LIVA HEALTHCARE 2017
COST-EFFECTIVENESS ANALYSIS

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LIST OF ACRONYMS

ApEHR:	Institute of Applied Economics and Health Research Aps
COPD:	Chronic Obstructive Pulmonary Disease
CVD:	Cardiovascular Disease
NPV:	Net Present Value
SMBG:	Self-Monitoring of Blood Glucose
T2DM:	Type 2 Diabetes Mellitus

1. INTRODUCTION

This report presents the background, methodology and results of a cost-effectiveness analysis of LIVA intervention, including budget impact analysis.

The main focus of this study is the impact of LIVA intervention on the patients with diabetes mellitus, therefore the benefits associated with impacts on patients with other chronic diseases are not examined within the scope of the current analysis, even though lifestyle changes also has huge impact on pre-diabetic patients, patients with cardiovascular diseases and patients with chronic obstructive pulmonary diseases (COPD).

Following the project background description as well as presentation of the research team, the report defines the aim of the project and outlines research questions. The following section describes the methods selected for the cost-effectiveness and budget impact analysis of the LIVA intervention, as well as provides description of data applied in this study. The results section states the main findings of the analyses, as well as provides an overview of the obstacles subject to further development and improvement. The next section contains a discussion of results, followed by the concluding section.

2. PROJECT

LIVA Healthcare A/S has requested ApEHR to conduct a budget impact analysis of the LIVA intervention based on real world data obtained from the LIVA platform as well as scientific literature. The evaluation will be used as an argumentation for the effectiveness of the intervention and hence the return on investment for municipalities. At the same time, the study will set up a framework in which the LIVA intervention can be evaluated as new data are collected, hence improving the data foundation of the analysis. Furthermore, it is the intention to work out a full health economic evaluation of the intervention based on LIVA platform data combined with national registry data.

2.1 CLIENT

LIVA Healthcare A/S

Danneskiold-Samsøes Alle 41

DK-1434 Copenhagen K

Denmark

2.2 PROJECT TEAM

The following researchers are involved in the project.

Table 1 Project team

Projektteam	Position	Rolle i projekt
Camilla Sortsø	PhD. Projektleder og videnskabelig ansvarlig for sundhedsøkonomiske analyser, ApEHR	Projektleder, Videnskabelig ansvarlig
Anastasija Komkova	Cand.econ. Projekt assistent, ApEHR	Forsker samt projekt assistent
André Sode	COO & CFO, LIVA	Projektansvarlig fra LIVA
Carl J. Brandt	MD. Lægelig ansvarlig, LIVA	Projektansvarlig fra LIVA

2.3 BACKGROUND OF LIVA

The LIVA platform for digital management of lifestyle changes in patients with chronic diseases such as diabetes, heart diseases and chronic obstructive pulmonary disease (COPD) has been developed by LIVA Healthcare A/S, based on many years of experience in the partner circle from the development and operation of NetDoktor, SlankeDoktor, SundhedsDoktor and PraksisDiætisterne, which all are forerunners of LIVA. Based on the previous experience, the internet based platforms have proved to be effective in weight reduction. For instance, a 7kg weight reduction has been achieved among 21 obese patients within the 4 months and maintained within the 20 months of the follow-up period, by means of the interactive internet-based platform SlankeDoktor [1].

The modern LIVA platform works as follows:

- A relationship is built in a meeting between patient and healthcare professional (health coach).
- In the meeting an individual lifestyle plan is established for the patient, and a contract between the two about the lifestyle plan is agreed upon.
- After the initial meeting the patient will use a smartphone/web to work on the plan with the following functionalities:
    - Self-monitoring of vital data such as activity, diet, sleep and other data adapted to the relevant disease.
    - Online guidance in text/video by dietitian, nurse, physiotherapist or other healthcare professionals.
    - Adjustment of their individual lifestyle plan together with the healthcare professional.

- Participation in an online community of like-minded patients.
- Reception of smart notifications as feedback on their registrations/missing registrations.

The foundation of the platform is the built-in integration of communication and collaboration between the main actors in the process of making the patient's lifestyle changes successful. All communication between the therapist and patient is thus available to all involved parties together with data collected.

Via LIVA, the patient can monitor his/her own state of health by entering several ongoing measurements, be in dialogue with a municipal or regional health coach, participate in motivational courses online to get started with physical movement and a healthier lifestyle. Finally, the patients can interact with each other and follow each other's progress anonymously to encourage each other to have a healthier lifestyle.

In a digital "cockpit" the municipal health coaches can remotely monitor the condition of the participating patients and thus identify patients at risk, before their condition deteriorates to a highly demanding level, and implement some early intervention, such as additional guidance or referral to a physician or other preventive measures.

3. AIM OF THE PROJECT AND REASEARCH QUESTIONS

The aim of this study is to assess the extent to which it is cost-effective for Danish municipalities to invest in the LIVA platform for patients with diabetes mellitus.

The project will answer the following questions:

- What is the effectiveness of the LIVA intervention in reducing weight among overweight and obese diabetes patients?
- What are the impacts of the LIVA intervention on social welfare?
- How will investment in the LIVA platform affect the budget of a single municipality in Denmark and what is the expected return on investment?

4. METHODS

Within the scope of the current study we assess the cost-effectiveness of the LIVA intervention, based on the real-world data obtained from the LIVA Healthcare A/S, as well as available literature, used as an input in a cost-effectiveness model. The main focus of this study is the impact of the LIVA intervention on the patients with diabetes, therefore the benefits associated with weight reduction among the patients with other chronic diseases are not quantified in this study.

The study reviews the existing literature that examines the impacts of weight change among T2DM patients on healthcare costs in the USA [2-5], Australia [6] and Spain [7]. In order to expand the scope of this study beyond the impacts of weight change on healthcare costs, we apply the estimated societal costs of diabetes mellitus in Denmark [8] as an input in our model. Based on the explored literature, the hypotheses regarding the impacts of the weight change among diabetes patients on the societal costs in Denmark are formulated.

Applying the real-world data collected from the LIVA App users, we estimate the impacts of the intervention on weight change of diabetes patients.

The cost-effectiveness of the LIVA platform is therefore assessed, comparing the costs of intervention with the benefits (costs savings) attributable to the reduction in weight of overweight and obese type 2 diabetes patients.

As part of the budget impact analysis, the return on the municipal investments in the platform is estimated within a 10 years period. A 3% discount rate is applied to calculate the total Net Present Value of the intervention.

4.1 LITERATURE REVIEW

There are several studies examining the impacts of weight change among diabetes patients on healthcare costs in the USA, Australia and Spain. The available literature primarily focuses on the impacts of weight change on the healthcare costs, analyzing both the all-cause costs and diabetes-specific costs. Here, the healthcare costs include the medical costs (primary and secondary care costs) and costs of pharmaceuticals. Table 2 presents a summary of the relevant literature.

Yu and colleagues (2007) estimated the economic impacts of a 6-month weight change among 458 diabetes patients in the USA. Using the generalized linear models with log link function, the authors estimated that 1 % of body mass change is statistically significantly associated with 3.1% change in total healthcare costs within a one year follow-up period. In this study, healthcare costs are examined as a sum of medical costs and pharmaceutical costs [2].

A larger population consisting of 2110 individuals with type 2 diabetes has been examined by Bell et al (2014). The population has been arranged into three cohorts, according to the weight change within the up-to-one year weight observation period: weight loss >3%; weight gain>3% and weight neutral where change is within the 3 % of the initially measured body mass. The latter cohort is used as a reference. In line with the above-mentioned study [2], the generalized linear models with log-link function were used to examine differences in costs. According to the estimates, more than 3% weight loss is associated with 11.2% decrease in the total all-

cause healthcare costs (medical and pharmaceuticals), and 13.7% in the diabetes specific healthcare costs. The medical costs were 13.7% lower within the all-cause costs, and 16.8% lower in the diabetes -specific costs. The expenditures on the pharmaceuticals are estimated to be 3.2% and 7.3% lower respectively, however, the estimates were not statistically significant. The estimates for the weight gaining cohort indicate that more than 3 % of weight gain increases the all-cause healthcare costs by 17.26%. The authors did not find statistically significant impacts of weight gain on the costs of pharmaceuticals [3].

One of the recently published studies by Mukherjee and colleagues (2016), examined the impacts of weight change on healthcare costs in the USA among 1520 individuals with diabetes. The researchers estimated the predicted health care cost outcomes at 0%, 2.5% and 5% change of body mass. On average, 1% decrease in body mass is associated with 2.6% decrease in consumption of diabetes-specific medicine. As a sub-group analysis, authors focused on the obese patients with no incidence of previous cardiovascular disease (CVD), considering that the majority of patients are not experiencing CVD within the first 10 years of their disease. Within the sub-group analysis, 1% weight loss is associated with 2.5% decrease in the expenditures on the all-case and 3.2% on diabetes-specific pharmaceuticals. The diabetes-specific medical costs decrease on average by 3.2% with one percent weight loss and increase by 3.7% with weight gain [4].

Another study published in 2016, conducted by Nichols and colleagues estimated the economic impacts of maintaining weight within the 5% of baseline versus weight increase for more than 5%. The study examined 8154 patients in the USA over a four year period and estimated that more than 5% weight gain is associated with 13.8% increase in medical costs, whereas the individuals that have maintained their weight have decreased the medical costs by 5%, compared to the baseline year. Total healthcare costs were 4,7% lower in the no change group and 14% higher in the weight gain group, whereas expenditures on the pharmaceuticals were 6,5% lower and 15% higher respectively [5].

Based on the evidence from Australia, over 4.3 years of follow-up, the weight loss of 5% or more, is associated with the 13.3% reduction in diabetes-specific pharmaceutical costs [6].

While the above-mentioned literature investigates the impacts of weight change as a percentage of initial body mass, Dilla et al. (2012) examine an effect of one unit Body Mass Index (BMI) change among 738 diabetes patients in Spain. Applying a two-slope model, authors estimated that 1 unit decrease in BMI among the non-BMI gainers (no change in BMI and weight loss) is associated with 8% reduction in diabetes-specific healthcare costs, whereas one unit of BMI increase leads to 20% increase in the total healthcare costs [7].

Table 2 Characteristics of populations examined in the reviewed literature

Weight change	Weight observation period	Population (% of total population)	Age (mean)	Weight (mean)	BMI (mean)	Female (%)	Source
Weight loss							
≥5% of body mass	4.3 years	185(31.4%)	64.9	83	30.1	57.8%	Davis et al. (2011)
5% of body mass	6 months	1520 (100%)	55.1	101.9	≥30	47.1%	Mukherjee et al. (2016)
>3% of body mass	1 year	967(46%)	59.7	100.7		55.8%	Bell et al. (2014)
2.5% of body mass	6 months	1520 (100%)	55.1	101.9	≥30	47.1%	Mukherjee et al. (2016)
1% of body mass	6 months	234 (51%)	59		34	47.9%	Yu et al. (2007)
1 unit of BMI	1 year	434 (58.8%)	65		29.73	44.9%	Dilla et al. (2012)
Stable weight							
0% of body mass	6 months	1520 (100%)	55.1	101.9	≥30	47.1%	Mukherjee et al. (2016)
-3%; +3% of body mass	1 year	970 (46%)	60	97		50.7%	Bell et al. (2014)
-5%; +5% of body mass	4 years	2553(31.3%)	58.6		33.3	47.6%	Nichols et al. (2016)
<5% of body mass	4.3 years	405(68.6%)	62.1	81		53.6%	Davis et al. (2011)
Weight gain							
1% of body mass	6 months	224(49%)	56.3		33.4	40.2%	Yu et al. (2007)
2.5% of body mass	6 months	1520 (100%)	55.1	101.9	≥30	47.1%	Mukherjee et al. (2016)
>3% of body mass	1 year	173 (8%)	56.7	96.2		39.9%	Bell et al. (2014)
5% of body mass	6 months	1520 (100%)	55.1	101.9	≥30	47.1%	Mukherjee et al. (2016)
≥5% of body mass	4 years	1020 (12.5%)	50.4		35.2	50.1%	Nichols et al. (2016)
1 unit of BMI	1 year	304 (41.2%)	65		31.81	47.0%	Dilla et al. (2012)

Summing up the examined literature, the weight loss among diabetes patients is coupled with reductions in healthcare costs, both medical and pharmaceuticals. According to the reviewed studies, a 1% reduction in weight is associated with a 3.1% reduction in all-cause healthcare costs [2] or 2.9% decrease in diabetes specific healthcare costs [4], based on a 6-month weight observation period with a subsequent 1 year of costs data follow-up. Furthermore, the evidence suggests that loss of more than 3% of body mass implies 11.2% decrease in total healthcare costs, compared to the less than 3% change in body mass [3]. Results from Spain indicate that decrease in 1 point of BMI is associated with 8% reduction in the diabetes specific healthcare costs [7].

4.2 HYPOTHESES

The findings from the literature review indicate that the different research groups have estimated more or less similar impacts of weight change on the healthcare costs of diabetes patients.

Expanding our focus beyond the healthcare sector, we expect that the weight change among the diabetes patients will bring similar reductions in the nursing costs as well as diminish the productivity loss of overweight and obese diabetes patients.

Therefore, the further cost-effectiveness analysis of LIVA intervention is based on the following hypotheses:

- A 1% reduction in weight among diabetes patients in LIVA cohort leads to 3.1% reduction in societal costs, hereunder healthcare costs, nursing costs and costs associated with productivity loss.
- At the highest estimates, we assume that more than 5% reduction in weight will decrease the costs by no more than 15.5%.

4.3 MODEL SPECIFICATION

The model developed within the scope of this study examines the cost-effectiveness of LIVA intervention. The two alternative scenarios are considered, where the baseline scenario is compared with the LIVA intervention.

A_0: Baseline scenario. No intervention has been introduced. The health status of diabetes patients follows the "business-as-usual" path. The societal costs of diabetes in Denmark [8] represent the reference costs.

A_1: Alternative scenario. The LIVA intervention has been introduced. The formulated hypotheses are applied to estimate the impacts of the weight change attributable to the LIVA platform on the societal costs of Diabetes as well as on the budgets of Danish municipalities.

4.4 DATA

Data from the 7th of June 2016 through the 1st of June 2017, has been obtained from LIVA Healthcare Aps and analyzed in this study. The initial population of LIVA Healthcare consists of 1780 individuals who participated in the intervention at any time point from the 7th of June 2016 until the 1st of June 2017 and have registered their weight parameters at least once throughout the study period (Table 3).

Table 3 Study sample selection

Analysis	Number of individuals	Mean duration, days (min; max)
Initial Population	1780	31.5 (0;348)
Study Population	193	178.6 (90; 348)
Study Population - Diabetes	51	191.0 (92; 328)
Study Population - Non-Diabetes	142	174.1 (90; 348)

In order to estimate the effect of LIVA platform on the weight change of the users, the study population has been narrowed to 193 individuals, who have been using the platform for 90 days or more, implying that there are at least 90 days (3 months) time span between the first and the last weight measurements.

As the particular focus of this study is the cost-effectiveness of the platform among the patients with chronic diseases, the study population has been split into two cohorts, where the first study population includes

diabetes patients and the second all the non-diabetes individuals. On average, diabetes patients have been in the study for 191 days (6.4 months), whereas patients without diabetes have used the platform for 174 days (5.8 months).

4.5 COSTS OF DIABETES

The societal costs of diabetes mellitus in Denmark have been examined by Sortsø and colleagues (2016), where authors applied real world data from the Danish National Registers and estimated the total costs of the Danish diabetes population in 2011 (N=318,729), as well as calculated the diabetes attributable costs as a difference between the actual costs of diabetes patients and costs of non-diabetes patients. The study categorized patients according to their complication status, indicating that the societal costs increase with patients developing more severe complications [8].

In the current study, we apply the total diabetes costs per person years (Table 4), in order to build a link between the weight change impacts examined in the literature/estimated within the LIVA population and societal costs of diabetes in Denmark. The diabetes specific healthcare costs considered in some of the studies [3-4; 6-7] cannot be directly compared to the diabetes-attributable costs [8] since the former capture medical costs with a primary and secondary diagnosis of diabetes while the latter capture all the costs that diabetes patients have, compared to non-diabetes patients.

Moreover, in the current study we do not distinguish between the complication groups, since the available LIVA data does not allow us to estimate the complication groups for the LIVA population precisely. We therefore apply average costs across three complication groups. The total costs per person-year and across gender are presented in the table below, where the relevant cost components are selected.

In the table below, the healthcare costs measure primary care services delivered by general practitioners and specialists and secondary care services including ambulant treatment and emergency room visits. Pharmaceutical costs measure the prescribed drug consumption, while nursing costs include costs of nursing services in own home/assisted facilities and nurse home visits. The productivity loss covers the income loss including difference between the annual income of non-diabetes patients and diabetes patients, the loss of income through the absenteeism from work and premature mortality. In contrast to the original study [8] we omit the costs component that reflects productivity loss in 2011 as a result of premature deaths before year 2011. The additional costs include: the costs of received support in forms of prevention, education and psychological assistance; the costs of self-monitoring of blood glucose (SMBG) appliances and insulin pumps; medical appliances (blind assistance, prosthetic appliances, wheel chairs); patients and informal care givers time; and depreciation of capital.

Table 4 Diabetes resource use per person across all complication groups

Cost component	Total costs per person-years (DKK)
Healthcare costs	**41,123**
W	38,368
M	43,719
Primary care	5,552
W	5,878
M	5,244
Secondary Care	35,571
W	32,490
M	38,474
Pharmaceutical costs	**6,421**
W	6,427
M	6,415
Nursing costs	**48,021**
W	61,116
M	35,680
Nursing home	21,360
W	27,812
M	15,281
Nursing in own home	17,127
W	21,798
M	12,724
Home nurse in own home	9,534
W	11,506
M	7,675
Productivity loss	**26,281**
W	18,770
M	33,360
Lost income	22,900
W	16,404
M	29,021
Lost productivity due to premature mortality	815
W	425
M	1,183
Absence	2,566
W	1,940
M	3,155
Total additional costs	**27,536**
W	25,829
M	29,145
Education, prevention, psychological assistance etc.	590
W	592
M	589
SMBG and pumps	1,667
W	1,680
M	1,654
Medical appliances	1,443
W	1,275
M	1,602
Patients' and informal care givers' time	8,674

W	8,646
M	8,700
Depriciation	15,163
W	13,638
M	16,600
Total for all cost items	**149,382**
W	150,511
M	148,318

Source: Sortsø et al., 2016.

4.6 COSTS OF DIABETES: MUNICIPALITIES

In Denmark municipalities share part of the social costs of patients with chronic diseases, hereunder municipalities co-finance diabetes patients' health care expenditures plus finance all nursing services.

The municipalities co-finance the healthcare expenditures, where the co-financing rate varies among the primary and secondary care, being 15.6% in the former and 25.9% in the latter [9]. All municipalities fully finance the nursing services, however, do not contribute to the expenditures on the pharmaceuticals.

As part of the income tax, Danish residents pay a municipal tax, that slightly varies among the municipalities, and on average constitutes 25.3% [10]. Therefore, productivity loss among the diabetes patients affects the budgets of municipalities.

The municipalities also share part of the additional costs, including the costs of prevention, education and psychological assistance. Moreover, the municipalities in Denmark finance the SMBG [11] and insulin pumps, as well as medical appliances. The costs of capital depreciation are shared by the municipalities according to the co-financing rate of the healthcare and nursing costs. The patients' and informal care givers' time is not included in the municipal costs of diabetes. Table 5 presents the total costs per diabetes patient that are shared by municipalities in Denmark.

Table 5 Share of diabetes costs payed by municipalities in Denmark

Cost component	Total costs per person-years (DKK)
Health care costs	**10,074**
W	9,328
M	10,778
Primary care	869
W	920
M	820
Secondary Care	9,206
W	8,408
M	9,957
Pharmaceutical costs	**0**
W	0

M	0
Nursing costs	**48,021**
W	61,116
M	35,680
Nursing home	21,360
W	27,812
M	15,281
Nursing in own home	17,127
W	21,798
M	12,724
Home nurse in own home	9,534
W	11,506
M	7,675
Productivity loss	**6,646**
W	4,746
M	8,436
Lost income	5,791
W	4,148
M	7,338
Lost productivity due to premature mortality	206
W	107
M	299
Absence	649
W	491
M	798
Total additional costs	**12,653**
W	14,304
M	11,096
Education, prevention, psychological assistance etc.	590
W	592
M	589
SMBG and pumps	1,667
W	1,680
M	1,654
Medical appliances	1,443
W	1,275
M	1,602
Patients' and informal care givers' time	0
W	0
M	0
Depriciation	8,953
W	10,758
M	7,252
Total for all cost items	**77,394**
W	89,495
M	65,990

5. RESULTS

5.1 BASELINE CHARACTERISTICS

On average, both diabetes patients and non-diabetes patients, who participated in the LIVA intervention for 90 days or longer, are obese at the baseline. Here, the non-diabetes cohort includes 6 patients with normal body weight.

The diabetes patients are on average 9 years older than non-diabetes individuals. There are 53% of females among the diabetes patients and 73% among the non-diabetes patients.

Table 6 Baseline characteristics of 193 individuals who participated in LIVA intervention for more than 90 days.

	Diabetes	Non-Diabetes
Individuals (n, %)	51 (26%)	142 (74%)
Age (years, SD)	56.5, ± 11.2	47.4, ± 13.2
Female (n, %)	27(53%)	104 (73%)
Weight (kg, SD)	100.0, ± 19.5	105.8, ± 25
BMI(kg/m2, SD)	33.7, ±6.3	35.8, ±7.4

5.2 EFFECTIVENESS OF LIVA INTERVENTION

According to the examined data, LIVA intervention is effective in weight reduction among the overweight and obese patients. On average, individuals with diabetes have reduced their weight by 3.91kg or 3.46% of their initial body mass, which corresponds to a 1.26-point change in BMI (Table 7). Within the diabetes population female patients lost on average 3.42% of the initial body mass, while male patients reduced their weight by 3.52%.

Within the non-diabetes cohort female patients lost more weight than male patients, where former reduced their body mass by 4.64%, while latter by 3.28%. The total average weight loss within the non-diabetes population is 4.27%.

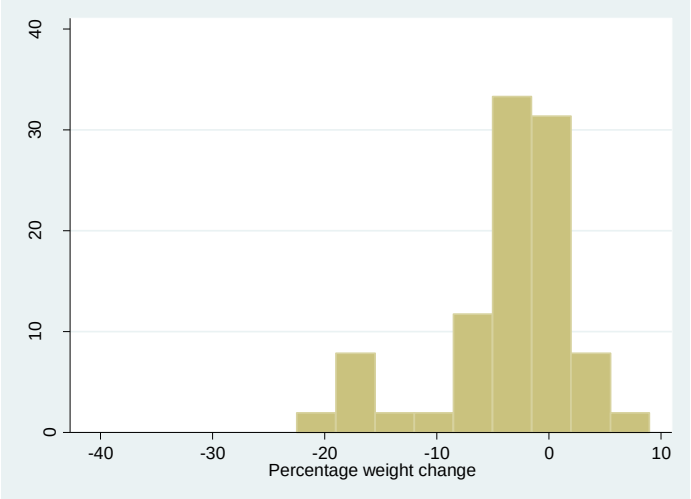
Table 7 The effect of LIVA intervention on study population

	Diabetes	Non-Diabetes
Duration (days)	191.0	174.1
Weight change (kg)	-3.91	-4.71
Weight change (% of initial weight)	-3.46%	-4.27%
Weight change (% of initial weight), Female	-3.42%	-4.64%
Weight change (% of initial weight), Male	-3.52%	-3.28%
BMI change (kg/m2)	-1.26	-1.60

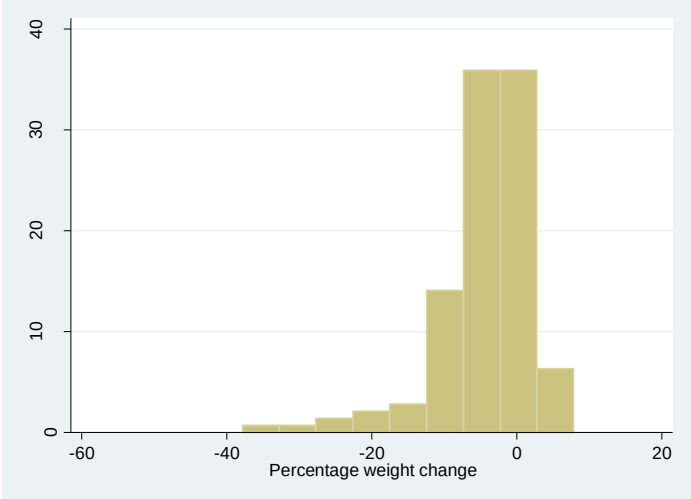
Figure 1 below illustrates the distribution of percentage weight change among the diabetes and non-diabetes patients, where negative numbers indicate weight loss and positive indicate weight gain.

Figure 1 Distribution of percentage weight change among the Diabetes and Non-Diabetes patients.

a)Weight change among Diabetes patients



b)Weight change among Non-Diabetes patients



As part of the data analysis, we examined the impacts of communication on weight change of LIVA platform users. We analysed the correlation between the percentage weight change and advisory and messaging frequency, applying a multiple regression model. According to the regression output, messages enhance weight loss, however the estimates were not statistically significant (Table 15 in the Appendix).

5.3 COST-EFFECTIVENESS OF LIVA INTERVENTION

According to the results presented in section 5.2, the LIVA intervention has proved to be effective in facilitating weight reduction among overweight and obese patients. Therefore, the cost-effectiveness of LIVA can be evaluated from the perspective of the cost savings that are associated with weight reduction among diabetes patients.

Applying the developed hypotheses, we expect that the average weight loss of 3.46% among the diabetes patients within the LIVA cohort will reduce the annual diabetes costs of a single diabetes patient by 10.73%.

We estimate that the effect of LIVA intervention diminishes total annual societal costs of diabetes by 16,045 DKK per individual, and allows Danish municipalities to save 6,954 DKK per diabetes patient, compared to the no intervention scenario (Figure 2).

Figure 2 Total societal and municipal diabetes costs per person-years (DKK)

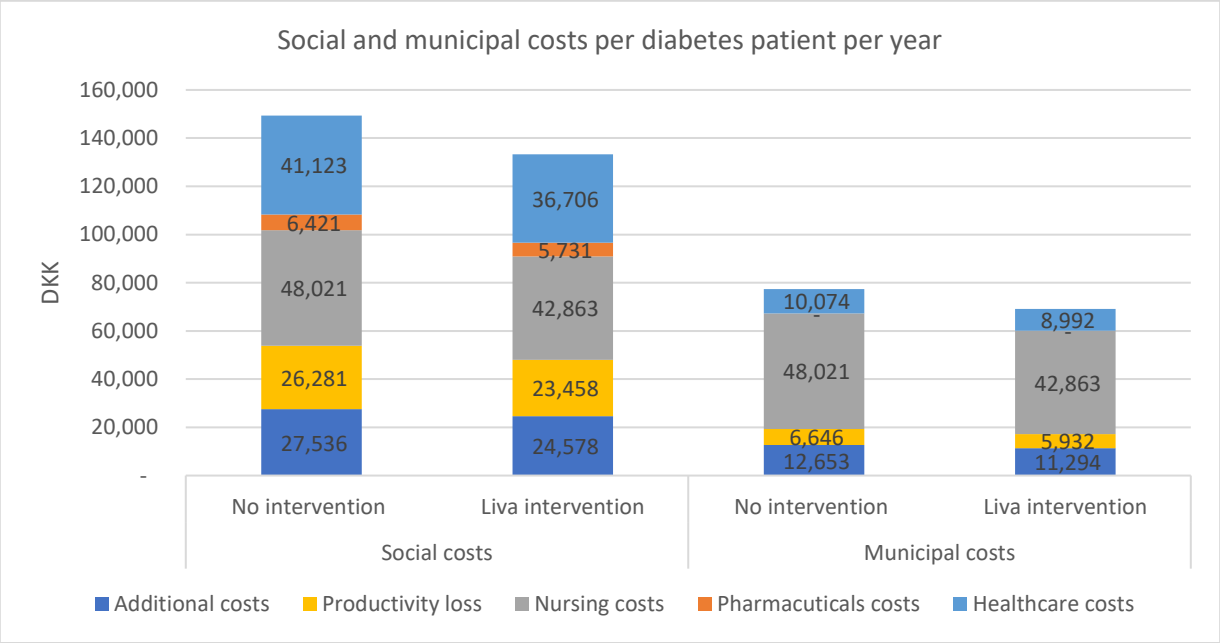


Table 8 below presents the intervention-attributable cost savings per individual per year, as well as total savings of the current study population, which consists of 51 diabetes patients, of those 53% females. The gender-specific costs savings presented in the table are based on the 3.42% weight loss among women and 3.52% among men within the LIVA diabetes cohort.

Table 8 Expected cost savings attributable to weight loss among LIVA diabetes population per year

Cost component	Societal costs savings per individual (DKK)	Total societal cost savings (DKK)	Municipal costs savings per individual (DKK)	Total municipal cost savings (DKK)
Health care costs	**-4,417**	**-225,268**	**-1,082**	**-55,186**
W	-4,067	-109,819	-989	-26,699
M	-4,765	-114,355	-1,175	-28,191
Primary care	-596	-30,413	-93	-4,758
W	-623	-16,825	-97	-2,632
M	-572	-13,718	-89	-2,146
Secondary Care	-3,821	-194,854	-989	-50,429
W	-3,444	-92,993	-891	-24,067
M	-4,193	-100,637	-1,085	-26,045
Pharmaceutical costs	**-690**	**-35,174**	**0**	**-**
W	-681	-18,397	0	-
M	-699	-16,780	0	-
Nursing costs	**-5,158**	**-263,057**	**-5,158**	**-263,057**
W	-6,479	-174,930	-6,479	-174,930
M	-3,889	-93,328	-3,889	-93,328
Nursing home	-2,294	-117,011	-2,294	-117,011
W	-2,948	-79,604	-2,948	-79,604
M	-1,665	-39,969	-1,665	-39,969
Nursing in own home	-1,840	-93,821	-1,840	-93,821
W	-2,311	-62,392	-2,311	-62,392
M	-1,387	-33,283	-1,387	-33,283
Home nurse in own home	-1,024	-52,225	-1,024	-52,225
W	-1,220	-32,933	-1,220	-32,933
M	-836	-20,075	-836	-20,075
Productivity loss	**-2,823**	**-143,965**	**-714**	**-36,404**
W	-1,990	-53,723	-503	-13,585
M	-3,636	-87,259	-919	-22,065
Lost income	-2,460	-125,443	-622	-31,720
W	-1,739	-46,953	-440	-11,873
M	-3,163	-75,910	-800	-19,195
Lost productivity due to premature mortality	-88	-4,466	-22	-1,129
W	-45	-1,216	-11	-307
M	-129	-3,095	-33	-783
Absence	-276	-14,056	-70	-3,554
W	-206	-5,554	-52	-1,404
M	-344	-8,254	-87	-2,087
Total additional costs	**-2958**	**-150,841**	**-1,359**	**-69,311**
W	-2738	-73,930	-1,516	-40,942
M	-3176	-76,233	-1,209	-29,025
Education, prevention, psychological assistance etc.	-63	-3,233	-63	-3,233
W	-63	-1,693	-63	-1,693
M	-64	-1,540	-64	-1,540
SMBG and pumps	-179	-9,129	-179	-9,129

W	-178	-4,808	-178	-4,808
M	-180	-4,327	-180	-4,327
Medical appliances	-155	-7,905	-155	-7,905
W	-135	-3,648	-135	-3,648
M	-175	-4,190	-175	-4,190
Patients' and informal care givers' time	-932	-47,514	-	-
W	-917	-24,746	-	-
M	-948	-22,757	-	-
Depriciation	-1629	-83,060	-962	-49,044
W	-1446	-39,035	-1,140	-30,793
M	-1809	-43,420	-790	-18,968
Total	**-16,045**	**-818,305**	**-8,313**	**-423,958**
W	-15,955	-430,798	-9,487	-256,156
M	-16,165	-387,955	-7,192	-172,609

5.4 COSTS OF LIVA INTERVENTION

The total costs of LIVA intervention paid by a Danish municipality consist of investment costs as well as operating costs.

The investment costs include the expenditures on the training of the health coaches employed on a part-time basis by municipalities, as well as basic preparation costs.

The operating costs cover the annual license fees for the individuals participating in the intervention as well as for the individuals in retention. It is assumed that after one year in the intervention citizens move to the retention phase, where they stay the following four years, whereas every year 20% of the initial population ultimately leaves the LIVA subscription.

Additionally, the operating costs include the salaries of the health coaches employed in the intervention and retention. The average annual salary of a full-time employee is assumed to be 499,200 DKK, including overheads. It is expected that within the workload of one full-time employee can be managed up to 600 individuals in the intervention, or up to 3000 individuals within retention phase. Within the intervention phase the individuals are guided by a health coach every week within the first three months. In the following two months, the consultations are provided every second week, whereas within the rest of the year the guidance takes place on a monthly basis. Therefore, within a year of intervention, an individual will receive 24 personal consultations with an average duration of 8 minutes. Within the retention phase an individual is guided by a healthcare coach every third month, where the length of the sessions is approximately 10 minutes.

Assuming that 600 individuals join the intervention each year, the costs of the LIVA are presented in Table 9 below. In order to guide individuals in the intervention and retention phases 4 health coaches are employed

on a part-time basis, corresponding to 1 full-time employee workload in the first year, whereas the workload is increasing over years along with the number of individuals in the retention phase.

Table 9 Costs of LIVA intervention (DKK), population: 600 individuals

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Investment costs	Pre-implementation costs	10,379	-	-	-	-	-	-	-	-	-
	Training costs	21,795	21,795	21,795	21,795	21,795	21,795	21,795	21,795	21,795	21,795
	Post-implementation costs	14,530	-	-	-	-	-	-	-	-	-
Operating costs	License fees	450,000	570,000	647,400	687,600	714,000	714,000	714,000	714,000	714,000	714,000
	Costs of health coaches	499,200	579,072	638,976	678,912	698,880	698,880	698,880	698,880	698,880	698,880
	Total costs	995,904	1,170,867	1,308,171	1,388,307	1,434,675	1,434,675	1,434,675	1,434,675	1,434,675	1,434,675
	Net Present Costs	995,904	1,136,764	1,233,077	1,270,498	1,274,690	1,237,563	1,201,518	1,166,522	1,132,546	1,099,559

Applying a 3% discount rate, the total net present costs of LIVA intervention within 10 years period are 11,748,640 DKK.

5.5 BUDGET IMPACT

The introduction of the LIVA intervention in a Danish municipality is associated with certain expenditures (investment and operating costs), whereas the benefits can be quantified in terms of costs savings attributable to the effectiveness of the platform. The savings of municipal diabetes costs attributable to the intervention, as well as investment and operating costs are reported in the sections 5.3 and 5.4 above.

In this section, we examine the impacts of LIVA intervention on a budget of a single municipality in Denmark, where 600 individuals join the intervention each year. Following the intervention phase that lasts 1 year, individuals join the retention phase, whereas 20% of initial population leave subscription every year.

We consider two baseline scenarios for the budget impact analysis. Baseline Scenario 1 (Table 10) illustrates budget impact of LIVA intervention for population which consists of 100% diabetes patients. Alternatively, Baseline Scenario 2 (Table 11) investigates budget impact for population with 26% diabetes patients, in line with the study population examined in this paper.

In the tables below, the Net Present Value (NPV) indicates the net costs of intervention, discounted at 3% rate. The negative numbers indicate the net cost savings. The cumulative NPV quantifies the total value of intervention up to a given year.

According to the budget impact baseline scenario 1 reported in Table 10, the LIVA intervention is cost-effective already from the first year of intervention, whereas the total net present value (net present cost savings) over the 10 years period are over 100 million DKK.

As a baseline scenario 2, we estimate the impact of LIVA on a budget of a single municipality, where only 26% of population are patients with diabetes (Table 11). Despite the fact that the costs are quantified for the total population of 600 individuals, while the savings are entirely attributable to the impact of LIVA platform on the individuals with diabetes, the investment in the LIVA intervention remains cost-effective from the year one. The total net present value of the 10 years period is almost 18 million DKK.

Table 10 Baseline Scenario 1. Budget impact analysis of LIVA intervention in population consisting of 600 individuals, 100% diabetes.

	Costs per population									
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Investment costs	46,704	21,795	21,795	21,795	21,795	21,795	21,795	21,795	21,795	21,795
Operating costs	949,200	1,149,072	1,286,376	1,366,512	1,412,880	1,412,880	1,412,880	1,412,880	1,412,880	1,412,880
Total costs	995,904	1,170,867	1,308,171	1,388,307	1,434,675	1,434,675	1,434,675	1,434,675	1,434,675	1,434,675
Savings - reduced medical costs	-649,250	-1,168,650	-1,558,200	-1,817,900	-1,947,750	-1,947,750	-1,947,750	-1,947,750	-1,947,750	-1,947,750
Savings - reduced use of pharmaceuticals	-	-	-	-	-	-	-	-	-	-
Savings - reduced use of nursing services	-3,094,788	-5,570,619	-7,427,492	-8,665,407	-9,284,364	-9,284,364	-9,284,364	-9,284,364	-9,284,364	-9,284,364
Savings - reduced productivity loss	-428,283	-770,910	-1,027,880	-1,199,193	-1,284,850	-1,284,850	-1,284,850	-1,284,850	-1,284,850	-1,284,850
Savings - reduced additional costs	-815,423	-1,467,762	-1,957,016	-2,283,186	-2,446,270	-2,446,270	-2,446,270	-2,446,270	-2,446,270	-2,446,270
Total savings	-4,987,745	-8,977,941	-11,970,588	-13,965,686	-14,963,235	-14,963,235	-14,963,235	-14,963,235	-14,963,235	-14,963,235
Net Cost/savings	-3,991,841	-7,807,074	-10,662,417	-12,577,379	-13,528,560	-13,528,560	-13,528,560	-13,528,560	-13,528,560	-13,528,560
Net Present Value	-3,991,841	-7,579,683	-10,050,351	-11,510,083	-12,019,950	-11,669,855	-11,329,956	-10,999,957	-10,679,570	-10,368,515
Cumulative Net Present Value	-3,991,841	-11,571,525	-21,621,875	-33,131,959	-45,151,909	-56,821,764	-68,151,720	-79,151,677	-89,831,247	-100,199,762

Table 11 Baseline Scenario 2. Budget impact analysis of LIVA intervention in population consisting of 600 individuals, 26% diabetes.

	Costs per population									
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Investment costs	46,704	21,795	21,795	21,795	21,795	21,795	21,795	21,795	21,795	21,795
Operating costs	949,200	1,149,072	1,286,376	1,366,512	1,412,880	1,412,880	1,412,880	1,412,880	1,412,880	1,412,880
Total costs	995,904	1,170,867	1,308,171	1,388,307	1,434,675	1,434,675	1,434,675	1,434,675	1,434,675	1,434,675
Savings - reduced medical costs	-172,051	-309,302	-412,240	-480,866	-515,178	-515,178	-515,178	-515,178	-515,178	-515,178
Savings - reduced use of pharmaceuticals	-	-	-	-	-	-	-	-	-	-
Savings - reduced use of nursing services	-820,119	-1,474,354	-1,965,030	-2,292,148	-2,455,706	-2,455,706	-2,455,706	-2,455,706	-2,455,706	-2,455,706
Savings - reduced productivity loss	-113,495	-204,034	-271,938	-317,207	-339,842	-339,842	-339,842	-339,842	-339,842	-339,842
Savings - reduced additional costs	-216,087	-388,467	-517,752	-603,941	-647,036	-647,036	-647,036	-647,036	-647,036	-647,036
Total savings	-1,321,752	-2,376,157	-3,166,960	-3,694,162	-3,957,763	-3,957,763	-3,957,763	-3,957,763	-3,957,763	-3,957,763
Net Cost/savings	-325,849	-1,205,289	-1,858,789	-2,305,855	-2,523,088	-2,523,088	-2,523,088	-2,523,088	-2,523,088	-2,523,088
Net Present Value	-325,849	-1,170,184	-1,752,087	-2,110,184	-2,241,731	-2,176,438	-2,113,046	-2,051,501	-1,991,749	-1,933,737
Cumulative Net Present Value	-325,849	-1,496,033	-3,248,119	-5,358,303	-7,600,034	-9,776,471	-11,889,517	-13,941,019	-15,932,767	-17,866,504

5.6 SENSITIVITY ANALYSIS

Within the scope of sensitivity analysis, we examine the impacts of LIVA on a budget of a municipality where a smaller population of 200 individuals participates in the intervention each year.

Table 12 demonstrates the impact of LIVA intervention on a budget of municipality, where entire population consists of diabetes patients. Here, the investment in the intervention will pay off starting from the year one, where the total savings over a 10 years period are approximately 31 million DKK.

Alternatively, a population with only 26% diabetes patients is considered (Table 13). The investment in the intervention will pay-off within the first three years of intervention, whereas the total savings in a municipal budget will reach almost 4 million DKK over 10 years.

As part of the sensitivity analysis we examine the impact of the time allocated for communication between the health coach and patient in intervention/retention, on the budget of a municipality. As stated in section 5.4, within the year of intervention, patient receives 24 personal consultations with a health coach where an average duration of a single consultation is approximately 8 minutes, whereas in the year of retention, there are 4 quarterly sessions with average duration of approximately 10 minutes.

As an alternative, we examine LIVA platform where the treatment starts with a one-hour face-to face meeting between the patient and the healthcare professional, followed by approximately 10 minutes-long online sessions throughout the year (total time allocated for consultations is 288 minutes per year). In the retention phase an individual is guided quarterly, where the sessions are approximately 14,5 minutes long on average (total counseling time per individual in retention is 58 minutes per year).

As demonstrated in Table 14, the investment and operating costs are affected by the increase in counselling time. Nonetheless, the introduction of the platform in the Danish municipality remains cost-effective from the year one, in case population of 600 diabetes patients is considered.

Table 12 Alternative Scenario 1. Budget impact analysis of LIVA intervention in population consisting of 200 individuals, 100% diabetes.

	Costs per population									
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Investment costs	23,352	10,898	10,898	10,898	10,898	10,898	10,898	10,898	10,898	10,898
Operating costs	616,400	643,024	662,992	676,304	682,960	682,960	682,960	682,960	682,960	682,960
Total costs	639,752	653,922	673,890	687,202	693,858	693,858	693,858	693,858	693,858	693,858
Savings - reduced medical costs	-216,417	-389,550	-519,400	-605,967	-649,250	-649,250	-649,250	-649,250	-649,250	-649,250
Savings - reduced use of pharmaceuticals	-	-	-	-	-	-	-	-	-	-
Savings - reduced use of nursing services	-1,031,596	-1,856,873	-2,475,831	-2,888,469	-3,094,788	-3,094,788	-3,094,788	-3,094,788	-3,094,788	-3,094,788
Savings - reduced productivity loss	-142,761	-256,970	-342,627	-399,731	-428,283	-428,283	-428,283	-428,283	-428,283	-428,283
Savings – reduced additional costs	-271,808	-489,254	-652,339	-761,062	-815,423	-815,423	-815,423	-815,423	-815,423	-815,423
Total savings	-1,662,582	-2,992,647	-3,990,196	-4,655,229	-4,987,745	-4,987,745	-4,987,745	-4,987,745	-4,987,745	-4,987,745
Net Cost/savings	-1,022,830	-2,338,725	-3,316,306	-3,968,027	-4,293,887	-4,293,887	-4,293,887	-4,293,887	-4,293,887	-4,293,887
Net Present Value	-1,022,830	-2,270,607	-3,125,937	-3,631,307	-3,815,063	-3,703,945	-3,596,063	-3,491,323	-3,389,634	-3,290,907
Cumulative Net Present Value	-1,022,830	-3,293,437	-6,419,374	-10,050,681	-13,865,744	-17,569,689	-21,165,753	-24,657,076	-28,046,710	-31,337,618

Table 13 Alternative Scenario 2. Budget impact analysis of LIVA intervention in population consisting of 200 individuals, 26% diabetes.

	Costs per population									
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Investment costs	23,352	10,898	10,898	10,898	10,898	10,898	10,898	10,898	10,898	10,898
Operating costs	616,400	643,024	662,992	676,304	682,960	682,960	682,960	682,960	682,960	682,960
Total costs	639,752	653,922	673,890	687,202	693,858	693,858	693,858	693,858	693,858	693,858
Savings - reduced medical costs	-57,350	-103,101	-137,413	-160,289	-171,726	-171,726	-171,726	-171,726	-171,726	-171,726
Savings - reduced use of pharmaceuticals	-	-	-	-	-	-	-	-	-	-
Savings - reduced use of nursing services	-273,373	-491,451	-655,010	-764,049	-818,569	-818,569	-818,569	-818,569	-818,569	-818,569
Savings - reduced productivity loss	-37,832	-68,011	-90,646	-105,736	-113,281	-113,281	-113,281	-113,281	-113,281	-113,281
Savings – reduced additional costs	-72,029	-129,489	-172,584	-201,314	-215,679	-215,679	-215,679	-215,679	-215,679	-215,679
Total savings	-440,584	-792,052	-1,055,653	-1,231,387	-1,319,254	-1,319,254	-1,319,254	-1,319,254	-1,319,254	-1,319,254
Net Cost/savings	199,168	-138,131	-381,764	-544,186	-625,397	-625,397	-625,397	-625,397	-625,397	-625,397
Net Present Value	199,168	-134,107	-359,849	-498,007	-555,657	-539,473	-523,760	-508,505	-493,694	-479,315
Cumulative Net Present Value	199,168	65,060	-294,789	-792,796	-1,348,453	-1,887,925	-2,411,685	-2,920,190	-3,413,884	-3,893,198

Table 14 Alternative Scenario 3. Budget impact analysis of LIVA intervention in population consisting of 600 individuals, 100% diabetes; 1 FTE operates 400 individuals in intervention/2000 individuals in retention.

	Costs per population									
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Investment costs	70,056	32,693	32,693	32,693	32,693	32,693	32,693	32,693	32,693	32,693
Operating costs	1,198,800	1,438,608	1,605,864	1,705,968	1,762,320	1,762,320	1,762,320	1,762,320	1,762,320	1,762,320
Total costs	1,268,856	1,471,301	1,638,557	1,738,661	1,795,013	1,795,013	1,795,013	1,795,013	1,795,013	1,795,013
Savings - reduced medical costs	-649,250	-1,168,650	-1,558,200	-1,817,900	-1,947,750	-1,947,750	-1,947,750	-1,947,750	-1,947,750	-1,947,750
Savings - reduced use of pharmaceuticals	-	-	-	-	-	-	-	-	-	-
Savings - reduced use of nursing services	-3,094,788	-5,570,619	-7,427,492	-8,665,407	-9,284,364	-9,284,364	-9,284,364	-9,284,364	-9,284,364	-9,284,364
Savings - reduced productivity loss	-428,283	-770,910	-1,027,880	-1,199,193	-1,284,850	-1,284,850	-1,284,850	-1,284,850	-1,284,850	-1,284,850
Savings – reduced additional costs	-815,423	-1,467,762	-1,957,016	-2,283,186	-2,446,270	-2,446,270	-2,446,270	-2,446,270	-2,446,270	-2,446,270
Total savings	-4,987,745	-8,977,941	-11,970,588	-13,965,686	-14,963,235	-14,963,235	-14,963,235	-14,963,235	-14,963,235	-14,963,235
Net Cost/savings	-3,718,889	-7,506,640	-10,332,031	-12,227,025	-13,168,222	-13,168,222	-13,168,222	-13,168,222	-13,168,222	-13,168,222
Net Present Value	-3,718,889	-7,288,000	-9,738,931	-11,189,460	-11,699,795	-11,359,024	-11,028,179	-10,706,970	-10,395,116	-10,092,346
Cumulative Net Present Value	-3,718,889	-11,006,890	-20,745,820	-31,935,281	-43,635,076	-54,994,100	-66,022,279	-76,729,249	-87,124,365	-97,216,711

5.7 LESSONS LEARNED

Based on the performed analysis we identified a few observations for further investigation, that could potentially enhance the quality of the data obtained from the LIVA platform.

- Not all LIVA App users register their weight parameters regularly, given that they actively use LIVA App. For instance, there are 47 diabetes patients who have used their LIVA App in the period from 1st of April until 1st of June 2017, of those 22 individuals have registered at least one other parameter, besides weight or steps.

  A potential solution to encourage weight registrations could be a development of a pop-up notification system for the App users or distribution of the emails with the reminders to register weight parameters.
- A few LIVA App users have registered weight parameters that indicate a rapid weight change. Assuming that the realistic weight change per day is less than 0.5kg, some individuals have registered weight parameters that correspond to more than 1kg weight change per day. An example is illustrated in Figure 3 in the Appendix.
- In order to avoid typing mistakes, in could be useful to highlight the weight change on a graph, attracting user attention to a possible mistake or integrate a pop-up question, asking whether the weight measurement is correct.
- According to the current data, there is no significant correlation between the message or advice frequency and weight change. The further analysis examining an increased study population and based on the longer observation period would clarify the impacts of advices and messages on weight change among the platform users.
- An improved registration of the co-morbidities could strengthen the data and allow the distribution of diabetes patients across the complication groups, thereby providing a base for further research.

  Short explanatory texts of the chronic diseases that appear at the registration could enhance the data quality.

6. DISCUSSION

The current study evaluates the cost-effectiveness of LIVA intervention and estimates the budget for Danish municipalities. The study applies the real-world evidence data from the LIVA Healthcare to investigate the weight change among the LIVA App users, including patients with diabetes.

According to the examined data, the distribution of female and male patients in the diabetes cohort is approximately equal (53% and 47%), while females constitute the majority in the non-diabetes population or

73%. Moreover, the results indicate that men with diabetes have lost slightly more weight (as a percentage of initial body mass), compared to women in diabetes cohort and men in the non-diabetes population. These findings indicate that it is more difficult to activate men to participate in the LIVA intervention, however men with diabetes are more motivated.

Reviewing the existing literature, we formulated the hypotheses regarding the impacts of the weight change among diabetes patients on the social welfare, and consequently on the budgets of Danish municipalities. The majority of the examined studies investigated the short-term impacts of the weight change among diabetes patients on the healthcare costs, focusing their analysis rather on one year of follow-up, following the weight observation period. Therefore, the long-term impacts of weight change on the societal costs of diabetes are associated with some uncertainty.

The cost savings attributable to the LIVA intervention estimated within the scope of the cost-effectiveness analysis are based on the average weight loss in the LIVA diabetes cohort, since observed difference in weight loss as a percentage of the initial body mass is relatively small between the males and females. The gender-specific weight estimates could be applied in the future analysis, in case a bigger and more unevenly distributed across gender groups diabetes population is examined.

The main focus of this study is the impact of LIVA intervention on the patients with diabetes, therefore the benefits associated with weight reduction among the patients with other chronic diseases are not quantified explicitly within the scope of this study. Furthermore, within the scope of the budget impact analysis we examine the impacts of LIVA intervention on the budgets of Danish municipalities, where the costs are quantified for the population as a whole, including the non-diabetes patients, whereas the benefits (cost-savings) are captured solely based on the diabetes cohort. Further studies are needed to investigate the impacts of LIVA intervention on societal, and consequently municipal costs of patients without diabetes.

In general, a register based study with observation of the actual costs of diabetes as well as non-diabetes patients that participate in LIVA over a longer follow-up period, and subsequent comparison with control population could strengthen the results of this study.

7. CONCLUSIONS

In this study, we applied real-world data from the LIVA platform users, as well as evidence from the literature to evaluate the cost-effectiveness of the LIVA intervention and impacts on the budgets of Danish municipalities.

We have confirmed the effectiveness of LIVA intervention in weight reduction among the overweight and obese individuals, where diabetes patients lost on average 3.46% of the initial body mass. Moreover, we examined

the impacts of weight loss attributable to the LIVA intervention on the societal costs of diabetes, indicating that LIVA intervention decreases societal costs of diabetes by 16,045 DKK per patient year, thereby improving social welfare. As the municipalities in Denmark share part of the diabetes societal costs burden, the effectiveness of LIVA intervention in weight reduction implies 8,313 DKK savings per individual in annual municipal costs of diabetes.

Furthermore, within the scope of this study we examined the impacts of introducing LIVA intervention on the municipal budgets. Assuming that 600 individuals join the intervention annually, the investment in the LIVA platform will pay off already after one year of intervention, when the savings in the municipal costs of diabetes will offset the expenditures associated with LIVA platform implementation and operation. According to the analysis performed, the pay-off period of the municipal investments in the intervention depends on the number of LIVA users and proportion of diabetes patients, as well as on a number of health coaches involved.

Our study establishes a framework for a further evaluation of the LIVA intervention, where the new data can be examined to enhance the results of the current analysis.

8. REFERENCES

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Table 15 Regression estimates (output from STATA)

Source	SS	df	MS		
Model	727.030274	8	90.8787843	Prob > F	0.0149
Residual	6797.36437	184	36.9421977	R-squared	0.0966
				Adj R-squared	0.0573
Total	7524.39464	192	39.1895554	Root MSE	6.078

Number of obs	=	193			
F(8, 184)	=	2.46			

pct_weight_change	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
duration	-.0216302	.0072095	-3.00	0.003	-.035854	-.0074063
partnerId	-.0012672	.0083465	-0.15	0.879	-.0177344	.0152001
Age	.0365954	.0372483	0.98	0.327	-.0368933	.1100841
sex	-.2870565	1.018554	-0.28	0.778	-2.296603	1.72249
Diabetes	.51021	1.076404	0.47	0.636	-1.61347	2.63389
bmistart	-.1267146	.065192	-1.94	0.053	-.2553346	.0019053
sentMessageCount	-.0503709	.039593	-1.27	0.205	-.1284856	.0277437
receivedAdviseCount	.0680927	.0489637	1.39	0.166	-.0285098	.1646952
_cons	2.674494	6.463171	0.41	0.679	-10.07696	15.42595

Figure 3 Registered weight parameters of a single diabetes patient