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Can nursing homes patients' appetite be increased by  
using brightly coloured dinner plates?

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**Can nursing homes patients' appetite be increased by using brightly coloured dinner plates?**

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MALK5000: Master's Thesis

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### **Abstract**

This thesis uses behaviour analysis to conduct an experiment among dementia patients living in nursing homes. Malnourishment among dementia patients is common due to difficulties with eating or reduced appetite. Studies showed that changing pale-coloured or white plates to new ones with brighter colours and high colour contrast can help increase food consumption. An experiment was conducted in three nursing home wards where the majority of the patients were diagnosed with dementia. In the experiment, the old plates were changed to bright coloured ones and the amount of food waste was recorded to see if there were any changes in eating behaviour. The experiment also explored the potential reasons behind any changes in appetite. Motivating operations and stimulus control were discussed in the thesis, including how they might influence the amount of food consumed by elderly nursing home patients. The results of this experiment showed no significant increase in appetite; however, it is worth noting that the experiment was prematurely terminated due to rising Covid-19 numbers in the nursing home wards.

*Keywords: dementia, food waste, nursing home, motivating operation*

### **Abstrakt**

Oppgaven bruker atferdsanalyse for å gjennomføre et eksperiment blant demenspasienter som bor på sykehjem. Underernæring blant demenspasienter er svært vanlig på grunn av spisevansker eller nedsatt appetitt. Det ble utført et forsøk på tre sykehjemsavdelinger hvor flertallet av pasientene lider av demens. Studier viste at å endre de lyse eller hvite tallerkener til nye med sterkere farger og høy fargekontrast kan bidra til å øke appetitt. På de tre sykehjemsavdelingene ble de gamle tallerkenene endret til fargesterke og mengden matavfall ble registrert for å se om det er endringer i atferd. Hva årsaken bak disse endringene i appetitt kan være, ble også undersøkt. Motivasjonelle operasjoner og stimuluskontroll ble diskutert i oppgaven og hvordan de kan påvirke mengden mat som konsumeres av eldre sykehjems pasienter. Resultatene av dette eksperimentet viste ingen signifikant økning i appetitten; eksperimentet ble imidlertid avsluttet tidligere på grunn av økende Covid-tall på sykehjemsavdelingene.

*Nøkkelord: demens, matsvinn, sykehjem, motivasjonelle operasjoner*

### **Can nursing homes patients' appetite be increased by using brightly coloured dinner plates?**

Reducing food waste is the 12<sup>th</sup> of the 17 Sustainable Development Goals which were written and intended to be achieved by the United Nations (UN). These Global Goals were set up in 2015 and the UN aims to achieve them by 2030. The 12<sup>th</sup> goal aspires to “ensure sustainable consumption and production patterns” (UN, n.d.-b). The UN argues that every year one third of all food is thrown out without consuming it. This is especially problematic because 24% of all greenhouse gas emissions come from food production and food production takes up 37% of the world's global land surface.

The Norwegian Government is working on achieving the goals set by the UN by the year 2030. This means that Norway's plan, signed in 2017, is to reduce food waste by 50% in 13 years (Klima-og miljødepartementet, 2020). These guidelines suggest that Norway's food waste should be significantly reduced in the coming years. Food waste is a very important issue; 400 000 tons edible food was thrown out in 2020, which has a value of 20 billion NOK (Stensgård et al., 2021). Several municipalities in Norway have started projects on reducing food waste in their social sectors. One of these is Aurskog-Høland municipality. The project is called “Prosjekt Matvinn 2021”, and its definition and scope commenced in May 2021 by the preparation of the project initiative.

The main goal of Prosjekt Matvinn 2021 is to reduce the overall amount of wasted food by 25% during the project's timeline; 35% by 2025; and finally, to reach Norway's goal of 50% less food waste by 2030. It is important to become more sustainable and climate-friendly with the food production in the social care sector. Through this project, the municipality wishes to contribute less to the negative environmental impact and to ensure a good living environment for current and future generations, with a goal to reduce greenhouse-gas emissions. The climate plan also specifies that all sectors of the municipality should

implement measures to reduce food waste. This can help the environment and the municipality can also save a significant amount of money as a result (Aurskog-Hølandkommune, 2018).

To succeed in reducing food waste in the social care sector, both in the short and long term, the project will focus on informing and communicating knowledge, e.g., by conducting training for employees, increasing knowledge about food waste and the benefits of a greener diet, and increasing user participation in the preparation of food selection (Aurskog-Hølandkommune, 2021).

One part of Prosjekt Matvinn 2021 is to conduct a study following the findings of the study “Sustainable Food Consumption in Nursing Homes: Less Food Waste with the Right Plate Color?” by Hansen and Derdowski (2020). This study indicates that the right coloured plate can help elderly nursing home patients suffering from dementia increase their food intake. Malnutrition and decreasing food intake are serious issues which many nursing homes face. Elderly patients are often struggling to keep a healthy weight, often resulting in malnourishment. This can cause serious negative health complications.

Norway's population (like many other Westerns countries) is ageing, and this results in the increasing demand for nursing home beds (Christensen et al., 2009). The number of patients with dementia is also on the rise. The World Health Organization (WHO) argues that a slight decline in intellectual competence is a normal part of the ageing process. Dementia, however, affects the part of the brain which is responsible for learning new things. Advanced-stage dementia patients often forget to consume food which can lead to malnutrition (WHO, 2017).

This thesis follows three wards of two nursing homes: Aurskog Nursing Home with ward Østkroken and Bjørkelangen Nursing Home with wards Skjermet Syd and Skjermet Øst.

All patients in Bjørkelangen Skjernet Syd and Øst wards are suffering from progressed dementia. Some of the patients in Aurskog Østkroken ward have been diagnosed with dementia, but not all of them.

The study by Hansen and Derdowski (2020) argues that it is possible to decrease food waste from 26% to 9% by switching to bright-coloured plates. Designs with bright colours can positively influence dementia patients (Valla & Harrington, 1998). The goal of this thesis is to conduct an experiment with reversal design and see if it is possible to achieve similar results as the study conducted by Hansen and Derdowski (2020). The nursing homes are currently using either completely white plates (Bjørkelangen Skjernet Øst and Syd ward) or plates with a light green rim and white centre (Aurskog Østkroken ward). These plates are going to be changed to the same type of bright-coloured plates which were used in the study written by Hansen and Derdowski (2020). If the experiment can achieve similar results as the one written by Hansen and Derdowski (2020) then the nursing homes will be able to help their patients as well as reduce their food waste significantly by simply implementing one small change.

The thesis aims to see if there can be a correlation between increased food intake and the colour of the plate it was served from and to understand the reason for these changes, if they occur. Ofei et al. (2015) write that the foodservice sector is among the ones with the highest amount of food waste. The amount of food waste differs depending on the food sector setting, but approximately 25% of the food served in workplace canteens is thrown out. It is estimated that Danish nursing homes had a food waste of between 20-27%. Hansen and Derdowski (2020) write that food which was served in nursing homes must be thrown out, it cannot be warmed up again or used elsewhere. There are phone applications or websites which try to reduce food waste by selling food at the end of the day for a reduced price for



consumers, but nursing homes cannot participate in these actions. It is therefore important to reduce food waste as much as possible inside the nursing homes.

Several studies examine malnutrition among elderly patients with dementia and there can be many reasons behind decreased appetite among nursing homes patients. Appetite can decrease due to drug therapy with this side effect or depression (Divert et al., 2015). As dementia moves forward, the patients might have difficulties remembering to consume food or recognizing it in the long run. Eventually there might be a need for constant support when food is served. Inefficient support from the nursing home can also contribute to malnutrition. Residents with dementia who need support have a higher risk of developing malnutrition than patients who are able to consume food alone (Jung et al., 2021).

Several studies experiment with different methods to increase food intake. According to Divert et al. (2015), patients living in nursing homes have a much higher chance of developing malnutrition than the elderly living at home. Up to 38% of nursing home patients can experience malnutrition compared to 10% of the elderly living in their own homes. The lack of calorie and nutrient intake can cause serious health problems. The study shows that a more detailed explanation of menus can contribute to an increased food intake among nursing homes patients.

Villarroel et al. (2012) suggest that 11.1% of food lunch and dinner served in nursing homes is thrown out. The average calorie intake was 1575 kcal/day; 44% of nursing home patients were consuming less calories than recommended which can result in malnutrition. The writers suggest that serving food with higher caloric content is important and can be done without increasing the amount of food served. Food can be prepared with the addition of high energy supplements such as milk powder or egg yolk. The amount of food served this way

can be smaller and the calorie density higher. This is a cost and time-effective way to increase the amount of calories patients take in.

Mamhidir et al. (2007) write that a training programme created for nurses working with dementia and Alzheimer's patients was implemented. The nurses who went through the training learned more about these diseases and what changes the patients go through as the disease develops. After the training the nursing home started to weigh their patients, alongside a control ward where no training was given. There was a weight increase for 13 out of 18 patients in the nursing home where the training was conducted, while there were no changes observed in the control ward. The nurses reported more contact with the patients and a better environment after the training was introduced (Mamhidir et al., 2007). Dyck and Schumacher (2011) write that although there are methods and organizational strategies which are proven to give positive results, the nursing homes often do not have the resources or the time to implement changes in their routines.

Changes in the environment or routine can increase the amount of food that dementia patients consume, according to Herke et al. (2018). The authors also argue that the training of nurses, educating them, can significantly improve the life of the patients. This article compared different studies which were aimed at improving the lives of dementia patients, but several of these studies were too small and they did not provide convincing results.

Studies by Hansen et al. (2018) and Hansen and Derdowski (2020) argue that implementing small changes, such as changing the plates the dinner is served on can give the desired results, increasing the amount of food eaten significantly. The study by Hansen et al. (2018) lasted three weeks and included 12 dementia patients.

There are several articles reviewing elderly dementia patients and how different colours around them can cause a change in their behaviour. Serving food to dementia patients

on plates with stronger colours can help them outline and recognize the surroundings more easily which might in turn contribute to increased calorie intake (Hansen et al., 2018).

Between 60-70% of dementia cases are attributed to Alzheimer's disease (AD). Semantic memory loss appears early on in most AD cases; more than 50% of the mild cases. This can lead to difficulties with object recognition. Adlington et al. (2009) suggest that image format consisting of strong colours or contrasts can have a positive effect on object recognition. The study conducted by Adlington et al. (2009) shows that adding details to surfaces helps dementia patients recognize living things or man-made objects. A study conducted by Dunne et al. (2004) also suggests an increase in calorie intake when plates with higher contrast were used. The study used white plates and cups during the baseline period which were later swapped with higher contrast red plates and cups after 10 days. This provided an easily distinguishable contrast against the food served. The study found a 24.6% increase in food intake and 83.7% increase in liquid intake. The authors also tested the effects of light blue and dark blue plates on the patients. The light blue plates showed no significant change compared to white plates, but the dark blue showed nearly as high an increase in food consumption as the red plates (Dunne et al., 2004).

Maintaining and improving dementia patients' skills is a challenging task.

Steingrimsdottir and Arntzen (2019) write that behavioural interventions showed great results in improving or maintaining behaviour in people with autism, but dementia patients might need and benefit more from other types of interventions. The authors suggest that nurses must have a balance between taking care of the patients and providing too much help. If dementia patients get more than the necessary amount of help, they can become passive which further deteriorates their physical and mental health. Improving dementia patients' behavior or re-establishing their basic skills can be challenging as they have difficulties learning new things and the outcome of learning strategies is unpredictable.

Small changes in dementia patients' surroundings and routines in nursing homes can positively affect their mental states and increase independence among them, including in relation to their eating behaviour (Melin & Göttestam, 1981 as cited in Steingrimsdottir & Arntzen, 2019). Increased independence might then contribute to higher calorie intake skills (Steingrimsdottir & Arntzen, 2019). An important research topic with regard to dementia patients is to increase consumption of foods and liquids.

Arntzen et al. (2015) write that there are currently no methods to stop the development of dementia or provide a cure, but there are procedures which might help patients reestablish their basic skills or improve their memory. There have been several studies conducted to help patients regain some of their basic skills. One experiment the authors conducted was a morphing procedure. One patient with dementia went through several appointments where the name of a nurse was gradually morphed into the nurse's picture, while also hearing the nurse's name. This procedure was able to help the patient remember the correct names of the nurses. The results showed a 77.7% correct response rate. Morphing can be used to change stimulus control. Stimulus control happens when the behaviour of an organism changes in the presence or absence of a certain stimulus (Miltenberger, 2016). Everything we do in our lives is influenced by stimuli. This morphing technique might help the target behaviour get under correct stimulus control. The authors write that the technique where one stimulus is morphed into another one is comparable to stimulus control shaping.

The increase in food intake might be explained by the high contrast colour of the plates which might help dementia patients see them and might help them understand why the plates are there. According to Dunne et al. (2004), objects with high colour contrast were more easily recognizable to dementia patients than light colours. The new plates which were used in Aurskog and Bjørkelangen nursing homes were easier to see with their bright red-

orange edges. This might help dementia patients understand what these are and why they are there.

A decrease in calorie intake among dementia patients can be due to several reasons and explanations. The experiment is also focused on finding out what the reason behind the anticipated changes in calorie intake is. It might be traced back to the fact that dementia patients forget what the feeling of hunger means or what they are supposed to do when they see food (Alzheimer's Society, n.d.). Even though they see the food, which is a common unconditioned stimulus, they might need help to understand why it is there. Food can be an unconditioned stimulus which can evoke the desire to eat. Stimulus control is when changes in behaviour are caused by application or removal of stimulus (Cooper et al., 2020). A stimulus can increase the likelihood of a behaviour occurrence. When people get food and they are hungry, they will most likely eat that food.

The desire to eat food can vary depending on how hungry people are. Motivating operation (MO) can explain the reason why food can have different influencing effects in different scenarios. MOs are processes which change the reinforcing value of a certain stimulus. MOs can be separated into two categories: the first includes the effects which change a behavior by reinforcement or punishment of other environmental events, and this is called the reinforcer-establishing effect. The other category can alter the organism through how often an occurrence of a behavior's repertoire appears and this is called the evocative effect (Laraway et al., 2003, p. 407). Establishing operations increase the value of reinforcers; abolishing operations decrease the value of reinforcers (Laraway et al., 2003).

The two effects of MOs can appear when people are food deprived. The food's value increases, and hunger can also evoke behaviour that earlier led to the consumption of food. A hungry person can therefore find it more enjoyable to eat and might eat bigger portions than a

person who has just eaten (Tapper, 2005). Food deprivation is considered an unconditioned establishing operation (UEO), meaning that the urge to eat is not a learnt behaviour (Laraway et al., 2003). Patients with dementia however can forget what the feeling of hunger means or what they are supposed to do when they are hungry. Even though they see the stimulus (food on a plate) they might need help understanding what it means. The patients might have difficulties connecting the feeling of hunger with the food in front of them. Using plates which are easier to see and recognize might provide the additional help dementia patients need to increase their calorie intake (Dunne et al., 2004).

Steingrimsdottir and Arntzen (2019) suggest that too much help can cause negative changes in dementia patients' behaviour. By only changing the plates, this might provide the necessary intervention without offering too much help. If the experiment in Aurskog and Bjørkelangen nursing home shows similar results to the study conducted by Hansen and Derdowski (2020), then the municipality might be able to take a step in the direction of reaching their goal by the end of their project period. This way the experiment can also show experimental control since the changes happened as they were anticipated to. However, there are several factors which must be taken into account when food intake increases. Can it be that the dinner tasted better on certain days? Is it possible that patients consumed more food because they were in a better mood, as the Easter holiday was coming, most likely the patients were visited more often by their families? Or can increased food intake be attributed to different contrasts; the patients were maybe able to see their food on colourful plates better than on the original ones?

## **Concepts**

The terms frequently used in behaviour analysis are important to clarify in order to understand the thesis' perception. Behaviour analysis often uses familiar terms, but their interpretation can vary from everyday speech.

The mention of food waste indicates that the food finished the food supply chain, reached the consumers, but wasn't eaten because it was thrown out, before or after expiration dates (UN, n.d.-a). Studies show that food waste at the consumer level can often be reduced by behavioural control, establishing practises connected to grocery shopping and learning new methods of using leftovers (Stancu et al., 2016).

Behaviour analysis as part of radical behaviourism was a term first explained by Skinner as a new scientific approach in 1938. He explained it as control over variables. He argued that behaviours were influenced by external variables and that if behaviour needed to be changed, it could be done through external changes.

Reversal design is a single-case experimental design which is often used when a single subject or group is being researched. This experimental design was chosen to conduct the experiment because it was important to show experiment control. Experimental control shows that the changes in behaviour are happening as they were expected to. The design is able to show that there is a correlation between a behavior and specific changes in the environment; the changes must happen because the independent variable was introduced (Cooper et al., 2020). Reversal design is conducted by first determining a target behaviour which is the behaviour that needs to be changed. The first step in reversal design is to document a stable baseline and establish a steady state responding.

Cooper et al. (2020) write that all three elements of baseline logic need to be taken into account when conducting an experiment. The three elements are: prediction, verification,

and replication. Prediction - when capturing the baseline, the goal is to establish a steady state of responding. When the steady state is established, a prediction can be made about what would happen next. The behaviour can be predicted in the baseline period. If it is correctly predicted how the next data point is, then the steady state is reached. A stable baseline does not necessarily need to be flat, it can be ascending or decreasing as long as the next data point can be predicted. Verification - when there is a stable baseline, then the independent variable can be implemented. If the behaviour stays at the baseline level, then the independent variable did not have an effect. The prediction element tests the theory that the independent variable changes the behaviour. Confounding variables could have come in and caused the change, which is why it is important to implement the replication element. Replication - the baseline conditions must be replicated. If the experiment returns to its baseline condition when the independent variable is removed, then it is likely that the independent variable caused the changes in behaviour (Cooper et al., 2020).

Pierce and Cheney (2017) argue that this stability happens when the number of responses – or in this case the amount of food waste - is roughly equal. When a steady state is achieved, an independent variable can be introduced, and the behaviour continues to be studied. After the variable is applied and a steady state is achieved again, the variables are then removed (Baldwin & Baldwin, 2001). If the changes reverse, then there is control over the analysis. The goal in this experiment was to conduct an ABAB design. An ABAB design is conducted by adding another phase to the original reversal design. After the independent variable is removed and the behaviour is in its original state, the same independent variable is introduced again. If the behavior changes again then it is very likely that the independent variable caused the changes.

### **Scoping review**



Scoping review is a fairly new method which is becoming more widespread as a way to manufacture research evidence (Pham et al., 2014). It does not have a universal definition established yet, but generally scope reviews are made before starting the experiment to identify the size of available relevant studies (Grant & Booth, 2009). This method can be especially useful when a research area has not been widely studied or the topic is complex.

Arksey and O'Malley (2005) argue that scoping can be used when the research question discusses broader topics and less defined issues. The writers list four reasons as to why a scoping review can be recommended. Firstly, to see the amount, dimension, and character of the already existing research papers. Secondly, to see if it is reasonable to conduct a regular review. Thirdly, to give a description and make a summary of research data. Fourthly (and finally), to recognize the holes and missing parts of previous studies. In this thesis the scoping review is used for the first reason. It is necessary to see the amount and dimension of research papers focusing on food waste and increased calorie intake among patients with dementia.

### ***Relevant research papers***

In order to summarize research papers focusing on food waste and increased calorie intake among patients with dementia three different databases were used: Scopus, Web of Science and PsycINFO. The following research terms were applied in the databases: “nursing home”, “dementia” and “food intake”. These terms were put in the search bar together and were connected with the AND setting. Only peer-reviewed English articles written after 2010 were considered for inclusion in this thesis. The articles had to be published after 2010 to be able to use current data as well as to limit the number of results. The articles had to contain at least two of the listed terms in their title or abstract. Alongside this method, several references of the study written by Hansen and Derdowski (2020) were considered to be included. From

the library's website 11 relevant articles were downloaded. The searches were administered in March 2022.

### *Selection of research papers*

After applying the listed settings into the databases, Web of Science had 24 articles; Scopus 157 articles; and PsycINFO had 41 articles. Using the EndNote program, it was possible to eliminate the duplicate results. This way, there were a total of 217 search results left. After a thorough review, most of these results were removed because the articles did not comply with the criteria. For the article to be kept, it had to focus on food waste or nursing homes. After these criteria were applied, the number of articles decreased to 27. All these 27 articles were read through, and several of them were removed because they focused on changing the food in the nursing homes to increase calorie intake. After a further thorough readthrough, there were a total 11 articles left.

## **Method**

### **Data**

#### *Subjects*

The data used in the experiment was collected from three nursing home wards. There were six-six patients living in each ward in Bjørkelangen nursing home and 15 in Aurskog nursing home. All patients in Bjørkelangen Skjermet Øst and Skjermet Syd are suffering from dementia, while the Østkroken ward in Aurskog is home to somatic patients, some of them with dementia diagnosis. The nursing home patients were able to eat independently, they were not fed by the nurses.

All patients in the study written by Hansen and Derdowski (2020) were patients with dementia. It is interesting to see if there is any difference in results between the ward with only dementia patients and the ward with somatic patients.

### *Data collection*

Data collection started on the 24<sup>th</sup> of March. The goal of the first phase was to collect data of the original plates which lasted until the 3<sup>rd</sup> of April. The nursing homes had 11 days to collect data. Unfortunately, as predicted, there were some days when the nurses were not able to collect data due to their busy schedules. Østkroken ward from Aurskog was able to collect data on nine days during this period. Skjermet Øst from Bjørkelangen recorded 10 days with data, while Skjermet Syd had nine days with data.

The next phase started on the 4<sup>th</sup> of April. The nursing homes changed their plates to the new one, colourful ones. This phase was set up to last until the 13<sup>th</sup> of April. Østkroken ward was able to provide data on seven days, while Bjørkelangen Skjermet Øst recorded data on eight days. Unfortunately, there was a serious Covid-19 outbreak in Skjermet Syd ward, which meant that the patients were provided food from disposable plates. This meant that data was only recorded on two days.

The plan was to continue the experiment with changing the plates back to the original ones, but due to rising Covid-19 numbers the nursing homes had to end the data collection prematurely. This way the experiment ended after the first two phases.

There were two types of original plates used in the first phase of the experiment. The two wards in Bjørkelangen nursing home had plain, white porcelain plates without any pattern on them. Aurskog nursing home used porcelain plates with a white centre and light green

rims. The new plates were made by Culina. These plates had a white centre, and bright yellow-orange rims.

The data collected from each nursing home ward were summarized before they were used in the thesis. The collected data cannot be connected to any patients, only the weight of the plates was recorded in the experiment. It is not possible to know which plate belonged to which patient as there was no personal information saved.

## **Design**

The goal was to conduct an experiment with reversal design in order to see if changing the plates to colourful ones can cause a change in behavior. An ABAB design was expected to be conducted throughout a couple of weeks. ABAB design was chosen to show experimental control and high levels of internal validity. If the changes in behaviour happen when the plates are changed, then a conclusion can be drawn that the independent variable causes the changes.

The first phase (A) was used to collect data about the usage of old plates. The old plates were weighed with food on them before and after dinner was served. Only the plates and the food on them were weighed, cutlery or napkins were removed. The goal of phase A was to have a baseline and achieve steady-state. The variation between the amount of food waste was surprisingly high. The range between food waste in Aurskog Østkroken ward was 0-971 gram, in Bjørkelangen Skjermet Øst 34-773 gram and in Bjørkelangen Skjermet Syd 0-1268 gram.

After 11 days the second phase (B) was introduced. In this phase the plates were changed into the new, bright-coloured ones. The goal here was also to achieve steady-state, which can take some time, as the behaviour usually goes through a transition period. After 10

days the behaviour did not show significant change and the range between food waste was broad. In Aurskog Østkroken ward the range was between 76-921 gram and somewhat smaller in Bjørkelangen Skjermet Øst with 132-418 gram. Due to a Covid-19 outbreak in Bjørkelangen Skjermet Syd, there were only two occasions when data was provided which cannot be used to draw a correct conclusion.

In the third phase (A) the plan was to change the plates back to the original ones (white centred with green rims in Aurskog Østkroken and white ones in Bjørkelangen Skjermet Øst and Syd) and to continue monitoring the amount of food waste. A change in behaviour was expected as the independent variable was removed. Unfortunately, due to the rising Covid-19 numbers the experiment had to be shut down after the first two phases. This decision was made after a meeting with the department heads and the representative of the municipality. With the rising number of sick patients, the nurses did not have the capacity to record data, and patients diagnosed with Covid-19 have their food served on disposable paper plates which would have made the experiment impossible to conduct.

In the fourth, last, phase (B) the plan was to swap back the plates to the new, bright-coloured ones again. A convincing demonstration of experimental control would have shown a decrease in food waste when the independent variable was introduced again.

The study expected an increase in calorie intake when the independent variable was introduced. This would have shown that there was experimental control. But if this would have happened, it might have been problematic to go through with the withdrawal of the independent variable in the third phase. There can be ethical concerns with the implementation of the reversal changes. The subjects of this study were patients in nursing homes, most of them diagnosed with dementia. Consumption of enough calories is often challenging for these patients. If the experiment would have worked as it was anticipated, it

would have been ethically problematic to reverse a change which provides a positive effect in the patients' diet and increases their calorie intake without significant changes or extra tasks (Cooper et al., 2020).

## **Procedure**

Before the experiment started, I had a meeting with the department head of Aurskog Østkroken ward and the representative of the municipality in order to discuss how the experiment can be conducted. After finding and reading the article written by Hansen and Derdowski (2020), it was decided to carry out a similar experiment. The representative of the municipality asked every nursing home in the municipality if they had the resources to join the experiment. One more nursing home, Bjørkelangen Skjermet, with wards Øst and Syd decided to participate.

The procedure to conduct the experiment was the following: each ward was informed in advance what their tasks were going to be. Figure 1 shows the form that needed to be filled out by the nurses every evening. The form was written in agreement with the department heads and their requests were taken into account. There was a Zoom meeting held before the experiment started where the nurses and department heads went through all the steps and were enlightened as to how and why this study can be beneficial; they were also encouraged to ask questions.

The food served in the nursing homes is made in the municipality's central kitchen and is sent to the nursing homes every day. The meals arrived packaged and needed to be heated up in the nursing homes and were then served by the employees. The meals came in large plastic bags, not in portion sizes. The nurses decided on the size of the portion individually and served it to the patients. The meals were served without trays, only plates and glasses were given to the patients. Patients were given a choice to either eat in the common dining

hall with others or in their room alone. The number of patients who chose to eat in the dining hall and alone was around 50-50%.

Table 2 illustrates the municipality's guidelines for the portion sizes. It is important that every patient gets the amount of nutrition they need, and everyone is supposed to get approximately the same amount of food.

The experiment only recorded data from dinners, specifically only main courses. Breakfast and lunch were not included in the study. The days when patients had soup as a main course were not included in the experiment as no new type of soup plates were bought. The wards used Liden Basic scales to measure the plates. The plates' weights before food were the following: new plates: 770 g, old plates Bjørkelangen Skjermet Øst and Syd: 633 g, old plates Aurskog Østkroken: 540 g. The results recorded only show the weight of food, it does not include the weight of plates. The foods' weight was always recorded in gram.

In the first phase, the nurses were asked to document each plate's weight with dinner before serving it to the patients. Later, when the patients finished their meal, the nurses weighed the plates again with the rest of the dinner on them. The plates were weighed individually because the patients ate dinner at different paces. Nurses were not able to wait and collect the plates all at once, they gathered them successively. When a patient finished their meal, the nurses collected their plate. The plate was measured immediately, and the nurses wrote down the number on the form. They did not have to remember which plate belonged to which patient, because the data collected was aggregated before using it in the thesis. Only the total amount from each ward was recorded in the summary. The filled-out form was then sent to me daily in order to keep record of them. Some residents needed special dietary food (diabetes); they were also included in the experiment.

There were some exceptions when data was not supposed to be collected. Some patients regularly ate smaller portions, and so they were not included in the experiment. There were some days when patients needed to be fed by the nurses; on such days the patients were not included in experiment either.

The nursing homes were informed that the different phases would last between 7-10 days. This was because it was important to reach steady-state in the measurements, meaning that the results should not change too much from day to day. It was important because in order to show experimental control the changes must be predictable. The elements of baseline logic – prediction, verification, replication - are important to follow (Cooper et al., 2020). In the end the first period lasted 11 days, while the second phase 10 days. It was not possible to have more days dedicated to data collection for every phase because of the tight schedule.

## **Results**

In accordance with the earlier study written by Hansen and Derdowski (2020) similar results were expected. Their study showed that the amount of food waste decreased from 26% to 9%. As mentioned earlier the experiment in Aurskog and Bjørkelangen nursing homes had to be ended prematurely and only the two first phases were successfully conducted

After the first phase was completed, the following numbers were recorded: with nine days of data, Aurskog Østkroken ward had a total of 32821 g of food served and 5087 g was returned to the kitchen as food waste. This means that 15.5% of the dinner ended up in the bin. After the plates were switched to the new ones the experiment continued the same way. In the second phase Aurskog Østkroken provided data on seven separate occasions, the amount of food served was 30883 g and, of that amount, 4223 g was returned to the kitchen. 13.7% of the dinners served during this period were thrown out.



In the first phase, Bjørkelangen Skjermet Øst had sent in data on 10 days. The ward served 14087 g dinner to its patients. 2714 g was returned to the kitchen, meaning that 19.3% of the food served as dinner during these days was not eaten. In the second phase Bjørkelangen Skjermet Øst provided data on eight different days. 12510 g of dinner was served to the patients during these days and 2325 g was sent back to the kitchen. 18.6% of the dinners ended up in the bin.

Bjørkelangen Skjermet Syd provided data on nine days during the first phase. 13524 g of food was served as dinner, and 3332 g was thrown out as food waste. This ward had the highest amount of food thrown out with 24.6%. During the second phase, there was a Covid-19 outbreak in Bjørkelangen Skjermet Syd ward, which meant that patients got their food served on disposable plates. The patients were served dinner on the new plates only on two occasions, meaning that there is only two days' worth of data. The results cannot be used to compare them to the results from phase one and therefore a conclusion cannot be drawn.

Due to the Covid-19 outbreak, only the results from Aurskog Østkroken and Bjørkelangen Skjermet Øst wards were compared. The comparison shows that there was no significant change in the patients' eating behaviour. In Aurskog Østkroken ward the amount of food waste decreased from 15.5% to 13.7% and in Bjørkelangen Skjermet Øst the food waste decreased from 19.3% to 18.6%. This shows a 1.8% decrease in Aurskog Østkroken and a 0.7% decrease in Bjørkelangen Skjermet Øst.

## **Discussion**

### **Summary of results**

The thesis discussed the following question: Is it possible to decrease food waste among nursing home patients by changing the colour of the dinner plate? This experiment was based on an article written by Hansen and Derdowski (2020) which had positive findings.

The experiment was conducted in three different nursing home wards and the goal was to see if an increase in calorie intake can be achieved by switching out white and light-coloured plates to new ones with a more noticeable, bright colour contrast.

The expected results were similar to the results Hansen and Derdowski (2020) got in their own experiment with similar circumstances, which was a decline from 26% food waste to 9%. This change in behaviour could contribute to reducing malnutrition among dementia patients. Only the first two phases were conducted, as the nursing homes did not have the capacity to continue to record data due to Covid-19 outbreak in the nursing homes.

Although the experiment's four phases were not completed, there were results of the first two phases from two wards. These results were compared. The data from phase A showed a great variety in the amount of food waste throughout the 11 days. After 11 days the independent variable – the new, bright coloured plates – were introduced. The data was recorded for 10 days. The results after the introduction of the independent variable did not show significant changes in the amount of food waste.

The amount of food waste during the baseline phase was 26% in the study conducted by Hansen and Derdowski (2020). In Aurskog Østkroken ward the amount was 15.5% during the first phase. In Bjørkelangen Skjermet Øst ward the amount of food waste during the first phase was 19.3%. The results showed that the nursing homes had a significantly lower amount of food waste already in the first phase than the nursing home in the study carried out by Hansen and Derdowski (2020).

However, after the independent variable was introduced the decline in the amount of food waste did not occur as anticipated. In Aurskog Østkroken 13.7% of the dinners served was thrown out, while the amount was 18.6% in Bjørkelangen Skjermet Øst ward. This meant only a 1.8% decrease in Aurskog Østkroken ward and a 0.7% decrease in Bjørkelangen Skjermet Øst ward. This change can be attributed to many different factors, not necessarily only to the new plates. The amount of food waste was already significantly lower in Aurskog and Bjørkelangen nursing homes than in Hansen and Derdowski's study (2020) in the first phase. There might also be a possibility that nurses paid more attention to the patients' needs and wishes.

As discussed earlier, dementia patients often cannot connect the feeling of hunger to the food in front of them or they forget what they are supposed to do when food is served to them (Alzheimer's Society, n.d.). The food, which is a stimulus when people feel hunger might no longer be functional for the dementia patients. The articles written by Dunne et al. (2004) and Hansen and Derdowski (2020) showed that food served on bright coloured plates helped dementia patients perceive the plates and food on them easier, but the decrease in food waste was less significant in Aurskog Østkroken and Bjørkelangen Skjermet Øst and Syd wards.

### **Limitations and further research**

There are some circumstances which can have an effect on the experiment's outcome. These are important to discuss in order to see the weaknesses of the experiment. An experiment has a high internal validity if it can be concluded that no other variables apart from the independent variable are the reasons for the change in the behaviour (Cooper et al., 2020). It means that the changes in behaviour can only be attributed to the independent variable being introduced and in case of changes there are no other factors which can explain

them, only the intervention. Threats to internal validity must also be discussed; these are things which can reduce the experiment's internal validity (Cooper et al., 2020). There are some factors which could have influenced the dementia patient's appetite besides the colour of their plates. There is a chance that the patients did not like the food that day or were not hungry.

High external validity suggests that the findings of the study can be generalised to other groups as well, not only dementia patients. Although the experiment focused on dementia patients, there were some somatic patients without dementia diagnosis in Aurskog Østkroken ward. The least amount of food waste recorded in the first phase was 15.5% in Aurskog Østkroken ward. There were somatic patients as well as dementia patients in this ward which can contribute to the relatively low amount of food waste recorded. Bjørkelangen Skjermet Øst and Syd has only dementia patients, and the amount of food thrown out here was higher with 19.3% and 24.6% respectively.

The experiment had some limitations which need to be considered when the results are discussed. The original plan was that the experiment would last until steady-state is achieved in all phases. The plan was to have 1-2 weeks for every phase in the experiment. Due to the unfortunate circumstances brought about by Covid-19, only the first two phases were completed before the experiment was subsequently shut down.

There are some aspects of the experiment which could be changed in a potential similar experiment. It would be interesting to conduct the experiment with a longer period for every phase, to see if the results can achieve a steady-state. The experiment could also be conducted by weighing every meal served in the nursing homes. This could provide more data and it would be possible to see if there are any changes in different parts of the days. It might be possible that patients react differently to food served on red plates in the morning, during

the day or in the evening. The reversal design study conducted by Dunne et al. (2004) followed the changes during both lunch and dinner, and both the original white plates and cups were changed to bright red plates and cups. The results showed significant increase in food and liquid intake when the red tableware was used, but there were differences recorded in the amount of food waste during lunch and dinner in both phases.

The type of food served to patients can also be a problem. The individual food preferences of dementia patients can influence the amount of food waste. There is a possibility that some patients did not eat much of the dinner because they simply did not like the dinner that day. There is also a possibility that the patients were not hungry on specific days (having perhaps eaten a larger lunch).

An experiment could be carried out with longer periods of the different phases. The results in both phase A and phase B showed a great variety in the amount of food waste. To be able to show experimental control, before starting the experiment a questionnaire could be filled out by the nurses with the most popular meals among patients. This could then be sent to the kitchen, which would subsequently only make the most-liked meals during the experiment period.

The data recorded could be even more precise if the experiment could be set up in a way that patients get the same meal on the same days of the different phases. E.g.: If on day one, in phase A the meal served is meatballs, then the same could be served on day one in phase B as well. This would show if there was a significant difference in food waste even when the same meals were served to the patients.

Instead of reversal design, a multiple baseline design could be used in the future. When a multiple baseline design is used, it is not necessary to reverse a successful

intervention. In case of a multiple baseline design the different nursing home wards could have the intervention applied at different times.

## **Conclusion**

The aim of this thesis was to replicate the experiment conducted by Hansen and Derdowski (2020). The goal was to see if an increase in calorie intake could be achieved by switching plates and why these changes happen. The results of the first two phases did not show a change in behaviour. Only two of the planned four phases were completed as the experiment was required to come to an early end due to rising Covid-19 numbers in the nursing homes.

There have been other experiments similar to this one and their results showed positive results in eating behaviour under similar circumstances; all these experiments showed that the calorie intake of the patients increased when food was served on bright-coloured plates (Kruger & Dunning, 1999; Hansen et. al, 2018; Hansen & Derdowski, 2020). Dunne et al. (2004) suggest that dementia patients are able to focus on objects with brighter colours more easily and are able to see the contrasts. This can help them understand that food is served to them.

Food is an unconditioned stimulus which usually evokes responses when people are hungry. This response can vary depending on how long a time has passed since the person has last eaten. Connecting the feeling of hunger to having food can become difficult for dementia patients. The progression of dementia can make patients forget what they are supposed to do when they are hungry or see food.

Behaviour analysis techniques are commonly used to help correct people's behaviour, to teach them new things or to improve their behaviour. Patients with dementia can have

similar needs and difficulties when new things are taught to them or when the current level of their cognitive skills are maintained. Steingrimsdottir and Arntzen (2011) argue that stimulus equivalence procedures could be used to record the progression of dementia and to maintain the skills patients already possess. Morphing procedure which was designed to teach the names of the nurses to a dementia patient also showed positive results (Arntzen et al., 2015). A literature review administered by Steingrimsdottir and Arntzen (2019) showed that there are only a few articles written on the topic of dementia patients and behaviour analysis.

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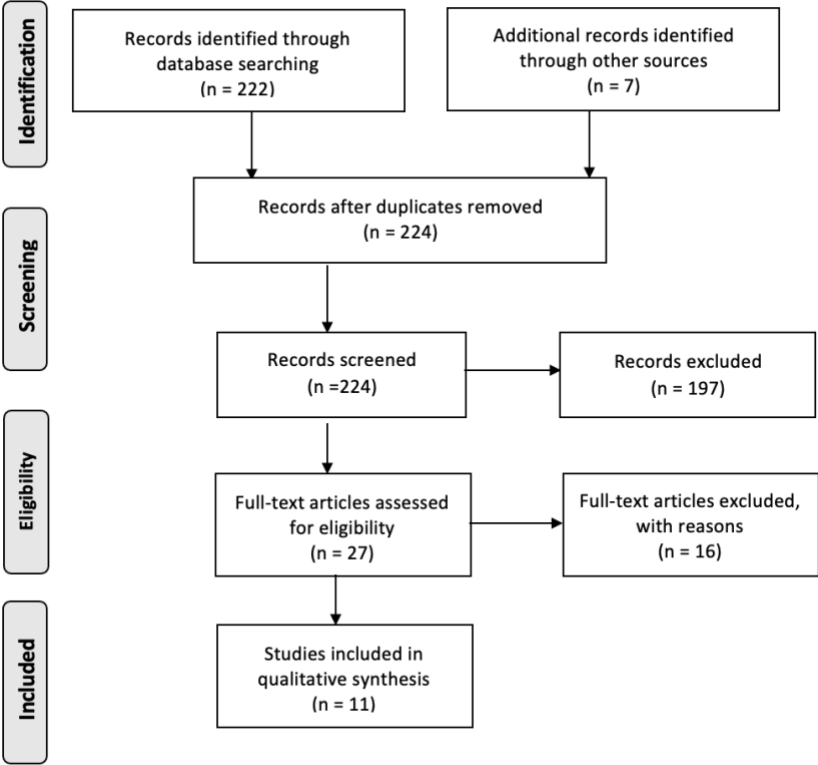
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Figure 1

PRISMA 2009 flow diagram of the scoping review



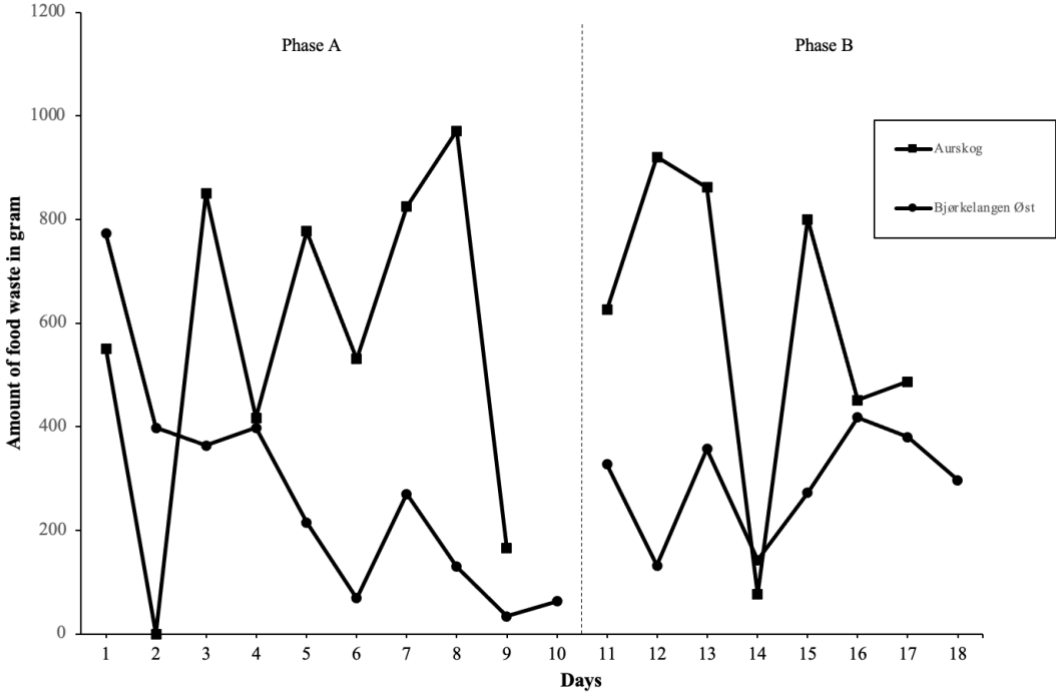
**Figure 2**

*Bright-coloured plates used in the second phase of the experiment*



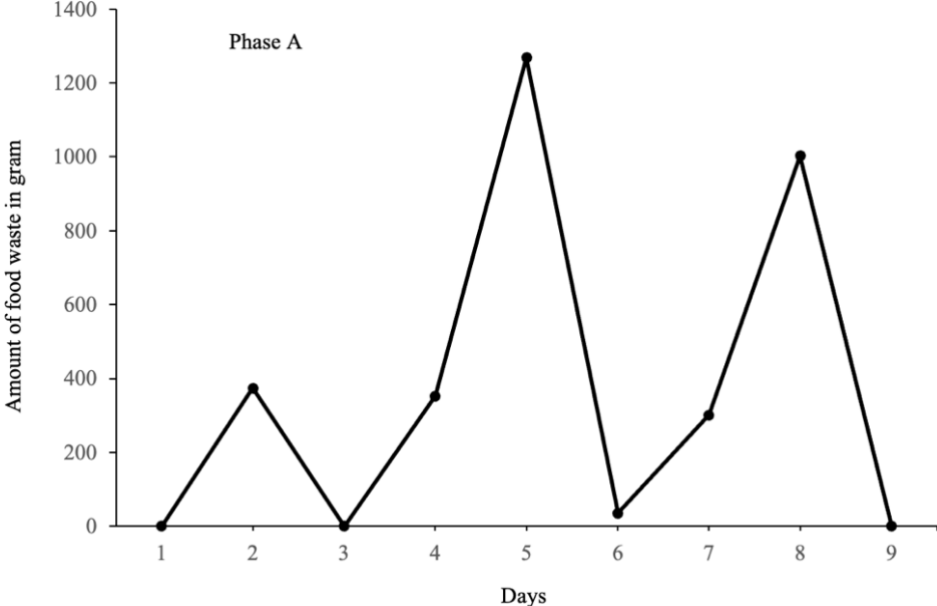
**Figure 3**

*Changes in amount of food waste during phase A and B in Aurskog Østkroken and Bjørkelangen Skjermet Øst ward*



**Figure 4**

*Changes in amount of food waste during phase A in Bjørkelangen Skjermet Syd ward*





**Table 1***Form used in the experiment*

| Dato:   | Gamle (G) eller nye (N) tallerkener: |                                |
|---|--------------------------------------|--------------------------------|
| Avdeling:   |                                      |                                |
| Middagsmeny:  |                                      |                                |
| Kommentarer (noen spiste ikke, spiste et separat måltid, osv.): |                                      |                                |
| Nr.   | Middagens vekt før servering         | Middagens vekt etter servering |
| 1   |                                      |                                |
| 2   |                                      |                                |
| 3   |                                      |                                |
| 4   |                                      |                                |
| 5   |                                      |                                |
| 6   |                                      |                                |
| 7   |                                      |                                |
| 8   |                                      |                                |
| 9   |                                      |                                |
| 10  |                                      |                                |
| 11  |                                      |                                |
| 12  |                                      |                                |
| 13  |                                      |                                |
| 14  |                                      |                                |
| 15  |                                      |                                |
| 16  |                                      |                                |
| 17  |                                      |                                |
| 18  |                                      |                                |

**Table 2***Guidelines for portion sizes*

|                |                             |
|----------------|-----------------------------|
| Potatoes       | 2-3 (depending on the size) |
| Meatballs      | 2 pieces                    |
| Sauce          | 1 dl                        |
| Vegetable      | 100 g (or 2 dl)             |
| Casserole dish | 2 dl                        |
| Porridge       | 3 dl                        |
| Fish           | 1 piece                     |
| Pancake        | 2 pieces                    |

**Table 3***Amount of food waste in Aurskog Østkroken ward*

| Aurskog Østkroken ward – Original plates |               |              |       | Aurskog Østkroken ward – New plates |               |              |       |
|--|---------------|--------------|-------|-------------------------------------|---------------|--------------|-------|
| Date                                     | Before dinner | After dinner | Rest  | Date                                | Before dinner | After dinner | Rest  |
| 24/03                                    | 4099          | 551          | 13.4% | 04/04                               | 5043          | 626          | 12.4% |
| 25/03                                    | 2604          | 0            | 0%    | 05/04                               | 5020          | 921          | 18.3% |
| 26/03                                    | -             | -            | -     | 06/04                               | -             | -            | -     |
| 27/03                                    | 3666          | 850          | 23.2% | 07/04                               | -             | -            | -     |
| 28/03                                    | 2201          | 417          | 18.9% | 08/04                               | 4525          | 862          | 19%   |
| 29/03                                    | 4720          | 777          | 16.5% | 09/04                               | -             | -            | -     |
| 30/03                                    | 3513          | 531          | 15.1% | 10/04                               | 3390          | 76           | 2.2%  |
| 31/03                                    | 5187          | 825          | 15.9% | 11/04                               | 4510          | 800          | 17.7% |
| 01/04                                    | 4380          | 971          | 22.2% | 12/04                               | 3985          | 451          | 11.3% |
| 02/04                                    | -             | -            | -     | 13/04                               | 4410          | 487          | 11%   |
| 03/04                                    | 2451          | 165          | 6.7%  | <b>Total</b>                        | 30883         | 4223         | 13.7% |
| <b>Total</b>                             | 32821         | 5087         | 15.5% |                                     |               |              |       |

**Table 4***Amount of food waste in Bjørkelangen Skjermet Øst ward*

| Bjørkelangen Skjermet ward Øst – Original plates |               |              |       | Bjørkelangen Skjermet Øst ward – New plates |               |              |       |
|--|---------------|--------------|-------|---|---------------|--------------|-------|
| Date   | Before dinner | After dinner | Rest  | Date  | Before dinner | After dinner | Rest  |
| 24/03  | 1807          | 773          | 42.8% | 04/04                                       | 1532          | 327          | 21.3% |
| 25/03  | 1342          | 398          | 29.7% | 05/04                                       | 1343          | 132          | 9.8%  |
| 26/03  | 1161          | 364          | 31.4% | 06/04                                       | -             | -            | -     |
| 27/03  | 1991          | 398          | 20%   | 07/04                                       | 1571          | 357          | 22.7% |
| 28/03  | -             | -            | -     | 08/04                                       | 1343          | 142          | 15.6% |
| 29/03  | 1542          | 215          | 13.9% | 09/04                                       | -             | -            | -     |
| 30/03  | 1462          | 69           | 4.7%  | 10/04                                       | 1378          | 272          | 19.7% |
| 31/03  | 1613          | 270          | 16.7% | 11/04                                       | 1891          | 418          | 22.1% |
| 01/04  | 1100          | 130          | 11.8% | 12/04                                       | 1818          | 380          | 20.9% |
| 02/04  | 862           | 34           | 3.9%  | 13/04                                       | 1634          | 297          | 18.2% |
| 03/04  | 1207          | 63           | 5.2%  | <b>Total</b>                                | 12510         | 2325         | 18.6% |
| <b>Total</b>                                     | 14087         | 2714         | 19.3% |   |               |              |       |

**Table 5***Amount of food waste in Bjørkelangen Skjermet Syd ward*

| Bjørkelangen Skjermet Syd ward – Original plates |               |              |       | Bjørkelangen Skjermet Syd ward – New plates |               |              |       |
|--|---------------|--------------|-------|---|---------------|--------------|-------|
| Date   | Before dinner | After dinner | Rest  | Date  | Before dinner | After dinner | Rest  |
| 24/03  | 1518          | 0            | 0%    | 04/04                                       | -             | -            | -     |
| 25/03  | 1748          | 374          | 21.4% | 05/04                                       | -             | -            | -     |
| 26/03  | 943           | 0            | 0%    | 06/04                                       | -             | -            | -     |
| 27/03  | 1569          | 352          | 22.4% | 07/04                                       | -             | -            | -     |
| 28/03  | 2169          | 1268         | 58.4% | 08/04                                       | 1484          | 162          | 10.9% |
| 29/03  | 1402          | 35           | 2.5%  | 09/04                                       | 914           | 0            | 0%    |
| 30/03  | 1302          | 301          | 23.1% | 10/04                                       | -             | -            | -     |
| 31/03  | 2135          | 1002         | 46.9% | 11/04                                       | -             | -            | -     |
| 01/04  | -             | -            | -     | 12/04                                       | -             | -            | -     |
| 02/04  | -             | -            | -     | 13/04                                       | -             | -            | -     |
| 03/04  | 738           | 0            | 0%    | <b>Total</b>                                | 2398          | 162          | 6.8%  |
| <b>Total</b>                                     | 13525         | 3332         | 24.6% |   |               |              |       |

## ROS analysis

When conducting a study, it is important to take the risks into account. These risks can influence the outcome of the experiment. There are several factors which can be considered and mapped out before conducting the experiment. The purpose of the ROS analysis is to identify conditions and incidents that may pose a risk against successfully carrying out the experiment.

| ID | Risk element             | Description   | Probability (1 rarely- 4 often) | Consequence (1 low- 4 very high) | Risk | Measures   |
|----|--------------------------|---|---------------------------------|----------------------------------|------|--|
| 1  | Not enough data recorded | Employees not having time to weigh plates.                                | 3                               | 2                                | 5    | The employees were informed that skipping a few measurements is not a huge problem; it was taken into account when the experiment was set up.  |
| 2  | Incorrect data           | Employees weighing the plates incorrectly.                                | 2                               | 4                                | 6    | The employees were shown through a presentation how the weighing needs to happen, in addition to having information sheets in their breakrooms.  |
| 3  | Covid-19 outbreak        | Covid -19 among patients which makes it impossible to use the new plates. | 3                               | 4                                | 7    | The nursing homes follow all national Covid-19 guidelines in order to avoid an outbreak.   |
| 4  | Temporary employees      | Temporary employees not getting informed about the project.               | 1                               | 3                                | 4    | The employees were shown through a presentation how the weighing needs to happen, in addition to having information sheets in their breakrooms. They were informed through their social media group as well. |

## **Ethical considerations**

Studies that include personal data are obligated to be sent to the Norwegian Centre for Research Data (NSD). NSD reviews the ethical concerns and makes sure that data which includes personal information are collected and stored according to applicable regulations. An experiment must be sent in if the collected data can be traced back to individuals. The NSD's approval was not required in this experiment and so it was not sent to the NSD for consideration. NSD writes that as long as no personal information is collected in the project and participants cannot be identified, the project does not need to be sent in and therefore does not require approval.

In this experiment, the nursing home wards never recorded data connected to individual patients, names, or any other type of identification. Personal information regarding the patients was not stored. All data was recorded daily on paper sheets. The forms used were developed with the help and support of the municipality's representative and the department heads of the nursing homes. The forms were approved by the municipality's representative and the nursing homes before the experiment was started. On the form only the amount of food served and thrown out was recorded, without any additional information. On hectic days when nurses were busy and had more things to do, no data was recorded and sent in; the patients were always prioritized. The data collected was then summarized and only the final numbers are used in this thesis. Therefore, participants cannot be identified in any way through the collected data.