je tiens à vous remercier pour vos nombreuses contributions. L'année 2025 a été une autre année marquante pour l'Association des infirmières spécialisées en plaies, stomies et continence Canada (ISPSCC®). Nous y avons renforcé nos programmes phares ainsi que l'Institut de soins des plaies, des stomies et de la continence, tout en accueillant de nouveaux membres et en déployant d'importantes initiatives qui contribueront à assurer notre succès continu pour les années à venir.

En travaillant ensemble, nous avons réalisé de beaux progrès vers nos objectifs stratégiques et collaboré au lancement de programmes éducatifs clés, tels que le programme virtuel d'apprentissage ECHO autochtone sur les soins des plaies. Nous avons aussi complété notre premier contrat avec le ministère de la Santé et des Soins de longue durée de l'Ontario pour la formation de 90 infirmières et infirmiers en bien-être de la peau (SWAN™) dans les foyers de soins de longue durée (SLD) de l'Ontario. Nous avons maintenant entrepris notre deuxième contrat visant la formation de 150 SWANs™ et de 600 préposés aux services de soutien personnel dans les SLD de l'Ontario.

L'une de nos initiatives majeures est le prochain congrès conjoint du World Council of Enterostomal Therapists (WCET®) et de l'ISPSCC®, qui aura lieu au Vancouver Convention Centre du 24 au 28 avril 2026. Notre passion commune pour l'excellence des soins en plaies, stomies et continence demeure au cœur de notre collaboration avec le WCET®. Nous sommes véritablement reconnaissants d'avoir l'occasion de rassembler des infirmières et infirmiers spécialisés en plaies, stomies et continence de partout dans le monde afin de partager les pratiques exemplaires et d'apprendre les uns des autres.

Je vous remercie de votre engagement et de vos efforts continus. Chacune et chacun d'entre nous joue un rôle important dans le travail à venir, et je suis convaincue qu'ensemble, nous accomplirons de grandes choses. Je vous souhaite, ainsi qu'à vos proches, une année 2026 heureuse et remplie de succès ! •

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Ostomy / Stomies: Mary Engel
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View the full list of academic advisors at / Voir la liste complète des conseillers académiques: www.wocinstitute.ca.

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Exploring Factors Associated With Complications Among Persons With Spinal Cord Injury Undergoing Surgical Closure of Stage 4 Pelvic Pressure Injuries

ABSTRACT

This study examined physiological and environmental variables associated with wound complications in persons with spinal cord injury (SCI) who underwent surgical repair of stage 4 pelvic pressure injuries (PI). A cohort of 88 patients undergoing 100 surgeries at one tertiary care hospital in Toronto, Canada, was identified. Patient-specific risk and operative variables were obtained from patient records and administrative data. Bivariate and Poisson regression analyses were used to model predictors of open versus closed wounds, 3 to 6 weeks following the surgical procedures. Eighty-eight patients having 100 surgical encounters were identified. Twenty-nine percent of the surgical encounters in females were open at 3 to 6 weeks postoperatively. Patients who had received more than 50 homecare nursing visits in the year before the index surgical date were less likely to have an open incision at the surgical follow-up clinic visit (incidence rate ratio [IRR] = 0.49; 95% confidence interval [CI] = 0.24, 0.99; p = 0.048). Patients who required surgical revision were more likely to have an open incision at the surgical follow-up clinic visit (IRR = 1.89; 95% CI = 1.15, 3.09; p = 0.01). Increased age, living in northern Ontario, and smoking were linked to a higher risk of open incision, though these findings were not statistically significant. Female gender and having peripheral vascular disease were identified as reducing the risk of having an open incision at the surgical follow-up clinic visit, but the findings were not statistically significant. Complication rates (incision open at routine surgical follow-up) were found to be 37% in this sample of SCI patients undergoing surgical closure of stage 4 PI. Future prospective studies to mitigate some of the risk factors are warranted.

Key Words: Pressure injury, surgical reconstruction, spinal cord injury, complications, risk factors

Exploration des facteurs associés aux complications chez les personnes atteintes d'une lésion de la moelle épinière ayant subi une fermeture chirurgicale de lésions de pression pelviennes de stade 4

RÉSUMÉ

Cette étude a examiné les variables physiologiques et environnementales associées aux complications des plaies chez des personnes atteintes d'une lésion de la moelle épinière (LME) ayant subi une réparation chirurgicale de lésions de pression (LP) pelviennes de stade 4. Une cohorte de 88 patients ayant subi 100 interventions chirurgicales dans un hôpital de soins tertiaires à Toronto, au Canada, a été identifiée. Les facteurs de risque propres aux patients ainsi que les variables opératoires ont été extraits des dossiers médicaux et des données administratives. Des analyses bivariées et des régressions de Poisson ont été

utilisées pour modéliser les prédicteurs de plaies ouvertes par rapport aux plaies fermées, de 3 à 6 semaines après les interventions chirurgicales. Quatre-vingt-huit patients ayant eu 100 interventions chirurgicales ont été recensés. Chez les femmes, vingt-neuf pour cent des plaies chirurgicales étaient encore ouvertes de 3 à 6 semaines après l'intervention. Les patients ayant reçu plus de 50 visites de soins infirmiers à domicile au cours de l'année précédant la date chirurgicale de référence étaient moins susceptibles de présenter une incision ouverte lors de la visite de suivi chirurgical (rapport de taux d'incidence [RTI] = 0,49; intervalle de confiance [IC] à 95 % = 0,24–0,99; p = 0,048). Les patients ayant nécessité une révision chirurgicale étaient plus susceptibles de présenter une incision ouverte lors de la visite de suivi chirurgical (RTI = 1,89; IC à 95 % = 1,15–3,09; p = 0,01). L'âge avancé, le fait de vivre dans le nord de l'Ontario et le tabagisme étaient associés à un risque accru d'incision ouverte, bien que ces résultats n'aient pas été statistiquement significatifs. Le sexe féminin et la présence d'une maladie vasculaire périphérique ont été associés à une réduction du risque d'incision ouverte lors de la visite de suivi chirurgical, sans toutefois atteindre la signification statistique. Le taux de complications (incision ouverte lors du suivi chirurgical de routine) était de 37 % dans cet échantillon de patients atteints de LME ayant subi une fermeture chirurgicale de LP de stade 4. Des études prospectives futures visant à atténuer certains facteurs de risque sont justifiées.

Mots clés : Lésion de pression, reconstruction chirurgicale, lésion de la moelle épinière, complications, facteurs de risque

Conflicts of Interest:
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This article is based on a chapter in the doctoral research of Laura Teague that was originally completed in July 2020. Dr. Teague had begun the process of preparing her research for submission to *NSWOC Advance* (now the *Canadian Journal of Wound, Ostomy and Continence*) when she passed away in November 2023. Dr. Karen Campbell, a long-time colleague and friend of Laura's, continued the process, acting as a corresponding author, to ensure Laura's work was shared as she had intended. While Karen was able to revise the writing to suit our format, the research and references are Laura's own and were up-to-date at the time of her initial research. Her family has agreed to the publication of this work posthumously in her memory.

The corresponding author declares that there are no undisclosed conflicts of interest regarding the publication of this paper. David Breukelman agreed, as Laura's next of kin, for Karen Campbell to act on Laura's behalf in the preparation of this article and in providing NSWOCC with nonexclusive rights to publish and otherwise deal with or make use of this article, and any photographs/images contained in it, in Canada and all other countries of the world.

Dr. Dillon Browne agreed, as Gina Browne's next of kin, for Karen Campbell to act on Gina's behalf in the preparation of this article and in providing NSWOCC with no-exclusive rights to publish and otherwise deal with or make use of this article, and any photographs/images contained in it, in Canada and all other countries of the world.

All other authors consented directly to the corresponding author to provide NSWOCC with nonexclusive rights to publish and otherwise deal with or make use of this article, and any photographs/images contained in it, in Canada and all other countries of the world. All authors declare that there are no undisclosed conflicts of interest regarding the publication of this paper.

Availability of Data and Materials:
The data supporting the findings are available upon request from the corresponding author.

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INTRODUCTION

Spinal cord injury (SCI) is devastating to patients and their families, causing permanent disability, high morbidity, and mortality. In addition to immobility caused by the injury, denervation impairs wound healing in patients with SCI and increases their risk of developing pressure injuries (PIs).[1] Consequently, PIs are a common and serious secondary health issue for these individuals, resulting in both economic and medical burdens.[2-4]

The prevalence of PIs in the SCI population exceeds that of the general population and ranges from 8 to 59%.[2,3,5,6] Moreover, PIs in the SCI population impair quality of life, work or school attendance, and community integration.[1] In Canada, the economic burden of PIs in persons with SCI is significant but not fully understood. In a small Ontario sample of community-dwelling SCI persons, the estimated mean costs of a chronic PI were found to be C$4,725 per month, or C$56,700 annually.[7] In the US study by Brem et al,[8] the estimated direct healthcare cost of treating a single stage 4 PI in the community and the hospital was found to be US$124,327 and US$129,248, respectively. In a systematic review, the cost of PI treatment per patient across different healthcare settings ranged from €1.71 to €470.49 per day.[9] Countries included were Spain, US, Germany, France, Canada, and Italy.[9] A review of 52 cases of PI surgical closure in Denmark by Filius et al.[10] reported a mean direct cost of €20,957, with the majority of the cost being associated with hospitalization days.

PIs range in severity from non-blanchable erythema (stage 1) to full-thickness tissue loss (stage 4).[11] Best practice guidelines suggest that surgical reconstruction with a flap is an option for chronic stage 4 PIs that have failed more conservative approaches to treatment.[11-16] Patients become candidates for surgery after a comprehensive assessment. If they can be optimized nutritionally, are free of infection, are free of substance use (e.g., cigarettes, alcohol, and street drugs), and are willing and able to participate in postoperative recovery protocols, patients are offered surgical closure. Patients are assessed in a preadmission facility for anesthesia purposes. They undergo surgical reconstruction of the PI and recover on a therapeutic mattress while in the hospital for approximately 8 days. A 4–5 week institutionalization in rehabilitation or convalescent care with bed rest is always considered our standard of care. However, some patients choose to recover at home, as they have adequate resources and pressure redistribution mattresses to rest on. If the patient's incision remains closed 3–6 weeks after the surgical date, a progressive seating program in a rehabilitation centre is started.

Despite the efforts to select optimal surgical candidates, a systematic review of the literature and subsequent studies indicate that complication rates associated with PI surgical flap closure range from 8.9 to 58%.[13,17,18] Furthermore, PI recurrence rates among persons living with SCI whose PIs were treated through surgical flap closure ranged from 11 to 29% in cases with postoperative complications and 6 to 61% in cases without postoperative complications.[14,19-21] Reports describing various surgical flap treatments, complication rates, and risk factors for PI recurrence have identified the importance of structured rehabilitation care in the postoperative phase.[12,22] The high rate of surgical wound complications and the extensive costs associated with PI management suggest the importance of identifying predictors of wound complications.[12-14,17,23]

The purpose of this study was to explore factors associated with complications (open incision) of surgically reconstructed stage 4 PIs in SCI patients at 3 to 6 weeks' follow-up.

METHODS

Research Ethics Board approval was obtained from St. Michael's Hospital in Toronto, Ontario, as well as from the Institute of Clinical Evaluative Sciences (ICES) for the duration of the study. Data were obtained from an original cohort of adult SCI subjects studied to identify costs and healthcare utilization pre- and post-PI reconstruction, and were linked using a unique identifier to health administrative data (Figure 1). Of the 108 patients with 136 encounters, we excluded 11 (8.1%) patients who underwent surgery within 1 year. We further excluded 11 (10.2%) with 16 (11.8%) encounters as the outcomes were unknown. Finally, we excluded 7 (6.5%) patients with 7 (5.1%) missing covariates, which included income quintile and healthcare utilization in the 1-year lookback. In total, 88 patients with 100 procedures were included in this analysis.

Gender, age at time of SCI, age at time of surgery, level of SCI, completeness of SCI, rural address, Northern Ontario address, living status, employment status, neighbourhood income quintile, Charlson co-morbidity index, history of autonomic dysreflexia, smoking status, history of peripheral vascular disease, length of stay, revision surgery, discharge disposition, and 50+ community nursing visits in the year prior to surgery were recorded. Follow-up was 3 years from the index surgery admission date.

Data were retrieved from a variety of sources, including:

- Patient records.
- Discharge Abstract Database (CIHI-DAD).
- National Ambulatory Care Reporting System (NACRS).
- National Rehabilitation Reporting System (NRS).
- Registered Persons Database (RPDB).
- Homecare Database (HCD).

Statistical analysis was performed using SAS V9. 3, R. Descriptive data (categorical) are expressed in frequencies and percentages. Continuous variables are expressed in mean +/- standard deviation (SD) and median with interquartile range (IQR). A chi-squared (x^2) test was employed for categorical variables. One-way analysis of variance (ANOVA) was used to compare continuous variables. Kruskal–Wallis one-way analysis of variance was employed for continuous nonparametric values, expressed as median. Generalized estimating equations (GEEs) with exchangeable correlation structures were used to account for repeated measurements within subjects. The Wilcoxon Rank-Sum Test was employed to compare visit counts presurgery to 1 year postsurgery. Bivariate Poisson regression analyses were used to model predictors of open versus closed incisions at 3–6 weeks following the surgical procedure. A risk reduction (RR) >1 indicates that individuals with certain characteristic ulcers had increased risk with open incisions compared with those with closed incisions (Table 1).

RESULTS

Seventy-one percent of all surgeries performed were on male patients. The mean age at the time of SCI was 23.31 years (*SD*=13.47). The mean age at the time of surgery was 43.15 years (*SD*= 12.58). Twenty-three (23%) of the SCIs were cervical, 59 (59%) were thoraco–lumbar, and 18 (18%) were unknown. Completeness of the SCI was recorded for 11% of the subjects; 37%, had incomplete SCI, and 52% were unknown. Ninety-three percent lived at an urban address, and 10% lived at a northern Ontario address. Forty-seven percent lived in homes, 20% lived in apartments, and <5 (8.1%) were in assisted living. The living situation was unknown in 28% of the cohort. Eight percent were employed full time; 24%

were receiving a disability pension; and 55% had an unknown source of income.

Sixty-two percent of patients had closed incisions, and 29% had open incisions at the 3–6 week follow-up after index surgery. Significantly more patients in the open incision group were smokers (p=0.039) and had revision surgery. More patients in the group with closed incisions had over 50 nursing visits in the year prior to the index surgery, approaching statistical significance (p=0.061). Table 2 displays the univariate (unadjusted) robust Poisson model. This analysis accounts for repeated subjects using a GEE with an exchangeable correlation structure. Statistically significant variables in the univariate model were employed to build the Poisson regression model.

Table 3 summarises the multivariate analysis using the Poisson regression model. Persons receiving greater than 50 homecare nursing visits in the year prior to the index surgical date had a decreased risk of having an open incision at the surgical follow-up clinic visit (RR=0.49; 95% CI=0.24-0.99; p=0.048). Persons who required surgical revision had an increased risk of an open incision at the surgical follow-up clinic visit (RR=1.89; 95% CI=1.15-3.09; p=0.01). Increased age, income quintile, living in northern Ontario, and smoking were linked to greater open incision risk, but these results lacked statistical significance. Being female and having peripheral vascular disease were identified as reducing the risk of open incisions at the surgical follow-up clinic visit However, these risk factors were not statistically significant.

DISCUSSION

In the present study, 37 (37%) of patients experienced complications. Having consistent homecare visits was associated with a decreased risk of an open incision, whereas a person who required surgical revision had an increased risk of an open incision at the surgical follow-up clinic visit. Increased age, northern Ontario residence, and smoking were found to increase the risk of open incision but were not statistically significant. Being female and having peripheral vascular disease were identified as reducing the risk of an open incision at the surgical follow-up clinic visit, but these findings were statistically insignificant. To our knowledge, this is the first study to examine biophysical and environmental variables at 1 year prior to the surgical procedure.

Interestingly, there were no significant differences in complication rates across recovery locations (home with home care, rehabilitation, or other institution). This finding may be due to the small sample size or the intentional decision to send persons at higher risk to rehabilitation facilities. Further research is required to explore this phenomenon.

A retrospective study by Kierney et al.[24] was conducted in the U.S. to determine PI recurrence rates in 158 patients who underwent surgical flap closure of 268 PIs. This sample included traumatic and nontraumatic SCI persons. The follow-up time was 3.7 years. They reported a recurrence rate of 19% (49/268) over the same site. Analysis of risk factors associated with recurrence was not explored beyond identifying the location and type of surgery and the type of SCI. While the outcomes of that study cannot be compared with those of the present study, it is noteworthy that 81% of the patients did not re-ulcerate at the same operative site for an extended period of time.

Schryvers et al.[14] published one of the first reviews of PI reconstruction outcomes in Canada. In their sample size of 168 patients with 598 encounters of stage 4 PIs undergoing reconstruction, the outcomes included suture line dehiscence and revision surgery. They reported that 31% (185/598) had suture line dehiscence, with 11% (66/598) requiring revision surgery. They collected socio-demographic data and found that 95% (159/168) had SCI. While no robust statistical analyses were conducted, descriptive statistics were used to suggest that social factors, such as unemployment, living situation, race (indigenous), and drug use, in addition to surgical technique, may influence outcomes. Srivastava et al.[25] conducted a small prospective study of 25 SCI patients with 39 PIs to determine outcomes of PI reconstruction. Four participants (16.6%) had initial complications: wound dehiscence 8.3% (2) and delayed graft healing 8.3% (2). The duration of follow-up was 12 to 21 months (mean=15.4, +7.45 months). Four participants (17.3%) had ulcer recurrence. Given the small sample size, a regression analysis to explore risk factors for complications would not have been adequately powered and therefore would not have been useful.

Ahluwalia, Martin, and Mahoney[12] conducted a retrospective review of stage 3 and 4 PI reconstruction in 78 patients from a consecutive cohort who had 104 flap procedures following surgical reconstruction of a stage 3 or 4 PI between 1997 and 2007 in Toronto, Canada. Complications and recurrence rates were examined by PI location and reconstruction method, enabling direct comparison of surgical outcomes. Complications were defined as any incision that failed to heal immediately postoperatively, including minor dehiscence, infection, and flap necrosis. They reported an overall flap complication rate of 16% (17/104), with a wound recurrence rate of 7% (7/104), and concluded that a combination posterior medial thigh fasciocutaneous flap with a biceps femoris muscle flap could be recommended as a first-choice option for ischial pressure wound reconstruction. No univariate or multivariate analyses were performed. While this review was intended to evaluate outcomes of flap selection, other variables, such as those collected in the administrative database, were not considered to potentially influence flap outcomes.

Keys et al.[23] conducted a retrospective review of 135 American veteran patients with SCI who underwent 227 PI flap closure procedures with a primary outcome of recurrence of

Figure 1: *Flow Chart of Study*

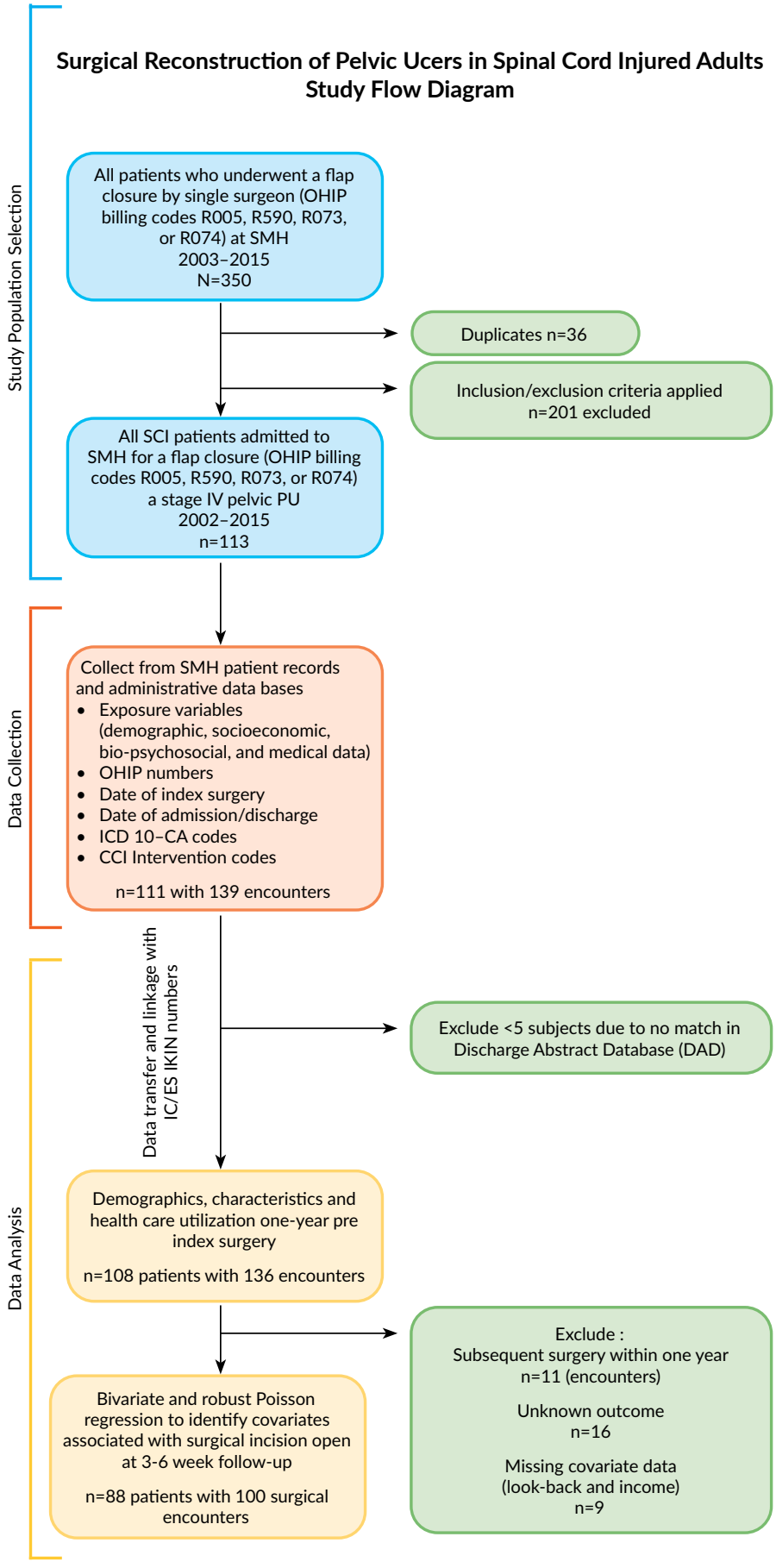

Table 1: *Demographics and Bivariate Analysis of Incision Closed vs. Open*

VARIABLE	INCISION CLOSED (N=62)	INCISION OPEN (N=38)	TOTAL (N=100)	P
Gender				
Female	20 (32.3%)	9 (23.7%)	29 (29.0%)	0.359
Male	42 (67.7%)	29 (76.3%)	71 (71.0%)	
Age at time of SCI (years)				
Mean ± SD	20.54 ± 10.90	25.14 ± 16.56	23.31 + 13.47	0.104
Median (IQR)	23 (17–28)	25 (17–36)	23 (17–30)	0.206
Age at time of surgery (years)				
Mean ± SD	41.44 ± 11.72	45.95 ± 13.56	43.15 ±12.58	0.082
Median (IQR)	41 (32–51)	47 (38–57)	43 (34–53)	0.10
Level of SCI				
Cervical	15 (24.2%)	8 (21.1%)	23 (23.0%)	0.81
Thoracic/Lumbar	37 (59.7%)	22 (57.9%)	59 (59.0%)	
Unknown	10 (16.1%)	8 (21.1%)	18 (18.0%)	
Completeness of SCI				
Unknown	22 (35.5%)	15 (39.5%)	37 (37.0%)	0.74
Complete	6 (9.7%)	<=5 (13.2%)	11 (11.0%)	
Incomplete	34 (54.8%)	18 (47.4%)	52 (52.0%)	
Lives at Rural Address				
No	59 (95.2%)	34 (89.5%)	93 (93.0%)	0.28
Yes	<=5 (4.8%)	<=5 (10.5%)	7 (7.0%)	
Northern Ontario Address				
Yes	<=5 (4.8%)	7 (18.4%)	10 (10.0%)	0.03
Living Status				
Home	24 (38.7%)	23 (60.5%)	47 (47.0%)	0.06
Apartment	12 (19.4%)	8 (21.1%)	20 (20.0%)	
Assisted living	<=5 (8.1%)	0 (0.0%)	<=5 (5.0%)	
Unknown	21 (33.9%)	7 (18.4%)	28 (28.0%)	
Employment Status	<=5 (6.5%)	<=5 (10.5%)	8 (8.0%)	0.36
Full time	16 (25.8%)	8 (21.1%)	24 (24.0%)	
ODSP	<=5 (1.6%)	0 (0.0%)	<=5 (1.0%)	
WSIB	10 (16.1%)	<=5 (5.3%)	12 (12.0%)	
Unemployed	31 (50.0%)	24 (63.2%)	55 (55.0%)	
Unknown	<=5 (6.5%)	<=5 (10.5%)	8 (8.0%)	0.36

VARIABLE	INCISION CLOSED (N=62)	INCISION OPEN (N=38)	TOTAL (N=100)	P
Nearest Census-Based Neighbourhood Income Quintile (within CMA/CA)				
1	13 (21.0%)	9 (23.7%)	22 (22.0%)	0.57
2	14 (22.6%)	7 (18.4%)	21 (21.0%)	
3	8 (12.9%)	<=5 (7.9%)	11 (11.0%)	
4	14 (22.6%)	6 (15.8%)	20 (20.0%)	
5	13 (21.0%)	13 (34.2%)	26 (26.0%)	
Charlson Community Index				
0	34 (54.8%)	21 (55.3%)	55 (55.0%)	0.22
1	<=5 (1.6%)	0 (0.0%)	<=5 (1.0%)	
2	27 (43.5%)	14 (36.8%)	41 (41.0%)	
3	0 (0.0%)	<=5 (5.3%)	<=5 (2.0%)	
4	0 (0.0%)	<=5 (2.6%)	<=5 (1.0%)	
History of autonomic dysreflexia				
Unknown	<=5 (8.1%)	<=5 (7.9%)	8 (8.0%)	0.99
No	48 (77.4%)	29 (76.3%)	77 (77.0%)	
Yes	9 (14.5%)	6 (15.8%)	15 (15.0%)	
Current smoker				
Yes	14 (22.6%)	16 (42.1%)	30 (30.0%)	0.04
History of peripheral vascular disease				
No	60 (96.8%)	34 (89.5%)	94 (94.0%)	0.136
Yes	<=5 (3.2%)	<=5 (10.5%)	6 (6.0%)	
Length of stay (days)				
Mean ± SD	7.89 ± 3.08	8.58 ± 6.48	8.15 ± 4.65	0.473
Median (IQR)	8 (6-8)	7 (5-8)	7 (6-8)	0.21
Revision surgery required				
Yes	<=5 (3.2%)	10 (26.3%)	12 (12.0%)	<. 0.01
Discharge Disposition				
Community	13 (21.0%)	15 (39.5%)	28 (28.0%)	0.20
Rehab	44 (71.0%)	20 (52.6%)	64 (64.0%)	
Other institution	<=5 (3.2%)	<=5 (5.3%)	<=5 (4.0%)	
Unknown	<=5 (4.8%)	<=5 (2.6%)	<=5 (4.0%)	
50+ HC nursing visits (year prior)				
Yes	57 (91.9%)	30 (78.9%)	87 (87.0%)	0.06

Note. *N*=97.

Table 2: *Univariate (unadjusted) Robust Poisson Model*

VARIABLE	IRR	95% CI		P
Male gender				
Yes	1.33	0.71	2.41	0.36
Living in a northern residence				
Yes	1.80	1.24	3.15	0.02
Greater than 50 homecare nursing visits in year prior				
Yes	0.56	0.34	0.97	0.03
Revision surgery				
Yes	2.66	1.74	3.87	0.00
Disposition to rehabilitation facility				
Rehab	0.59	0.37	0.94	0.03
Peripheral arterial disease				
Yes	1.82	1.05	3.16	0.03
Smoking				
Yes	1.74	1.08	2.79	0.02
Skin flap on anatomical ischium				
Yes	0.6			0.19
Bladder incontinence				
Yes	0.80	0.31	1.98	0.63
Bowel incontinence				
Yes	0.71	0.37	1.55	0.36
Rural residence				
Yes	1.34	0.76	3.04	0.44
Income quintile				
5	1.20	0.78	2.31	0.55
4	0.62	0.62	0.41	0.23
3	0.62	0.12	0.64	0.38
2	0.89	0.28	1.64	0.74
Regional Postal Code				
P-Northern	1.47	0.65	41.6	0.42
M-Toronto	0.67	0.26	1.83	0.43
L-GTHA	0.93	0.37	2.39	0.88
Discharge disposition				
Unknown	0.32	0.10	2.32	0.19
Other institution	0.94	0.36	2.45	0.90
Current consumption of >2 alcoholic drinks/day				
Yes	1.31	0.32	5.35	0.71
Type of anesthesia				
Unknown	1.03	0.51	2.65	0.95
Regional	0.53	0.09	3.09	0.48
Monitored	1.35	0.44	3.98	0.59
Spinal	1.77	0.74	4.07	0.18

VARIABLE CONT'D	IRR CONT'D	95% CI CONT'D		P CONT'D
Cause of SCI				
Unknown	0.62	0.25	2.12	0.41
Traumatic	0.97	0.57	1.81	0.91
Nontraumatic	0.28	0.04	1.80	0.18
Completeness of SCI				
Complete	0.89	0.54	1.59	0.66
Incomplete	1.19	0.56	2.55	0.66
Positive intraoperative wound culture				
No	1.35	0.43	6.22	0.67
Yes	1.38	0.42	4.60	0.60
Diabetes				
Yes	1.44	0.94	2.58	0.17
Family Support				
Yes	1.35	0.43	4.48	0.62
Hypertension				
	1.43	0.90	2.54	0.18
SCI Injury Level				
Unknown	1.19	0.61	2.91	0.67
Thoracic/ Lumbar	1.06	0.54	2.08	0.86
Cervical	1.32	?	?	0.40
Marital Status				
Unknown	1.73	0.72	4.01	0.21
Divorced	0.86	0.26	2.75	0.81
Married	0.88	0.48	1.70	0.69
Myocutaneous flap performed in location 1				
	0.96	0.54	1.59	0.88
Obesity				
Yes	0.63	0.25	2.09	0.41
Osteomyelitis				
Yes	1.32	0.47	3.56	0.59
Osteoporosis				
Yes	0.64	0.11	3.49	0.61
Use of chronic pain meds				
Yes	1.13	0.63	1.96	0.66
History of pneumonia				
Yes	0.87	0.17	4.28	0.86
Renal disease				
Yes	0.71	0.18	2.89	0.64
Help at home				
Yes	0.88	0.46	1.78	0.71
History of spasticity				
Yes	1.44	0.83	2.40	0.17

Note. N=100.

Table 3: *Incidence Rate Ratio of Open Incision at Follow-up in a Surgical Clinic Using a Poisson Regression*

VARIABLE	IRR	95% CI		P
Age (per year older)	1.01	0.99	1.03	0.13
Female vs. male	0.86	0.45	1.61	0.63
Income quintile 5 vs. other	1.42	0.83	2.45	0.20
Northern Ontario residence	1.30	0.73	2.30	0.38
Skin flap on anatomical location 1	0.76	0.36	1.63	0.48
50+ homecare nursing visits (year prior)	0.49	0.24	0.99	0.05
Surgical revision needed	1.89	1.16	3.09	0.01
Peripheral vascular disease	0.85	0.39	1.87	0.69
Smoking	1.72	0.91	3.23	0.09

Note: N=100

PI at the operative site. Secondary outcomes included incisional dehiscence and operative revision. Their follow-up time was 6 weeks; the final endpoint was unclear. They reported 88 recurrences of PIs after flap surgery (39%) of 227 operations performed. Thirty-six (16%) had dehiscence necessitating a return to the operating room. A glycosylated hemoglobin (A1C) level less than 6% and previous same-site flap failure were associated with both dehiscence and recurrence (OR=2.15 and 3.84; and OR=6.51 and 3.27). Younger age and albumin less than 3.5 g/dL were associated with early flap failure (OR=5.95 and 2.45). Ischial wound location correlated with late recurrence (OR=4.01). They also reported that patients with multiple risk factors had operative success rates that approached zero. The younger age as a risk factor was in contrast to our study findings. The PI (ischial) site as a risk factor would be congruent, as this bony prominence would be exposed to the highest risk for people sitting in wheelchairs for prolonged periods.

Sameem et al.[13] conducted a meta-analysis of 55 studies, which showed an overall surgical complication rate of 19% and a 9% ulcer recurrence rate. Follow-up times ranged from 1 to 93 months. Site complications included wound infection, hematoma, abscess, surgical wound dehiscence, and ulcer recurrence. This study compared outcomes based solely on operative techniques. There were no analyses of risk factors for surgical complications or recurrence rates. While there was heterogeneity in patient populations and follow-up times, the study author concluded that PI flap closure is an effective intervention in the context of careful patient selection and optimization during the pre- and post-operative periods.

Larson et al.[26] studied 101 SCI patients with 179 encounters of PI reconstruction. The complication rate was 17.3% (35/179). Suture-line dehiscence, infection, and distal flap necrosis were the complications recorded. The mean follow-up period was 436 days. They examined nutrition (low albumin levels) and positive bone cultures as risk factors for complications and ulcer recurrence, but did not find any significant differences between those with and without complications. These findings were aligned with the present study.

Chiu et al.[27] conducted a similar study with 181 surgical flap encounters between January 2002 and December 2013. Their study compared outcomes between different types of reconstruction procedures. Outcome measures included suture line dehiscence, infection, hematoma, flap necrosis, and PI recurrence. Complication and recurrence rates for all flaps were 46.5% (84/181) and 16% (29/181), respectively, and there were no statistical differences between the types of flap reconstruction. In multivariate regression analysis, serum albumin of less than 3.0 g/dl, ischial site of surgery, and paraplegia were found to be significant risk factors for wound complications. This study had 48% (87/181) of the encounters with SCI.

Diamond et al.[28] conducted a retrospective review of 320 patients who underwent PI flap closure in the U.S. from 2011 to 2012. This study included all persons with PI and was not specific to SCI. The 30-day flap failure rate was 1.9% (n=6), the reoperation rate was 4.7% (n=15), the SSI rate was 8% (n=25), and dehiscence was 4.7% (n=15). The overall 30-day complication rate was 19% (n=61). In their regression analysis, previous steroid use was found to increase the odds of flap failure (OR 15.42, p=0.02). In our study, steroid use was not found to be a significant risk factor.

Bamba et al.[18] conducted a retrospective chart review of 276 patients who underwent flap reconstruction for a PI between 1997 and 2015. The characteristics of patients were analyzed to identify those with complications, including PI recurrence, wound dehiscence, and wound infection. The demographics indicated that 82.6% (231/276) of the sample had SCI. They reported an overall complication rate of 58% (162/276). In this sample, multivariate regression analysis of ischial PI was found to be the only independent risk factor for both major and minor complications (RR=2.63; 95% CI=1.52-4.54; p < .01). In our study, the location of the reconstruction did not increase the risk of open incision.

Gargano and colleagues[29] conducted a prospective study reviewing sequential patients treated with two types of flap coverage over 36 months from 2011 to 2014. Fourteen (70%) were SCI patients. A total of 8 (40%) complications occurred in the conventional surgical flap operations. While they found no statistical differences between the two groups, the sample size was small, and no multivariate analysis was performed.

In a larger, retrospective review of 1,248 patients from 2005 to 2015 in Utah, U.S., Kwok et al.[30] reported an overall complication rate of 35.0% (437/1,248 following PI reconstruction). Complications included mortality, postoperative blood transfusion, surgical site infection, UTI, sepsis, wound dehiscence, pneumonia, septic shock, ICU stay with ventilation, renal impairment, myocardial infarction, pulmonary embolism, and DVT. The reported rates of surgical site infection and wound dehiscence were 8.09% and 4.57%, respectively. There were no reoperation encounters reported. These findings are difficult to compare with our study, as it was unclear how many of the subjects had SCI. The surgical site complication rate was significantly lower than in other studies. Surgical wound complications accounted for 12.7% (158/1,248) of the 35% complication rate that was reported. On multivariate regression, obesity was independently associated with complications (OR=11.325; 95% CI=1.00, 1.74; p < 0.044), and flap closure was again associated with fewer complications (OR=0.71; 95% CI 0.55, 0.91; p < 0.008).

Tran et al.[31] reviewed administrative data on PI reconstruction outcomes from the National Surgical Quality Improvement Project (NSQIP) database in Boston, U.S. The study reviewed 755 surgical encounters and reported an overall complication rate of 25% at day 30, post-operatively. While surgical incisional dehiscence, superficial and deep organ space infection, reoperation, and readmission infection accounted for 6.9% (52/755) of the complication rate, they also included bleeding, septic shock, deep vein thrombosis, and pulmonary embolism as complications. Moreover, only 28% (210/755) of the sample had SCI as a diagnosis. Consequently, comparing these results with the present study is not feasible.

Finally, Wong et al.[32] conducted a systematic review of the literature to compare outcomes of reconstructive surgery for closing PIs (stage 2 or above) with no surgery or alternative forms of surgery across care settings. They found no randomized controlled trials supporting or refuting the role of reconstructive surgery for PIs. They concluded there is a need for more rigorous and robust research in this area.

Our study has several strengths and limitations. This is the first known study that combines patient records with administrative data to explore factors that may influence outcomes of surgical flap closure of PIs in SCI persons. Second, using retrospective data from patient records and administrative databases rather than survey data may reduce recall bias and response bias. The nature and size of the sampling (a convenience sample from a single centre study, a single surgeon, and a convenience sample in Canada) can therefore limit the generalizability of the findings. Environmental and psychosocial variables, such as timely access to surgical consultation, surgical wait times, delays in access to coordinated SCI-specific health care, mental health, lifestyle choices, and high-risk behaviours, were not available in either the patient records or administrative databases and could introduce confounding factors.

CONCLUSION

This Canadian cohort of patients demonstrated a high rate of postoperative wounds being open at the postsurgery clinic follow-up visit. Our study and literature review show that complications of surgical flap closure present a

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3 Source: Allen D, Robinson T, Schmidt M, Kieswetter K. Preclinical assessment of novel longer-duration wear negative pressure wound therapy dressing in a porcine model. Wound Rep Reg. 2023;31:349-359. Information contained within conducted animal studies has not been evaluated by the U.S. Food & Drug Administration.

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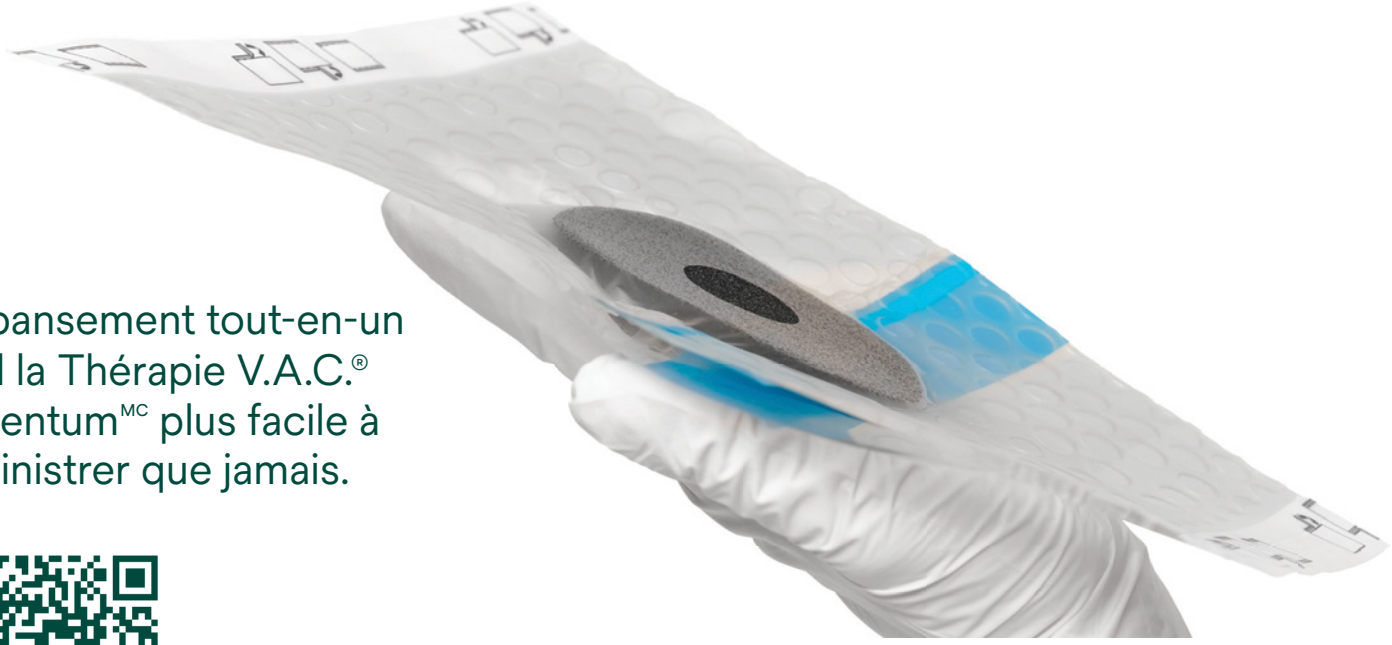

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3 Source : ALLEN, D., T. ROBINSON, M. SCHMIDT et K. KIESWETTER. « Preclinical assessment of novel longer-duration wear negative pressure wound therapy dressing in a porcine model », *Wound Rep. Reg.*, vol. 31 (2023), p. 349-359. L'information contenue dans les études menées chez les animaux n'a pas été évaluée par la Food and Drug Administration des États-Unis.

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formidable challenge. These complications can contribute to delayed wound closure, delayed rehabilitation, reduced quality of life, and continued financial burden on the health-care system. Sameem et al.[13] provide data suggesting that there are no differences in outcomes based on the type of flap used for PI reconstruction. Significantly more of the patients who received more than 50 nursing care visits in the previous year had closed incisions at the surgical follow-up visit. Those who were incrementally older, from a northern Ontario residence, and requiring surgical revision were more likely to have an open incision. Although this is a small sample size, delivering regular nursing care and increasing access to specialized SCI care in rural areas may improve outcomes.

Our data, similar to other studies conducted in developed countries, suggest that not only surgeons but the entire interdisciplinary team need to revisit and collaborate on their risk-reduction efforts. This study identifies numerous risk factors to consider when offering flap reconstruction. Prospective studies or studies with data collected through registries specifically designed for SCI patients may identify more complete, relevant, and modifiable characteristics or risk factors that can inform prospective interventional studies within this rare population. Building screening tools and comparing models of care delivery in persons with SCI undergoing PI reconstruction are suggested to determine whether surgical outcomes can be improved in this complex patient population. •

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Detailing Prevention Recommendations From the RNAO Best Practice Guideline – Pressure Injury Management: Risk Assessment, Prevention, and Treatment, Fourth Edition

ABSTRACT

Background

Pressure injuries (PIs) constitute some of the costliest adverse events in hospitals, in long-term care facilities, and in homecare settings. PIs are painful and can impact quality of life. Depending on the stage of the injury and whether there are complications or comorbidities, healing may take weeks, months, or years and can contribute to premature mortality. The Registered Nurses' Association of Ontario (RNAO) released a best practice guideline (BPG) in November 2024 with evidence-based recommendations on the assessment, prevention, and treatment of PIs. This paper focuses on the prevention of PIs that are outlined in this guideline.

Methods

Best practice guidelines are based on systematic reviews and developed using the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach. A panel of PI experts was convened to guide the process. We conducted a systematic literature review focusing on three preventive areas as related to PIs: repositioning frequency, care bundles, and use of prophylactic dressings. We searched seven databases for relevant English-language studies published since January 2018. Two reviewers independently assessed the research for eligibility and for risk of bias and determined the validity of the evidence using the GRADE approach.

Results

We screened 1,295 articles for 3 priority research questions. Of these articles, 234 full-text publications were reviewed for relevance, and 14 were used to inform 3 recommendations on repositioning frequency, preventive care bundles, and the use of prophylactic dressings.

Conclusion

This paper provides nurses and other members of the interprofessional team, including persons and their families, with evidence-based recommendations for preventing PIs.

Key Words: Pressure injury, prevention, repositioning, care bundle, prophylactic dressings

Présentation détaillée des recommandations en matière de prévention issues de la ligne directrice sur les pratiques exemplaires de l'Association des infirmières et infirmiers autorisés de l'Ontario (AIIAO) – Gestion des lésions de pression : évaluation du risque, prévention et traitement, quatrième édition

Résumé

Contexte

Les lésions de pression (LP) constituent l'un des événements indésirables les plus coûteux dans les hôpitaux, les établissements de soins de longue durée et les milieux de soins à domicile. Les LP sont douloureuses et peuvent nuire à la qualité de

vie. Selon le stade de la lésion et la présence de complications ou de comorbidités, la guérison peut prendre des semaines, des mois ou des années et peut contribuer à une mortalité prématurée. L'AIIAO a publié en novembre 2024 une ligne directrice sur les pratiques exemplaires comprenant des recommandations fondées sur des données probantes concernant l'évaluation, la prévention et le traitement des LP. Le présent article porte sur la prévention des LP telle qu'énoncée dans cette ligne directrice.

Méthodes

Les lignes directrices sur les pratiques exemplaires reposent sur des revues systématiques et sont élaborées selon l'approche GRADE (Grading of Recommendations Assessment, Development, and Evaluation). Un groupe d'experts en lésions de pression a été réuni pour orienter le processus. Nous avons mené une revue systématique de la littérature portant sur trois domaines de prévention liés aux LP : la fréquence du repositionnement, les ensembles de soins et l'utilisation de pansements prophylactiques. Sept bases de données ont été interrogées afin de repérer des études pertinentes publiées en anglais depuis janvier 2018. Deux évaluateurs ont examiné indépendamment les études pour en déterminer l'admissibilité et le risque de biais, et ont évalué la validité des données probantes à l'aide de l'approche GRADE.

Résultats

Nous avons examiné 1 295 articles portant sur trois questions de recherche prioritaires. Parmi ceux-ci, 234 publications en texte intégral ont été évaluées pour leur pertinence, et 14 ont été utilisées pour éclairer trois recommandations concernant la fréquence du repositionnement, les ensembles de soins et l'utilisation de pansements prophylactiques.

Conclusion

Cet article fournit aux infirmières et infirmiers ainsi qu'aux autres membres de l'équipe interprofessionnelle, y compris les personnes recevant des soins et leurs familles, des recommandations fondées sur des données probantes pour la prévention des lésions de pression.

Mots-clés : lésion de pression, prévention, repositionnement, ensemble de soins, pansements prophylactiques

Conflicts of Interest:
The author(s) Brenda Stade, Amy Burt, Nafsin Nizum, Giulia Zucal, and Lyndsay Howitt declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Corey Heerschap is President of Nurses Specialized in Wound, Ostomy and Continence Canada and is the past inaugural Secretary for the Canadian Pressure Injury Advisory Panel.

Dimitri Beeckman conducts research at Ghent University (BE) and Örebro University (SE) that is supported by medical device manufacturers. This funding is applied to conduct independent research and the Sponsor roles are within the universities. There is no influence of companies in the design, execution, analysis, and interpretation of the study and the findings. Funding has been received from: 3M Healthcare, Mölnlycke Healthcare, Frontier Medical Group (UK), and Essity.

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INTRODUCTION

A pressure injury (PI) is localized damage to the skin and/or underlying tissue caused by pressure, by pressure in combination with shear, or by friction. PIs, also called pressure ulcers or bedsores, usually occur over a bony prominence but may also result from contact with a medical device or other object.[1–4] Risk factors for PI development include low body mass index, older age, low physical activity or immobility, existing PIs, malnutrition, male sex, anemia, hypoalbuminemia, diabetes, hypotension, and loss of sensation.[2,3]

In Canada, estimates of PI prevalence across all healthcare institutions from 1990 to 2003 were 26 per cent (95% confidence interval [CI], 25.2% to 26.8%).[3,5] In Ontario, hospitalization rates were 60 persons per 100,000 people in 2014–2015.[3,6] However, both provincial and national statistics on PI rates are lacking, reflecting a need for improved monitoring and reporting. Globally, PIs account for a large share of wound care. According to the Global Burden of Disease Study 2017, PI incidence has remained relatively stable, underscoring the need for continued improvement.[3,7]

PIs are among the most expensive adverse events in health care.[3,8] In Ontario, Canada, the total net adjusted hospitalization cost of a hospital-acquired PI between 2002 and 2006 was C$44,000 to C$90,000 compared with C$11,000 to C$18,500 for a preadmission PI.[3,9] In the United States, annual hospital-acquired PIs are estimated to cost more than US$26.8 billion.[10] Approximately 59% of those costs are attributable to Stage 3 and 4 full-thickness wounds, which affect 13.3% of patients, and require significant hospital resources and clinician time.[3,10]

A stage 3 or 4 pressure injury resulting after hospital admission has been designated as a "Never Event" by the Canadian Patient Safety Institute (now Healthcare Excellence Canada).[3,11] These severe injuries can lead to serious complications, such as blood and bone infections.[3,11] PIs can be very painful and can impact the quality of life of patients and those providing care. Healing varies depending on the stage of the PI, complications, comorbidities, and other factors and can range from weeks to months to years.[3,12] Finally, a 2025 Canadian Institute for Health Information (CIHI) study found that the percentage of long-term care residents whose stage 2 to 4 pressure ulcers worsened was 2.6%, which shows improvement in the management of PIs.[13]

In November 2024, the Registered Nurses' Association of Ontario (RNAO) published a best practice guideline (BPG) to provide nurses (i.e. nurse practitioners, registered nurses, registered practical nurses, and nursing students) and other members of the interprofessional team with evidence-based recommendations and resources related to the assessment, prevention, and treatment of PIs in pediatric, adult, and older adult populations. The guideline is titled *Pressure Injury Management: Risk Assessment, Prevention and Treatment, Fourth Edition*.[3]

To inform the development of the guideline, the RNAO guideline team conducted an environmental scan of existing guidelines and held key informant interviews and discussion groups with experts in PIs. A panel was formed that included nurses, occupational therapists, physiotherapists, dietitians, persons with lived experience, researchers, and educators.

All expert panel members declared conflicts of interest prior to their participation and on an ongoing basis, using a standard form.

The new BPG is the Fourth Edition and replaces three previous RNAO BPGs: *Risk Assessment and Prevention of Pressure Ulcers* (2005), with a revision of the same name in 2011, and *Assessment and Management of Pressure Injuries for the Interprofessional Team* (2016 revision).[3] Given the enormous scope of the guideline and the importance of the topic, this paper focuses on the guideline's three recommendations pertaining to the prevention of PIs.

METHODS

The Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) approach guided the development of the new BPG.[14] GRADE is a method for rating the quality of quantitative evidence in systematic reviews (SRs).[15] Recommendation questions were determined by the expert panel and the RNAO BPG team for prevention recommendations 2, 3, and 4 (Table 1). The expert panel discussed and shared their insights on caring for persons at risk of or living with PIs.[3]

Table 1: *Prevention Recommendations 2, 3, and 4 Out of the Total 6 Recommendations in the BPG*

Recommendation question #2: Should a specific repositioning frequency be recommended over another frequency for persons with pressure injuries or those at risk of developing them?
Recommendation question #3: Should preventative care bundles be recommended or not for the prevention of pressure injuries?
Recommendation question #4: Should the use of prophylactic dressings be recommended or not for the prevention of pressure injuries?

Recommendation numbers used are consistent with the full BPG

Systematic Retrieval of the Evidence

The SRs were registered in PROSPERO (CRD42023437862). RNAO's BPG guideline development and research team and a health sciences librarian developed search strategies for each research question. A search for relevant research studies published in English from January 2018 to March 2023 was conducted across the following databases: Cumulative Index to Nursing and Allied Health (CINAHL), MEDLINE, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Embase, Emcare, and APA PsycINFO. An updated search was conducted in June 2024. These searches can be found in the Methodology section of the full BPG and are titled "Pressure Injuries Systematic Review Search Strategies.pdf"; see https://rnao.ca/media/7995/download.

Eligibility Criteria

Two reviewers independently screened studies for eligibility by first exporting all search results into DistillerSR (Evidence Partners, Ottawa, Ontario, Canada). The initial screening was conducted using titles and abstracts. Full studies were included if they addressed the research question and outcomes, were published in English, and were accessible for retrieval.[3,16] Dissertations, commentaries, narratives, anecdotal articles, letters to the editor, editorials, consensus documents, discussion papers, case studies, case series, and conference presentations were excluded.[15] Any disagreements were resolved through consensus.[3,15,16]

Data Extraction and Quality Appraisal

Data extraction was completed on standardized Excel sheets (Microsoft Corp) by the two reviewers, independently and in duplicate. The study population, characteristics, and outcomes of interest were obtained. Any disagreements were resolved through consensus.[3,15,16]

The two reviewers independently quality-appraised all studies, using the ROBIS tool for SRs, the RoB 2.0 tool for RCTs, and the ROBINS-I tool for nonrandomized studies.[17–19] The body of evidence for each recommendation was assessed using GRADE, which considers risk of bias, inconsistency, imprecision, indirectness, and publication bias.[15,16]

For each recommendation, the overall certainty of evidence was determined to be high, moderate, low, or very low.

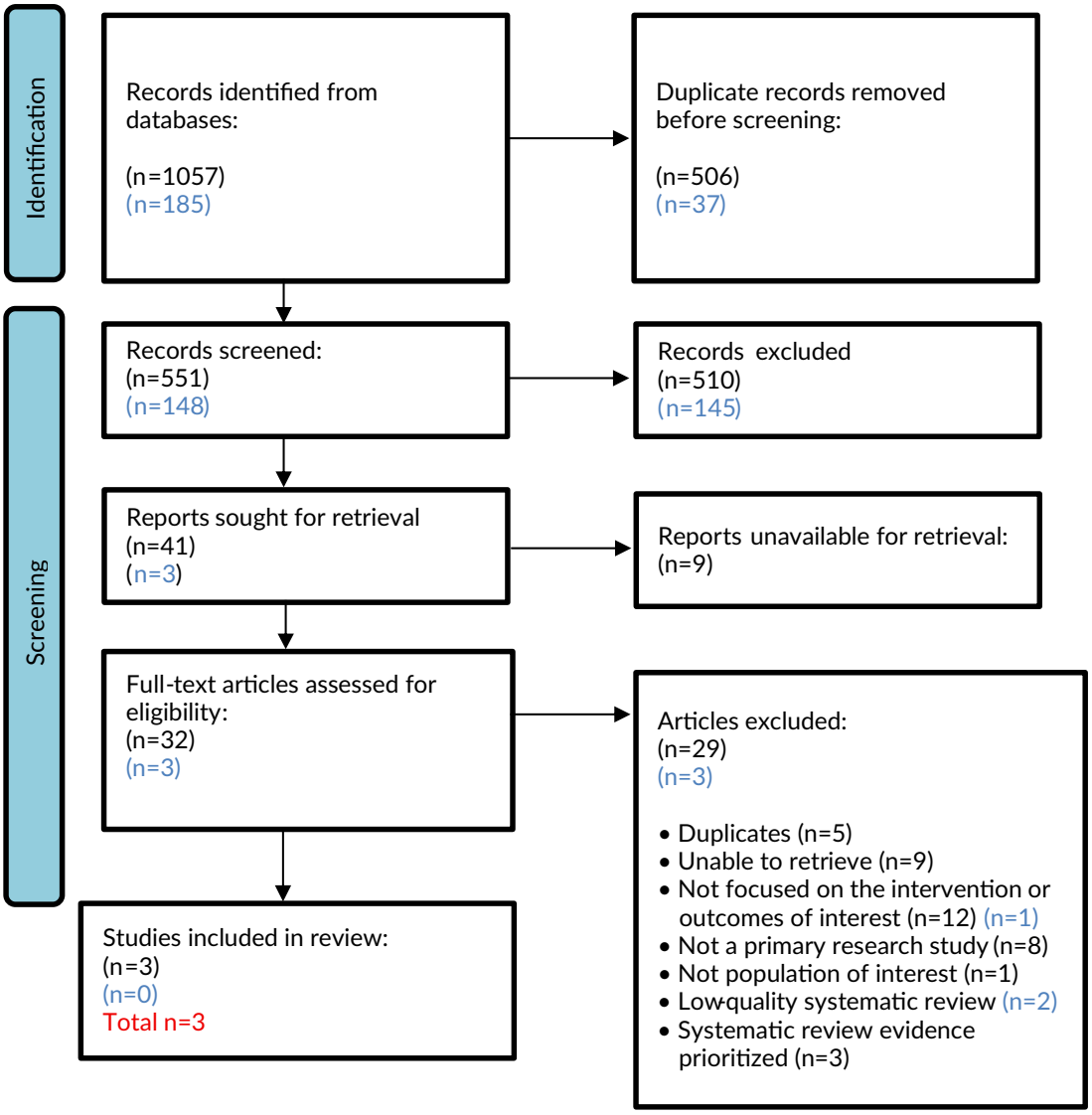
Recommendation Formulation

The two reviewers grouped the studies by theme and drafted recommendation statements. GRADE evidence profiles and Evidence-to-Decision (EtD) frameworks were also developed for each recommendation and provided to the expert panel to inform decision-making. Each recommendation included a direction, either for or against an intervention, and a strength, either strong or conditional, after considering benefits and harms; the certainty of the evidence; values and preferences; and health equity considerations.[3,15,16] Consensus among panel members was used to determine the final direction and strength of the recommendations. Article review process PRISMA diagrams for recommendation question #2, #3, and #4 are found in Figures 1, 2, and 3, respectively.

Figure 1: *Article Review Process PRISMA Diagram for Recommendation Question #2*

Recommendation question #2: Should a specific repositioning frequency be recommended over another frequency for persons with pressure injuries or those at risk of developing them?

n=original search
n=update search

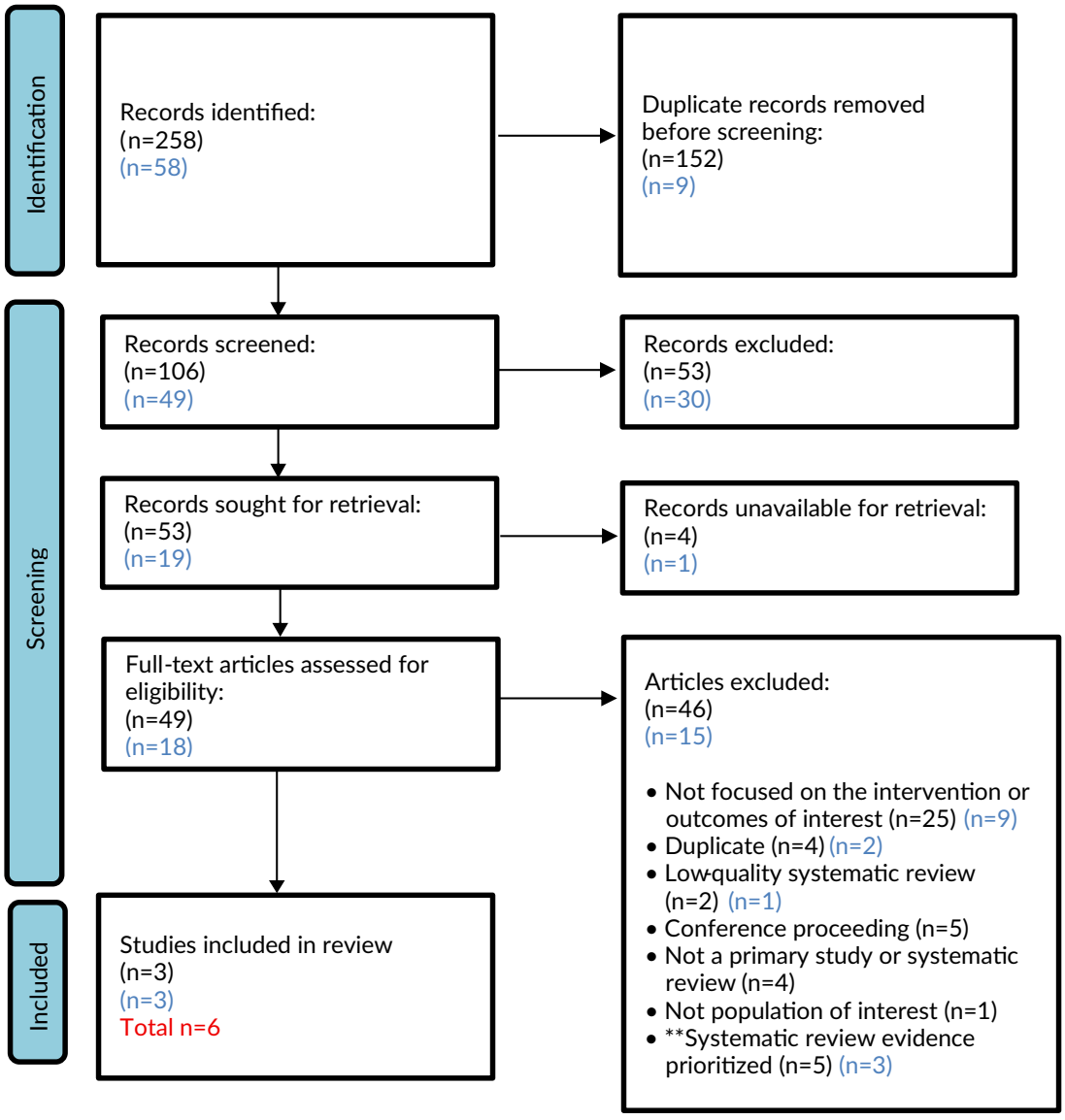


Source: Adapted from: Page M, McKenzie P, Bossuyt P, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Syst Rev. 2021;10(89). Available from: https://doi.org/10.1186/s13643-021-01626-4

Figure 2: *Article Review Process PRISMA Diagram for Recommendation Question #3*

Recommendation question #3: Should preventative care bundles be recommended or not for the prevention of pressure injuries?

n=original search
n=update search

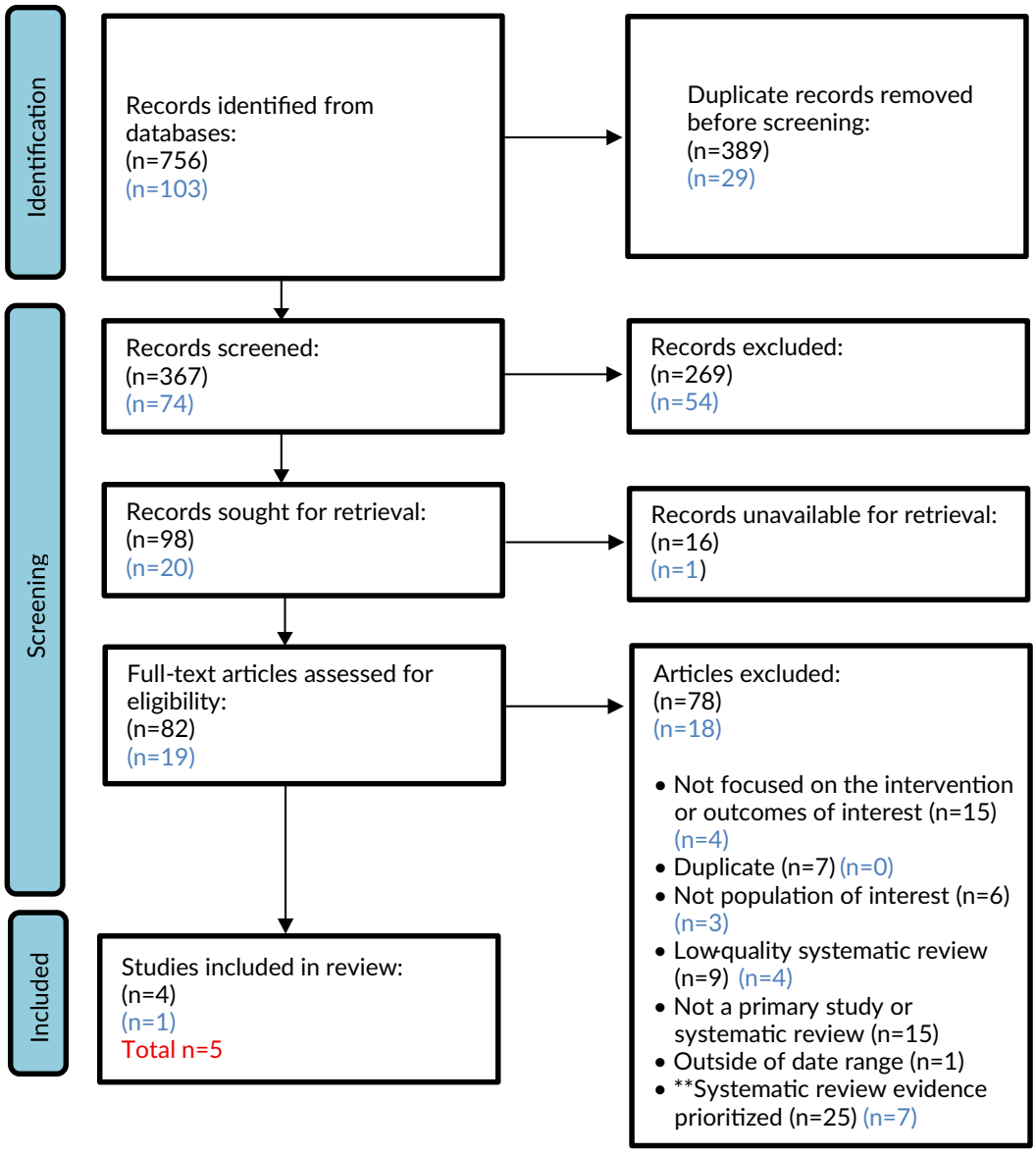


Source: Adapted from: Page MJ, McKenzie JE, Bossuyt P, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic review. Available from: http://www.prisma-statement.org/

Figure 3: *Article Review Process PRISMA Diagram for Recommendation Question #4*

Recommendation question #4: Should the use of prophylactic dressings be recommended or not for the prevention of pressure injuries?

n=original search
n=update search



Source: Adapted from: Page M, McKenzie P, Bossuyt P, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Syst Rev. 2021;10(89). Available from: https://doi.org/10.1186/s13643-021-01626-4

RESULTS

Two reviewers screened 1,295 articles pertaining to the three research questions. Of these, 234 full texts were examined for relevance, and 14 articles were included to inform three recommendations, which are described below.

Recommendation 2.0: The expert panel suggested that nurses and health providers reposition persons at risk of pressure injuries every 2–4 hours. Repositioning refers to turning people to change their body position to relieve and/or redistribute pressure. Repositioning reduces the duration of pressure on the tissues, thereby decreasing tissue hypoxia.[1,3,20] To inform this recommendation, the panel included 1 SR with 5 randomized controlled trials (RCTs), 1 additional RCT, and 1 nonrandomized study (NRS).[3,20–22] The interventions and comparators assessed were: two-hourly versus three-hourly and four-hourly repositioning; three-hourly versus four-hourly repositioning; four-hourly versus six-hourly repositioning; three- or four-hourly versus two-hourly repositioning; and five-hourly versus three-hourly repositioning. These studies focused on two outcomes: PI incidence and precursor signs and symptoms of PI among adults at risk of a PI.[3,20–22]

Three RCTs found that the evidence is very uncertain regarding whether two-hourly compared with four-hourly repositioning decreases pressure injury incidence. The relative risk (RR) was 1.06 (95% CI, 0.80–1.41). This translates to no more or no fewer pressure injuries per 100 people who receive two-hourly repositioning versus those who receive four-hourly repositioning (ranging from three fewer to three more).[3,20]

Two RCTs compared two-hourly to three-hourly repositioning. The evidence suggests that these repositioning schedules offered no difference in PI incidence (RR 4.06; 95% CI 0.87–18.98 and RR 0.90; 95% CI 0.69–1.16).[3,20]

One RCT found that there may be a reduction in PI incidence with three-hourly repositioning compared with four-hourly repositioning (RR 0.20; 95% 0.04-0.92).[3,20]

One RCT compared four-hourly to six-hourly repositioning and found that four-hourly repositioning may improve PI incidence, but the evidence was very uncertain (RR 0.73; 95% 0.53–1.02).[3,20]

Another RCT examined an alert system based on repositioning every 2, 3, or 4 hours. No PIs were noted during the study period; however, prior to the intervention, the PI incidence was 5.24%.[3,21]

One nonrandomized study compared three-hourly to five-hourly repositioning and found that three-hourly repositioning may decrease PI incidence. However, the evidence is very uncertain (OR 0.51; 95% CI 0.27–0.97).[3,22] This suggests that for every 100 people who receive three-hourly repositioning rather than five-hourly repositioning, one less person will have a PI (ranging from 2 fewer to no more or less).

For three-hourly repositioning compared with five-hourly, three-hourly repositioning may decrease precursor signs and symptoms of PI; however, the evidence is very uncertain (RR 0.40; 95% CI 0.17–0.90).[3,22] This suggests that for every 100 people who receive three-hourly repositioning rather than five-hourly repositioning, one less person will have precursor signs of PI (ranging from 2 fewer to no more or less).[3,22]

The expert panel noted that person/caregiver satisfaction, PI healing rate, and PI worsening rate are critical outcomes to examine, but these were not measured in the research.[3] The expert panel also noted that while health provider staffing levels could be a barrier to repositioning frequency, a lack of health providers does not negate the need for repositioning.[3]

Considering the overall magnitude of benefits across all studies, there may be little to no difference between two-, three-, or four-hourly repositioning; however, repositioning at these intervals may decrease PI incidence compared to five- or six-hourly repositioning.[3] No harms were noted. It is important to note that the certainty in the evidence is low due to serious or very serious risk of bias and imprecision in the studies. Based on this, the expert panel determined the strength of the recommendation to be conditional.[3]

Recommendation 3.0: The expert panel suggested that nurses and health providers implement preventative care bundles for persons at risk of pressure injuries. Preventative care bundles are groups of evidence-based interventions delivered together to ensure standardized care. When performed together, they aim to result in a better outcome than if performed individually.[23]

This recommendation was informed by one SR of 1 RCT and 19 NRS, and 5 separate NRS.[24–29] The interventions within the bundles included PI risk assessment, skin assessment, nutrition, activity, participation in PI education, and other interventions. The populations studied were at risk of pressure injury. Most studies focused on adults,[24–28] while one study focused on children over one month old.[29]

In the SR, one RCT reported that the incidence of PIs (at any stage) was lower in the care bundle group than in the control group (RR 0.42; 95% CI 0.24–0.76).[3,24] This suggests that for every 100 people who receive the preventative care bundle, 31 fewer people will have a PI of any stage (ranges from 13 to 40 fewer). When Stage 2 pressure injuries in the RCT were examined, the incidence was also lower in the preventative care bundle group (RR 0.38; 95% CI 0.14–1.02), indicating that for every 100 people who receive the preventative care bundle, 12 fewer people will have a Stage 2 PI (ranging from 16 fewer to no more or less). Nineteen NRS[3,24] that examined bundled care interventions all reported decreased PI incidence. An effect estimate was not calculated due to variation in the reporting and missing details across studies.[3,24]

Three NRS reported on the health provider's compliance.[3,25,26,27] Care bundles may increase provider compliance, but the evidence is very uncertain. In one study, compliance was 85% in the intervention group compared with 50% in the control group.[3,25] Another study reported that compliance was 5% higher in the care bundle group than in the control group.[3,26] A third study reported high compliance with the bundle (78.9%).[3,27]

In a systematic review, one nonrandomized quality improvement study reported on the outcome of person satisfaction.[24] Ninety-seven per cent of 213 patients surveyed were satisfied with the intervention.[3,24]

Care bundles may reduce precursor signs and symptoms of PI, but the evidence is very uncertain. Three NRS reported on this outcome.[3,26,28,29] Stage 1 PI decreased following implementation of the preventative care bundle.

The expert panel noted the importance of examining the effect of preventative care bundles on adverse events. However, these outcomes were not measured in the literature.[3] The overall certainty of the evidence for these outcomes was very low because of serious and very serious risk of bias across the outcomes and imprecision for two outcomes. Given the very low certainty of the evidence, the expert panel determined the strength of the recommendation to be conditional.[3]

The panel also emphasized the importance of preventative care bundles for people with darker skin tones, particularly in areas of the world with higher populations of people with darker skin tones. This is due to the increased risk of missing early signs of pressure injury. An additional study concluded that people with darker skin tones are more likely to develop higher-stage pressure injuries across health settings.[3,30]

Recommendation 4.0: The expert panel recommended that nurses and health providers use multilayer foam silicone dressings (MFSDs) as a prophylactic measure for individuals at risk of pressure injuries, in addition to other preventative care strategies. These dressings should be applied to specific at-risk body locations, considering the potential for shearing, friction, and pressure. A prophylactic dressing helps prevent pressure and shearing forces and is an adjunct to repositioning and support surfaces. MFSDs have a soft silicone adhesive, are self-adherent, and contain multilayer foam. Dressings with a silicone interface can also protect newly healed tissue.[3,31]

One SR informed this recommendation of six RCTs and three additional RCTs (one of which included unpublished data).[32–35] The population included adults at risk of developing PIs.

One SR reported pressure injury incidence.[3,32] MFSDs may reduce pressure injury incidence compared to no MFSDs (RR 0.25; 95% CI 0.16–0.41). This suggests that for every 100 people who receive the intervention, 9 fewer people will have a PI (ranging from 10 to 7 fewer).

One SR of three RCTs reported on the outcome of precursor signs and symptoms when using MFSDs compared to no dressings.[3,32] MFSDs may decrease precursor signs and symptoms; however, the evidence is very uncertain (RR 0.27; 95% CI 0.08–0.90). This suggests that for every 100 people who receive the intervention, 7 fewer people will have a PI (ranging from 8 fewer to 1 fewer).

One RCT, based on unpublished data, reported on the quality of life for persons using MFSDs compared to no dressings.[3,35] MFSDs likely result in little to no difference in quality of life. Mean quality of life score on day 14 was 0.40 (SD 0.28) in the intervention group compared to 0.42 (SD 0.27) in the no dressings group.

Two RCTs reported on pain for persons using MFSDs compared to no dressings.[34,35] There was little to no difference in pain between the two groups. In two RCTs, two patients in the intervention groups reported sacral pain, and those in the control group reported no sacral pain.[3,33,34]

One RCT reported on person satisfaction for those using MFSDs compared to no dressings.[3,33] MFSDs may result in higher satisfaction scores than the no-dressing group.[3,33]

One RCT reported 33 adverse device events in 28 patients.[3,35] Most of the adverse events were mechanical skin injuries, including skin tears or skin stripping (n=11), PI occurrence (n=3), and blister formation at the edge or underneath the dressing (n=3).[3,35] Additionally, heel dressings caused two patients to fall without significant injury when the dressings were in direct contact with the floor surface.[3,35] One study within a SR reported that no dressing-related adverse events occurred during the trial.[3,32] The remaining trials in this SR did not provide adverse event data.[3,32]

The expert panel noted there may be benefits to using MFSDs for individuals at risk of pressure injuries. Adverse events were minimal and not reported across all studies. MFSDs are adjunct interventions to other prevention strategies, such as repositioning and support surfaces. However, the certainty of the evidence is very low because of serious to very serious risk of bias and imprecision across all outcomes. Therefore, the expert panel determined that the strength of the recommendation to be conditional.[3]

DISCUSSION

Implementation and Feasibility

Recommendation 2.0: A lack of availability of positioning devices may be a barrier to offloading patients at risk for PI

formation. One study[36] found that a lack of device availability for positioning may be a barrier to offloading patients at risk of pressure injury formation. The study also noted that repositioning a critically ill patient requires two people and can impact decisions made when caring for patients with a wound. Furthermore, it was found that ensuring clear options were available and ensuring understanding of how equipment functions or what specific methods to use may improve decisions related to wound management.[36]

When discussing the implementation of the turning and repositioning recommendation, the expert panel noted that healthcare teams, including occupational therapists, should collaborate with persons and/or essential caregivers when planning an individualized repositioning schedule/frequency within a two to four hour interval. This approach considers everyone's situation, while also recognizing the risk of tissue damage from prolonged immobility.

The expert panel also emphasized the importance of providing health education to persons and/or their essential caregivers on the benefits and techniques of repositioning. They noted the need to be mindful of caregiver burden and feasibility, as caregivers may require support to assist with repositioning in home and community settings. This is consistent with findings from a meta-synthesis focusing on formal caregivers' experiences in caring for individuals at risk for, or living with, a PI.[37] This meta-synthesis highlighted that caregiver education on risk factors, turning and positioning, and dressing changes was perceived to improve PI prevention. However, it also noted that nurses can be reluctant to engage family caregivers due to the risk of overburdening.[37]

Recommendation 3.0: The expert panel suggested that nurses and health providers implement preventative care bundles for persons at risk of PIs. The expert panel noted that preventative care bundles should be customized and contextualized to the person and practice setting while aligning with guiding principles of person-centred care and shared decision-making.[3] This approach ensures that patients receive optimal skincare, nutrition, management of moisture/incontinence, support surface management, and other components of the bundle in a person-centred manner.

When implementing a care bundle, it is important to educate patients and caregivers about its purpose and components. This not only supports a reduction in pressure injury incidence post-implementation but may also lower the care costs due to improved outcomes.[3]

The expert panel also suggested integrating feedback on the bundle's effectiveness into future revisions and planning, promoting continuous improvement in care delivery. One study[38] found that peer-reviewed papers reported the adaptation of preexisting care bundles, leading to improved care.

Recommendation 4.0: When selecting dressings for preventative use, it is crucial to consider the person's comfort and preferences, as some dressings may cause discomfort.[3] This discomfort may be due to contraindications in dressing use, such as sensitivity or allergy to dressing components. In addition, persons with darkened skin may have an unidentified PI, which can result in pain at the dressing site.[3]

An ideal dressing is designed to reduce friction between the back of the dressing and the support surface and/or clothing, has five layers, and is large enough to cover the pressure point or at-risk body locations. While these dressings can be costly,[3] the silicone self-adherent border on multilayer foam dressings allows for wound inspection and reapplication without needing complete replacement, which may help reduce costs. Health providers should follow the manufacturer's guidance on dressing use, including instructions for cutting or shaping the dressing. Dressings can typically remain in place for up to 7 days, as specified by the manufacturer, and should be changed when soiled or saturated. If there is difficulty identifying the manufacturer of the product, the nurse educator, nurse manager, or the setting's purchasers should be consulted.[3]

Finally, hands-on education for health providers should accompany the intervention, including training on skin assessment and reassessment, as well as on applying and reapplying the dressing to prevent injury. Whenever possible, patients and caregivers should be included in the education process. Nurses serve as educators, advocates, and leaders in promoting a culture of patient safety and quality improvement within health care settings. Consequently, investing in nursing education, training, and professional development is essential for optimizing pressure injury prevention.[39]

Implications for Future Research

Future research should focus on a broader range of important outcomes, such as person/caregiver satisfaction, injury-healing rate, and PI worsening rate, when comparing repositioning frequencies. For instance, higher-quality research is needed to evaluate the impact of different repositioning frequencies.

Bundles were included if they consisted of an integrated set of two or more interventions implemented together, rather than a set of preventative care options, a guideline, or an intervention focused solely on education. Future research that examines differences in bundles, including the number of interventions implemented together and similarities among them, would provide more insight. The panel identified adverse events as important outcomes but did not examine them in the research.[3]

Currently, there is a lack of research on the impact of prophylactic dressings in community, home care, and primary care settings. Qualitative studies examining provider and patient preferences, as well as the facilitators or barriers of

using prophylactic dressings, would add valuable insights. Measuring pain in persons using prophylactic dressings and accounting for differences in skin tone may also yield beneficial outcomes.

Limitations

Future editions of the guideline should prioritize studies conducted in additional settings, including home care and primary care. Increased research on PI in children would also strengthen the evidence base for recommendations. The research was also conducted using only studies published in English; additional studies in other languages that provide congruent or conflicting evidence may exist. Finally, higher-quality research throughout may increase confidence in the evidence and change the strength of the recommendations.

CONCLUSION

The purpose of this paper is to provide nurses and other members of the interprofessional team, including persons and their families and others, with evidence-based recommendations for preventing PIs. We recognize that people at risk of developing PI and their essential caregivers are experts in their own health and decision-making. Collaboration among the interprofessional team, persons with lived experience, and essential caregivers is critical to achieving better health outcomes. •

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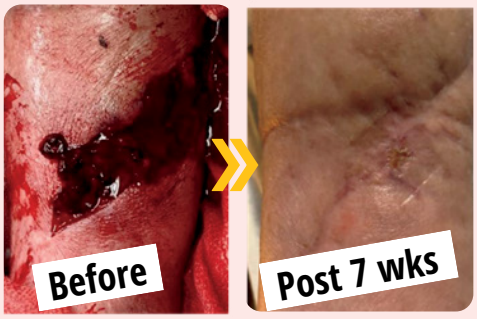

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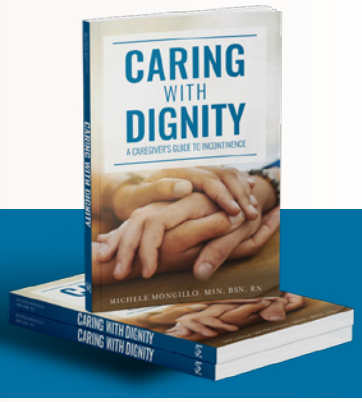

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