

STAKEHOLDERS

Stakeholders	Category	Description
<p>1. Wheelchair using dementia patients</p> <p>All wheelchair-bound patients who cannot or have difficulty adjusting themselves into a different position.</p>	Primary	<p>Dementia patients at Kensington Gardens sit in wheelchairs for the majority of their day, but do not have the physical strength or mental capability to shift themselves; this may cause them to develop pressure ulcers, spinal problems and other health issues from remaining in the same position for too long [A14]. Their attempts to shift themselves to relieve pain often causes injuries due to falling. As the current method of having staff members physically shift their position does not adequately address the problem and also causes the patients additional injuries, these patients would prefer a new solution that is able to relieve their pain without the negative side effects of bruising [A1].</p> <p>Furthermore, patients or their families are responsible for 25% of mobility aids cost which may arise from a potential solution, whereas the other 75% is supported by the Municipal government. [17][B1]</p> <p>Reframing: The stakeholders of this opportunity should not be restricted to wheelchair using dementia patients only, but all wheelchair bound patients who cannot adjust position by themselves.</p> <p>There is no distinct connection between dementia and repositioning in the original RFP, any wheelchair bound patients who has limited mobility suffers from similar problems of developing pressure ulcers due to prolonged sitting, and manual effort or machine involvement is needed to reposition the patients every two hours for non-dementia patients as well. [2]</p>
2. Nursing Home Staff	Primary	Currently, the staff members are responsible for repositioning patients in wheelchairs every two hours

Any caregiver for wheelchair-bound people.		without injuring them. This process takes time and staff members must keep track of several wheelchair-bound patients due to the nursing home being understaffed. They would greatly appreciate a reduction in the effort required to aid their patients in shifting positions so that they may focus on other responsibilities [A2].
3. Family of wheelchair users	Secondary	Family members of the wheelchair-using residents are greatly interested in their well-being and would not to see them get injured by people they are paying to take care of their relatives. They also may be required to pay hospital fees to address health problems caused by prolonged poor sitting, which tend to be expensive [18]. Thus, they would want to see a reduction in the amount of injuries and discomfort that their relative(s) living in the Kensington Garden Nursing Home receive. If the patient's family is responsible for monthly payments, they would be responsible for the 25% of the mobility aids cost that would arise from a potential solution [B1].
4. Other Non-Wheelchair Using Residents	Secondary	Other Kensington Gardens residents may be impacted by the side effects caused by the introduction of a solution to this opportunity. They would prefer that the solution does not bother them in their daily activities in the Nursing Home, for example, they would be annoyed if the solution caused many large noises [A15].
5. Other Impaired Wheelchair-Using Residents	Secondary	<p>Although this RFP focuses on the community of wheelchair patients at Kensington Gardens who have dementia, the other wheelchair-using residents who have difficulty shifting by themselves due to other reasons such as physical disabilities will also be able to benefit from a solution to this opportunity.</p> <p>This is stakeholder #1 now.</p>

High level Objectives

1. ~~Reduce negative effects of prolonged sitting in one position of the residents. (S1, S2, S3, S5)~~
2. ~~Does not create disruption/inconvenience for the rest of the Kensington Gardens community. (S2, S4)~~
3. ~~Reduce staff involvement in changing the positions of residents. (S2)~~

1. Reduce staff involvement in changing the positions of the residents (S2, S1)
 - a. According to Daisy, the main concern in Kensington Garden is the limitation of resources. There are simply not enough caregivers to assist patients in repositioning every two hours.
 - b. Many patients that suffer from dementia refuse to cooperate, which makes the process of repositioning even longer for the staff.
 - c. Through validation from stakeholders, minimizing staff involvement should be the primary objective to fulfill.
2. Reduce negative effects of prolonged sitting in one position of the residents. (S1, S2, S3, S5)
3. Does not create disruption/inconvenience for the rest of the Kensington Garden. (S2, S4)
4. Ensure and maintain the level of comfort for residents while repositioning, and during sitting. (S1)

Detailed Objectives

1. ~~Prevent and relieve pressure buildup in the wheelchair user's body. (HL1)~~
 2. ~~Does not alarm the wheelchair user. (HL1)~~
 3. ~~Implement adjustable microclimate (ie. temperature/moisture control) of the wheelchair. (HL1)~~
 4. ~~Does not disturb the community. (HL2)~~
 5. ~~Minimize effort required from staff to shift position of wheelchair user. (HL3)~~
1. Minimize the manual involvement in repositioning of patients (HL1)
 2. Reduce the duration of repositioning (HL1)
 3. Reduce the maximum pressure buildup in the wheelchair user's body in areas of contact (HL2)
 4. Reduce the temperature change of the contact surface (HL2)
 5. Reduce the moisture of the contact surface (HL2) [5]
 6. Reduce the shear and friction force while repositioning (HL2, HL4) [4]

7. Minimize the noise created by the design (HL3)

Metrics

1. ~~Pressure applied by the device shifting the user.~~ (DO1, DO2)
 1. Maximum pressure applied on the user by the device. (DO3)
 2. Amount of force needed to be applied to the patients by the staffs to finish repositioning
 2. Amount of noise in decibels caused by the device. (DO2, DO4)
 3. Time between every position shift measured in sec. (DO1)
 4. Time duration of each position shift measured in sec. (DO2, DO5)
 5. Temperature of the surfaces of contact between the patient and the seat cushion measured in degree celsius. (DO3, DO2)
 6. Moisture measured through the perspiration test stated in ISO 16840-11. Measured in %humidity [20](DO3) Criteria
 - a. The
 - a. The test measures perspiration dissipation of wheelchair seat cushions by making use of a test apparatus called the Perspiration Rigid Cushion Loading Indenter (PRCLI). The test makes use of measuring the impedance of the surface over an one hour period after 10mL of NaCl solution is discharged between the cushion and the PRCLI to determine how well the cushion dissipates perspiration. (See [20] for a more detailed description of the process and apparatus)
 7. Dimensions of the design (DO4)
 8. Force required by staff for one adjustment as measured by "Glove test" (DO5)
 - a. Glove test is the measure of the indent inside two memory foam gloves (or similar material that compresses when force is applied) involved in one sitting position shift. Deeper indent will correlate with the amount of applied force in operating

Constraints

1. Design must be implementable within the maximum dimensions set for wheelchairs in CAN/CSA-Z323.4.2-86 [21] (see Appendix C: 21 for diagram) (M7)

2. The overall pressure distributed at sacral and ischial area has to be smaller than 55%, or < 30% of pressure is present under one ischium, or < 11% of pressure under sacrococcygeal area. [1]
3. Noise created while operating must be below 50 decibels (i.e. basic conversation). [22] (M3)
 - a. Dementia patients are startled easily when called upon with a calm tone by staff members. Therefore, a decibel level higher than 60 dB will startle the dementia patient. [A15]
4. Areas in which there is contact with the resident's body must not increase by more than 1° C in temperature at any point in the continued use of the wheelchair (roughly 12 hours per day). (M5)
 - a. Studies have shown that body temperature often increases by 1-2° C in 24-96 hours before pressure ulcers develop, thus it is important to reduce this natural temperature increase caused by body heat. [13]
5. Residents must be shifted every 15-30 minutes [23].
6. Duration of shift must be 30-90 seconds [23].

Standalone Constraints:

1. The solution must retain features of a wheelchair such as its size, mobility, and ease of use by the staff. Since these patients are greatly reliant on the wheelchair's mobility by being pushed around by staff members for roughly 12 hours every day, it is paramount that the solution can still be used in a similar fashion. If the solution is such that it must be directly installed onto the current wheelchairs used at Kensington Garden, it should not inhibit any of these functions.

Criteria

1. More time between shifts is preferred up to a maximum of 30 minutes. (M3)
2. Lower pressure values are preferred. (M1)
3. Lower noise created is preferred. (M2)
4. Lower change in temperature is preferred. (M5)
5. Lower moisture levels are preferred. (M6)
6. Lower force required from staff for adjustment is preferred. (M8)
7. Lower duration of shift is preferred (M4)
 - a. Since the staff must monitor the position shift of every wheelchair patient, it would benefit them if they had to spend less time monitoring each patient.
8. Lower cost is preferred (S1, S3)
 - a. Patients themselves or their families are required to pay for their wheelchairs

References

[1]

<https://www.resna.org/sites/default/files/legacy/conference/proceedings/2013/Wheelchair%20Seating/Draper.html>

There are specific postural and anatomical characteristics that cause people with spinal cord injuries to be at higher risk for pressure ulcer development. Muscle atrophy, reduced or no movement, postural changes related to stability-seeking posterior pelvic tilt with forward curved thoracic spine all contribute to risk of pressure ulcer development. ([Byrne & Salzberg, 1996](#); [Drummond, Breed, & Narechania, 1985](#); [Hobson & Tooms, 1992](#)) One study showed that when >55% of overall pressure is distributed at sacral and ischial area, or when >30% of pressure is present under one ischium, or >11% of pressure under the sacrococcygeal area, a person with spinal cord injury is at increased risk for developing a pressure ulcer. ([Verschueren, Post, de Groot, van der Woude, van Asbeck, & Rol, 2011](#)) A smaller range of trunk movement results in smaller range of center of pressure distribution and is a contributing factor to development of pressure ulcers. ([Karatas, Tosun, & Kanatl, 2008](#))

[2]<https://medlineplus.gov/ency/patientinstructions/000147.htm>

If you use a Wheelchair

Make sure your wheelchair is the right size for you.

- Have your doctor or physical therapist check the fit once or twice a year.
- If you gain weight, ask your doctor or physical therapist to check how you fit your wheelchair.
- If you feel pressure anywhere, have your doctor or physical therapist check your wheelchair.

Sit on a foam or gel seat cushion that fits your wheelchair. Natural sheepskin pads are also helpful to reduce pressure on the skin. DO NOT sit on a donut-shaped cushions.

You or your caregiver should shift your weight in your wheelchair every 15 to 20 minutes. This will take pressure off certain areas and maintain blood flow:

- Lean forward
- Lean to one side, then lean to the other side

If you transfer yourself (move to or from your wheelchair), lift your body up with your arms. DO NOT drag yourself. If you are having trouble transferring into your wheelchair, ask a physical therapist to teach you the proper technique.

If your caregiver transfers you, make sure they know the proper way to move you.

Mobility problems

Possible reasons for having a mobility problem are:

- having a spinal cord injury that causes some or all of your limbs to be [paralysed](#)
- brain damage caused by an event such as a [stroke](#) or [severe head injury](#), which results in paralysis
- having a condition that is causing progressive damage to the nerves your body uses to move parts of the body – such as [Alzheimer's disease](#), [multiple sclerosis \(MS\)](#) or [Parkinson's disease](#)
- having severe pain that makes it difficult to move some or all of your body
- having a fractured or broken bone
- recovering from the effects of surgery
- being in a [coma](#)
- having a condition that makes it difficult to move your joints and bones – such as [rheumatoid arthritis](#)

[3]<https://www.sharecare.com/health/bed-sores/who-get-pressure-ulcers>

Risk factors for bedsores

Pressure ulcers are more common among:

- Patients who are immobilized because of injury, illness, or sedation
- Individuals with long-term spinal cord injuries - compression of certain areas can be constant; damaged skin as well as poor circulation increases the risk of damage and lowers the chances of healing

Also, patients with long-term spinal cord injuries, or neuropathic conditions [including diabetes](#), have reduced sensation, so they often do not feel a developing bedsore and lie on it, making it worse.

[4]<http://www.mayoclinic.org/diseases-conditions/bedsores/basics/causes/con-20030848>

Causes

By Mayo Clinic Staff

Bedsore are caused by pressure against the skin that limits blood flow to the skin and nearby tissues. Other factors related to limited mobility can make the skin vulnerable to damage and contribute to the development of pressure sores. Three primary contributing factors are:

- **Sustained pressure.** When your skin and the underlying tissues are trapped between bone and a surface such as a wheelchair or a bed, the pressure may be greater than the pressure of the blood flowing in the tiny vessels (capillaries) that deliver oxygen and other nutrients to tissues. Without these essential nutrients, skin cells and tissues are damaged and may eventually die.

This kind of pressure tends to happen in areas that aren't well-padded with muscle or fat and that lie over a bone, such as your spine, tailbone, shoulder blades, hips, heels and elbows.

- **Friction.** Friction is the resistance to motion. It may occur when the skin is dragged across a surface, such as when you change position or a care provider moves you. The friction may be even greater if the skin is moist. Friction may make fragile skin more vulnerable to injury.
- **Shear.** Shear occurs when two surfaces move in the opposite direction. For example, when a hospital bed is elevated at the head, you can slide down in bed. As the tailbone moves down, the skin over the bone may stay in place — essentially pulling in the opposite direction. This motion may injure tissue and blood vessels, making the site more vulnerable to damage from sustained pressure.

[5]<http://www.nhs.uk/Conditions/Pressure-ulcers/Pages/Causes.aspx>

Pressure ulcers can be caused by:

- pressure from a hard surface – such as a bed or wheelchair
- pressure that is placed on the skin through involuntary muscle movements – such as muscle spasms
- moisture – which can break down the outer layer of the skin (epidermis)

The time it takes for a pressure ulcer to form will depend on:

- the amount of pressure
- how vulnerable a person's skin is to damage

Types of pressure

There are three main types of pressure that can lead to the development of pressure ulcers.

These are:

- **interface pressure** – the pressure of the body pressing the skin down onto a firm surface
- **shear** – the pressure that occurs when layers of skin are forced to slide over one another or deeper layers of tissue; shear can occur when a person slides down or is pulled up out of a bed or wheelchair
- **friction** – pressure caused by something rubbing against the surface of the skin, such as a mattress or clothing

[6]<http://www.mayoclinic.org/diseases-conditions/bedsores/basics/prevention/con-20030848>

Repositioning in a wheelchair

Consider the following recommendations related to repositioning in a wheelchair:

- **Shift your weight frequently.** If you use a wheelchair, try shifting your weight about every 15 minutes. Ask for help with repositioning about once an hour.
- **Lift yourself, if possible.** If you have enough upper body strength, do wheelchair pushups — raising your body off the seat by pushing on the arms of the chair.
- **Look into a specialty wheelchair.** Some wheelchairs allow you to tilt them, which can relieve pressure.
- **Select a cushion that relieves pressure.** Use cushions to relieve pressure and help ensure your body is well-positioned in the chair. Various cushions are available, such as foam, gel, water filled and air filled. A physical therapist can advise you on how to place them and their role in regular repositioning.