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Recommendations for the development of a new aeromedical evacuation mattress

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Abstract

This study is an investigation into the best available evidence for selecting and evaluating an aeromedical transport mattress for reducing the incidence of pressure ulcers in Canadian Forces (CF) members undergoing long-duration aeromedical evacuation. A set of recommendations for a new mattress is made based on a literature survey of MEDLINE, CINAHL, and the Cochrane Library. No difference was found between different mattress categories (dynamic high-tech, static high-tech, and static low-tech) in reducing the incidence of pressure ulcers, but significant reductions were found when compared to standard hospital mattresses. Little evidence was found to support the clinical utility of biomedical measurements of tissue perfusion based on interface pressure, transcutaneous oxygen tension, and laser doppler flowmetry. Based on the literature findings, to minimize cost, maintenance, and power requirements, and meet operational ergonomic requirements, it is recommended that a static low-tech mattress made of visco-elastic foam be used with the following length, width, and depth dimensions: 193 cm x 62.5 cm x 12.7 cm. The effectiveness of this mattress would be best evaluated using a randomized controlled trial to compare it with the current standard of care mattress.

Résumé

Cette étude est une enquête sur les meilleures preuves disponibles pour la sélection et l'évaluation d'un transport aéromédical matelas pour réduire l'incidence des ulcères de pression au sein des Forces Canadiennes (FC) en cours de longue durée évacuation aéromédicale. Une série de recommandations pour un nouveau matelas est fait basé sur une revue de la littérature dans MEDLINE, CINAHL et la Cochrane Library. Aucune différence n'a été trouvée entre les différentes catégories de matelas (dynamique high-tech, high-tech statique, et statique low-tech) pour réduire l'incidence des ulcères de pression, mais des réductions significatives ont été observées par rapport aux matelas d'hôpital standard. Peu de preuves a été retrouvé à l'appui de l'utilité clinique des mesures biomédicales de la perfusion tissulaire basée sur la pression d'interface, la tension d'oxygène transcutanée et la vélocimétrie laser. Sur la base des résultats de la littérature, de minimiser les coûts, la maintenance et les exigences de puissance, et de rencontrer les exigences opérationnelles ergonomiques, il est recommandé qu'un statique low-tech matelas en mousse visco-élastique être utilisé avec la longueur, largeur, profondeur et les dimensions: 193 cm x 62,5 cm x 12,7 cm. L'efficacité de ce matelas serait le mieux évalué en utilisant un essai contrôlé randomisé à comparer avec la norme actuelle de soins matelas.

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1 BACKGROUND

A specific request has been made by the Canadian Forces Health Services to Defence Research and Development (DRDC) to select and evaluate an evidence-based mattress (or support-surface) for reducing the incidence of pressure ulcers in Canadian Forces (CF) members undergoing aeromedical evacuation. DRDC is a joint military-civilian research agency within the Department of National Defence (DND) that serves members of the CF. They respond to the scientific and technological needs of the CF by analyzing current scientific knowledge, conducting research projects, and proposing solutions for a given problem. (DRDC-RDDC, 2012)

1.1 Pressure ulcer incidence

Pressure ulcers (also known as decubitus ulcers, pressure sores, and bed sores) occur as a result of prolonged pressure on the body that reduces blood flow and cause damage to the underlying tissue. They often occur in patients with reduced mobility, at the interface between a bony prominence and an external surface, such as a chair cushion or bed mattress. While rates of pressure ulcers vary widely depending on institution and patient population, approximately 3-15% of patients in acute care hospital beds develop a pressure ulcer early during their stay (Bergstrom et al., 1996). Furthermore, the average hospital stay for a patient with a secondary diagnosis of pressure ulcers increases from five days to 12.7 days, with a cost per day of $1,600, averaging an additional total cost $12,320 per patient. (Allison Russo, 2008)

1.2 Staging and complications of ulcers

The clinical manifestations are often categorized according to the 2007 National Pressure Ulcer Advisory Panel (NPUAP) staging system (NPUAP, 2011; *npuap.org*, 2011; Pham et al., 2011):

Stage I: Intact skin with non-blanchable redness of a localized area usually over a bony prominence. Darkly pigmented skin may not have visible blanching; its color may differ from the surrounding area.

Stage II: Partial thickness loss of dermis presenting as a shallow open ulcer with a red pink wound bed, without slough. May also present as an intact or open/ruptured serum-filled blister.

Stage III: Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscle are not exposed. Slough may be present but does not obscure the depth of tissue loss. May include undermining and tunneling.

Stage IV: Full thickness tissue loss with exposed bone, tendon or muscle. Slough or eschar may be present on some parts of the wound bed. Often include undermining and tunneling.

Besides the psychosocial burden on the patient with regards to additional pain and wound care requirements, the main medical complication is the risk of infection. Systemic antibiotic use may be required for cellulitis and osteomyelitis (Huang, Schweitzer, Hume, & Batte, 1998), with rare case reports suggesting an association of pressure ulcers with endocarditis, and meningitis (Kaufman, 1971). Bacteremia and sepsis resulting from pressure ulcers have also been associated with mortality rates of 29-50% (Galpin, Chow, & Bayer, 1976).

1.3 Preventing pressure ulcers

Given the large burden pressure ulcers places on both the patient and healthcare system, much of the focus has been on prevention (Stechmiller, Cowan, & Whitney, 2008). There are a number of external and host dependent risk factors that can be assessed using either the Norton (NPUAP, 1989) or Braden (Bergstrom, Braden, Kemp, Champagne, & Ruby, 1998) scales. These include external pressure, shearing forces, friction, moisture, mobility status, incontinence, nutritional status, skin perfusion, and neurologic diseases. The primary preventive interventions include relief of the offending pressure itself through proper patient positioning or use of a pressure-reducing mattress (or support-surface). Regular turning and repositioning is indicated for patients at risk, typically every two-hours, although there is no evidence to support this particular time interval (Reddy, Gill, & Rochon, 2006). This technique, however, significantly increases the workload on healthcare providers. Therefore, the use of appropriate support-surfaces, the subject of this research project, may further reduce the development of pressure ulcers.

1.4 Support-surfaces

Support-surfaces consist of overlays (thin mattresses used on top of traditional mattresses) or traditional mattress replacements, which both reduce the incidence of pressure ulcers in two ways. First, they redistribute the force of gravity over a greater surface area, thus reducing the peak pressure in any given location. Second, they may reduce the duration of an area of the body is exposed to high peak pressure. In theory, the peak pressure on the body should not exceed the capillary closing pressure of 17 mmHg, so that optimal tissue perfusion is maintained (KOSIAK, 1961).

There are a wide array of commercially available support-surfaces, made with variety of materials at a variety of costs. These surfaces can be categorized into one of three broad groups: 1) dynamic high-tech, 2) static high-tech, and 3) static-low tech, each of which may include one or more subtypes (Fig. 1).

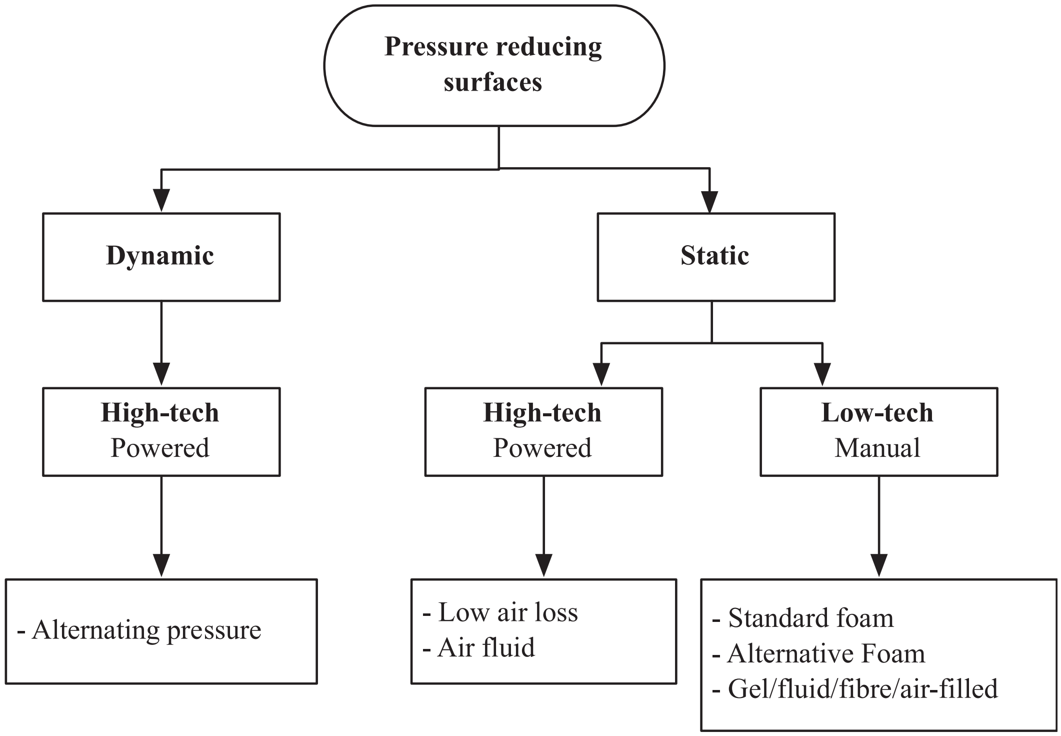


Figure 1 - Support-surface categories. Adapted from (Burnett, Clift, & Sprange, 2008).

1.4.1 Dynamic high-tech support surfaces

Dynamic high-tech support-surface primarily consist of alternating-pressure mattresses that mechanically alter the areas of high and low pressure experienced by the patient. This is accomplished by inflating and deflating various air pockets within the mattress using a powered air pump attached to the mattress (Fig. 2a). These are the most expensive support-surfaces available and can cost over $1000 for a whole mattress replacement. In addition the pump requires an external power source, and imposes additional standard maintenance requirements beyond infection control procedures.

1.4.2 Static high-tech support surfaces

Static high-tech support-surfaces are comprised of either low-air-loss or air-fluidized mattresses. Low-air-loss mattresses provide a continuous flow of warm air through the mattress cover to provide a drying effect on the skin and prevent patient overheating. The mattress is inflated to a specific pressure, based on the patient's anthropometric characteristics, and is maintained by an external air pump. Air-fluidized mattresses are filled with small ceramic or glass beads that act as a fluid when exposed to air flow. This allows an equal pressure to be exerted across the entire body, especially relieving bony prominences, such as the occiput and sacrum, of increased pressure. These systems can also cost several thousand dollars, and require additional maintenance and power as with the dynamic high-tech mattresses.

A)  B) 

Figure 2 - High-tech mattresses. a) Dynamic; b) Static.

1.4.3 Static low-tech support surfaces

Finally, the most widely studied support-surfaces are *static low-tech* mattresses. These mattresses are made of a variety of materials in a number of configurations, and may be made of standard foam (Fig. 3a), alternative foam (Fig. 3b), or may be filled with fibre, gel, fluid, or air. Alternative foam is typically a visco-elastic foam (memory foam), which is a polyurethane foam with increased viscosity (density) that conforms to body contours (Fig. 3c).

Both standard and alternative foam mattresses are available in several forms. Mattresses may be convoluted or contoured “egg crate” shaped, which facilitates airflow around the body (Fig. 3c). They may also be made of cubed foam, which is simply a foam mattress cut into cubes, which allows for individual movement of each cube (Fig. 3d). Low-tech static mattresses require the least maintenance and cost ($50 - $200).

A)  B) 

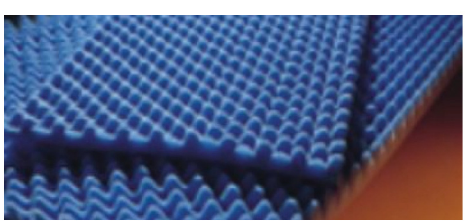
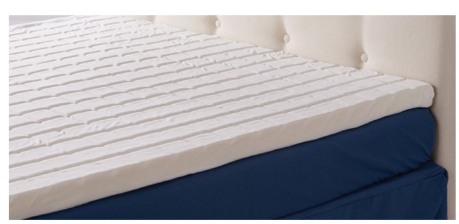
C)  D) 

Figure 3 - Low-tech static mattresses. □a) Standard foam; b) Alternative foam; □c) Convoluted/contoured foam; d) Cubed foam.

1.5 Pressure ulcers in the aeromedical context

Despite the risk of pressure ulcers described in aeromedical transport literature (Jernigan & Hurd, 2003), no formal evaluation of their incidence could be found. This is concerning, because it has been shown that Stage I pressure ulcers can develop in as little as two hours (Knox & Anderson, 1994), well within the timeframe of a long-duration Royal Canadian Air Force (RCAF) transatlantic aeromedical evacuation.

The space and equipment constraints of RCAF aircraft also present a unique challenge for healthcare workers to provide preventive maintenance for pressure ulcer development among injured CF personnel. Compared to a hospital setting, patients are typically only accessible from one side, forcing care providers to reach across the patient to change dressings or manipulate therapeutic or monitoring equipment. In some cases patients may even be stacked above one another, reducing overhead clearance and limiting the ability to increase or reduce the height of the bed. Without a direct connection to ground power sources, equipment must also be carefully selected. Airworthiness considerations for RCAF equipment of particular interest include power usage, radio interference, flammability, effect on emergency egress. Finally, care providers may be responsible for several critically ill patients at the same time, while negotiating these environmental demands.

Under these challenging conditions, it is essential to provide the most effective systems to support these healthcare workers. The question then is, what are the ideal dimensions and material specifications for the development of a new mattress for the aeromedical evacuation of Canadian Forces personnel lasting more than two hours, based on the current clinical evidence and considering the unique environmental requirements, for reducing the impact of pressure-reducing mattresses on pressure ulcer incidence?

2 METHODS

A review of the literature was conducted with three major objectives: 1) investigate the variety of support-surface types and materials currently available, 2) evaluate the current clinical evidence regarding types of support-surfaces and their impact on pressure ulcer incidence, and 3) assess the methods by which these support-surfaces are evaluated in a scientific setting. The literature review findings will be corroborated with an advanced practice wound care nurse researcher at a University teaching hospital. Furthermore, the proposed mattress specifications must also take into account several operational constraints, such as space and power limitations, in addition to the literature findings. Finally, an experimental protocol will be proposed to evaluate the effectiveness of the new mattress.

2.1 Literature review

A literature search of MEDLINE, CINAHL, and the Cochrane Library was conducted individually by the author, to include biomedical research, nursing research, and previous reviews of pressure-ulcer reducing support surfaces. The following search terms were used:

(mattress) OR (support surface) OR (cushion)

AND

(pressure ulcers) OR (decubitus ulcers) OR (bed sores)

AND

(prevalence) OR (incidence) OR (clinical outcomes)

The study population, patients undergoing RCAF aeromedical transport, is directly addressed by the research question. Care must be given, however, to interpret the currently available literature within this context. Much of the previous literature is centered around elderly patients, or those with significant co-morbidities (diabetes, vascular disease), which does not accurately describe the study population, who are generally younger in age and in relatively good health, but suffer from acute injuries.

2.2 Practical considerations

RCAF operational constraints of aeromedical evacuations in a broad range of aircraft and mattress standards must be taken into account when proposing the new mattress specifications. The following input parameters were used to inform the design of the mattress:

- Increase of anthropometric parameters from 50th percentile to 95th percentile man (see Appendix B)
- Dimensions must not compromise current transverse reach distances across the mattress
- Mattress material must meet non-flammability standards: ISO 12949:2011; ISO 12952-1:2010; ISO 12952-2:2010

When combined with the operational constraints of RCAF aeromedical evacuation, such as space, power, and cost, a set of recommendations will emerge that will define the appropriate specifications for a new mattress to be developed.

3 RESULTS

The initial search produced 148 results between the three databases, which was then narrowed to a total of 70 articles: 54 MEDLINE, one Cochrane review, and 15 CINAHL (see APPENDIX A). After reviewing the 148 abstracts, studies without quantifiable clinical outcomes and papers that appeared multiple times between databases were excluded. Only randomized, cohort, case-control, case series and cross-sectional studies were included in the final list, alongside review papers.

There are several weaknesses that were identified during the literature review that will impact the recommendations. First is the lack of healthcare provider blinding to the type of support-surface used. Knowing that a support-surface intervention is being used may unconsciously increase the level of care provided, inadvertently reducing the incidence of pressure ulcers. Second, many of the studies were limited by small sample sizes, which may explain why few significant differences were found between support-surface types. Also, there are several risk assessment tools, which led to inconsistencies between studies in the risk assessment of patients being randomized to the control or intervention groups. Clinical outcome data was also not clear in a number of studies; with some studies using stage I pressure ulcers as a study endpoint, while others used stage II pressure ulcers. Finally, many studies compared support-surface interventions to “standard hospital mattresses”, without adequately defining the physical characteristics and properties of the mattresses.

3.1 Summary of support-surface comparisons in the literature

Results in the literature are reported as the incidence of pressure ulcers when comparing a pressure reducing support-surface to a typical hospital bed or another pressure reducing support-surface. These research findings have been summarized in Table 1.

Table 1 - Comparison of support-surface types. □Not enough evidence (?), no significant decrease (X) or significant decrease (>) in the incidence of pressure ulcers.

compared to -->	**Dynamic high-tech**	**Static high-tech**	**Static low-tech**	**Standard mattress**
Dynamic high-tech		?	X	>
Static high-tech			X	>
Static low-tech				>

1. **Mattress overlays are not effective.** Studies of support-surface overlays found no significant decrease in the incidence of pressure ulcers when compared to hospital mattresses and an increase in incidence when compared to mattress replacements. (Conine, Daechsel, & Lau, 1990; Iglesias, Nixon, Cranny, &

Nelson, 2006; Nixon et al., 2006; Sanada et al., 2003; Vyhlidal, Moxness, Bosak, Van Meter, & Bergstrom, 1997)

2. **Dynamic high-tech is better than standard foam.** Dynamic high-tech mattresses (alternating-pressure) was found in two studies to be effective at reducing the incidence of pressure ulcers when compared to both standard foam, and hospital mattresses. (Cullum, Deeks, Sheldon, Song, & Fletcher, 2000; Sanada et al., 2003)

3. **Static high-tech is better than standard foam, but not static low-tech.** Only one study showed a significant decrease in the incidence of pressure ulcers compared to a standard operating room mattress (Inman et al., 1999). Other studies could find a significant difference, as well as no difference between static high-tech mattresses and static low-tech mattresses (Cullum et al., 2000).

4. **Static low-tech is better than standard foam, but all static low-tech are the same.** Several large studies comparing several types of static low-tech mattresses (air/fluid filled, cubed foam, convoluted foam, and alternative foam) to hospital mattresses found that they reduced the incidence of pressure ulcers. They did not, however, find any significant differences between static low-tech subtypes. (Gray & Smith, 2000; Gunningberg, 2006; Hofman, Geelkerken, Wille, & Hamming, 1994; Russell, Reynolds, & Park, 2003; Vyhlidal et al., 1997)

5. **Dynamic high-tech is not better than static low-tech.** There is conflicting evidence regarding the effectiveness of dynamic high-tech mattresses over static-low tech mattresses. One study has shown superiority of dynamic high-tech mattresses in reducing pressure ulcer incidence (Gebhardt, Bliss, Winwright, & Thomas, 1996), while many have shown no difference (Cavicchioli & Carella, 2007; Conine et al., 1990; Price, Bale, Newcombe, & Harding, 1999; Sideranko & Yeston, 1994; Vanderwee, Grypdonck, & Defloor, 2005).

These findings were all supported by consultation with a wound care Subject Matter Expert responsible for support-surface purchasing at a large urban tertiary care centre. In addition, they recommended that thicker mattresses are more effective at reducing peak pressures.

3.2 Mattress evaluative techniques

There are several biomedical techniques used to evaluate mattress performance. In theory, the goal is to maintain a peak pressure less than the capillary closing pressure of 17 mmHg for optimal tissue perfusion (KOSIAK, 1961). Tissue subjected to pressures exceeding this value extended period of time will result in breakdown as metabolic products accumulate and cells are deprived of oxygen. These techniques are based on measuring tissue oxygenation and forces applied to the body. One widely used method is called interface pressure measurement, which measures the pressures at the skin-support interface. There are also two other methods that have been proposed in the literature, transcutaneous oxygen tension, and laser doppler flowmetry, but so far have not produced reliable data. All three techniques are investigated and summarized below.

3.2.1 Interface pressure measurements

Interface pressure (IP) measurement makes use of a mesh network of force sensors between a patient and the support surface (Fig. 4) (Yip et al., 2009). It outputs a scalar measurement of the magnitude of the forces acting perpendicular to the skin at the points of contact. Tekscan, BodiTrak and XSensor are several commercially available models of interface pressure measurement devices, but are generally very expensive (>$10,000).

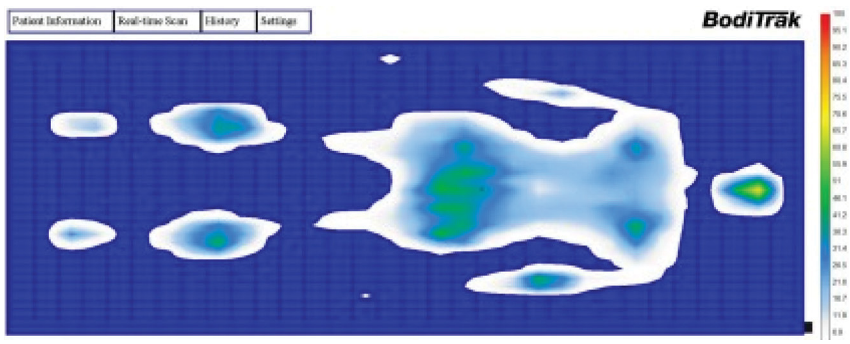


Figure 4 - An output screen capture of interface pressure measurements.

The use of this method depends on knowing the forces and durations that cause pressure ulcers. The theoretical value often cited for force is 17 mmHg, the pressure at which capillaries are no longer able to remain patent, but there is inconclusive research that determines at what specific pressures impaired tissue perfusion occurs. Capillary closing pressure also does not fully determine the extent of impaired perfusion, as it is highly dependent on the intrinsic and extrinsic risk factors for developing pressure ulcers described in Section 1.3. (Sprigle, 2011)

While there have been a number of IP studies, there is concern regarding their reproducibility and scientific validity. Simple IP measurements are insufficient to describe the complexities of underlying tissue deformation, and support surface shear forces and friction. Furthermore, results are heavily influenced by the alteration in skin-support interface dynamics caused by the sensor network itself, the unreliability in sensor data caused by drift and movement, and disagreement in the literature regarding the most appropriate analytical techniques (peak vs. average pressure). (Rithalia, 2005)

Finally, there is no clinical evidence to support absolute IP measurement as a valid predictive tool for the risk of pressure ulcer formation. Therefore, these measurements could be used to identify unacceptably high interface pressures and rule-out support surfaces, but they are not suitable for selecting a specific support surface (Pipkin & Sprigle, 2008).

3.2.2 Transcutaneous oxygen tension

Transcutaneous oxygen tension measurements are frequently used in a wound care setting in patients with peripheral vascular disease as a diagnostic test for peripheral arterial insufficiency. It uses sensors applied directly to the skin that generate an electrical current when exposed to oxygen that can be translated into arterial blood pO_2 (Fig. 5). While useful in a clinical setting, it has not been demonstrated to provide any useful data due to the size of the sensor-skin-support interface disruption, and unclear relationship between arterial pO_2 and tissue viability. (Rithalia, 2005)

Figure 5 - Typical distal limb sensor arrangement used for transcutaneous oxygen tension measurements.

3.2.3 Laser doppler flowmetry

As with transcutaneous oxygen tension measurements, laser doppler flowmetry is frequently used in a wound care setting. Laser doppler flowmetry uses two optical lasers to measure doppler shifts resulting from arterial blood flow. Reductions in blood flow are thought to contribute to ulcer formation when tissue is exposed to prolonged pressure (Deitrick, Charalel, Bauman, & Tuckman, 2007; Sanada et al., 2003). Only one study found that dynamic high-tech mattresses had significantly greater mean sacral blood flow when compared to static low-tech mattresses (Jan, Brienza, Boninger, & Brenes, 2011). Unfortunately this method is limited in its utility for support-surface comparisons by the necessity for direct skin contact during measurement, its relative inaccuracy, small area of circulatory evaluation, and lack of supporting literature.

4 Discussion

This research aims to contribute to the academic literature by addressing the health issue in a previously unexplored context, that of long-duration aeromedical evacuation. There are several key findings that inform the design of the new RCAF mattress for aeromedical evacuation. First, there is abundant evidence that standard hospital mattresses are inferior to pressure ulcer reducing mattress replacements. Second, there seems to be no difference between support-surface categories (dynamic high-tech, static high-tech, and static low-tech) in their effectiveness at reducing the incidence of pressure ulcer formation. Third, there does not seem to be enough evidence to predict the effectiveness of support-surface interventions using biomedical evaluation over clinical outcome studies.

4.1 Recommendations

Considering these literature findings, the operational constraints of the RCAF regarding cost, power, weight, material flammability standards, and anthropometric requirements, the following recommendations are suggested. The design of a new aeromedical evacuation mattress for the reduction of pressure ulcer formation should be:

Recommendation 1: A static low-tech mattress

Rationale:
- Lack of evidence for increased benefit of static or dynamic high-tech mattresses.
- Reduced cost, increased reliability, and no additional maintenance or power requirements.

Recommendation 2: Made of visco-elastic foam (bonded Airflex 40/50 and Airflex 20/30 material)

Rationale:
- Meets flammability standards
- According to mattress contractor (Lifeport) recommendations

Recommendation 3: Increase thickness to 12.7 cm.

Rationale:
- Subject matter expert consultation
- Aircraft interior constraints to maintain adequate reach distance

Recommendation 4: Increase width to 62.5 cm and increase length to 193 cm.

Rationale:
- Anthropometric measurements increased from 50th to 99th percentile.

Given the lack of strong data supporting the predictive value of biomedical measurements of skin perfusion in pressure ulcer formation, and lack of data collected by the RCAF on current pressure ulcer incidence rates, it is recommended that the strongest evaluative protocol would be a randomized controlled trial establishing that the incidence of pressure ulcers on the new mattress is less than the old mattress. Patients would be randomized between the old aeromedical evacuation mattress (current standard of care) and the new aeromedical evacuation mattress while controlling for the risk of developing a pressure ulcer based on the Norton or Braden scale. The main study end-point would be the formation of any stage of pressure ulcer.

4.2 Conclusions

These recommendations are expected to result in a decrease of the incidence of pressure-ulcers experienced by patients undergoing RCAF aeromedical transport of greater than two hours in duration. Furthermore, this aims to reduce the burden on healthcare providers and improve their quality of care, reduce the healthcare costs related to treating these secondary injuries, and improve the quality of life for patients by reducing the duration of hospital stay, as well as preventing infection and ulcer associated pain.

In the broader scope of the CF community, reduced healthcare costs and healthier service members will contribute to continued operational excellence. In addition, the research will contribute to the greater international military and civilian aeromedical transport community, by providing sound scientific recommendations for future support-surface considerations.

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Annex A – Table of results for support surface intervention outcomes

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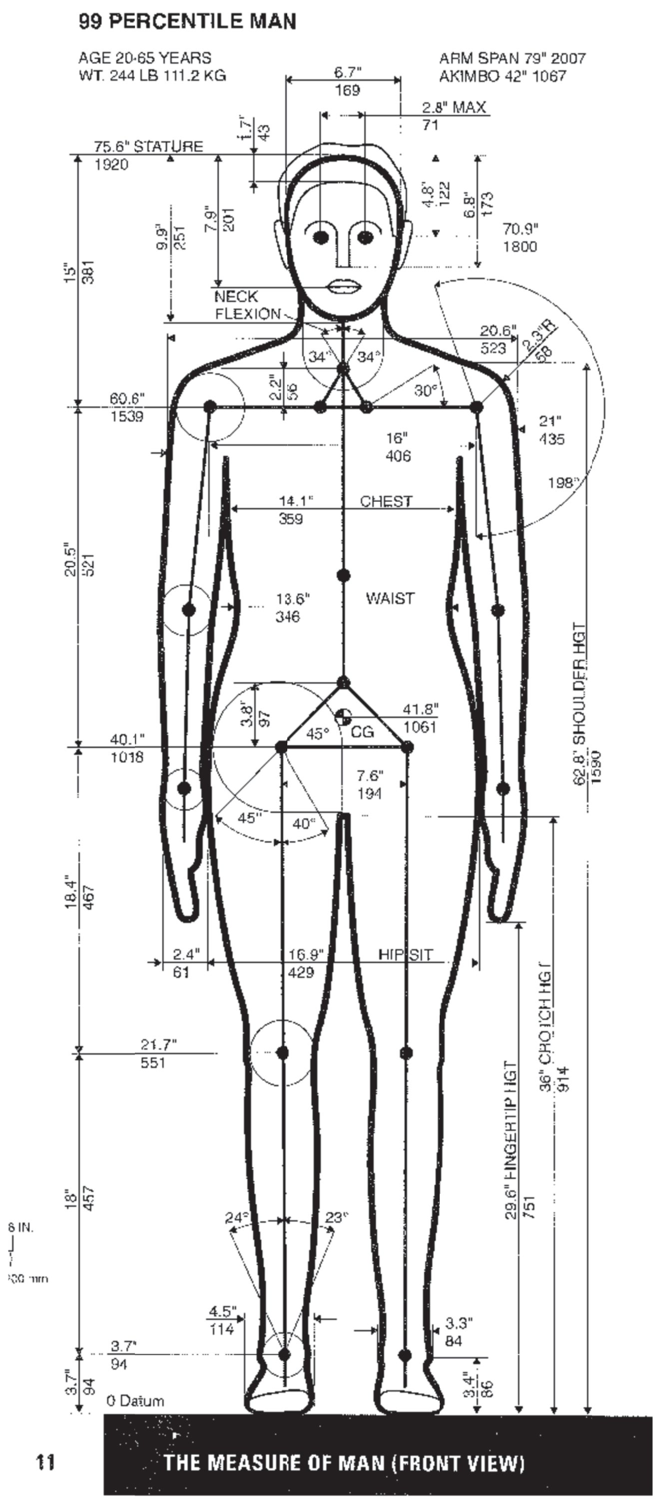
Annex B – 99th percentile man



11

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Recommendations for the development of a new aeromedical evacuation mattress. (U) (U)

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(U) This study is an investigation into the best available evidence for selecting and evaluating an aeromedical transport mattress for reducing the incidence of pressure ulcers in Canadian Forces (CF) members undergoing long-duration aeromedical evacuation. A set of recommendations for a new mattress is made based on a literature survey of MEDLINE, CINAHL, and the Cochrane Library. No difference was found between different mattress categories (dynamic high-tech, static high-tech, and static low-tech) in reducing the incidence of pressure ulcers, but significant reductions were found when compared to standard hospital mattresses. Little evidence was found to support the clinical utility of biomedical measurements of tissue perfusion based on interface pressure, transcutaneous oxygen tension, and laser doppler flowmetry. Based on the literature findings, to minimize cost, maintenance, and power requirements, and meet operational ergonomic requirements, it is recommended that a static low-tech mattress made of visco-elastic foam be used with the following length, width, and depth dimensions: 193 cm x 62.5 cm x 12.7 cm. The effectiveness of this mattress would be best evaluated using a randomized controlled trial to compare it with the current standard of care mattress.

(U) Cette étude est une enquête sur les meilleures preuves disponibles pour la sélection et l'évaluation d'un transport aéromédical matelas pour réduire l'incidence des ulcères de pression au sein des Forces Canadiennes (FC) en cours de longue durée évacuation aéromédicale. Une série de recommandations pour un nouveau matelas est fait basé sur une revue de la littérature dans MEDLINE, CINAHL et la Cochrane Library. Aucune différence n'a été trouvée entre les différentes catégories de matelas (dynamique high-tech, high-tech statique, et statique low-tech) pour réduire l'incidence des ulcères de pression, mais des réductions significatives ont été observées par rapport aux matelas d'hôpital standard. Peu de preuves a été retrouvé à l'appui de l'utilité clinique des mesures biomédicales de la perfusion tissulaire basée sur la pression d'interface, la tension d'oxygène transcutanée et la vélocimétrie laser. Sur la base des résultats de la littérature, de minimiser les coûts, la maintenance et les exigences de puissance, et de rencontrer les exigences opérationnelles ergonomiques, il est recommandé qu'un statique low-tech matelas en mousse visco-élastique être utilisé avec la longueur, largeur, profondeur et les dimensions: 193 cm x 62,5 cm x 12,7 cm. L'efficacité de ce matelas serait le mieux évalué en utilisant un essai contrôlé randomisé à comparer avec la norme actuelle de soins matelas.

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(U) aeromedical evaluation; mattress; pressure ulcers