Abstract

This request for proposal addresses the prevalent need of physical exercise in the community of homebound seniors in Toronto. Homebound seniors are defined in this RFP as citizens over the age of 65 who spend most of their time in private residences and have limited transportation outside of their home. 14.4% of Toronto’s population is senior citizens, of which 93% do not live in institutions. \[1\][2]

Statistics from a government census indicate that 58.6% of seniors were considered physically inactive. \[2\] Insufficient exercise has been directly linked to higher mortality rates, which negatively impacts one’s quality of life. This problem is especially dominant in the homebound community, in which members do not have convenient access to recreational centres, and spend many hours alone. \[3\] The goal of the proposal is to structure requirements for a design solution to this problem, as well as provide insight on stakeholder views and reference designs.

Stakeholders who are affected by this problem include seniors themselves, caregivers, senior group representatives and possible manufacturers. In addition, the City of Toronto also has a vested interest, as the municipal government has funded initiatives and established committees to develop strategies aiming to improve the quality of life of older Torontonians. \[4\]

It was discovered that the main reason for seniors not exercising is their lack of motivation. Thus, the engineering design problem revolves around developing technology that will improve not only their physical health, but also their motivation to exercise. The engineering problem discusses the means by which to create safe and ergonomic environments for home-based physical activities, increasing their perceived chance of success, and decreasing their perceived cost of utilizing the technology. The RFP will continue to analyze current solutions and connect design objectives with stakeholder goals in a meaningful way that will inspire a first year engineering design team to produce a divergent solution.

References

Request for Proposal

Increasing Physical Activity of Homebound Senior Citizens in Toronto

2/16/2013
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1. Introduction

There is an evident lack of regular physical exercise within the community of homebound senior citizens in Toronto. The demographic of homebound senior citizens is defined in this request for proposal as the population of citizens over the age of 65 who spend most of their time in private residences and have limited transportation outside of their home. This community in need is discussed in detail in Section 2: Community in Need. Because Toronto’s senior population is increasing dramatically due to the influx of aging baby boomers, the consequences of insufficient exercise are becoming more urgent. These consequences, including the deterioration of mental and physical wellbeing, will be discussed in Section 3: The Problem.

Furthermore, this document scopes the cause of the lack of exercise as a matter of motivation, and defines the specific engineering problem based on the factors that directly affect motivation. In addition, the request for proposal analyzes stakeholders of the project, as well as describes why current solutions are ineffective. The purpose of this document is to describe the community in need, outline the problem, discuss the considerations of stakeholders, and determine specific engineering requirements for solving the problem.

2. Community in Need

Community: a group of people that share a set of values, needs, characteristics, and/or goals

Homebound Senior Citizens in Toronto

Homebound seniors are defined as a community of citizens aged 65 and over who spend most of their time in private residences and have limited access to services outside the home. As of 2011, senior citizens comprise approximately 14.4% of the population of Toronto, 93% of which live in private dwellings.\textsuperscript{[1]} 21.7% of these seniors live alone.\textsuperscript{[2]} Due to the transition of baby boomers, born between 1946 and 1965, into their elderly ages, the senior cohort is expected to increase drastically in the coming years.\textsuperscript{[3]} It is projected that between 2011 and 2031, their population will increase by one-third.\textsuperscript{[1]} This request for proposal acknowledges the need to fulfill the needs of the quickly expanding community of homebound seniors in Toronto.

As citizens reach their senior ages, physical activity levels decline considerably. According to the 2006 report titled \textit{A Portrait of Seniors in Canada} issued by the federal government, only a mere 18.5% of citizens aged 65 and over were considered physically active, while a majority consisting 58.6% were deemed physically inactive.\textsuperscript{[2]} Furthermore, the prevalence of obese seniors has risen drastically in the past two decades, hovering at around 25% in 2004, compared to only around 15% in 1979.\textsuperscript{[2]} Although obesity can be caused by a wide assortment of factors outside of simply exercise, a lack of physical activity undoubtedly contributes a sizeable portion to the aforementioned figure. Both sources of data were drawn from a national report; however, it can be assumed that there is minimal discrepancy between these trends in Toronto and the country as a whole. It is evident that seniors are generally not exercising enough to reap maximal health benefits. Thus, it is even less likely that homebound seniors will achieve the recommended levels of exercise. Specific reasons will be discussed in section 3.

Older individuals also tend to be less socially active than their younger counterparts.
In Ontario, 14% of seniors reported to have no close friends, while 15% reported to have no other friends. Furthermore, 82% of seniors aged 75 and over reported that they had not met any new people in the last month. The issue of loneliness is even more significant.

3. The Problem

The problem identified in our community is that homebound seniors, devoid of the intensive care-giving services provided by nursing centres, are unable to achieve adequate exercise. This leads to deterioration in their quality of lives, as they are unable to maintain healthy lifestyles.

3.1 The Need for Exercise

**Need**: a condition that must be fulfilled to satisfy an individual/community in terms of achieving a higher quality of life.

Exercise is essential for the healthy aging of seniors. Research has demonstrated a distinct inverse relationship between physical activity and mortality rates, a key metric of one’s quality of life. Ignoring external factors such as genetics, or smoking habits, it is proven that increased levels of physical activity in the latter stages of one’s lifetime result in greater longevity. The Public Health Agency of Canada states that the benefits of exercising for seniors include reduced possibility of developing of medical conditions that result in premature death, namely heart disease, stroke and osteoporosis. In addition, exercise has a large effect on seniors’ functional ability and overall independence, substantiated by a study on 10,000 old adults, which found that “those most active were twice as likely as sedentary people to die without disability”. Another advantage to exercising often is the increased possibility of obtaining social connections with peers, which in turns promotes overall health. Data from the Community Health Survey cited in an article released by PHAC says that “67 percent of seniors who are active three or more times a week are in good health, compared to 36 percent who are infrequently active”, which relates exercise and general well-being. In order to achieve health benefits, older adults need at least 150 minutes of moderate-intensity aerobic activity every week, as well as muscle-strengthening activities on at least two days per week (see Appendix D). As discussed in section 2, homebound seniors are generally inactive, and do not fulfill the recommended weekly exercise hours.

3.2 A Lack of Motivation

The key inhibitor of inactivity in homebound seniors is their lack of motivation to exercise. The American Academy of Physical Medicine and Rehabilitation derived a simple motivation equation (Fig. 1), which merges four essential factors together, each either having a direct or inverse relation with seniors’ motivation to exercise. These four factors are the following: one’s perceived chance of success, the perceived importance of the goal, perceived cost and finally, the inclination to remain sedentary.
Perceived importance of the goal undoubtedly impacts one’s motivation. However, this reason constitutes more of a social issue that is very education-based, and is beyond the scope of an engineering design team. As a result, the main area of focus lies in the other three factors. Perceived chance of success can be impacted by engineering considerations including the implementation of social engagement or active feedback. Perceived cost and inclination to remain sedentary are grouped as one factor, because perceived cost is intrinsically a reason for one to remain sedentary, and is not regarded in this document as a separate factor. The following subsections will discuss the impact of these motivation factors, apply the ideas to the community in need, and draw more specific reasons for inactivity.

3.2.1 Perceived Chance of Success

Perceived chance of success, or self-efficacy, is defined as the belief in one’s capability to fulfill a goal.\textsuperscript{[10]} According to a focused review, elderly people “exhibit less exercise self-efficacy than other age groups.”\textsuperscript{[11]} This problem, in fact, is attributed to the negative stereotyping seniors often receive when it comes to physical activity.\textsuperscript{[12]} Subsequently, seniors are often embarrassed to exercise, especially in public. However, it is true that by exercising in groups, this apprehensiveness can be drastically lessened.\textsuperscript{[13]}

Therefore, exercising in groups will increase a senior’s perceived chance of success. Research has indicated that seniors tend to benefit from following people of similar age while exercising, such as receiving training from older adults. A phone interview conducted with Bethany Vallentin, the recreational programmer at North York Seniors Centre, affirmed that most of the seniors that use their services come for the social interaction.\textsuperscript{[14]} A CBC article supported the notion of seniors exercising together, stating that studies from the Annals of Behavioral Medicine found that people in their 60’s and 70’s prefer exercising with people their age.\textsuperscript{[15]} In addition, census data from Stats Canada showed an obvious inverse relationship between loneliness and self-perceived health.\textsuperscript{[16]} When seniors have a higher belief in their own wellbeing, they are more confident and thus more likely to engage in frequent physical activity.\textsuperscript{[17]}

As delineated in section 2, homebound seniors are generally lonely, and do not experience the social interaction needed to ameliorate their perceived chance of success. Contact with Christie Woods, an employee at the Better Living Health Toronto further corroborated that “community involvement is key, because a lot of [seniors] really are lonely.”\textsuperscript{[18]} Contact with stakeholders further corroborated this claim, as senior care workers largely emphasized the importance of social engagement (see Appendix C). Thus, it can be concluded that increased social engagement is critical in motivating seniors to exercise. Moreover, seniors are more likely to believe they can succeed if they are provided with support and feedback related to their task.
3.2.2 Perceived Cost x Inclination to Remain Sedentary

This RFP groups perceived cost and inclination to remain sedentary as synonymous, as their applications to the community in need are tightly linked. Essentially, these two co-existing factors boil down to factors that discourage homebound seniors from exercising. Intrinsic barriers include fear of injury, illness, crime, and pain aggravation. However, these reasons vary in intensity from individual to individual, and are excluded from the scope of the engineering problem. Instead, design efforts will be focused on eliminating external obstacles. The aforementioned external obstacles include the following: weather constraints and lack of transportation.

i. Weather Constraints

The Toronto climate is moderate, and one of the mildest in Canada. Spring and summer temperatures range from 15 °C to 25 °C. In winter months, the subzero temperatures are often unpleasant. Approximately 50 mm of precipitation, including rain or snowfall, occur each month. In order to minimize discomfort and temperature gradients from the environment to the body, it is suggested that outdoor exercises be conducted in temperatures of around 15 to 20 °C. As noted in a report on healthy aging issued by the Canadian government, “Long cold winters and icy surfaces make it difficult for older people to walk and resume activity out-of-doors,” and “high levels of smog on hot summer days pose a significant risk to health and life”. Due to the variable weather conditions in Toronto, exercising outdoors, such as on one’s lawn or in parks, is not preferable (see Appendix C for more interview transcript).

ii. Lack of Transportation

Homebound seniors, by definition, have limited means of independent transportation. In fact, an overwhelming number of homebound seniors live by themselves. Statistics from the Labour Force Survey reveal that approximately 30% of Toronto seniors live alone as sole occupants of a private dwelling. Services such as the Toronto Transit Commission’s WheelTrans cater to those only with a certain degree of physical disability and permanency of the disability. For example, WheelTrans recently tailored their services for seniors who qualify for 60 points in their system, based solely on degree of disability. This new system has resulted in thousands of eligible seniors being cut off. Thus, it is inconvenient for many homebound seniors to access services such as exercise classes outside of the home. More expedient solutions are to be found by the design team.
3.3 Scoping Diagram

Quality of Life: quantifiable measurement of satisfaction with way of living

4. Stakeholders

Stakeholders are groups of people who are affected by the problem at hand. The problem is directly related to the physical health of homebound senior citizens. Thus, seniors are the primary stakeholders of this problem. Caregivers, senior group representatives, manufacturers of technology, and the City of Toronto are second stakeholders.

4.1 Primary Stakeholders

Community in Need - Homebound Senior Citizens

Homebound seniors are the primary users of the engineering solution and thus have the biggest stake in this project. The objective of this RFP is to design technology that will increase physical activity homebound seniors. As the biggest stakeholder, they have the most concern regarding the product. Their concern can be broken up into 3 general categories: safety, ease, and cost.

Many seniors do not exercise due to a health problems or pain. Since this product is going to be designed for seniors of such physical ability, safety must be a major priority in this project. The product must be implemented in a way to minimalize injuries. Ease of use is another major factor for homebound seniors. As most of the expected users are mentally or physically impaired in some way, the difficulty associated with using the product must be taken into account. Moreover, another major barrier and reason why seniors do not exercise is their lack of motivation or their laziness. The ease of use of the product plays a major role in whether the product will be used. To accommodate the laziness of some seniors, the product must be easy and ready to use whenever a user desires. In 2010, the average income for a senior male living in Canada was $33 800 and the average income for a senior female living in Canada was $28 500. As most of the interest for this product comes from non-working seniors, the cost of the solution must be taken into account for these stakeholders.
4.2 Secondary Stakeholders

Caregivers

Caregivers are those who deliver care to others that are in need of assistance due to mental or physical health conditions. In 2007, over 2.7 million people in Canada aged 45 to 64 were caregivers to seniors. This accounts for 73% of all caregivers for seniors, thus there are currently over 3.7 million caregivers for seniors. Senior caregivers have a close relationship with the seniors this product is intended for. Many, if not all of the caregivers are responsible for the wellbeing of seniors. Thus, they have a stake in this project because they are concerned with the safety and the enjoyment of the senior. Moreover, these stakeholders may want seniors to be able to use the product independently so the targeted seniors are not restricted to using the product while the caregiver is present.

Senior Group Representatives

Groups representing seniors such as the Ontario Society (Coalition) of Senior Citizens' Organizations (OCSCO) and CARP (previously known as the Canadian Association for Retired Persons) also have a stake in this product. Their mission statements both include enhancing the quality of life of seniors. One aspect that defines the quality of life for an individual is physical health. Thus, these groups are concerned with the safety of the product as an unsafe product will potentially harm the physical health of the users and ultimately reduce the quality of life of the user. Moreover, social interaction improves the health of seniors, so these groups will be interested in promoting this product.

Manufacturers

Manufacturers have a stake in this project because they are interested in the end product being as cheap as possible. Moreover, they are responsible for being able to keep up with the demand for the product and developing efficient processes. Manufacturers also have the responsibility of ensuring that every product contains no defects or malfunctions.

City of Toronto

The City of Toronto is also concerned with the wellbeing of the municipal population of seniors, and is a secondary stakeholder. The city is responsible for funding services such as senior centres, TTC WheelTrans, long-term care, security, advocacy engagement, and parks. The departments associated with these services are the departments of Toronto Transportation Services, Toronto Homes of the Aged Division, and Toronto Employment and Social Services Division. Solutions may include implementation that requires approval from the city, especially if the solution can be expanded for use in community centers or other institutions.

5. Engineering Design Problem

This RFP calls for designs of a device or system to address the lack of exercise in the community of homebound seniors. Firstly, this framing focuses on improving the physical
health of the individual by implementing effective exercise regimes. Secondly, the framing aims to elevate a senior’s motivation to exercise. By designing to overcome the barrier of accessibility, the perceived cost and inclination to remain sedentary decrease, and by increasing self-efficacy, the perceived chance of success is greatly increased; overall, this will lead to increased motivation. Thus the solution should not only give seniors a setting for physical activity, but also tackle the problem of motivation which will in turn lead to the increased probability of the continued of use of the solution.

5.1 High Level Objectives

The solution’s aim is to achieve objectives 1 and 2 through the methods listed below:

1) To improve the physical health of the individual through exercise and
2) To increase motivation and therefore probability of engaging in physical activity by:
   a. Decreasing perceived cost and inclination to remain sedentary: creating a safe and ergonomic environment for physical activity which is accessible to all seniors within their own homes by
   b. Increasing perceived chance of success: improving the self-efficacy of the individual through engagement and feedback in these forms:

5.2 Detailed Design Requirements (Criteria, Constraints and Stakeholder Considerations)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Metrics</th>
<th>Constraints</th>
<th>Stakeholder Considerations</th>
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<tbody>
<tr>
<td>The more tailored the exercises can be to individual seniors the better</td>
<td>Do they have adjustments for different levels of physical ability? Yes/no</td>
<td>Exercises must be approved by physiotherapist or senior care workers</td>
<td>Physiotherapists will also be concerned for the safety of the senior, if exercises are inappropriate, (too advanced, or difficult for senior to do) they are more likely to injure themselves rather than get healthier.</td>
</tr>
<tr>
<td>The more variety of exercises the solution can accommodate</td>
<td>Number of different body systems the exercises</td>
<td>Must be able to include exercise catered to at least one of each:</td>
<td>Physiotherapists will be concerned with whether or not the senior gets a wide range of exercises tailored to improving different aspects of physical health. By</td>
</tr>
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e better (see appendix D) impact

- Improving cardiovascular system
- Improving balance
- Improving strength in arms and legs
- Relaxation/breathing

including a variety of exercises a physiotherapist will be able to assign exercise programs tailored to the individual. A larger variety will also allow both the senior and physiotherapist more freedom in choice of exercise for higher levels of enjoyment.

The stronger and more balanced the senior is after completing the exercises the better

Weight that can be lifted [kgs], score on balance test, how far they can walk without being fatigued [meters]

Must increase by 5% after one month of use of solution

Seniors and caregivers are concerned with the independence of the senior; by improving these categories a senior is less prone to falling, more mobile and able to carry/hold more things and therefore more independent. This criterion is included to test the validity of the exercises, and to measure the success of the solution.

To increase motivation and therefore probability of engaging in physical activity

*Decreasing perceived cost and inclination to remain sedentary: creating a safe and ergonomic environment for physical activity which is accessible to all seniors within their own homes*

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<th>Criteria</th>
<th>Metrics</th>
<th>Constraints</th>
<th>Stakeholders</th>
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<tr>
<td>The easier the set-up is the better</td>
<td>The less -Time it takes to set up [minutes] -Number of steps</td>
<td>≤ 30 minutes of set-up time the first time (by a caregiver) ≤ 3 minutes of set-up the times after that (by a senior)</td>
<td>The caregivers want the senior to be able to engage in physical activity independently, and quickly. The more time it takes to set-up the less willing the senior is to use the product. By making it simple to set up it is more available to a wider variety of seniors. If the general set-up can be done by a caregiver, and then require minimal to no set-up afterwards, it will be more accessible to a higher number of seniors. Representatives are also more likely to market a product that is simple and easy to use.</td>
</tr>
<tr>
<td>The less space it takes in the home of the senior the better</td>
<td>Square meters</td>
<td>≤ 1 m²</td>
<td>Homebound seniors have varying amounts of space that they have access to, the less space the product takes, and the more seniors the product will be available to. Also by restricting the size to ≤ 1m² most home gym equipment is restricted, because it is usually not suitable for homebound seniors, see reference designs.</td>
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The less the total cost for the senior of the system or device the better

<table>
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<tr>
<th>CAD</th>
<th>Device:</th>
<th>System:</th>
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<tr>
<td>$\leq$ 300</td>
<td>$\leq$ 50 annually</td>
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The seniors and caregivers are not likely to spend a lot of money on an expensive machine. Increasing the cost, increases the cost of exercising, so to increase the chances of the seniors investing in the device or system the cost should be minimized.

The less the total cost of making the device or upholding the system the better

<table>
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<th>CAD</th>
<th>Less than</th>
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<tbody>
<tr>
<td>Device:</td>
<td>$\leq$ 300</td>
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<tr>
<td>System:</td>
<td>$\leq$ 50/senior annually</td>
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Manufacturers of a device are more likely to produce a device that is low in cost and easy to manufacture. Representative groups for seniors may be willing to invest in a system for the sake of seniors but since most are Non-profit, the lower the cost the easier it is for them to manage.

**Other Considerations related to decreasing perceived cost and inclination to remain sedentary**

- **Must adhere to the City of Toronto Accessibility Design Guidelines**
  - Many Seniors are confined to a wheelchair and may not be able to participate in all activities. The design team must make sure that the product/system is accessible.

- **Must be usable within the home of the senior/or regardless of the weather conditions in Toronto.**
  - By minimizing the scope of the problem to the confines of the seniors’ homes, the design team will overcome the barrier of Toronto weather conditions and the product will also be more accessible as the senior does not have to leave their home. The focus will be on designing a system or device to aid in the physical activity rather than to create a transportation system to bring seniors to exercise facilities.

- **All personnel and equipment involved must abide by the Canadian Fitness Safety Standards**
  - Seniors should have access to trained professionals who understand how to treat and teach them. The design team must consider the safety of the seniors in creating a solution to the problem. This also decreases the perceived cost and inclination to remain sedentary as a senior who feels safe completing their exercise routine is more likely to continue.

**Increasing perceived chance of success: improving the self-efficacy of the individual through engagement and feedback** *(references in this section refer to [35], section 5._)*

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<th>Criteria</th>
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<th>Constraints</th>
<th>Stakeholders</th>
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<tbody>
<tr>
<td>The more accomplishments a senior can feel while exercising the better the less set-backs the senior is likely to experience the better</td>
<td>Number of goals achieved (an achieved goal can be taken as a performance accomplishment)</td>
<td>Must show at least one accomplishment (goal achieved) per exercise.</td>
<td>Seniors are often worried about</td>
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<table>
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<tr>
<th>The more</th>
<th>Number of role</th>
<th>Must have at</th>
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positive and relatable role models which exhibit slow progress and errors that the senior can engage with the better.\[35, \text{section 5.2}\]

<table>
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<tr>
<th>Models</th>
<th>Can the senior relate to the role model? Yes/no</th>
<th>least one role model, or peer which the senior can look up to and engage with.</th>
<th>whether or not they have the ability to exercise; giving them a role model to look up to, or some peers to engage with will show them that physical activity and getting healthier is feasible and takes time. If they can relate to the role model they will better understand that if they do not succeed right away, through time and diligence rewards will come. [35, \text{section 5.2}]</th>
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The more real-time feedback from a credible source the better. \[35, \text{section 5.3}\] The more reassurance of struggle and progress to further change the better. \[35, \text{section 5.4}\]

| How many times does a senior hear encouraging/assuring words from a professional or caregiver? \[\text{number}\] | At least one sentence of feedback per exercise completed. | Seniors are more likely to continue exercising if they are encouraged to do better, or assured that the fatigue or feelings that they are experiencing are normal and they are on their way to healthier lifestyles. \[35, \text{section 5.3}\] Feedback and encouragement during or directly after the exercise is completed, is more relatable and allows for a senior to reflect on their performance and to feel more confident. |

The more specific the feedback is the better

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<tr>
<th>Examples</th>
<th>Must include at least general feedback.</th>
<th>Seniors are more likely to respond to feedback that is personal rather than general. It tells them specifically what they did well for them to feel accomplished, what they can improve on so they can continue to get better, and gives them a goal to achieve the next time they attempt the task.</th>
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<tr>
<td>General: \textit{Good job! Well done! Keep up the good work!} More tailored: \textit{You scored ___ on this task, you improved by ___} % Specific: \textit{During the exercise you did ____ well, next time you should work on improving ____ lets set a goal of ___ for next time.}</td>
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### 5.3 Reference Designs

The existent reference designs today do not fulfill the above engineering requirements. However, it is viable to incorporate effective and advantageous concepts from many of these following designs into an improved one.
Specialized Fitness Machines

There currently exists an assortment of exercise equipment catered specifically to the elderly. Instead of being designed for maximum muscular usage, these machines aim to stabilize joints and better control muscle to provide a secure exercising experience. Whereas the majority of machines use elastics and weights, current technology employs hydraulics to provide a natural fluid resistance reducing the soreness that may occur in seniors. One company spearheading the movement to hydraulic resistance is Fit Express, and they advertise that their equipment delivers more fluid motion, versatility and less eccentricity. However, the majority of these products are manufactured for public use in community centers, thus they do not directly affect the physical activity of homebound seniors. In addition, this equipment is meant for singular use, and thus does not directly provide feedback or engagement. Also, each machine only works a specific area of the body, and as a result, the variety of exercises is limited.

Video Game Simulations

In-Home Console Games

Video game consoles such as the Nintendo Wii or Xbox Kinect provide simulated forms of exercise for consumers in the comfort of their own home. A recent CNN article cited a study by the National Council of Strength and Fitness by noting that exercise video games “improved mobility, dexterity, coordination” in the elderly. There has been a significant increase in these fitness-based games, categorized as exergames, over the last decade as manufacturers strive to promote healthy gaming. A recent article in Time magazine noted that although the main target of these games was young adolescents, seniors are the group reaping the most benefits, acquiring better balance after repeated sessions. While these exergames provide a more amusing method of obtaining exercise, they lack direct feedback, which is conducive to continued physical activity as outlined in our design requirements. In addition, the purchase of these exergames requires a console which may be difficult to set up for seniors who are less technologically-savvy. Another drawback associated with this reference design is that the majority of video games targets a younger audience, and may require a level of coordination that is too high for many seniors.

Microsoft’s Exergamers Wellness Club

In Los Angeles, Microsoft started a venture called the ‘Exergamers Wellness Club” in conjunction with the municipal government and non-profit organizations. Using their Xbox Kinect technology in senior centres, this program incorporates interactive gaming and health-monitoring tools to enhance seniors’ well-being. The mayor of Los-Angeles is very supportive of Microsoft’s initiative expressing that “The Exergamers Wellness Club allows seniors to improve their physical, mental and social well-being by participating in friendly competition, interactive gaming and tracking their health online”. There are a variety of activities encouraging exercise and social engagement, ranging from bowling simulations to dancing. Also, the element of friendly competition is added to spur continued interest in exercise, as tournaments are held between senior centres across other cities. In fact, the retention rate is excellent, as ninety percent of the participants in the program attended at least three-quarters of the fitness classes. A key component to the legitimacy of this reference design is the social aspect, which increases the seniors’ happiness as well. This is evidenced by
the remarks of the CEO of one of the senior centres implementing this program, who says that “all members reported feeling happier, enjoying life more and feeling empowered and in charge as a result of participation [in the program]”. Unfortunately, this program is only applicable in public group settings outside the home, but an ideal solution could encompass aspects of this technology while connecting homebound seniors from inside their homes.

**Instructional Exercise Videos**

Instructional exercise videos have the advantage of portability and providing professional guidance to seniors, many of whom are not properly educated on how to exercise.\(^{[39]}\) Furthermore, these videos allow for the senior to exercise without leaving the home, while still receiving instruction from knowledgeable professionals. The element of feedback provides some encouragement, but it is generic. Another downfall of using this reference solution is the lack of flexibility, as the choice of exercise is limited to the selected video. Furthermore, another disadvantage is the inevitable boredom by repeating the same exercises, which might deter seniors from continuously using the same product.
6. Appendix

6.1 Appendix A: Definitions

Community: a group of people that share a set of values, needs, characteristics, and/or goals
Quality of Life: quantifiable measurement of satisfaction with way of living
Need: a condition that must be fulfilled to satisfy an individual/community in terms of achieving a higher quality of life.
Accessibility: In our RFP, it is defined as the ease of obtaining exercise equipment, instruction or environment, in terms of cost or transportation.
Adequate physical activity: Defined as between at least 150 minutes of moderate to vigorous aerobic exercise per week, as stated in the Canadian Physical Activity Guidelines. [41]
Aerobic Exercises: Physical Activities that promote the circulation of oxygen in the blood and increased the rate of breathing to improve the respiratory system. [42]
Ergonomic Environment: A setting in which the user can comfortably and efficiently exercise.
Encouragement: verbal or textual support providing constructive feedback to the person exercising.
Exercise: Activity requiring physical effort, with the purpose of increasing one's health and well-being.
Inclination to Remain Sedentary: The perceived short-term benefits or the willingness to not engage in physical activities, caused by poor habits, psychological issues outside environment
Homebound seniors: Seniors who live in individual residences, and have limited means of transportation and spend the majority of their time in the home.
Professional instruction: Direct guidance from a trained person in the exercise industry on how to exercise safely and properly.
Self-efficacy: One's internal belief in his/her capabilities to succeed in a particular situation; in our case it is the confidence in exercising effectively. [43]
Social Engagement: The act of meeting new people and interacting with a group of people through visual and audio means.
6.2 Appendix B: Figures and Tables

Table 2.1.13

<table>
<thead>
<tr>
<th>Age group</th>
<th>Active</th>
<th>Moderate</th>
<th>Inactive</th>
<th>Total</th>
<th>Total</th>
<th>Active</th>
<th>Moderate</th>
<th>Inactive</th>
<th>Total</th>
<th>Active</th>
<th>Moderate</th>
<th>Inactive</th>
<th>Total</th>
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<tr>
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<td>100.0</td>
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<td>25.1</td>
<td>49.0</td>
<td>100.0</td>
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<td>55 to 64</td>
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<td>25.0</td>
<td>52.4</td>
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<td>26.1</td>
<td>53.1</td>
<td>100.0</td>
<td>24.4</td>
<td>23.9</td>
<td>51.7</td>
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<td>65 to 74</td>
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<td>52.8</td>
<td>100.0</td>
<td>17.4</td>
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<td>58.2</td>
<td>100.0</td>
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<td>26.1</td>
<td>46.6</td>
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<td>67.0</td>
<td>100.0</td>
<td>9.6</td>
<td>17.5</td>
<td>72.9</td>
<td>100.0</td>
<td>19.8</td>
<td>23.0</td>
<td>67.2</td>
<td>100.0</td>
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<tr>
<td>65 and over</td>
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<td>22.9</td>
<td>58.6</td>
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<td>24.6</td>
<td>25.0</td>
<td>50.4</td>
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</tbody>
</table>


Figure 6.2.1 Physical Activity Levels in Canada

Figure 6.2.2 Seniors Living in Institutions (those who do NOT live at home)
Figure 6.2.3 Senior Living Arrangements in Canada

Table 4.1.1
Living arrangements of seniors, by age group, 1981 to 2001

<table>
<thead>
<tr>
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<tr>
<td>Institutional</td>
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<td>37.4</td>
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<td>8.8</td>
<td>8.5</td>
<td>7.4</td>
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<td>Spouse</td>
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<td>44.1</td>
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<td>37.3</td>
<td>39.9</td>
<td>12.7</td>
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<td>16.2</td>
<td>42.7</td>
<td>44.8</td>
<td>45.4</td>
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<tr>
<td>Children or grandchildren</td>
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<td>16.3</td>
<td>18.9</td>
<td>17.0</td>
<td>12.8</td>
<td>16.0</td>
<td>21.1</td>
<td>15.1</td>
<td>15.8</td>
<td>17.9</td>
<td>15.1</td>
<td>17.6</td>
</tr>
<tr>
<td>Alone</td>
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<td>21.7</td>
<td>21.5</td>
<td>30.0</td>
<td>32.6</td>
<td>33.0</td>
<td>22.4</td>
<td>27.8</td>
<td>33.7</td>
<td>24.2</td>
<td>25.6</td>
<td>26.7</td>
</tr>
<tr>
<td>Others</td>
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<td>5.7</td>
<td>2.9</td>
<td>7.2</td>
<td>6.5</td>
<td>2.8</td>
<td>6.3</td>
<td>6.3</td>
<td>2.6</td>
<td>6.5</td>
<td>6.0</td>
<td>2.9</td>
</tr>
<tr>
<td>Total</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Sources: Statistics Canada, Censuses of Population.

Figure 6.2.4 Obesity Levels in Canadian Seniors

Table 1
Three types of exercise for the elderly

<table>
<thead>
<tr>
<th>Type of exercise</th>
<th>Activities recommended for the elderly</th>
<th>Potential benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic/endurance</td>
<td>Walking, Cycling, Aquatic or swimming, Low-Impact aerobics</td>
<td>Cardio-respiratory, Weight loss/control, Glycemic control, Pain control, Mood and cognition, Sleep, Balance</td>
</tr>
<tr>
<td>Resistance/Strength</td>
<td>Free weights, Weight machines, Elastic bands/tubing, Body weight against gravity</td>
<td>Muscle strength, Bone mass, Physical functioning, Mobility</td>
</tr>
<tr>
<td>Balance and Flexibility</td>
<td>Stretching, Yoga, Tai-Chi, Stair-climbing, Balance boards, balls, and elastic bands</td>
<td>Balance, Fall prevention, Mobility, Reaction time</td>
</tr>
</tbody>
</table>

Figure 6.2.5 Chart Displaying the Three Major Exercise Types and its Benefits
6.3 Appendix C: Interviews with Stakeholders

i. Interview with Mr. Jirong Ma

Date: February 1, 2013
Interviewee: Mr. Jirong Ma, 78-year old homebound senior citizen living in Scarborough
Contact information: 110 Bamburgh Circle, (416) 281-1028
Medium: In-person interview conducted in Cantonese

Excerpts from the interview:

Q: How much time do you spend alone at home?
A: I am almost always at home. I live with my wife so I am not alone, but she is the only one I'm with.

Q: How often do you do exercise?
A: I don’t make an effort to exercise, but when I was recovering from surgery I just walked laps around the house every day.

Q: What type of exercise do you do?
A: I do things like shovel the driveway and mow the lawn.

Q: How hard is it to get out of the house?
A: Sometimes I take a bus that is not a far walk, but only to go to get groceries and to go shopping. I cannot drive.

Q: Why don’t you exercise more?
A: I really disliked walking around the house because it was very boring. Now that I am in better health, I want to exercise but I have become very sensitive to the cold so I don’t like going out to the park.

Q: What if it was the summer, or not so cold?
A: My wife likes to do taichi on the lawn sometimes, but I feel silly doing them with her.

Q: Have you thought about exercising at a senior centre or community centre?
A: I think it’s too inconvenient to get there, because of the public transit.

ii. Interview with Mrs. Bethany Vallentin

Date: January 29, 2013
Interviewee: Bethany Vallentin, Recreational Programmer at the North York Seniors Centre
Contact Information:
Active Living Centre & Administrative Office
21 Hendon Avenue
Toronto, ON M2M 4G8
P: 416 733.4111
Medium: Phone interview

Excerpts from the interview:
Q: Are there seniors who aren’t able to access your services?
A: Most people who come here drive here, or take the TTC. We also have a transportation service for a fee, but that isn’t a popular method of getting here.

Q: Does social interaction have an impact on motivation to exercise?
A: Yes, for many people it’s the main reason they come. Although, of course, it differs from person to person. However, there are lots of individual exercise rooms that some seniors use just for exercising and not social interaction.

Q: Are seniors motivated to exercise on their own time? Does their motivation increase when they enter a senior home?
A: It depends, again. I think the social aspect is a big reason, but again it’s not the only reason.

Q: What are the main reasons of seniors not using your services?
A: Mostly because of financial reasons, but we provide subsidies

Q: What are the biggest needs of homebound seniors? What are some services you provide for them?
A: We do provide some services for homebound seniors, like we run errands for them and help them out with housework. We also do security calls.

Q: Do you have exercise programs for homebound seniors?
A: No.

iii. Interview with Christie Woods

Date: February 6, 2013
Interviewee: Christie Woods, senior social worker at Better Living Health
Contact information: 416 447 7244 ext 725 or Cwood@betterlivinghealth.org
Medium: Phone Interview

Key Responses:
Q: How do you motivate senior citizens to exercise?
A: The best way to motivate seniors to exercise is to encourage them to be independent. A lot of them are used to being helpless and dependent, and it’s important to let them know that they’re capable.

Q: How do you encourage them to be independent?
A: You have to encourage them to want to exercise. A lot of them want to lose weight, and so we ask them if they are interested in losing weight. Then, they are more interested in exercising because they can see the good that comes out of it.

Q: Are there any other ways?
A: A lot of them are really lonely at home, so we tell them a lot of other seniors are going as well. Then they are more excited. Community involvement is key, because a lot of them really are lonely.

6.4 Appendix D: Exercise Guidelines

The Centre for Disease Control, a well-respected health organization has outlined general guidelines for adults aged 65 and over to follow. [44]

- For Adequate Health Benefits, seniors should choose one of these options
a) Two and a half hours of moderate-intensity aerobic activity a week (for optimal benefits, five hours of this activity per week is advised)

b) 75 minutes of vigourous-intensity aerobic activity a week (for optimal benefits, 150 minutes of this activity per week is advised)

c) A balance mix of moderate and vigourous aerobic activity a week

AND

Two or more days per week on muscle strengthening activities which works all major muscle groups, such as legs, hips, abdomen, chest, shoulders and arms

**Aerobic Activities** include
- Brisk walking (moderate)
- Running/jogging (vigourous)

The vigour of the activity is measured by the pace at which the senior breathes and his/her heart rate (the higher, the more vigourous).

**Muscle Strengthening Activities** include
- Lifting Weights
- Working with resistance bands
- Push-ups and sit-ups
- Heavy Gardening
- Yoga
References


“Canadian Physical Activity Guidelines For Older Adults – 65 Years or Older”. Internet: http://www.csep.ca/CMFiles/Guidelines/CSEP_PAGuidelines_older-adults_en.pdf [Feb 15, 2013]

