Addressing the UN's Sustainable Development Goals Through Reykjavík's Strætó Bus Systems

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Abstract

The Reykjavik bus company, Strætó, tasked us with finding ways to integrate UN Sustainable Development Goals 3, 4, and 5 into their operations.

Using data from qualitative observation, expert interviews, GIS mapping, online surveys, and interviews with bus drivers, we created informational posters to direct bus patrons to information regarding health and well-being, quality education, and gender equality. We also advised Strætó on which routes and languages would be most effective for poster display.

The data also led to recommendations; the addition of new bus stops at health and education centers, and undertaking studies one addressing rider perceptions of safety, and one the feasibility of special rural health access routes.

Executive Summary

The goal of this project was to help Strætó integrate UN Sustainable Development Goals (SDGs) into their operations. We collected data to create informational posters and policy recommendations to provide resources and information regarding **health and well being**, **quality education**, and **gender equality**.

Background

For our project, we focused on SDGs 3, 4, and 5. For SDG 3 Good Health and Well-Being, we addressed the issue of cardiovascular disease which is the cause of 15.3% of total deaths in Iceland. The issue of the upper secondary dropout rate will be focused on SDG 4 Quality Education since it is currently at 16.5%. Finally, for SDG 5 Gender Equality, we will be targeting the rate of sexual assault for women which has increased from 1.7% in 2013 to 4.1% in 2019.

Methods

In order to complete our goal, we laid out three research objectives:

1. Determine Information for Informational Posters
2. Understand Rider Demographics
3. Determine Which Routes to Target for Each SDG

Objective 1 was important to ensure that the facts and resources we provided on our informational posters were accurate and relevant to the issues and demographics we intended to address. We accomplished this primarily through **expert interviews**. We interviewed Arna Hauksdóttir, a professor of Public Health at the University of Iceland, as well as her colleague Thor Aspelund. We were also able to conduct an interview with Rúnar Helgi Haraldsson, a specialist in secondary school issues.

Objective 2 was intended to develop an understanding of the characteristics of bus riders in Reykjavík. We first accomplished this with a period of **qualitative observation** on bus routes across the city. We used observation sheets to note information about ridership numbers and demographics on each route. This information helped inform our other research methods and served to ground us in the local context of our research. The bulk of our work towards Objective 2 was done through **online surveys**. We worked with Strætó to place QR codes linked to our survey on 8 bus routes and 2 bus stations. The survey collected data about bus riders that pertained to our three SDGs. The survey asked about the rider's gender, age, education level, exercise frequency, family history of cardiovascular disease, and perception of safety while on the bus. It also collected data on the bus rider's sentiment about seeing ads on the bus and language preferences. To round out our understanding of rider demographics, we also conducted **bus driver interviews**. This gave us another perspective on rider demographics and the benefit of the driver's many years of experience.

Objective 3 was to identify certain routes to target with our informational posters and policy recommendations. The first method we employed was **GIS mapping**. We compiled a list of locations of resources that were important to each SDG. These included medical clinics, pharmacies, schools, and swimming pools. We then compiled these resources in a GIS map that related the position of aforementioned resources and Straeto bus stops. The final method we used to identify routes was **online surveys.** In addition to

obtaining demographic information, we were able to ask questions specific to the SDGs as well as what bus the riders were on.

Results and Analysis

For SDG 3, survey responses echoed our previous research about the prevalence of cardiovascular disease amongst Icelanders. Our survey results indicated that a large proportion of riders either had a family history of cardiovascular disease, or had a substandard frequency of physical activity. Through our research, the team found two resources where Icelanders can go to learn more about the disease and its effects: The World Health Organization fact sheet on cardiovascular disease, and the Icelandic Heart Association's heart disease risk calculator.

For SDG 4, the age and education level distribution of our QR code surveys validated that we were targeting the correct demographic through our informational posters. Our interview with Haraldsson gave us further information about the local context and a resource called Næsta Skref, a website compiling different career paths and educational options for students. However, we did not find any relevant disparities between bus routes, and our GIS mapping indicated that Strætó already had excellent coverage and access to upper secondary schools.

For SDG 5, our online survey results indicated that a higher proportion of female bus riders stated that they did not feel safe on the bus, as compared to male riders. In addition, neither our online surveys or bus driver interviews revealed any instances of gender based violence on the bus. Based on this finding, we decided to address fear of crime on the bus with our policy recommendations. Through our expert interviews, we were directed to a webpage from the government with all the resources in the country for victims of gender based violence.

Deliverables

The team created a series of three **informational posters**, one for each SDG. The posters were created to quickly inform readers with statistics and lead them to resources regarding the problem specified on the posters. From our analysis of responses by bus

route, we recommend that the posters be distributed evenly across all bus routes, except for certain routes that require more focus. The SDG 3 poster should be more prevalent on routes 4, 6, and 12, the SDG 4 poster on route 1, and SDG 5 on routes 2, 4, and 12.

In addition to the posters, the team created three **policy recommendations.** The first policy recommendation is adding two additional stops which would make the two important resources more accessible than they currently are. One of the proposed stops is near Nautholsvik, a geothermal beach, which would make the walk from the bus to the beach less than five minutes and excludes a portion from the current walk where there is no sidewalk. The second of the proposed stops is near two public health centers, Heyrn Heyrnarþjónusta, and Domus Læknar. Adding the stop closer to the two centers than the stops that currently exist, which are between 6 and 12 minute walk, would cut a majority of the walk which is through a parking lot with no designated walking path.

The second recommendation is a **rural medical care access study**. Our results indicated that with few exceptions, Strætó provides excellent access to medical care resources in Reykjavík. However, our expert interviews indicated a gap in access outside the city. Based on this, we recommend that Strætó conduct a study to investigate this issue. We also recommend that this study explore the feasibility of a special bus route to facilitate access to medical care resources in rural areas.

The final recommendation is a **fear of crime study**. Our surveys and interviews showed that fear of crime is significantly more prevalent than actual crime on the bus. Given that fear of crime has been shown to have negative effects on mental and physical health, especially in women, we recommend that Strætó conducts a study on methods to address this issue. We recommend that the study examine the impact of increasing CCTV surveillance, improving lighting and cleanliness, and placing an additional uniformed employee on night buses.

Conclusion

Through our research, we found that Strætó is already doing an excellent job of working towards SDGs 3, 4, and 5. We believe that our informational posters and policy recommendations are an effective way for Strætó to improve their progress towards these goals. That being said, the studies detailed above would not necessarily need to be

conducted by Strætó. Improving rural medical care access and reducing fear of crime are goals that other relevant organizations could work towards as well. The Sustainable Development Goals are intended to be a collective effort and we hope that this project could lay the foundation for any Icelandic organization to work towards a lasting impact on the community.

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1. Introduction

Over the past 20 years, international policy has developed and begun to focus on social equality, as well as increasing the standard of living. International organizations like the United Nations (UN) have informed many of the laws and legislation from the past several decades that have been focused on improving the lives of all. The UN recognized that there was a need to improve the standard of living throughout the world, which led to the creation of the 17 Sustainable Development Goals (SDGs). The 17 SDGs are goals that aim to improve the biggest problems that the Earth as a whole faces, as well as continue to develop society with increased ecological and social sustainability (The Division of Sustainable Development Goals).

Iceland places a strong emphasis on protecting the environment and ecological sustainability, as well as an emphasis on social equality. However, there is still room for improvement with respect to the UN's SDGs, as Iceland ranks 29th in the Sustainable Development Report (Sustainable Development Report, 2023). Iceland's public bus company Strætó, has been working towards achieving several of the SDGs, to improve their company and community. We worked with Strætó to help them with their goals of achieving the SDGs, and we specifically worked towards SDG 3, good health and well-being; SDG 4, quality education; and SDG 5, gender equality.

Through our research, we found that Iceland can improve on specific indicators discussed in section 2.2 for each of the three SDGs. For health and wellbeing, the team found that Iceland has a relatively high obesity rate (OECD, 2019, p. 7) and a high mortality rate due to cardiovascular disease (Statistics Iceland, 2020). In terms of education, Iceland has a high dropout rate in upper secondary education compared to the rest of the European Union (OECD, 2012, p. 7). While Iceland is a global leader in gender equality, gender-based violence is on the rise in the country (Prime Minister's Office, 2019). Each of the previously mentioned problems corresponds to the three SDGs we aimed to work towards through the use of public transportation.

The term sustainability is often associated with environmental sustainability, and the idea of creating a sustainable society is focused on its ecological impacts. What the introduction of the SDGs has shown is that human development is also a vital factor in

building a more sustainable society. Social sustainability is based on how formal and informal systems and processes come together to support healthy and livable communities for current and future generations (United Nations, 2023). This project seeks to address some of the benefits public transit can have on social sustainability that may not be readily apparent such as those pertaining to the three SDGs of this project.

The goal of this project was to help Strætó integrate UN SDGs into their operations. We collected data to create informational posters and policy recommendations to provide resources and information regarding health and well being, quality education, and gender equality. We met our goal through three research objectives: determine information sources for the informational posters, determine rider demographics, and explore which routes to target for each SDG. Through our goal and objectives, we aimed to make progress towards achieving SDGs 3, 4, and 5 with Strætó.

2. Background

In this chapter, we aim to provide information that is critical to understanding public transit in the context of the UN SDGs. To begin, we provide background information on Strætó, the sponsor of our project. Next, we discuss the UN SDGs, starting with their origin and content, before narrowing our focus to the three goals that our project addresses. We then explore what problems associated with these goals affect Iceland the most and how public transit can be used as a resource to improve them by examining existing research and areas where further investigation is needed.

2.1 Strætó

Strætó is the transportation company that operates the city bus system in the Reykjavík metro area. The company is owned by the municipalities of Reykjavík, Kópavogur, Hafnarfjörður, Garðabær, Mosfellsbær, Seltjarnarnes and Álftanes. Strætó provided over 11 million rides in the capital area in 2022 despite difficulties from the pandemic and the war in Ukraine. The company recently moved to a new app-based payment system, Klappið, and is in the process of updating its fleet of buses from diesel to electric.

In recent years, Strætó has been making strides to improve its sustainability based on the UN's SDGs, although rising costs as a result of global factors have placed financial pressure on Strætó which is a major obstacle for the company's goals for future sustainability (Strætó, 2021). They previously worked on achieving SDG 11, sustainable cities and communities; SDG 12, responsible consumption and production; and SDG 13, climate action (S. Harðardóttir, Personal Communications, April 19, 2023). The three previously mentioned SDGs focused on more ecological sustainability. However, the company now wants to focus on social sustainability and making a positive impact in their community by working towards SGDs 3, 4, and 5.

2.2 United Nations Sustainable Development Goals

In 2015, the UN met to create and discuss its 2030 Agenda for Sustainable Development. The last time such goals and recommendations were created was in 2000 at the Millennium Summit, where the UN established the Millennium Development Goals (MDGs). These goals aimed to reduce extreme poverty around the world by 2015. As the MDGs expired, and new pressing global problems arose such as climate change, the UN created the 17 Sustainable Development Goals during their 2015 meeting (The Division for Sustainable Development Goals).

The 17 SDGs were created to improve human development, quality of life, and environmental protection. When creating the SDGs, there was more of an emphasis on protecting the planet and stopping climate change than when the MDGs were created. According to Griggs (2014), scientists realized "that long term sustainable development needs to be conceptualized in terms of economy and society" (p. 2). Because of the aforementioned realization, the goals were developed with sustainably oriented social and economic problems and solutions in mind. In order to measure the progress made by the SDGs, the UN has developed and tracked a total of 232 indicators based on official statistics the UN has collected (The Division for Sustainable Development Goals, 2018).

Our project focuses specifically on working towards achieving SDGs 3, 4, and 5. SDG 3 looks to "Ensure healthy lives and promote well-being for all at all ages" (The Division for Sustainable Development Goals, 2018, p.3). SDG 4 aims to "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (The Division for Sustainable Development Goals, 2018, p.5). The final SDG examined is goal 5 which is to "Achieve gender equality and empower all women and girls" (The Division for Sustainable Development Goals, 2018, p.6). The SDGs that we focused on have the end goal of improving quality of life and human development, and we will examine how they can be applied to public transit.

2.3 Iceland's Implementation of UN SDGs

In June 2019, the Government of Iceland's Prime Minister's Office published a report that provides an overview of Iceland's progress towards achieving the SDGs set out by the UN in the 2015 meeting (Prime Minister's Office, 2019). The report includes an analysis of Iceland's national status, including its economy, social structure, and governance system. It then provides an assessment of Iceland's performance with regard to each of the 17 SDGs as well as the data supporting each of these goals.

As described in section 2.2. there are indicators for each goal that serve as specific ways each SDG can be achieved. Iceland has failed to meet indicator 3.4.1 which looks at decreasing the mortality rate related to cardiovascular disease, cancer, diabetes, and chronic respiratory disease (The Division for Sustainable Development Goals, 2018, p.3). In terms of education, Iceland can improve in areas related to indicator 4.1.2. which seeks to increase the completion rate of primary education, lower secondary education, and upper secondary education (The Division for Sustainable Development Goals, 2018, p.5). Finally, regarding gender equality, Iceland has been unable to meet indicator 5.2.2. which looks at reducing the number of women 15 and older who experienced sexual violence by someone other than an intimate partner (The Division for Sustainable Development Goals, 2018, p.6).

2.3.1 SDG 3: Good Health and Well Being

Sustainable Development Goal 3 addresses good health and wellbeing. The UN SDG tracker report outlines the areas regarding health and well being that can be improved throughout the world. For our project, we aimed to improve knowledge and awareness of obesity and cardiovascular disease through public transportation, as it directly works toward indicator 3.4.1 (The Division for Sustainable Development Goals, 2018, p.3).

Compared to the European Union (EU), Iceland is either below average or meets the European average on most of the top health concerns on the continent. However, the obesity rate compared to the EU average is almost double (OECD, 2021, p. 7). According to the World Health Organization, obesity rates in Iceland have been increasing throughout

the past decade, and the obesity rate as of 2017 is 27% (OECD, 2019, p. 7). Obesity increases the risk for many preventable diseases including diabetes, hypertension, and cardiovascular disease. In Iceland, as of 2020, cardiovascular disease is the leading cause of death and kills people at a rate of 187.84 per 100,000 people (Statistics Iceland, 2020). Obesity and cardiovascular disease are some of Iceland's most prominent health problems and directly align with the indicator this project is concerned with.

Part of what can contribute to obesity and cardiovascular disease is one's diet. About half of adults in the country do not eat any servings of fruit at least once a day, and one-third of adults do not eat any servings of vegetables at least once a day (OECD, 2019, p. 7). This is compared to Europe, where 67% eat one portion of fruit and vegetables daily (Eurostat, 2022). The lack of fruit and vegetables in Icelandic diets could be attributed to a lack of access to fresh produce and healthy food options. According to one research study, public transit has an impact on diet. If public transit companies can increase routes between areas with little access to grocery stores and other businesses that provide fresh produce, healthy food, and diet will become more accessible (Baek, 2016, p. 124).

There has been research into how public transportation can have an impact on obesity rates. A 2018 research study examined the relationship between the use of public transit and rates of obesity. The researchers used multiple sets of open data about transit usage and public health between 2000 and 2009 to find an association between public transit use and obesity. The research finds that there is a negative correlation between public transit use and obesity rates. Specifically, it was found that for every 1% increase in public transit, there was a 0.473% decrease in obesity (She, 2018). However, the She study does not examine the reasons behind why this relationship might exist.

Another research study investigates how man-made environments and different factors affect obesity. This study outlines that public transit possibly has an impact on obesity rates because it increases physical activity (Booth, 2005). Public transit naturally includes and encourages much more walking and cycling than other forms of transportation because public transit does not take one directly to their destination.

2.3.2 SDG 4: Quality Education

Iceland has several challenges in fully achieving SDG 4, which is concerned with quality education. By reducing the drop-out rate in upper secondary schools, increasing the number of students in technical and vocational studies, and increasing the number of teachers, there will be significant improvement in ensuring quality education for all (Prime Minister's Office 2019). All of the above are a few of the crucial limitations to SDG 4. We have decided to narrow our investigation down to the drop-out rate in upper secondary schools, which will directly contribute to improvements in UN indicator 4.1.2.

The Icelandic education system comprises four main levels: Pre-primary, compulsory, upper secondary, and tertiary education. Upper secondary education, intended for students aged 16-20 years, includes non-compulsory education and offers two pathways: academic education, which prepares students for university studies, and vocational education, which equips students with practical skills and prepares them for the workforce.

In 2022, the rate of leavers from education and training in Iceland was 16.5%, which was the highest of any European country, and well above the EU average of 9.6% (Eurostat, 2023). The Organisation for Economic Co-operation and Development (OECD) assessed this problem of school dropouts in Iceland and recommended a series of strategies to combat it. Their report identified several "challenges to students' completion of upper secondary in terms of the quality of schools and the teaching, of the structure of education, of the incentives from the labour market and the governance of the system (OECD, 2012, p. 7). One key issue identified is the disparity between the dropout rates of vocational and general education. For four-year upper secondary school programs from 2014-2017, the average difference between vocational and general education dropout rates was 17.1% for all students, 11.6% for males, and 21.9% for females. The average dropout rate for general education was 19.0% for all students, 24.4% for males, and 14.3% for females (Statistics Iceland, 2021).

While improvements to the school system are outside of the scope of our project, improving transportation access and the resource network for students have both proven to be reliable solutions in reducing the drop-out rate. A study conducted by Rowan

University found that students who were provided with transportation were less likely to be truant (Lorenzo, 2016, p. 14). This is also validated by a report published by the National Center for Research on Education Access and Choice (REACH), which found that transportation eligibility increased attendance for economically disadvantaged students (Edwards, 2022, p. 3). The OECD report also identified that a lack of guidance and career advice can lead to students placing less value in their upper secondary education (OECD, 2012, p. 7), though "all pupils in both compulsory and upper secondary schools have the right to receive counselling upon demand and most schools employ full-time professional counsellors" (Valsdóttir, 2023).

2.3.3 SDG 5: Gender Equality

In the World Economic Forum's 2022 gender gap report, Iceland was the highest-ranked country with a score of 0.908 where a score of 1 would indicate no gender gap. Iceland's high ranking is primarily due to its performance in the categories of education equality and political representation.

Iceland's global rankings for the health and survival and educational attainment categories are 121st and 68th respectively (World Economic Forum, 2022). The Icelandic government recognizes the ways in which they fall short on gender equality. In their 2019 report on implementing the 2030 SDGs, the Prime minister's office recognizes three main challenges to attaining SDG 5. The challenges addressed include gender divisions in labor and study choices, the gender divide at the high levels of business, and gender-based violence (Prime Minister's Office, 2019). Gender-based violence is a particularly important issue as it has been worsening in Iceland. The percentage of women aged 15 and over who had been a victim of a sexual offense in the past year was 4.1% in 2019, which is a significant increase over a rate of 1.7% in 2013 (Prime Minister's Office, 2019). This highlights the severity and pervasiveness of gender-based violence in Iceland and shows the importance of addressing this specific facet of gender inequality.

Users of public transit are an especially vulnerable group when it comes to sexual violence (Pedersen, 2020). Globally, women are at a significant risk for harassment and violence while using public transportation. Studies conducted in major United States cities

indicate that between 40 and 60% of commuters have experienced sexual harassment (Pedersen, 2020). Rates of harassment this high create inequality as women are effectively excluded from taking advantage of public transportation systems. Combatting this issue is key to ensuring that the benefits of transit are applied equitably.

2.4 Gaps in Previous Research

Previous research into the development of sustainable transit systems has primarily been concerned with improving the efficiency and usability of transit systems. This type of research is also concerned with urban land use and its associated economic and socio-political factors (Abdallah 2017). These papers explore sustainability through economic, environmental, and social factors, however, the social indicators are often discussed too shallowly. For example, in a 2018 report by the Journal of Transport and Land Use, the social indicators of public transit are defined as transport-related fatalities, transport accessibility, and variety of transport options (Currie 2018). These indicators are useful but they do not go beyond the surface-level effects that transit has on a population. When gauging the social impact of public transit, wider trends should be considered. Factors such as health, gender equality, and education are more robust indicators to consider when evaluating the impact of public transportation systems.

Other studies do consider broader social trends but they usually only consider one social trend and one social demographic. One example of this is a 2020 report by the National Library of Medicine, which explores the effects of public transportation on mental health for the elderly (Yang 2020). This is a robust way to look at the effects of public transport, but it does not consider how social trends intersect. A study that explores how the combined benefits of public transportation combine to affect broad development goals would be very effective in advancing the improvement of mass transit.

Studies on the use of informational posters for disseminating information via public transit are lacking, but those that do exist show promising results. A 2009 ad campaign to stop youth tobacco usage in Calgary utilized posters on buses and bus shelters to spread its message (Schmidt 2009). A survey of students conducted by the campaign reported that 80% of respondents liked the posters and 54% remembered the slogan that was on them.

This shows that informational posters on transit can be effective. However, the study was only targeted at youth ages 12-18 and had a limited scope. More research is required to determine if informational posters are an effective tool for use on public transit.

Studies on the effects of public transportation in Iceland are lacking. Strætó does not collect any sort of demographic data aside from ticket sales and how many people ride the bus. This project will seek to address these discrepancies in existing research.

3. Methodology

This project aims to develop a series of informational posters and policy recommendations to aid the Strætó public bus system in advancing Iceland's ability to meet the three UN SDGs.

The team created the following research objectives to achieve this goal:

Objective 1: Determine Information Sources for Informational Posters
Objective 2: Determine Rider Demographics
Objective 3: Explore Which Routes to Target for Each SDG

3.1 Determining Information Sources for Informational Posters

After conducting archival research, we continued our research by interviewing experts in Iceland. The goal for these interviews was to obtain a greater sense of the context behind the problems that we were addressing, and this provided a foundation for the informational posters that we designed. For each SDG, we reached out to experts who are directly involved with people affected by problems from each SDG.

3.1.1 Expert Interviews

Objective 1 is concerned with what information to present to the riders of the Strætó system and how best to present it. We sought out experts rather than solely gathering resources ourselves to ensure credibility in our informational posters.

For SDG 3, we reached out to Arna Hauksdóttir, a professor of Public Health at the University of Iceland. After getting in touch with her, we established an hour-long meeting with her and her colleague, Thor Aspelund, at the University of Iceland Center of Public Health Sciences. For SDG 4, we reached out to Menntamálastofnun, the Directorate of Education. When contacting Menntamálastofnun, we called them a week after not getting a response from our follow-up email, and we were able to schedule an interview with Rúnar Helgi Haraldsson, a specialist in secondary school issues. For SDG 5, we established

connections with domestic abuse centers and professors with relevant experience at the University of Iceland. We were unable to get responses from any of the experts we reached out to for SDG 5. During our interview with Arna Hauksdóttir, we learned she has expertise in women's mental health and the psychological effects of violence against women, and we were able to talk to her about SDG 5. We developed a set of questions tailored to each expert, shown in (Appendix A).

3.2. Determining Rider Demographics

In order to gain insight into the optimal ways of improving Strætó's ability to meet their SDGs, we determined what kinds of people take advantage of bus services in Iceland. The SDGs and indicators discussed here are closely related to specific variables such as gender, education level, and physical health status. Our policy recommendations and informational posters were targeted toward particular groups, so it was essential to have a strong understanding of who utilizes the bus system (Leeman, 2017).

3.2.1 Qualitative Observation

Before other survey methods were employed, we performed a qualitative assessment of the demographics on each bus route. Collecting data as passive observers this way provided a unique perspective that elicited data not found with other methods (Leeman, 2017). An observation sheet (Appendix D) was used to track ridership numbers at each stop and note general observations about bus travel and demographics.

Our process for determining demographics is as follows: We would first estimate the age of the passenger as young, old, or middle-aged. We made the assumption that a local would be familiar with the bus system and speak Icelandic. We identified tourists as speaking non-Icelandic languages, traveling in large groups, and dressing in significantly more foul weather gear than is deemed necessary by locals. We identified college students as young, more local than tourists, and carrying a backpack. These characteristics were used to place people into the categories.

Observations took place between 9:00 AM and 3:00 PM GMT on Thursday, August 31st, and were conducted on a total of 12 routes, spanning the entire Reykjavík capital area

as seen in Figure 1. We then compiled our observations into a spreadsheet that listed a number of the demographic categories mentioned above (Appendix D). Each route was listed under each relevant category. For example, if bus route 1 was observed to serve a notable amount of tourists and college students, it would be listed under both of those categories. We acknowledge that these observations are based on our assumptions and perceptions of people, and therefore not accurate and relevant for data analysis. However, these observations were intended to help us tailor our further research to the local context and give us a more nuanced approach to our other research methods.

Figure 1

Qualitative Observation Map

3.2.2 Online Surveys

We used the qualitative observations to create an online survey that was placed on buses and bus stops using QR codes. The purpose of the surveys was to collect further demographic data about riders and non bus riders. Prior to arriving in Iceland, the team devised two Qualtrics surveys. One with questions targeted towards bus riders, labeled "Bus Rider Survey" in Appendix B, asked bus riders about their experience with the bus system as well as questions pertaining to gender, education level, physical fitness, and health. The second survey targeted non bus riders, labeled "Non Bus Rider Survey" in Appendix B, and asked about reasons for not riding the bus, as well as the same questions

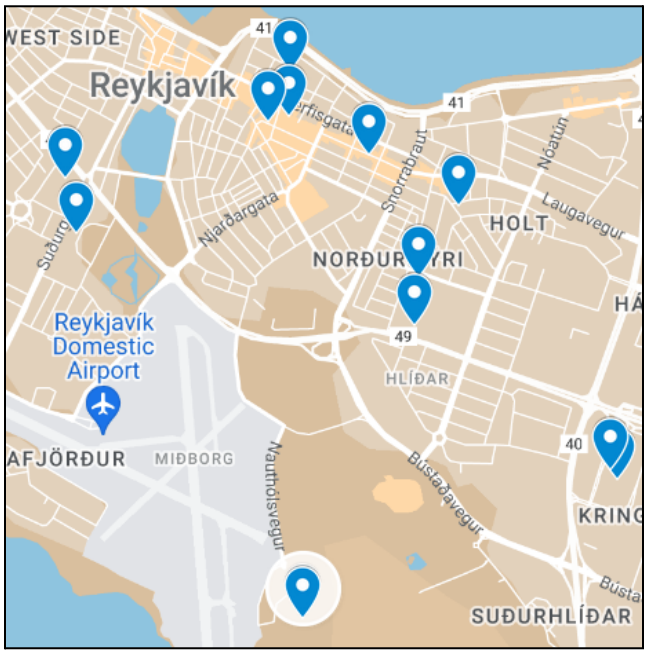
about gender, education level, physical fitness, and health. The surveys were in both English and Icelandic and were translated by our sponsor.

Figure 2

Bus Rider and Non Bus Rider QR Codes

We started the process of putting up the survey by creating a dynamic QR code for each survey, using the website QR Planet, that would bring users to our surveys. Then using Canva we created a design around the QR codes, seen in Figure 2. For the bus rider survey design, the design was printed as a sticker by Strætó, and then placed on buses and stations throughout Reykjavík. The stickers were placed on routes 1, 2, 3, 6, 11, 12, 15, and 18, and at stations Hlemmur, Mjódd, Ártún, and Lækjartorg. For the non bus rider survey, we printed out the design on paper and placed them around the city in parks, cafes, the University of Iceland, Reykjavík University, and the mall as seen in Figure 3.

Figure 3



Non-Bus Rider Survey Map

3.2.3. Bus Driver Interviews

Bus drivers represent a unique source of information on the bus travel experience. Compared to riders, drivers spend significantly more time on the bus, which provides additional insight into demographics and safety incidents over time. The surveys contain a list of questions pre-determined by the team, shown in Appendix C. Interviewing bus drivers with open-ended questions provided an opportunity to collect more expansive data than multiple-choice surveys and answers that gave insight that the team did not have before (D. Albudaiwi, 2017).

We contacted our sponsor, who recommended that we conduct our interviews at Hesthals, Strætó's headquarters, after one of our sponsor meetings with two former bus drivers. We then sat down in a meeting room and talked to each of the former drivers individually.

3.3. Exploring Which Routes to Target for Each SDG

In order for the team to provide policy recommendations and effectively use informational posters, we used the following methods to determine which routes should be targeted towards good health and wellbeing, quality education, and gender equality.

3.3.1. GIS Map

GIS maps are a powerful tool to visualize the geographical context of data. GIS can be used very effectively to map health disparities and can map multiple variables (S. Gupta, Personal Communications, April 14, 2023). We utilized GIS to create a map that highlights how the socio-economic issues studied in this project affect different areas in Reykjavík.

We used the free software QGIS, to create a resource map. The resource map was created to show bus stops throughout Reykjavík and their proximity to important spaces for each SDG like public health centers, pharmacies, public pools, and upper secondary schools.

The base map was created using the QuickMapServices plugin and selecting the OSM standard map. Bus stop location data was downloaded from Strætó's website and converted to a CSV file in Google Sheets. The data was then uploaded into QGIS, and the points were plotted on the map as blue diamonds. The team then compiled a list of public health centers, pharmacies, public pools, and upper secondary schools in the Reykjavík area, into a Google Sheets file along with their addresses, and coordinates. The locations of women's shelters are not public and were therefore not included on the map. The CSV file was uploaded from Google Sheets to QGIS, and the points of interest were converted to spots on the map.

After the points of interest were input on the map, we added a heatmap element that shows the density of bus stops throughout the map. This was done by selecting the heatmap option from the drop-down instead of single symbology to represent the Strætó stops. The color scheme Turbo was used, where the red regions represent the areas with the most bus stops in a 2000-meter radius, and the areas in dark blue are the least bus stop-dense areas.

3.3.2. Online Surveys

The online survey questions pertaining to each SDG were cross-referenced with the bus route associated with each response. This was used to identify any disparities between bus routes.

4. Results and Analysis

4.1. Information Sources for Informational Posters

4.1.1. Recommended Resources

Both interviews provided resources and websites specific to Iceland. In our interview with Arna Hauksdóttir, found in Appendix A, she directed us to two major resources regarding SDGs 3 and 5. For SDG 3 we were directed to Iceland's Directorate of Health website, and put into contact with them through Hauksdóttir. The website includes information about registered medical professionals in Iceland, public health statistics, as well as news and published material regarding public health. While this website includes many important resources regarding health in Iceland, there was not any easily accessible information about heart disease in Iceland. Upon further research, the team found the Icelandic Heart Association website, which includes information specifically about heart disease and heart-related issues like cardiologists and radiologists, and a risk calculator.

Hauksdóttir additionally referred the team to a webpage published by the city of Reykjavík with the purpose of assisting victims of gender based violence. The website directs viewers to a number of resources including to the women's shelter in Reykjavík called Kvennaathvarf, as well as Path Meeting, a counseling and support center for victims of sexual violence.

In the interview with Rúnar Helgi Haraldsson, found in Appendix A, he directed us to Næsta Skref, a website compiling different career paths and educational options for students. He explained that it is an information page made for those who are starting secondary education. This used to be a project that was provided by external educational

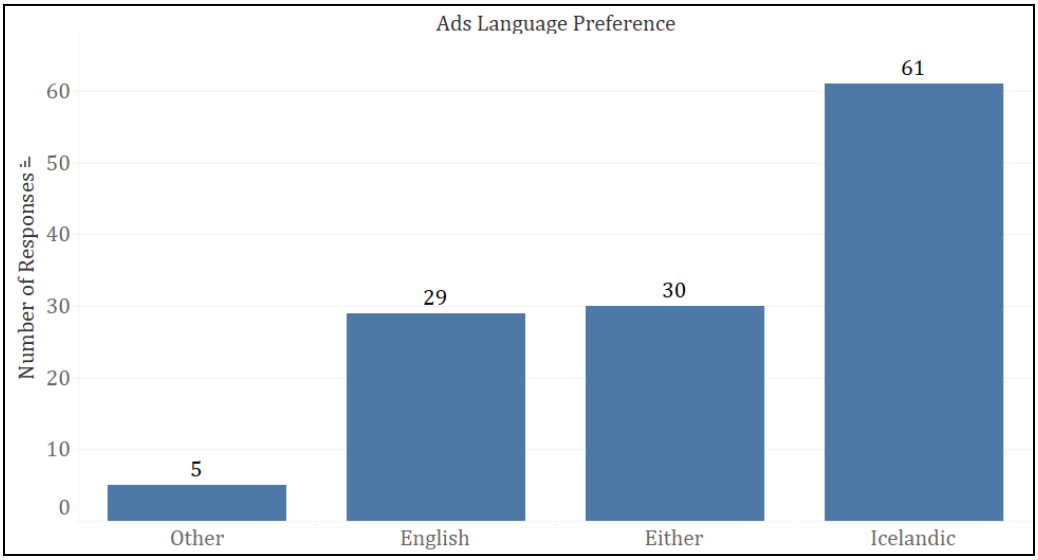
institutes, but the directorate had recently adopted it into their scope. It covers all of the secondary schools in the country, all study programs, and where to go, and has a contact page for receiving career counseling.

4.1.2. Local Context

Through a combination of online survey data, expert interviews, and qualitative observations, we discovered a number of nuances particular to Iceland that aided us in making our informational posters more suited to the local context.

Out of 134 responses to the survey question asking "Do you prefer seeing ads in Icelandic or English?"45.5% of people responded, "Icelandic", 21.6% of people responded "English", and 22.4% percent of people responded "Either" (Shown in Figure 4). Based on this data, we decided to recommend that Strætó distribute 25% of the posters in English and 75% of the posters in Icelandic.

Figure 4



Bus Rider Ad Language Preference

During the interview with Arna Hauksdóttir, we confirmed our research that indicated cardiovascular disease as the primary cause of death in Iceland. Thus, we decided to focus on cardiovascular disease for our SDG 3 poster. Thor Aspelund also mentioned that cancer was a major public health issue that would overtake cardiovascular disease in the near future as a primary concern. Despite this, we decided to maintain our focus on

cardiovascular disease, as the causes and prevention methods for cancer are too varied and poorly understood to put on a poster.

Hauksdóttir additionally brought up public pools as an important resource to include in our resource map, as they are vital to the physical and mental health of Icelanders. In terms of physical health, they offer a place to exercise by water-based activities. In terms of mental health, they provide a place to socialize and be outside all year round, including winter, thanks to the natural heating of the pools. Hauksdóttir emphasized that public pools should be easily accessible because of its importance to SDG 3 and the health of Icelanders.

Our interview with Rúnar Helgi Haraldsson pointed us to several key factors that contribute to students dropping out, which informed us on the content of our informational posters. The scope of the problem has changed over time, as there were fewer opportunities to pursue secondary education than there are now. Now, more students are going to school but are not succeeding. Poor performance at the grade school level is a worrying trend and one of the primary reasons for students leaving secondary education, which is compounded by the declining performance of Icelandic students in international assessments like the PISA test. In addition, Iceland has experienced an increase in people born outside the country or born to parents born outside the country. This group tends to have a higher dropout rate, which may be due to factors such as their perception of future prospects and challenges in understanding and performing well in Icelandic-language education.

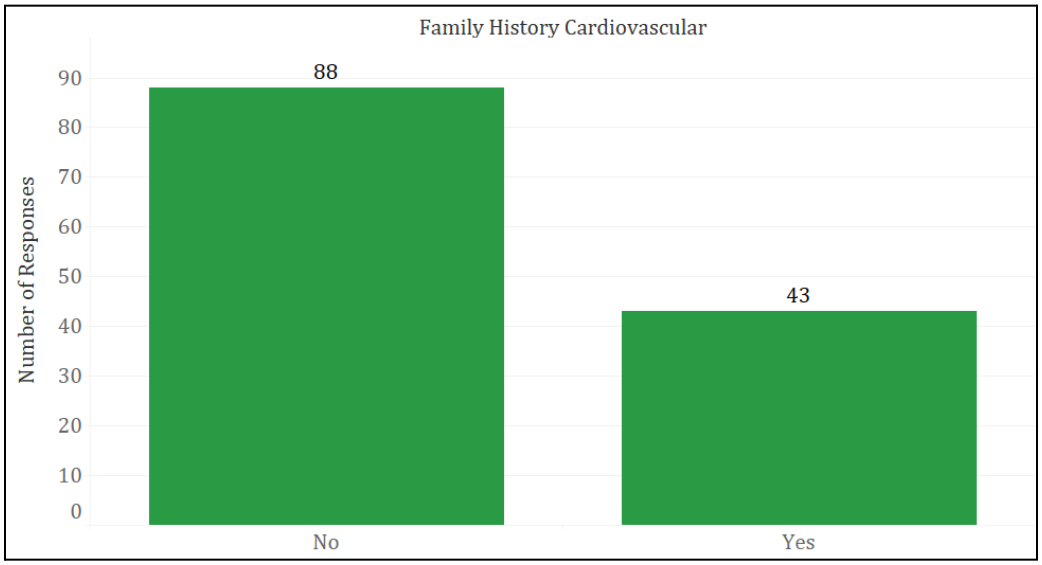
While transportation may be a contributing factor, Haraldsson mentioned that its exact significance has not been quantified, but it has been observed that students who do not gain admission to elite schools often need to travel long distances to attend an institution that the state has placed them in. To address the issue of dropout rates, Haraldsson emphasized the importance of success in the academic program as a guiding factor for students. Therefore, we decided to make our poster more informative than persuasive by directing students to helpful information and resources.

4.2. Rider Demographics

4.2.1. Demographic Analysis

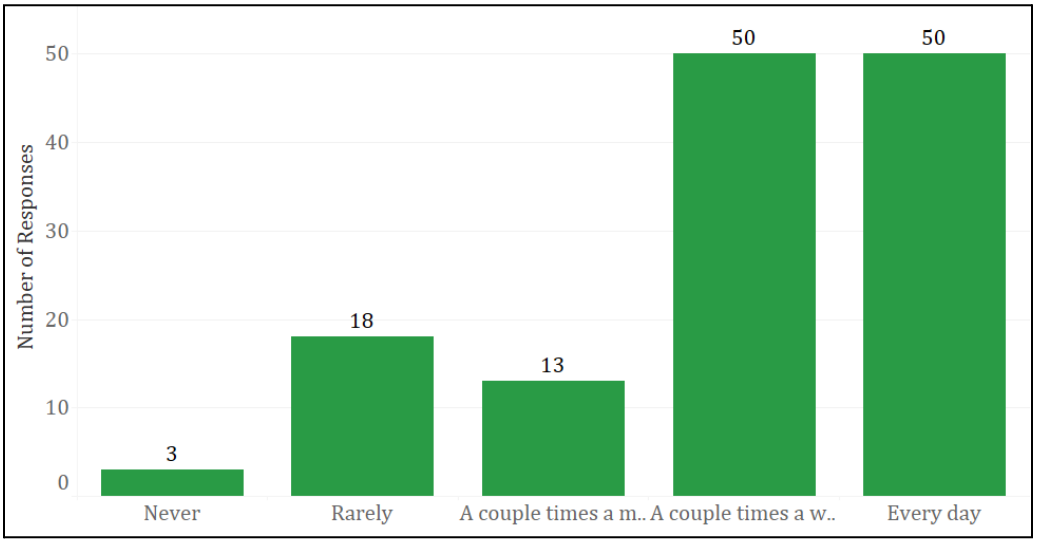
Through the online surveys, we determined a variety of useful statistics about bus riders that pertain to health, education, and safety. 97% of respondents were from Iceland, meaning that our data are from the community Strætó serves, rather than tourists. This ensures that our informational posters and policy recommendations are tailored towards permanent residents of Iceland.

Figure 5



Family History of Cardiovascular Disease of Bus Riders

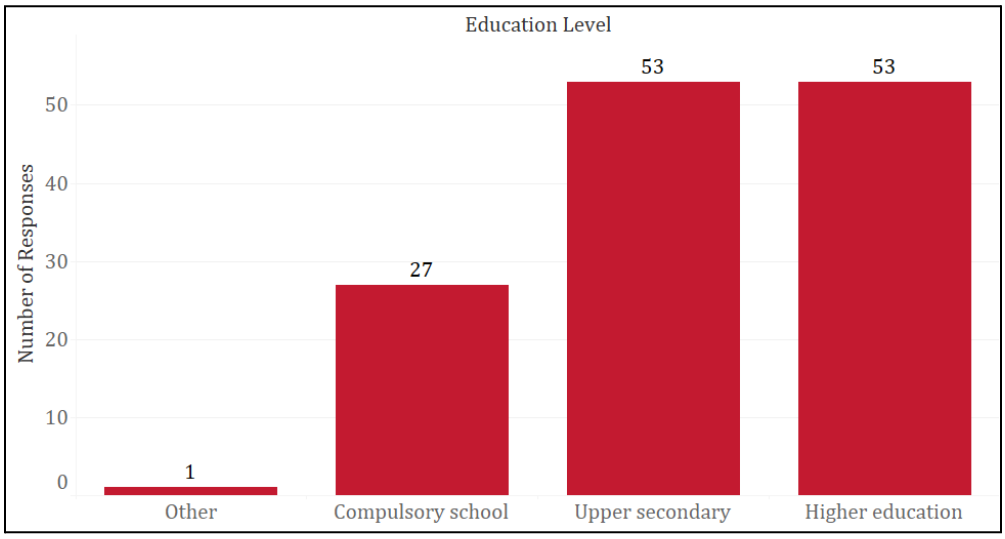
Figure 6



Physical Activity Frequency of Bus Riders

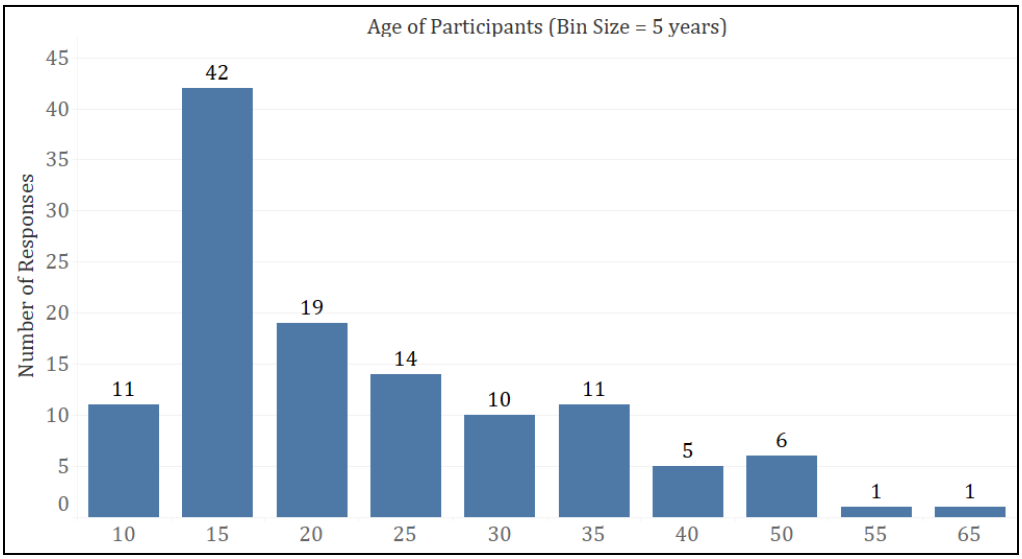
Figure 5 shows that 32.1% of respondents stated that their family has had a history of cardiovascular disease. This echoes our previous findings that cardiovascular disease is a prevalent issue in Iceland and justifies it as a target for our poster. When asked how many times a week they exercised, Figure 6 shows that 25.4% of respondents answered never, rarely, or a couple times a month. This falls below the World Health Organization's recommendation of muscle-strengthening activities at least twice a week in addition to 75-150 minutes of aerobic activity (Franklin et al. 2022). Based on this finding, our SDG 3 poster included a recommendation to increase physical activity. When asked if they had access to healthy/fresh foods, 11.8% of respondents said "No". This leads us to believe that recommending increased access to grocery stores would not be a feasible way to prevent cardiovascular disease.

Figure 7



Education Level of Bus Riders

Figure 8

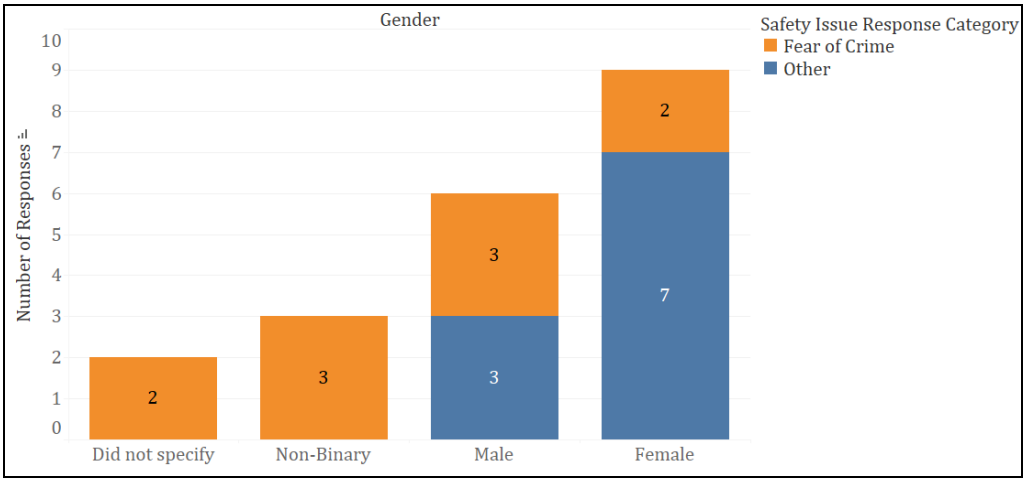


Histogram of Age of Bus Riders

As seen in Figure 7, 39.6% of our survey participants indicated that their education level was “Upper Secondary”. We also found that 20.2% reported their education level as “Compulsory School”, and 39.6% indicated “Higher Education”. In terms of addressing the dropout rate, however, our survey lacks the capability to differentiate between individuals

who have dropped out, current students, and graduates of upper secondary education. For instance, a person who has successfully completed upper secondary education and entered the workforce may interpret the question differently from someone who dropped out, yet both could have provided the same response. Nevertheless, we have evidence that our informational posters are targeted towards the right demographic. Based on our Bus Driver Interviews found in Appendix C, they observed that a majority of passengers were students, and from August to May the buses appeared to be busiest in the morning due to students. This is additionally supported by Figure 8, which shows that the highest proportion of respondents, 31.3%, were between the ages of 15 and 19, with the second highest proportion, 14.2%, being respondents between the ages of 20 and 24.

Figure 9



Gender Distribution of "No" Responses

Our results show that when asked if they feel safe on the bus and at bus stops, 18.7% of respondents said that they did not. Of those who did not feel safe, 48% of respondents were women. This would indicate that overall, women feel less safe on the bus than men. Those who did not feel safe on the bus also had an opportunity to provide a written response, which revealed an even greater disparity. The written responses fell into two categories: comments about general safety, and comments about fear of crime. The comments about general safety mostly pertained to the speed and recklessness of the bus drivers. One bus rider commented, "Some drivers drive like crazy", and another wrote, "The driving style of drivers has gotten worse every year". The comments about fear of crime stemmed from other passengers acting in a suspicious or intimidating manner. Several

responses mention groups of “dangerous teenagers” or “goons”. The only data that we collected that indicates the presence of gender based violence on the bus is one written response that stated “I have been harassed”. This data, shown in Figure 9, indicates that fear of crime is a more prevalent issue than gender based violence on the bus.

4.2.2. Limitations

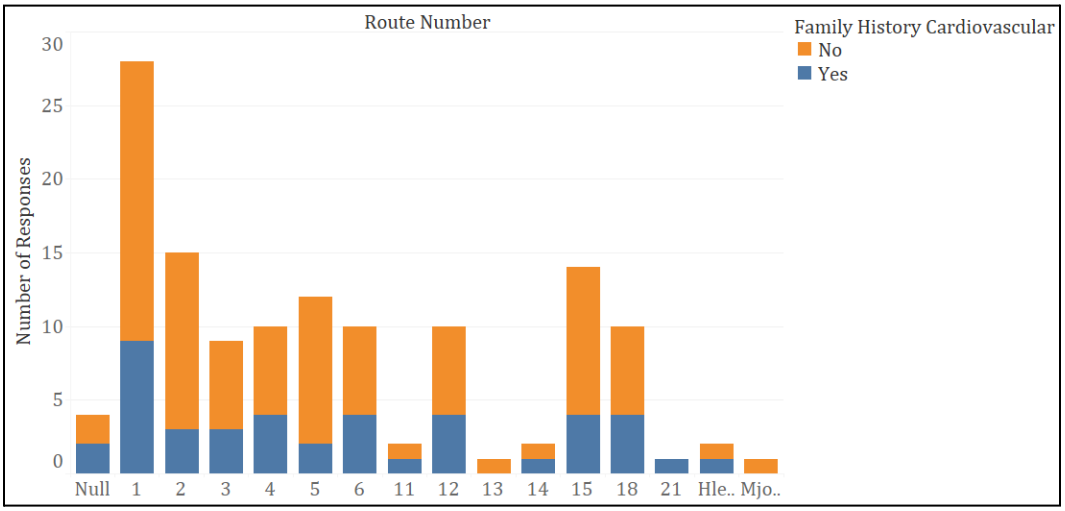
Because the bus rider survey was a random sampling it is not necessarily representative of the actual demographic distribution of bus riders. Certain groups could be more or less likely to scan a QR code in the first place. For example, elderly bus riders who are less familiar with technology may be less likely to scan the survey code. Additionally, our surveys may also have been influenced by response bias, as bus riders may have provided answers that would present themselves in a more favorable light. For example, some riders may have responded that they exercise more frequently than they truly do.

4.3. Routes to Target for Each SDG

In order to maximize the effectiveness of our informational posters, we will recommend that certain routes be prioritized with regard to specific posters. Due to limited space for posters on buses, this measure is necessary to increase the chances that those who would benefit from them the most will see them.

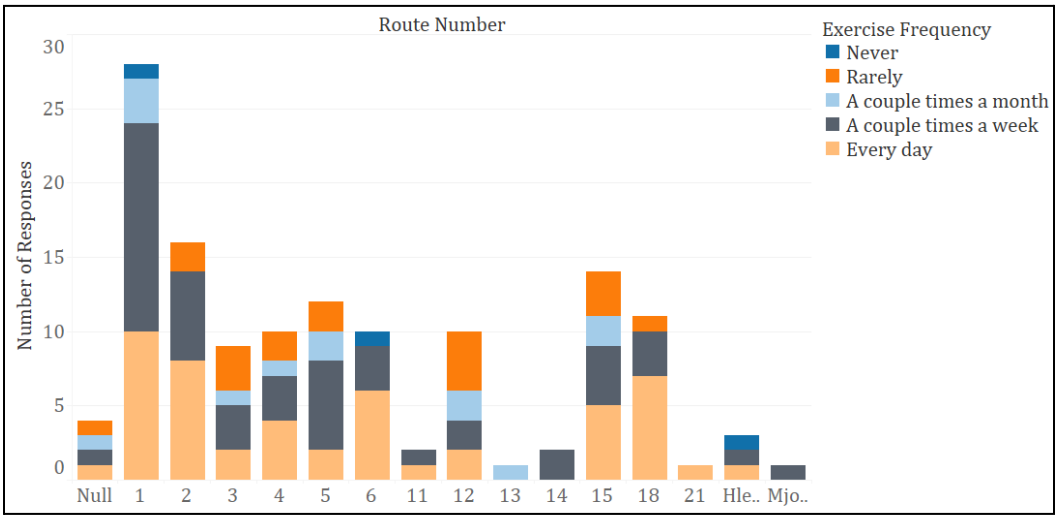
4.3.1. Routes to Target with each Poster

Figure 10



Family History of Cardiovascular Disease by Route Number

Figure 11

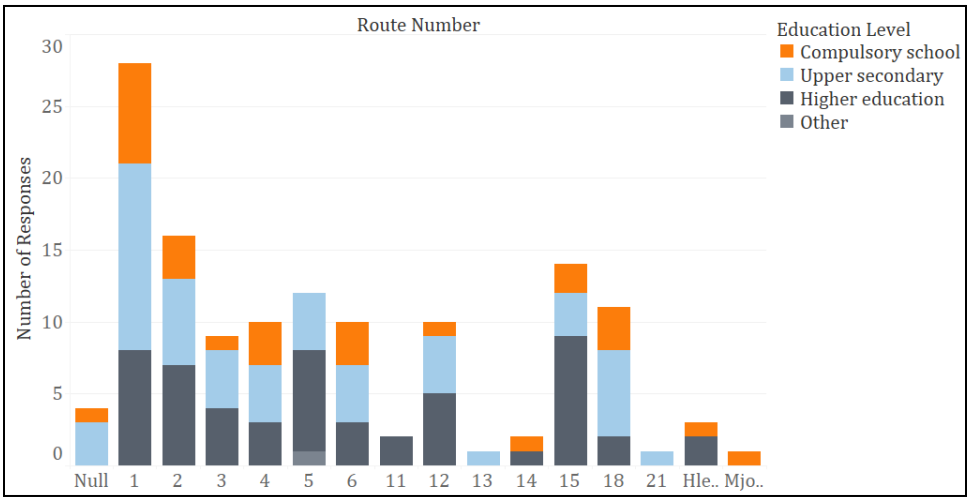


Exercise Frequency by Route Number

As seen in Figure 10, the distribution of family history of cardiovascular disease is relatively even across bus routes. Routes and stops that elicited fewer than five responses are discounted for the purposes of this analysis. The routes with the highest frequency of familial cardiovascular disease history were routes 4, 6, 12, and 18.4% of respondents on

these routes stated that their family had a history of cardiovascular disease. There is little overlap between familial cardiovascular disease history and exercise frequency, shown in Figure 11, with the exception of route 12. Of the responses on route 12, 60% had an exercise frequency of “A couple times a month” or “Rarely”. Based on this data, we recommend that Strætó prioritize routes 4, 6, and 12 with regard to the SDG 3 poster.

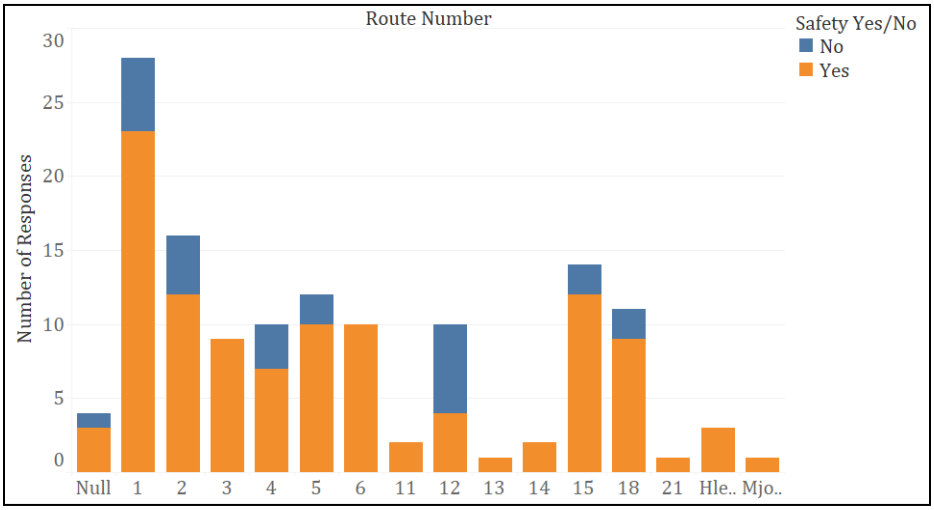
Figure 12



Education Level by Route Number

As seen in Figure 12, excluding route numbers with fewer than five responses, we observed the following proportions of respondents reporting their education level as "Upper secondary": 46.4% (Route 1), 37.5% (Route 2), 44.4% (Route 3), 40% (Route 4), 33.3% (Route 5), 40% (Route 6), 40% (Route 12), 21.4% (Route 15), and 54.5% (Route 18). While Route 15 exhibits a lower proportion of "Upper secondary" responses (21.4%), we can conclude that there are no statistically significant differences in these proportions across the various route numbers. Therefore, we decided to prioritize the display of our SDG 4 poster on the most popular routes to achieve maximum visibility.

Figure 13



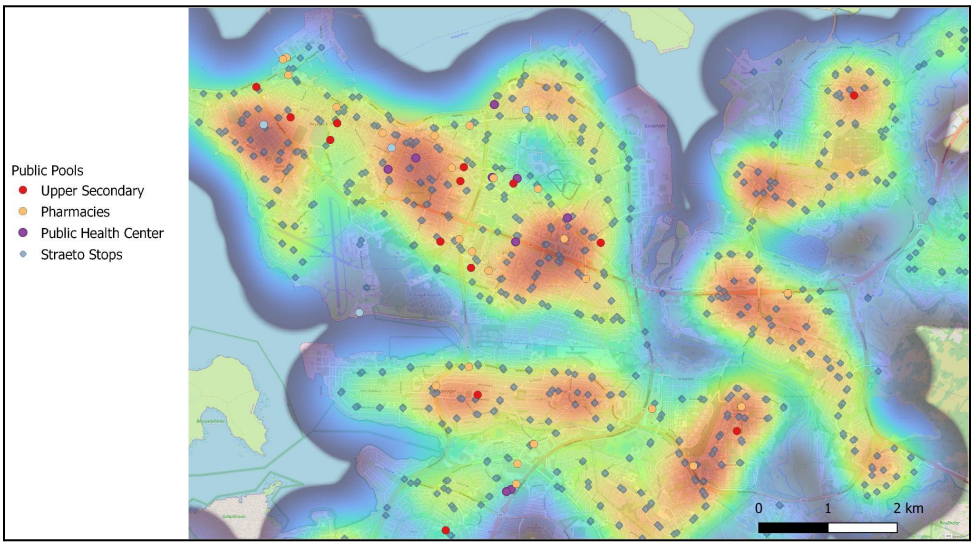
Rider Perception of Safety by Route Number

Figure 13 shows that a number of the surveyed routes have an above-average number of riders who do not feel safe on the bus. Of the responses on routes 2, 4, and 12, 25%, 30%, and 60% of respondents answered "No" on the safety question respectively. The average across all routes is 18.7%, meaning that the riders on these routes are more likely to feel unsafe on the bus. Based on this finding, we recommend that Strætó prioritizes placing the SDG 5 poster on routes 2, 4, and 12.

4.3.2. Resource Access by Bus

The resource map (Figure 14) shows the density of bus stops in the capital region and the proximity of important resources to the stops. There are three large high-density spots in Reykjavík: Vesturbær, the left spot of the three major spots on the peninsula; Hlíðar, the middle spot; and Háaleiti, the right spot. These three spots have the most bus stops, and similarly are where the most schools, health clinics, and pharmacies are. Even in areas where the bus stops are less clustered, the stops are still in close proximity to the resource locations throughout the capital region, not just in the downtown area.

Figure 14

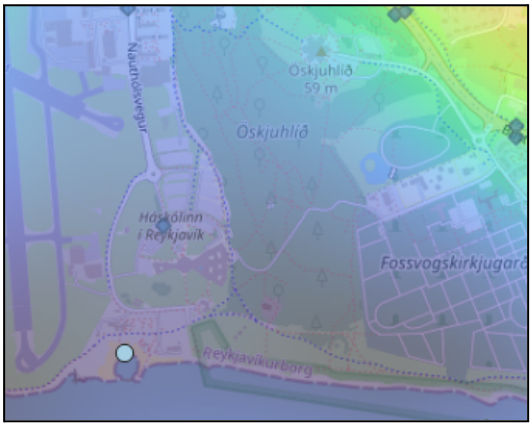


Resource Map

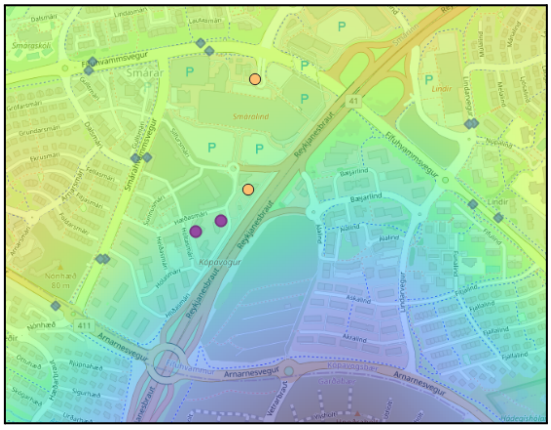
The upper secondary schools included in the resource map are within a five-minute walk of a bus stop. However, there are three SDG 3 resources on the map that are not easily accessible by bus. The first example of this is a geothermal beach called Nauthólsvík, closer shown on the map in Figure 15. On the resource map, the beach is in a low bus stop dense area as seen by the dark purple color.

The other two resources are health clinics located in close proximity to each other in Kópavogur. The health centers are called Heyrn Heyrnarþjónusta and Domus Læknar are shown in Figure 15. They are located on the outskirts of a moderately dense bus stop area, shown by light green color on the map.

Figure 15



Close up of Nauthólsvík from resource map



Close up of Heyrn Heyrnarþjónusta and Domus Læknar from the resource map

4.3.3. Limitations

The biggest limitation in determining which routes to target for each SDG was the fact that the locations of women's shelters were not disclosed for security reasons, which hampers our ability to recommend route changes to better access those resources. Additionally, when asked what route they were on, survey respondents did not always provide the direction they were going, instead only providing the route number. This reduces the accuracy of our geographic data. Due to this, we decided to conduct our data analysis using only the route number to maintain consistency.

5. Deliverables & Conclusion

5.1. Informational Posters

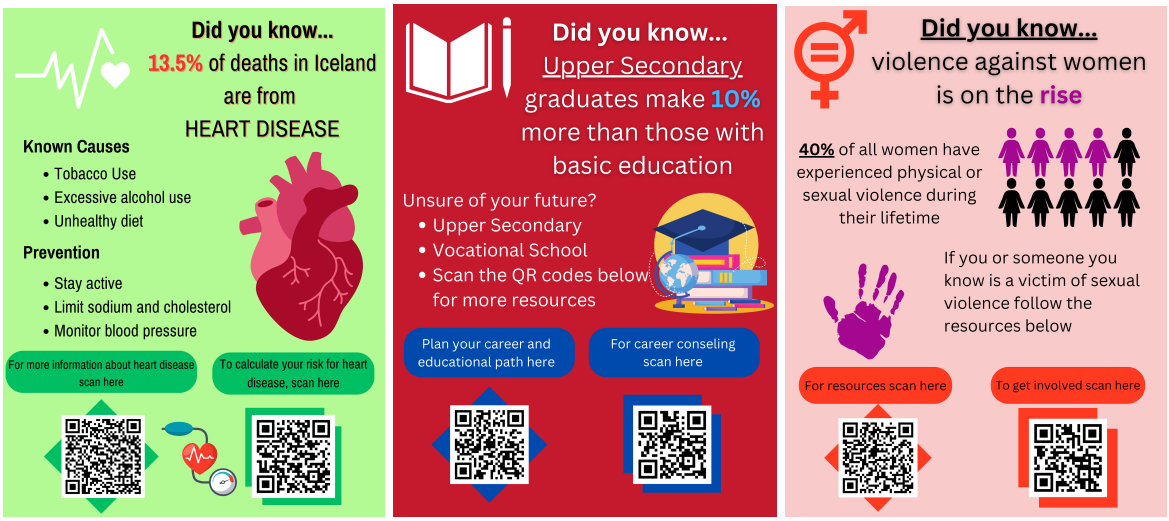
The health and wellbeing poster (Figure 16) targets SDG 3 by focusing on the primary health crisis in Iceland: cardiovascular disease. It uses eye-catching imagery and statistics (OECD, 2019, p. 5) to immediately get the reader's attention while they are on the bus. The title text is worded in the form of a question to make the reader think about how cardiovascular disease might affect them. It concisely shows the likely causes of the disease

and ways to prevent it. The poster provides a QR code web-linked to the World Health Organization fact sheet on cardiovascular disease, which provides more detailed information on symptoms and prevention. The poster also provides a link to the Icelandic Heart Association's cardiovascular disease risk calculator. This tool allows a user to input their health information such as height, age, blood pressure, and tobacco use and calculates their risk of developing cardiovascular disease. Based on the finding in section 4.3.1, we recommend that the placement of this poster is prioritized on routes 4, 6, and 12.

The education poster (Figure 16) targets SDG 4 by promoting the attendance of upper secondary education. It asks readers if they know that completing upper secondary school provides a monetary incentive (Statistics Iceland, 2021). It provides examples of upper secondary schooling for those unsure about their options. This poster also includes QR-Codes and they link to two subpages of the Næsta Skref website. The left QR code points to a resource for students to plan their educational path with respect to their career of choice. The right QR code points to a contact page for students to receive study and career counseling. Based on the finding in section 4.3.1, we recommend this poster is distributed evenly among all routes, with additional focus on route 1, as it is the most popular route.

The gender violence poster (Figure 16) targets SDG 5 by focusing on gender and sexual-based violence. It gets the reader's attention by asking them if they know about the recent increase in such violence, as it could be relevant to them specifically. It shows statistics (A. Hauksdóttir, personal communication, September 14, 2023) about the prevalence of gender and sexual-based violence to bring about further awareness. The poster includes web resources with information on women's shelters for those who may need it. It also links to The Icelandic Women's Rights Association for those who wish to get involved in combating this issue. Based on the finding in section 4.3.1, we recommend that the placement of this poster is prioritized on routes 2, 4, and 12.

Figure 16



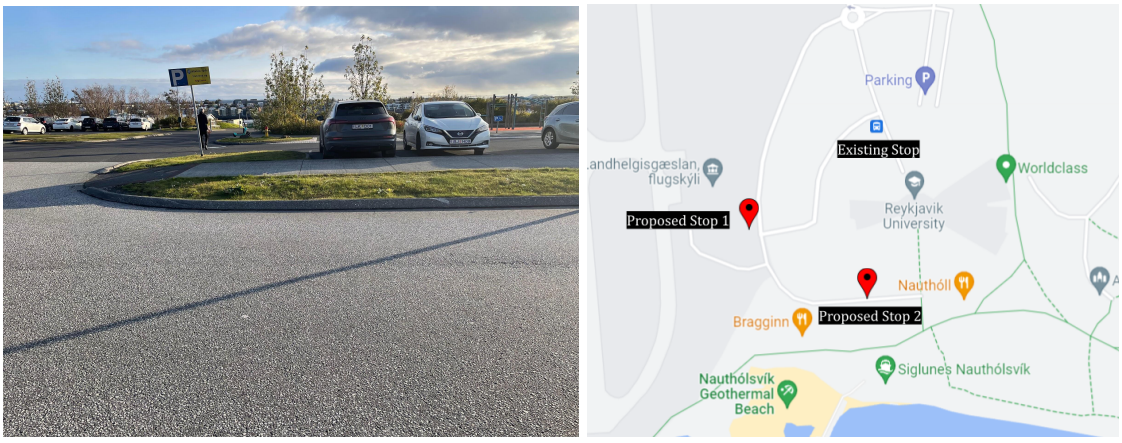
Informational Posters

5.2. Policy Recommendations

5.2.1. Additional Stops

As shown in the resource map (Figure 14), and section 4.3.3. Strætó's bus coverage makes a majority of the upper secondary schools, public health clinics, pharmacies, and public pools easily accessible through public transit. However, there are two resource points we have identified that would benefit from having closer and more accessible bus stops.

Figure 17



Proposed Nauthólsvík Stop Location

The first resource point is Nauthólsvík, a geothermal beach that is frequented by locals. The current closest bus stop is a six-minute walk, including a portion with no sidewalk. We propose that an additional bus stop added to route 8 would be beneficial in potentially increasing access to the swimming area. The first stop suggestion would be the most feasible, as it does not involve changing the route. The team found a location shown in Figure 17, which would cut out the part of the walk that does not have a sidewalk making access to this resource safer and more accessible. The second stop suggestion includes a slight extension to the route, which would bring passengers directly to Nauthólsvík. Near this stop is an area where the bus would be able to turn around and continue the route loop.

Figure 18

Proposed Medical Clinic Stop Location

The second resource point is two health clinics, Heyrn Heyrnarþjónusta and Domus Læknar. The closest bus stops are between a 6 and 12-minute walk depending on what direction you are coming from. In addition to this, there is not a dedicated walking path or sidewalks between the bus stops and the health clinics. The team proposes that there be a stop added to routes 21 or 24 at the location shown in Figure 18. This stop brings passengers much closer to the health clinics, and to an area where there is a dedicated walking path. Increasing the accessibility to these resources through public transit is important to affecting change regarding SDG 3.

5.2.2. Rural Medical Care Access Study

With the exception of the two examples listed in section 5.2.1, Strætó provides excellent access to health, safety, and education resources in Reykjavík. However, our expert interviews have indicated that this is not the case in more rural parts of Iceland. Medical care resources were noted as a particularly prevalent issue. This is due to geographic challenges as a result of lower population density; a limited number of medical centers must serve a wide geographic area, reducing accessibility. In addition, medical professionals are more reluctant to live and work in rural areas. A potential solution to the former would be to expand bus routes outside the city. We recommend that Strætó conducts or commissions a study that investigates the feasibility of a weekly bus that connects people from rural areas to a medical center. This study should also evaluate the need for increased access to medical care outside the capital, as this report does not cover that subject.

5.2.3. Fear of Crime Study

Survey and interview results indicate that fear of crime is a greater issue than crime on the bus. Fear of crime is linked to negative effects on mental and physical health (Lorenc, 2012). It is also more prevalent in female users of public transit (Yavuz & Welch, 2010). Based on this we recommend that Strætó conducts a study on the effectiveness of various measures to improve rider perceptions of safety. CCTV cameras are already in place on

buses, but increasing their number and visibility could potentially reduce fear of crime significantly. The study should also investigate the effect of lighting and cleanliness on buses and bus stops, as it has been linked to fear of crime (Yavuz & Welch, 2010). Finally, the effects of placing an additional uniformed employee on night buses should be investigated as well. This has been shown to be highly effective at reducing fear of crime in other transit systems, especially in women (Yavuz & Welch, 2010). This study should be conducted on the night bus, as this is most likely to show the greatest reduction in fear of crime.

5.3. Conclusions

Through our research, we found that Strætó is already doing an excellent job of working towards SDGs 3, 4, and 5. We believe that our informational posters and policy recommendations are an effective way for Strætó to improve their progress towards these goals. That being said, the studies detailed in sections 5.2.2 and 5.2.3 would not necessarily need to be conducted by Strætó. Improving rural medical care access and reducing fear of crime are goals that other relevant organizations could work towards as well. The Sustainable Development Goals are intended to be a collective effort and we hope that this project could lay the foundation for any Icelandic organization to work towards a lasting impact on the community.

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Appendix A: Expert Interviews

Interviewee: Arna Hauksdóttir
Date of Interview: 09/14/2023
Location: Sturlugata 8
Facilitator: Sophia
Scribe: Louis

1) What are the biggest public health problems facing Iceland?
2) Has cardiovascular disease and obesity been a problem in Iceland for a while or is it a newer problem?
3) Why is cardiovascular disease such a big problem in Iceland?
    a) Does it vary by region?
4) Regarding these problems, what are the biggest resources Icelanders should be taking advantage of?
5) Besides the previously discussed resources, is there any additional information that would be important to be shared on our informational posters?

Summary of Interview:

- Cardiovascular disease has been the primary issue and it has been getting better, but rates of obesity and type II diabetes have hampered progress. There is a shift towards cancer being the primary issue. The focus should be on cancer for the new generation. We should be aware of what substances replace unhealthy habits like tobacco and alcohol use. Alcoholism is also on the rise which is related to cancer. The effects of cardiovascular disease were so strong in the 80s and 90s that we are only now able to see other issues. A lot of progress has been made thanks to public health.
- Violence towards women is also a huge public health. Despite Iceland's high gender equality, 40% of all women have experienced physical or sexual violence during their lifetime. There is no indication of this dropping. This is very serious especially in a country like Iceland. This has dramatic health effects. The true cost of this has ever been calculated because we don't know about the consequences. We know about physical and psychological consequences but not during their lifetime. Things like premature death from suicide, alcohol use, etc. We would like to see these rates dropping. Regarding the gender equality goal and Strætó, I would look at rider security. Are bus stops well lit? Are there security cameras?

- Obesity rates are higher outside the capitol area. One thing is the access to healthcare and lack of specialists who are willing to live and work in rural areas. This is a problem and a threat to public health
- Due to extreme weather, you can't always just medivac people to Reykjavík via helicopter. One thing that comes to mind is how close bus stops are to healthcare clinics. It should be easy to travel by bus to a healthcare clinic. This is especially important for non-emergency problems, daily or weekly checkups, getting blood tests etc. Access to drug stores for prescriptions is also important. Swimming pools are also a really important thing in Iceland. They are very popular in Iceland due to easy access to warm water and are an important public health resource. It provides a chance for people to exercise and be outside year round despite bad weather. It is also a big social resource, acting like a community center especially in rural areas. This is especially important for older people.
- The directorate of health would be a good organization to contact. They have more experience in health promotion. The term "nudging" is key to understanding changing behavior. Certain groups respond in different ways to information sources. You will likely try to target young people the most because the bus is their main form of transportation. Traffic near the two universities in the afternoon is a big problem. You should try to contact the student union here because they are talking about parking spaces and access to free parking which is the wrong way of thinking about it. Free parking is a requirement for university students. If you walk through the campus area, there is a huge parking space full of cars.

Interviewee: Rúnar Helgi Haraldsson
Date of Interview: 09/25/2023
Location: Microsoft Teams Meeting
Facilitator: Arjun
Scribe: Joseph

1) What are some of the biggest problems Iceland faces involving the upper secondary education dropout rate? What hinders Iceland regarding this goal?
2) Has this also been a problem before this growing population?
3) Have you observed any relationship between transportation and the dropout rate?
4) Do you know how the dropout rates vary by region e.g., urban vs. rural?
5) What resources have you found to be helpful in these students making these decisions? What experience do you have in guiding students to not drop out?
6) What might be the reason why the dropout rate might be higher here than in other European countries? Have you compared them at all?

7) What message would you like to display to students? Do you think it would be useful for them to look at all these resources they have before they enter upper secondary education? What do you recommend for those resources?
8) Are there any other resources?

Summary of Interview:

- The problem of dropout rate starts earlier than just in upper secondary education. Iceland also has a growing number of people born outside the country or born to parents born outside the country, and this is a large part of the dropout population because of how these students see their future and partially because of poor performance in grade school. Additionally, more young men than women are dropping out.
- The high dropout rate has not always been the case; fewer students pursued secondary education in the past, as there were not as many opportunities. Now the trend is that more people are going to school but they are not all succeeding. Also, compared to Europe, there are fewer young men succeeding in math and reading skills than young women.
- There has not been much research into how transportation affects the dropout rate, but there has been a trend where some students tend to pursue the top schools, and if they get rejected, they often get placed into a school where there is room for them, which may be farther than they are willing to commute. In terms of differences between the urban and rural population of dropouts, that has been quantified on Statistics Iceland.
- The most covered factor that guides a student's decision to drop out is the success level in the program they are in. There are however many students returning to school post-COVID. This was something that was affected by the job market, as when it was not as good, many students tried to enhance their chances of going back to school. These are also usually people who have not succeeded in secondary education, but are returning in a different course of study. This trend holds for all secondary schools, but the most popular study program is VIT.
- Some of their lack of success can be attributed to students not being looked after by their guidance counselors in grade school. The website Næsta Skref provides educational and career guidance for secondary education, so directing students to that in our infographics could be helpful.

Appendix B: QR Code Surveys

Bus Rider Surveys

What Bus are you on? For example “1 Hlemmur”

How often do you ride the bus?

a) Every day
b) 1-4 times a week
c) A couple times a month
d) A couple times a year
e) Never

Education Level:

a) None
b) Compulsory school
c) Upper Secondary
d) Higher Education
e) Other:

Do you feel safe on the bus and at bus stops?

Yes/No

If no, Why?

Do you have access to fresh food?

Yes/No

How often do you exercise?

a) Every day
b) A couple times a week
c) A couple times a month
d) Rarely
e) Never

Does your family have a history of cardiovascular disease?

Yes/No

How do you feel about getting information/resources from ads on the bus?

a) Positive
b) Somewhat positive
c) Neutral
d) Somewhat negative
e) Negative

What information would be most helpful to see regarding health, education, or safety? (Pick 2)

a) Statistics
b) Numbers to call from help

c) Websites with more information
d) Expert recommended solutions
e) Other (Please Specify)

Do you prefer seeing ads in Icelandic or English?

a) Icelandic
b) English
c) Either
d) Other(Please Specify)

Age:
Gender:
Do you live in Iceland:

Non Bus Rider Survey

Education Level:

a) None
b) Compulsory school
c) Upper secondary
d) Higher education
e) Other:

Do you have access to healthy/fresh food?

Yes/No

How often do you exercise?

a) Every day
b) A couple times a week
c) A couple times a month
d) Rarely
e) Never

Does your family have a history of cardiovascular disease?

Yes/No

Do you ride the bus?

a) Every day
b) 1-4 times a week
c) A couple times a month
d) A couple times a year
e) Never

Which of the following affects your ridership? (Select all that apply)

a) Bus timeliness and reliability
b) Bus reliability
c) Bus safety
d) Distance from home/work to nearest bus stop
e) Other:

How do you feel about getting information/resources from ads on the bus?

a) Positive
b) Somewhat positive
c) Neutral
d) Somewhat negative
e) Negative

What information would be most helpful to see regarding health, education, or safety? (Pick 2)

a) Statistics
b) Numbers to call from help
c) Websites with more information
d) Expert recommended solutions
e) Other (Please Specify)

Do you prefer seeing ads in Icelandic or English?

a) Icelandic
b) English
c) Either
d) Other(Please Specify)

Which transportation methods do you use besides the bus (Select all that apply)

a) Driving
b) Walking
c) Biking
d) Scooter
e) Other

Age:

Gender:

Do you live in Iceland? Y/N

Appendix C: Bus Driver Interviews

Date of Interview: 9/28/23
Interviewee: Bus Driver 1
Location: Strætó HQ (Hesthals 14, 110 Reykjavík)
Facilitator: Arjun
Scribe: Joseph

Q1: How long ago were you a bus driver?

I was a bus driver for three years and I have been working inside of here since 2018. I started in 2015.

Q2: What routes did you drive on as a bus driver?

All routes for Strætó because we changed almost every three days in a row.

Q3: Do you remember what time of the day the route was the busiest?

It was in the morning from 7:30-9:00 and in the afternoon from 2:00-5:00.

Q4: Do you know if it was different by route?

It was line 1 and 6 and the busiest one because of traffic were numbers 5 and 15 because the roads were stuck and traffic was slow and they were never on time.

Q5: What kind of people were on the bus e.g. younger kids, college students, etc.?

Students in the university and high school mostly. I think many foreigners going to work.

Q6: Did you notice that certain groups relied on the bus more than others?

Students probably the most.

Q7: Did you have any medical emergencies happen on the bus?

No

Questions for Bus Driver B
Date of Interview: 9/28/23
Location: Strætó HQ (Hesthals 14, 110 Reykjavík)
Facilitator: Arjun
Scribe: Joseph

Q1: How long were you a bus driver?

I started driving in 2018 in this company and I drove for about 2-3 years and then I went into the central and I'm now the countryside and the region of Reykjavík I am seeing how they are driving and helping the passengers and the bus driver, mostly the bus drivers, I am taking care of them to make sure everything is right with detours, cancellations, etc. Driving here in Iceland is really fun, Strætó is very fun. There are a lot of different passengers both good and bad but it's always like that. But before I was a driver guide so I was driving up in the mountains and stuff like that of course backend driving and everything like that so I have been doing both since 2007. So I have been driving since 2007. The big buses with passengers and tourists meant everything but here is the most fun because you have all the different lines: children, older, middle, everything.

Q2: What kind of people did you see on the bus the most?

I saw them all at different times of the day of course on weekends it's more younglings. In Iceland eleven years and younger it's for free so they are running whatever and whenever and they go into one bus and go out and wait for the next bus. They are using it for transportation. But everyone is mostly youngsters and teenagers going to school.

Q3: What time of the day are the routes that you drove on the busiest?

The morning, but that depends on which month you are in. If you are in the school months it's in the morning from 7:30-10:30. Then I have full buses and I have to leave a lot of people at bus stops because we are so crowded that I have people up against the windows and everywhere. We have to think about the safety of the passengers too. That is a big thing here that we need more buses, but they are like ten minutes in between and we have extra buses in the morning and they do the best that they can. In the morning from August to May they start the schools, and then it is mostly nighttime in the summers, then it is a lot and we have started the night buses again. We are driving from 2-3:00.

Q4: Do you notice that when it is busy at a different time that the people are different e.g. office workers?

Yes of course when people are going home from work from 5:00-6:00 then it can be a bit more of the adults because the schools are until 2:00-3:30. So then you have that time range on the weekdays that there are a lot of youngsters and then it is 5-6:00m that it is more adults. But here in Iceland, we use a lot of cars and the traffic is mad at that time.

Q5: Have you seen any medical emergencies on the buses or at the stops?

I once got into an accident with a private car. I took the whole front of the car because the person in the car decided to take a ride on a light where he was not supposed to. He was on the phone. I did not feel it but I felt like I went up on the sidewalk but I decided to look in the mirror and I saw that the car had totally crashed. That was my first accident. I had never been in an accident before. It was okay with the passengers by the way.

Q6: Was this when you were a bus driver with Strætó?

Yes, and I was on the way to my first departure of the day so I didn't have any passengers. They were very fast in calling help and coming to me to make sure I was okay. They came with a new bus, they didn't need that because they didn't see anything on the bus. The car was a wreck. The first thought about that was that they were very fast about thinking about me personally and so I felt okay and everything was okay with me. You have small things going into the buses, going into lights. There are very narrow roads here in Iceland so you have to be careful because they have little islands with pins coming up. You have to be careful, you have to know where to drive. That's why I have been driving for three years and now I know how to do the detours for the buses. Then I have had youngsters going into buses at night, drugs, called the police for that. People stopped breathing on the bus, then you have emergencies where you just call the cops directly. They are very quick with that. No death thank god. It's not been like that for many years in Iceland for Strætó. But someone ran over a person in another company and she died. She was 16-17 years old. It was a dark place. The light was green for her and green for him and he didn't see her coming. Stuff like that has happened but it is just minor things that happen maybe one big thing happens 5-10 years between. Otherwise, I think that the bus drivers are really good and they are doing very well.

Appendix D: Bus Observation Sheet

Route:	Time/Date:	Observer:	Bus Late? Y/N
Stop:	Onboarded:	Offboarded:	Notes:
Stop:	Onboarded:	Offboarded:	Notes:
Stop:	Onboarded:	Offboarded:	Notes:
Stop:	Onboarded:	Offboarded:	Notes:
Stop:	Onboarded:	Offboarded:	Notes:
Stop:	Onboarded:	Offboarded:	Notes:
Stop:	Onboarded:	Offboarded:	Notes:
Stop:	Onboarded:	Offboarded:	Notes:
Stop:	Onboarded:	Offboarded:	Notes:
Stop:	Onboarded:	Offboarded:	Notes:
Stop:	Onboarded:	Offboarded:	Notes:
Stop:	Onboarded:	Offboarded:	Notes:
Stop:	Onboarded:	Offboarded:	Notes:
Stop:	Onboarded:	Offboarded:	Notes:
Stop:	Onboarded:	Offboarded:	Notes:
Notes (Demographics, Are Passengers Rushed?, Notable Incidents?):			

Compiled Observations:

Mostly Locals	Mostly tourists	Older People	College Kids	Families/Kids	Middle Age	Crowded	Empty	Nearly Empty
1 @ 1:00 pm S	1 @ 2:00 N	23 @ 11:00 AM	1 @ 9:00 am S	23 @ 12:00 pm	13 @ 11-12 pm W	1 @ 1:00 S	14 @ 1:15 pm W	1 @ 9:00 am S
6 @ 9:30 am	15 @ 9:30am	13 @ 11-12 pm W	1 @ 2:00 am N	16@2:40	11 @ 12 pm W	12@1:15	6 @ 10 am	23 @ 11:00 AM
12@1:15		14 @ 1:00 pm W	15 @ 9-10 am W			18 @ 2:10pm	15 @ 10:15 am	
16 @2:40		16 @2:40	12@:1:15					
			18 @ 1:45pm					

Appendix E: Translated Informational Posters

Appendix F: IRB Consent Forms

Informed Consent Agreement for Participation in a Research Study
5/1/2023
Student Investigators: Joseph Caproni, Louis Heck, Sophia Tomaselli, Arjun Venat
Principal Investigators: Herman Servatius & Brigitte Servatius
Contact Information: gr-IMTS-A23@wpi.edu,

Title of Research Study: Addressing the UN's Sustainable Development Goals Through Reykjavík's Strætó Bus Systems

Sponsor: Strætó

You are being asked to participate in a research study. Before you agree, you must be fully informed about the purpose of the study, the procedures to be followed, and any benefits, risks or discomfort that you may experience as a result of your participation. This form presents information about the study so that you may make a fully informed decision regarding your participation.

The purpose of this study is to collect data from those who use the bus system and those who do not, as well as field experts in order to improve Strætó's ability to meet sustainable development goals set by the United Nations.

The study will consist of a number of questions that will be used to assess demographics and user experiences related to public transit. Questions asked during this survey may mention crime and/or sexual assault. Results of this survey may be used to improve the quality of Strætó's bus services.

Records of your participation in this study will be held confidential so far as permitted by law. However, the study investigators, the sponsor or its designee and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB) will be able to inspect and have access to confidential data that identify you by name. Any publication or presentation of the data will not identify you.

For more information contact the team, Joseph, Louis, Sophia and Arjun at gr-imts-a23@wpi.edu, our advisors Herman and Brigitte Servatius at hservat@wpi.edu and bservat@wpi.edu respectively. You can additionally contact Ruth McKeogh irb@wpi.edu, or Gabriel Johnson at gjohnson@wpi.edu.

Your refusal to participate will not result in any penalty to you or any loss of benefits

to which you may otherwise be entitled. You may decide to stop participating in the research at any time without penalty or loss of other benefits. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit.

By signing below you acknowledge that you have been informed about and consent to be a participant in the study described above. Make sure that your questions are answered to your satisfaction before signing. You are entitled to retain a copy of this consent agreement.

- ☐ Check here to consent to an audio recording
- ☐ Check here to consent to a video recording

Date:
Print Name:

Signature:

In Person survey Script:

Thank you for letting us ask you some questions. Before we start, we're going to tell you why we are doing this research, what procedures we are following, and any benefits, risks, or discomfort that you may experience because of your participation. We are conducting this study to collect data from both people who use the bus system and those who don't in order to improve Strætó's ability to meet sustainable development goals set by the United Nations.

We are going to ask you some short questions so we can understand demographics and user experiences related to public transit. Questions asked during this survey may mention crime and/or sexual assault. We will be using results from this survey to improve the quality of Strætó's bus services. Records of your participation in this study will be held confidential so far as permitted by law. However, the study investigators, the sponsor or its designee and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB) will be able to inspect and have access to confidential data that identify you by name. We will not identify you in any publication or presentation of the data.

We have given you a paper with information on how to contact us. If you do not want to participate, that is ok, you won't receive any penalty or loss of benefits. You can also

decide to stop participating in our survey/interview at any time, and will not be penalized for it.. We have the right to stop or pause the survey questions at any time we see fit.

Now that you understand a bit more about the research we are doing, and the risks, can we ask you some questions? Can we record audio and video of the interview?

Appendix G: Project Timeline

	Week 0	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Observations								
Expert Interviews								
Bus Surveys								
Objective 1: Develop Information Sources								
Objective 2: Determine Rider Demographics								
Objective 3: Determine Routes to Target								
Data Analysis								
Informational Posters								
Policy/Route Recommendations								
Report Writing								