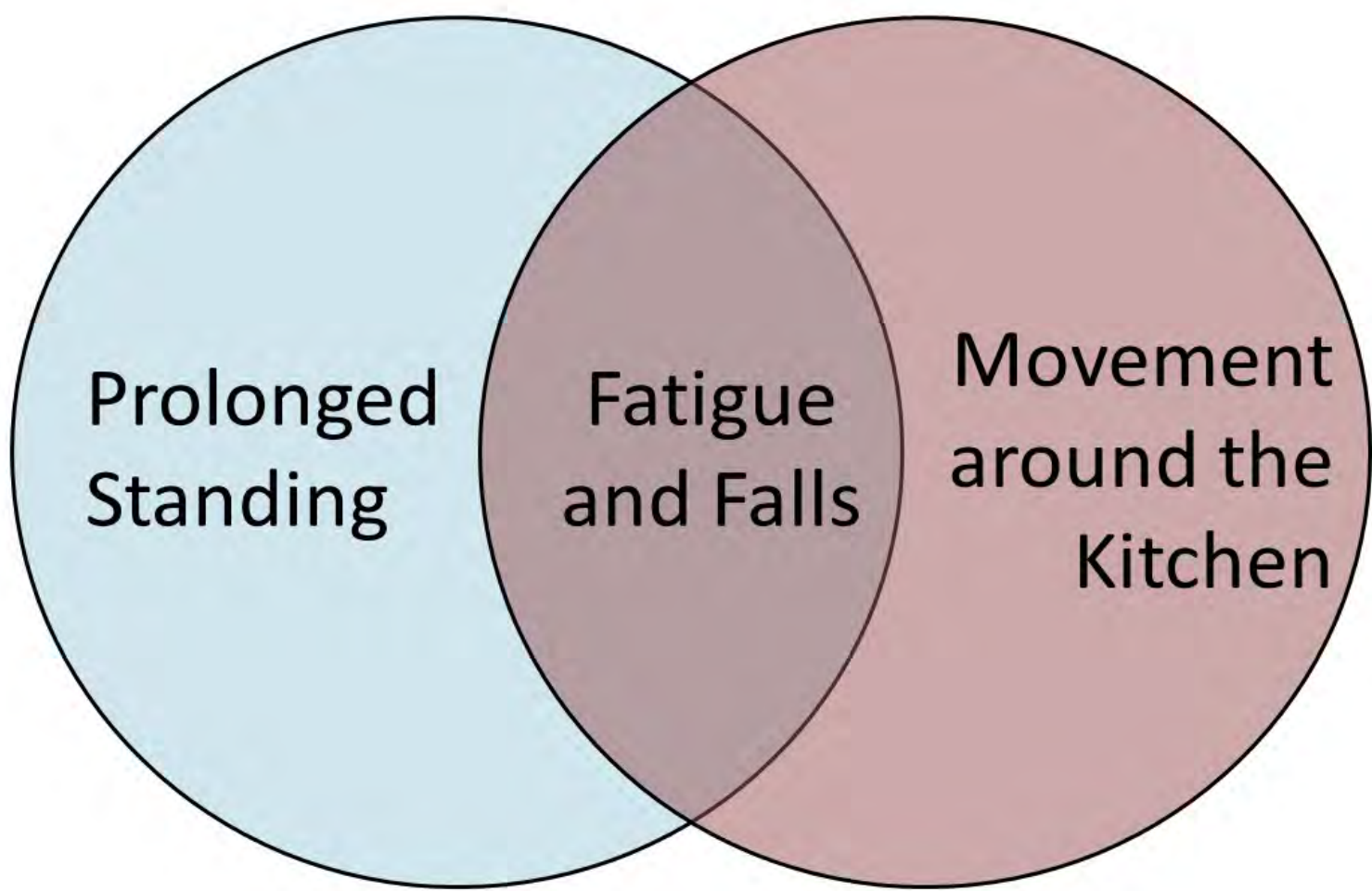


MULTIFUNCTIONAL MEAL PREP STATION

Smeya Shirley Deborah, Asia Falkner, Constance Norris Squirrell, Ann-Marie Sills, Jackie Zong ~ ARCH 6271~ December 2022

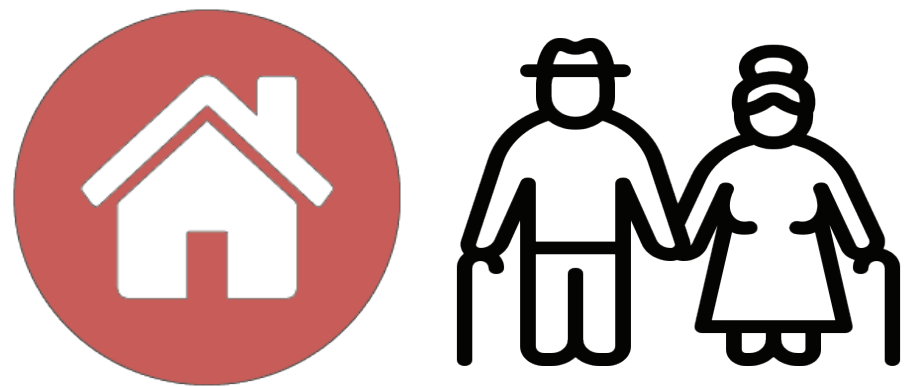


The Problem

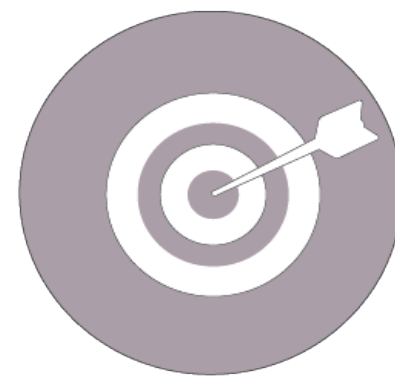


With aging and some physical conditions, autonomy maintenance can be put at risk. As a result, completing certain kitchen activities, such as meal preparation, can become a challenge due to prolonged standing (e.g., meal prepping) and frequent movement around the kitchen (e.g., searching for ingredients). Consequently, excessive standing and ambulation in the kitchen can cause fatigue and falls.

What is Aging-in-Place?



Aging-in-Place has become an emerging problem in the United States. According to the U.S. Census Bureau, past data indicates that there will be more older adults than children in 2034, and by 2060, about a quarter of Americans will be 65 years and older (Vespa, 2018). Currently, there is a great deficit in assisted living facilities and in-home caregiving, and many older adults prefer to or must live on their own. As people age, it can become more difficult to perform instrumental activities of daily living, such as cooking. Therefore, it presents barriers for them to maintain independence.



Aim & Purpose

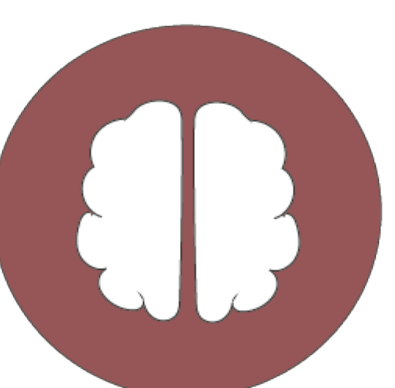
The end goal of this project is to help in the completion of a variety of meal prep activities independently, smoothly, and safely, and ultimately create better and more fulfilled livelihoods for people aging in place.

Additional Impact



Nutrition & Lifespan

Having a kitchen apparatus that allows for easier cooking may make users more likely to cook at home. The nutritional benefits wrought by preparing meals at home may increase lifespan. In fact, a study from Taiwan between 1999 and 2000, with nearly 2,000 participants, found that highly frequent cooking (i.e., more than five times per week) predicted better survival in the over 65 demographic. Meaning that accessible meal preparation could directly impact lifespan (Chen, Lee, Chang, & Wahlgvist, 2011).



Brain Health

A 2007 Japanese study examined the effectiveness of a cooking program to help dementia patients and assessed what they called the, "five principles of brain-activating rehabilitation: fostering a pleasant atmosphere, interactive communication, establishing social roles, giving and receiving praise, and errorless learning" (Murai & Yamaguchi, 2017). From the 29 participants in the study, it showed that a cooking program that applies the BAR principles can not only reduce the psychological and behavioral symptoms associated with dementia, but can also help maintain executive functions (i.e., planning, remembering, multi-tasking, etc.) (Suchy, 2009).



Social Stimulation & Sense of Self

A study from 2004 found that baking in a group setting was beneficial to mental health patients because it provided them with a sense of structure and confidence (Haley & McKay, 2004). Additionally, it provided them a social outlet. Notably, the participants enjoyed making something tangible and either keeping it or sharing it with others. A combination of these factors provided the participants with a sense of personal competence.



Financial

A 2017 study from Seattle with 437 participants showed that cooking more frequently at home was associated with both better diet quality and "reduced per capita food expenditures" (Tiwari, Aggarwal, Tang, & Drewnowski, 2017). Moreover, by making cooking easier at home via the design prototype, hopefully individuals will benefit financially in addition to their health.

The Evidence

30-60%

Studies have reported that 30% to 60% of community-dwelling older adults fall each year, with about half of fallers experiencing multiple falls (Rubenstein and Josephson, 2007). It is important to prevent older adults from falling, especially the first fall.

2nd most common place for falling

Additional research has found the place with the highest incidence of falls was the bathroom (18.25%), followed by the kitchen (18.25%). Most people reported they have suffered some kind of injury (92.03%), excoriations (46.52%) were the most common, followed by fractures (29.05%), and the sites with more episodes were the ankle (19.79%) and knee (18.25%) (Ferretti et al, 2013).

3/4

 deaths due to falls occur in elderly population

Accidents are the fifth leading cause of death in older adults (after cardiovascular, cancer, stroke, and pulmonary causes), and falls constitute two-thirds of these accidental deaths. About three-fourths of deaths due to falls in the United States occur in the 13% of the population aged 65 and older (Rubenstein and Josephson, 2007).

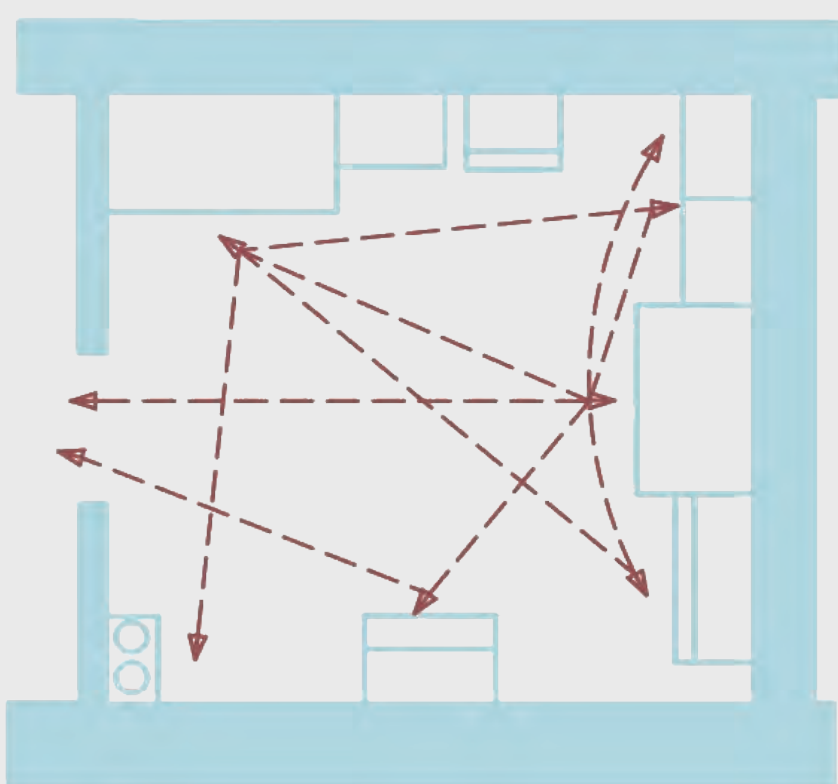


Figure 1. Movement in a conventional kitchen (Surmann and Reimann, 2017).

As demonstrated in Figure 1, traditional kitchen layouts are designed in a manner that results in frequent back and forth walking.

Common Cooking Scenarios

Cooking, along with many other kitchen activities, involves moving across the space and interacting with different types of equipment, such as furniture, storage, cabinets, and appliances.

Some of the tasks related to cooking, such as peeling, chopping, and more, require the person to adopt an uncomfortable or specific posture. This then calls for the person to stay standing up for long periods of time, which can contribute to joint or muscle pain, injuries, and fatigue.

Usually, when an individual is cooking, a lot of resources, supplies, ingredients, and equipment are required. Most of these are likely to be stored in different locations around the kitchen. Hence, the person must maneuver to various locations of the kitchen in order to access the element that will be used in the following procedural step.

Moving through the kitchen may increase the risk of falling, especially if we consider that it is an environment susceptible to liquids and foods spilling which can generate slippery floors.

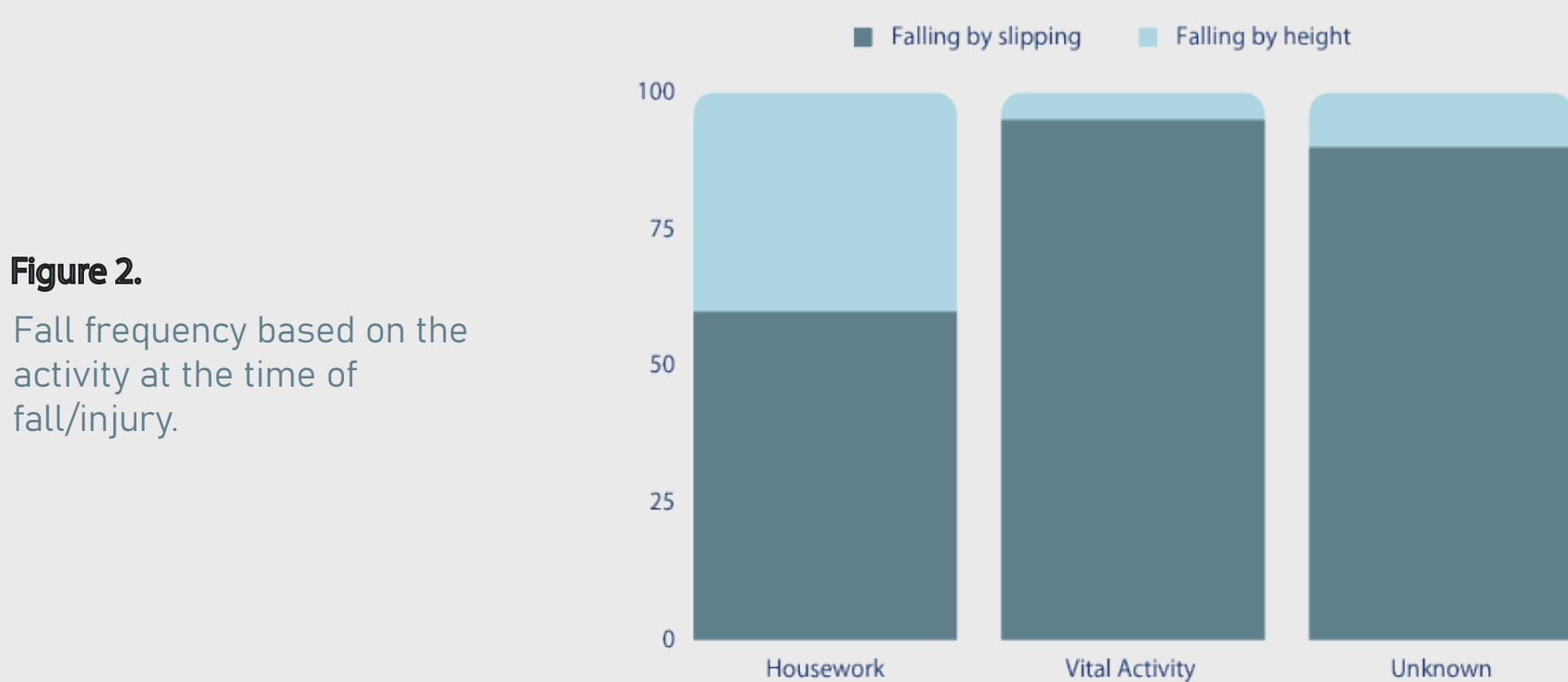
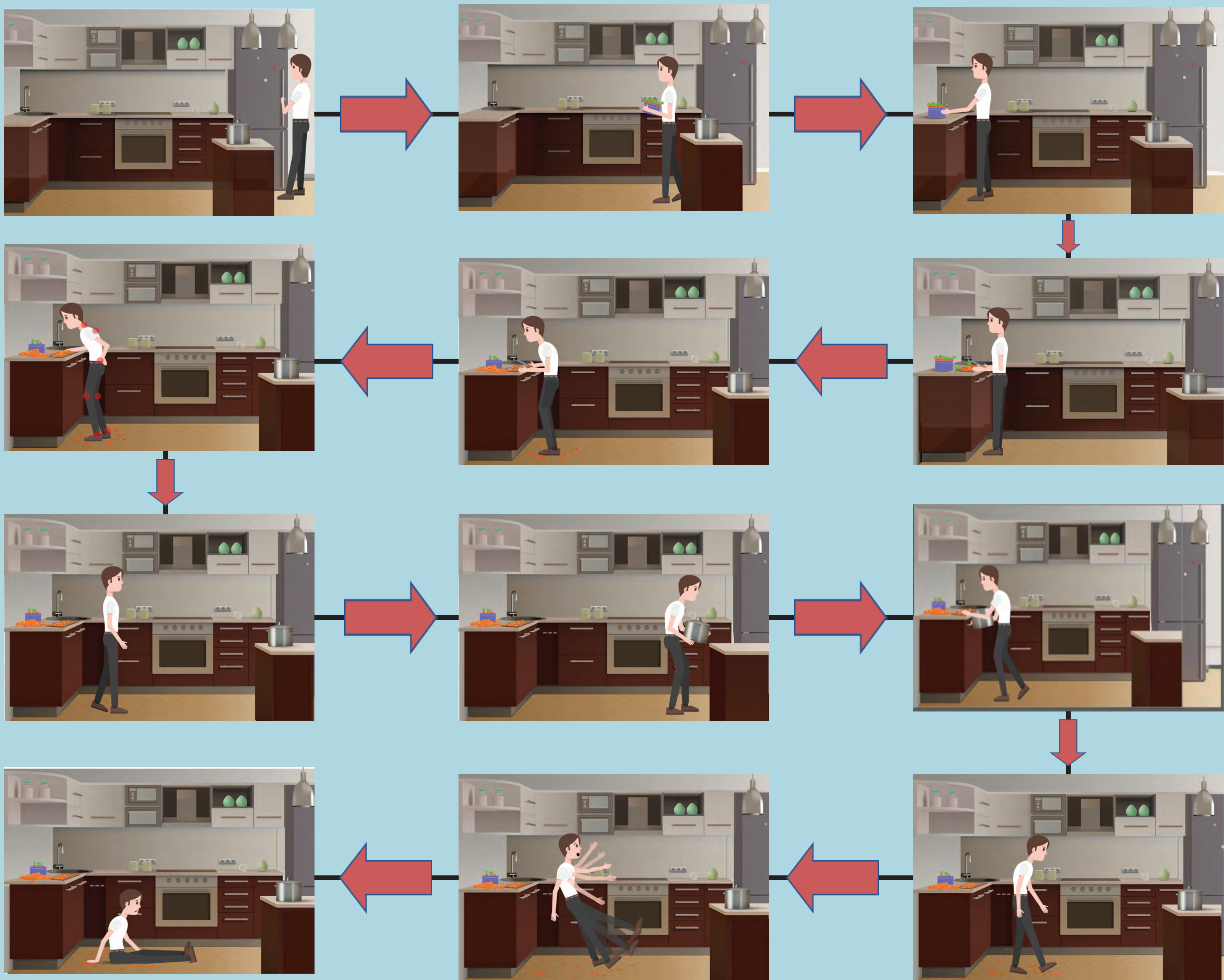


Figure 2. Fall frequency based on the time of fall/injury.

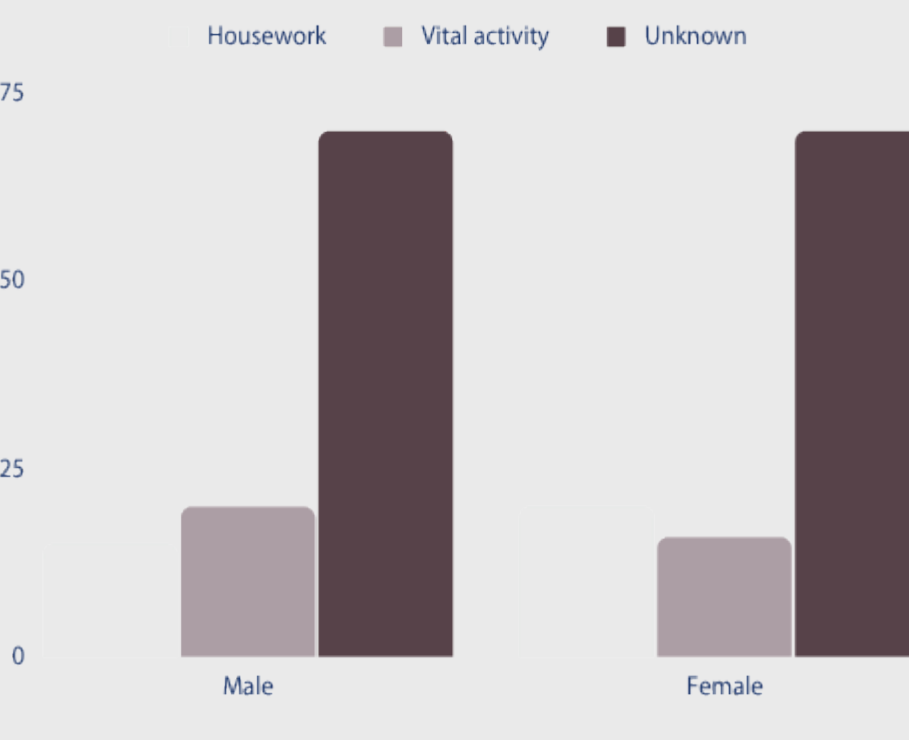


Figure 3. The proportion of activity at the time of the fall by gender.

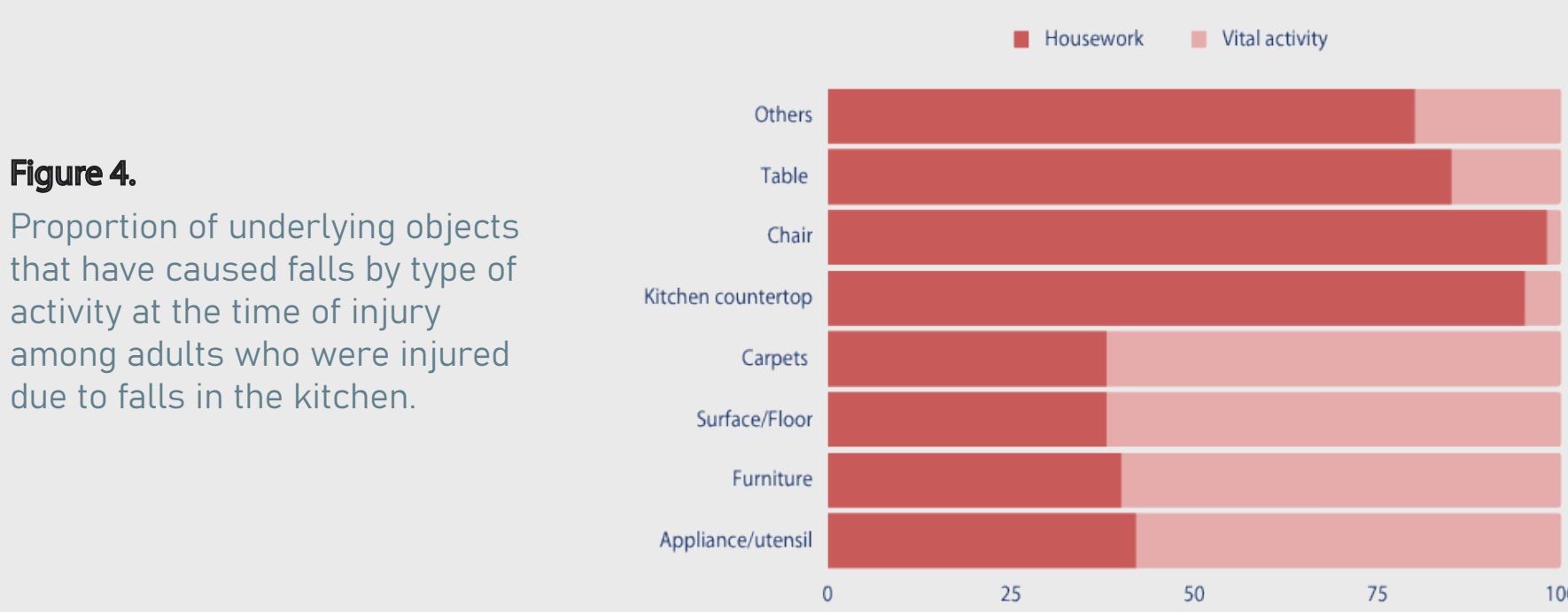


Figure 4. Proportion of underlying objects that have caused falls by type of activity among adults who were injured due to falls in the kitchen.

User Demographics



NICHOLAS

HIGH BLOOD PRESSURE

Sedentary lifestyle, weak muscles and limited aerobic capacity.

He is retired, and his pension is somewhat low, so he has a tight monthly budget. Ideally, he should consume meals prepared at home, prioritizing recipes low in sodium and cholesterol. As he lives alone, it is very important that he is able to cook by himself on a regular basis.



KATE

MYALGIC ENCEPHALOMYELITIS

Chronic fatigue syndrome, pain, dizziness.

Kate, like many mothers, has little time on her hands and many obligations. One of her main concerns is the health and well-being of her family, so she is very aware of their nutrition. She prioritizes organic and homemade food, but cooking can be very challenging due to her busy schedule and health condition.



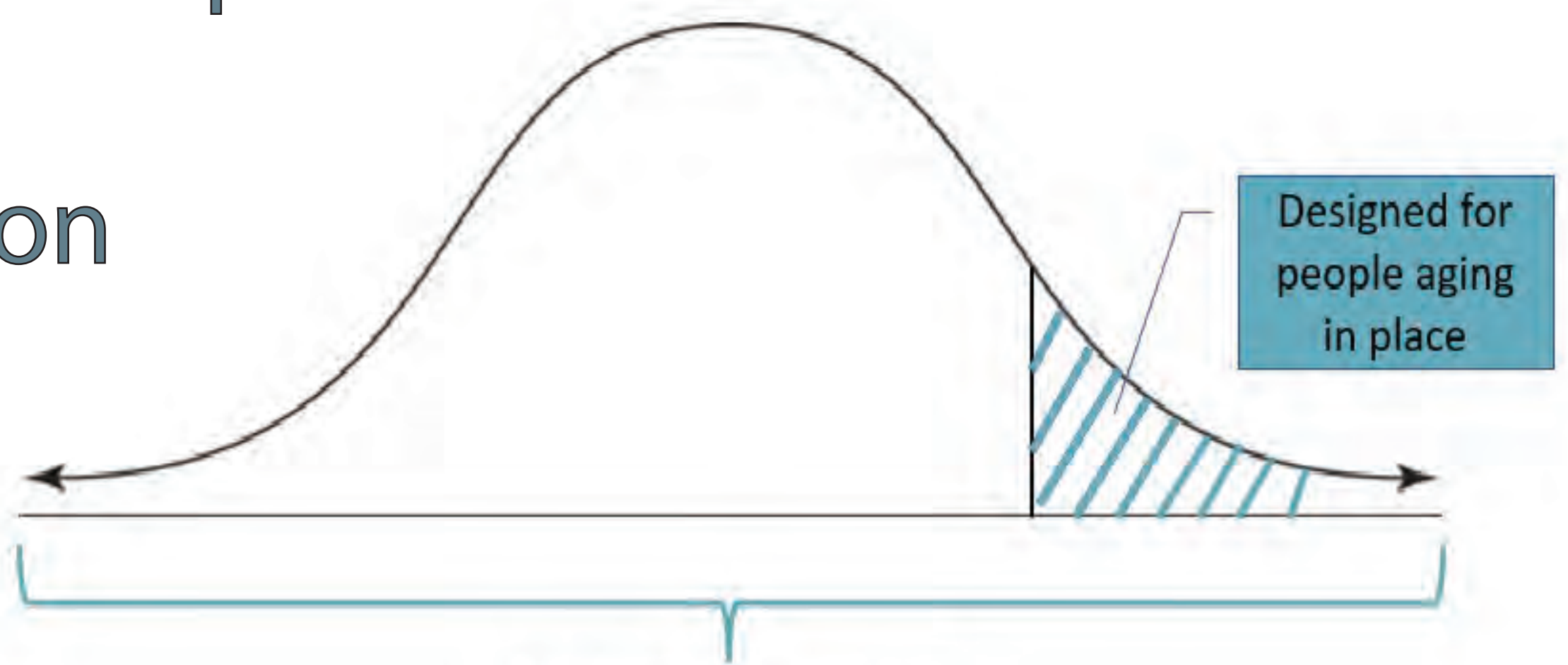
JESSICA

RHEUMATOID ARTHRITIS

Pain, stiffness, swollen joints, fatigue, muscle weakness.

She is a hard worker; very committed to her job, which can be stressful and time consuming. Since she has an immune condition, it is very important to keep herself as active as possible and to have a balanced diet, with low fat and minimal processed foods. Therefore, homemade meals are the best choice for her.

Design Principles and Conclusion



Applicable for Everyone

By keeping these five design principles in mind, the design strives to achieve maximum accessibility for meal preparation in the kitchen. A focus on prioritizing accessibility for those with the most needs means that it is functional and practical for everyone. With this design's many features such as its adjustable height, mobility, and array of kitchen tools, it allows users to prepare meals while seated. From literature, kitchen falls have been identified as a risk for older adults. This design can help prevent falls and fatigue brought on from prolonged standing and frequent ambulation.



Sit to Cook
Users can do all their meal prep in one sit



Within Reach
Every equipment of the table can be easily reached by spinning the top



Keep Meal Prep Fun
Cooking can be a tool to improve mental health and social connections



Durable Structure
Three-wheel design and braced legs make the product last for generations



Universal Design
Designed for elders, accessible to everyone

THE DESIGN PROTOTYPE | multifunctional meal prep station

The prototype has been designed keeping in mind to prevent a lot of movement during the preparation phase of cooking a meal. There is a provision for placing fruits, vegetables or other edibles in a steel container (as much as needed) before using the table. This helps in easy access of ingredients during the preparation.

The table has a lazy Susan placed in the middle of it, which is basically two rotating discs anchored on an axis which can help the users to access spices or other condiments that they might have to use while preparing simple meals, like a bowl of salad or a sandwich.

There is also provision for placing knives in a holder that is embedded at the centre of the table, along with a holder for basic cooking utensils like a whisk, spatula etc. The table also has extra cutting boards that are specific to different types of meat to prevent cross-contamination while preparing a meal.



The table, with a diameter of 80cm, has light-weight stone material for its cutting plane, so that it is easy to cut and also clean after use. The material extends on all sides of the table to provide ample space for work.



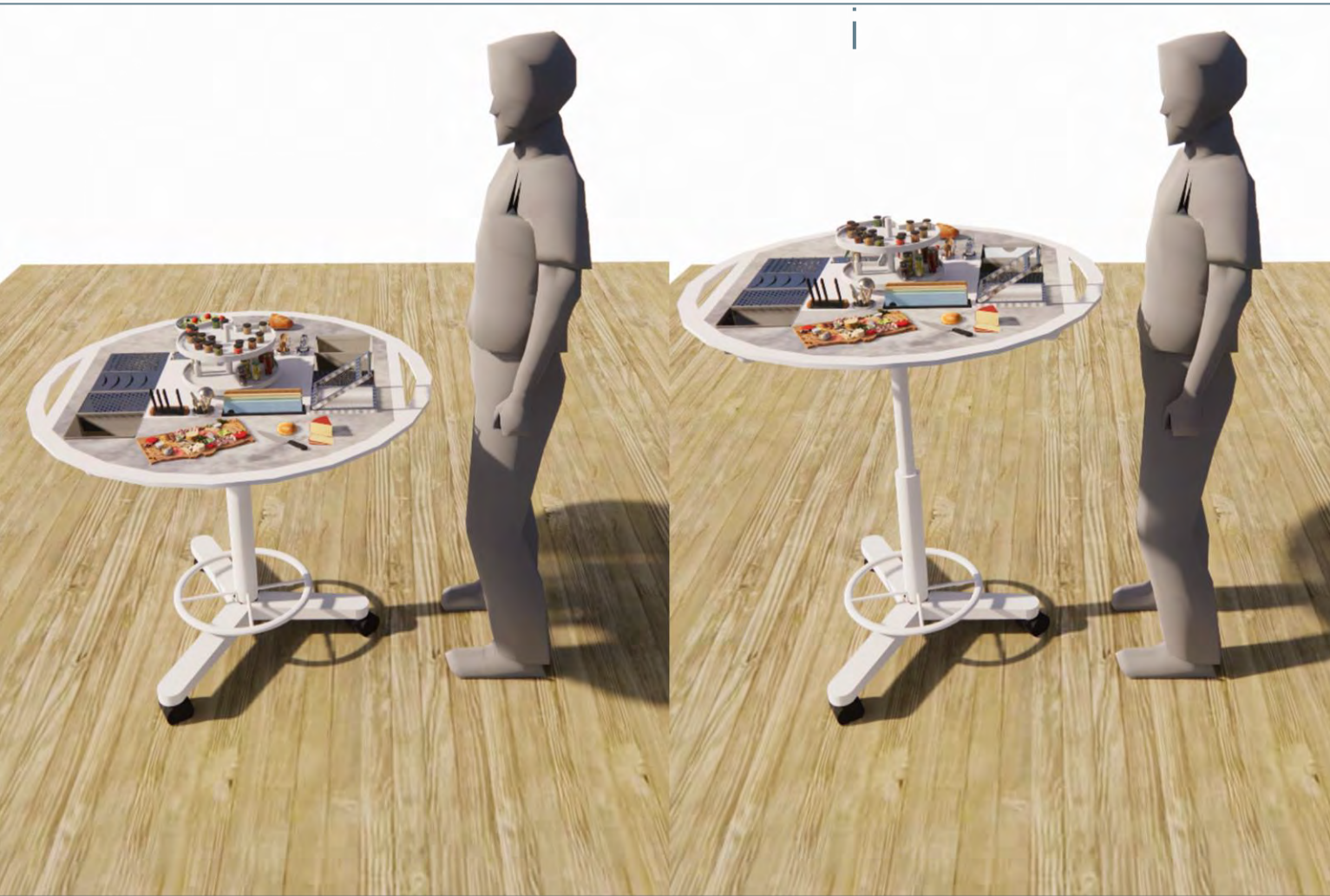
The whole table has been designed in a way that is rotatable (on its axis) so that users can access all sides of the board swiftly without moving around. The design has three legs for a higher dimensional stability. The provision of three axes gives directional freedom while helping to keep control of the movement of the table.



There are different types of blades for chopping, peeling, mashing and grating. Under each blade section, there is a collection container that helps to collect all the necessary produce from the work being done on the table. These containers can be pulled out of the table and again fitted in after use. There are also other empty containers that are present to discard waste or used utensils.



For the purpose of easy and comfortable rotation of the table, a spherical handgrip has been placed below the table. This design supports a natural hold and decreases hand tension. There is also a jar opening tool present under the table.



The table has been designed in a way that the height of the cutting plane is adjustable so that the users can work on the table in any comfortable position of their choice. It also has a circular foot rest for the comfort of seated users.



One key design feature of the table is that the whole unit is mobile. The table has lockable wheels on its base to make sure once in position it does not move around (which might cause accidents).

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