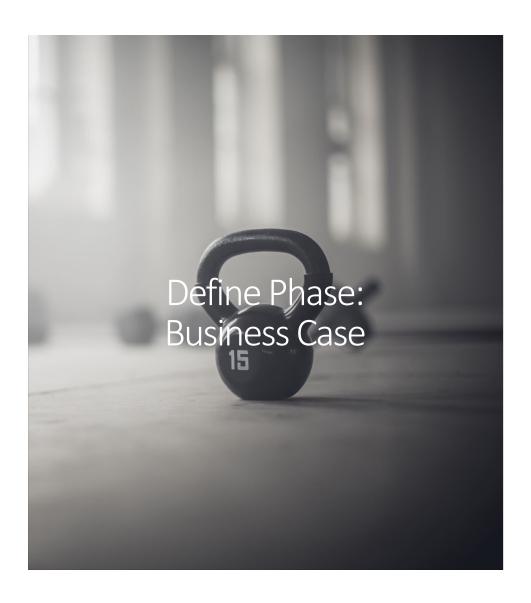


Weight Loss using Lean Six Sigma

By: Suren G Ulaganathan

August 2022



- My median weight* (in kg) over the first four months of 2022 (Jan – Apr) was 87.49 kg.
- I had never weighed this much in my adult life. I verified this through my Apple Health app which contains a record of my weight since graduating college in 2015. I knew that I had to do something about it now (when I'm still in my late 20s) rather than let my weight slip as work, family and life take over.
- Maintaining a healthy weight and lean figure is important not only for looking good but also to feeling good and having boundless energy to face all the problems that life throws at us.
- As the saying goes, healthy body = healthy mind. A healthier weight will allow me to be a better employee, son, partner and citizen.

^{*} I have used "weight" throughout this presentation to describe what is scientifically-speaking, mass.

Define Phase: Problem Statement

- My median weight (in kg) over the first four months of 2022 (Jan – Apr) was 87.49 kg.
- This is significantly higher than my previous median over the past few years. For instance, for the duration of the second half of 2021, my median weight was 81.5 kg (as tracked on the Apple Health app after weighing myself manually every 4 days).
- My goal is to reduce my weight to 83.5 kg by July 31, 2022. This goal was selected as this would bring my BMI* down to exactly 24.9 kg/m² which is at the edge of the Healthy BMI range. My current BMI, with a median weight of 87.41 kg, is 26.1 kg/m², which is in the Overweight range.

* BMI was calculated using my height of 1.83 meters (6 ft).

BMI formula = Weight (kg) / Height² (m²)

Define Phase: Operational Definitions

- I used an Etekcity brand digital weighing scale in kilogram units to weigh myself.
- Furthermore, I made it a point to weigh myself first thing after waking up every morning in the bathroom before my morning shower and before having had anything to drink or eat. This ensures that my body is well-fasted and at the same baseline as much as possible. [1]
- For instance, weighing myself at 6am one day and then another day after a heavy lunch at 1pm would not be a fair comparison as one's weight is known to fluctuate over the course of the day.

[1]: Source: https://health.clevelandclinic.org/when-is-the-best-time-to-weigh-yourself/

What was my weight every day and how is it reducing/increasing?

Data		Operational Definitions & Procedures					
What	Measure Type/Measure Data	How is it measured?	Related conditions to record	Sampling Notes	How/Where recorded?		
My weight in a fasted state early in the morning	Weight (kg)	- Measured first thing in the morning after waking up and before I have had anything to drink or eat. Furthermore, I will be measuring it without clothes on to maintain the same baseline as much as possible.	 By time of day for first meal By time of day for last meal By time to wake-up and sleep By total number of steps covered per day By total number of intensity minutes (Garmin includes all moderate and vigorous physical activities) 	-NIL-	Form on next slide		

Measure Phase: Data Collection Plan

The data collection plan was formulated using operational definitions and related conditions. The related conditions were from the overarching rule that weight gained or lost is equal to the calories in minus calories out. I also put in other factors that could affect my weight (such as the time I went to bed and the time I woke up). I found these by reading from a variety of books which are listed later in this presentation.

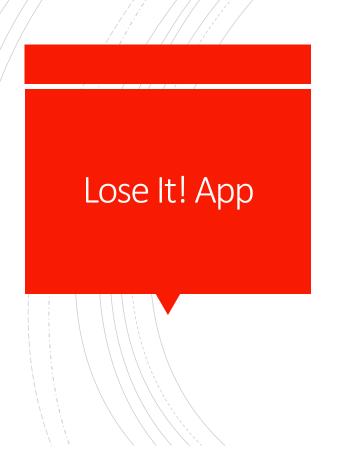
	Y	x	х	x	x	x	х	x
Day	Body weight taken next morning *	Net Calories +	Wake up time	Time of First Meal	Total Steps Completed	Daily Intensity Minutes	Time of Last Meal	Sleep time
01 Feb 2022	87.8 kg	+245	05:52	09:15	10,450	75	18:30	21:21
02 Feb 2022	88.2 kg	+431	05:44	10:20	4,500	0	18:00	21:53
03 Feb 2022	87.7 kg	+412	06:45	09:20	7,983	36	17:45	20:53
04 Feb 2022	87.9 kg	-124	07:12	08:31	14,294	109	17:55	20:32
05 Feb 2022	88.0 kg	-593	04:58	08:12	4,824	12	17:58	23:45

Measure Phase: Data Collection Form

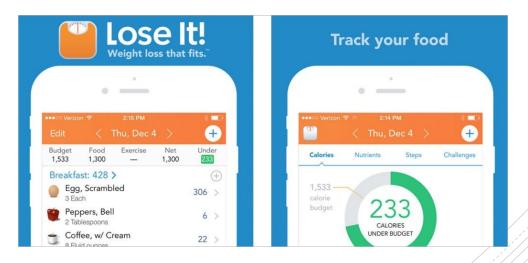
^{*}Body weight measurement was taken first thing the next morning as this would be the cumulative result of the previous day's activities (exercise, nutrition, sleep pattern and time of meals).

⁺ Read the next 2 slides to learn how I estimated my Net Calories using the Garmin Connect & Lose It! apps.





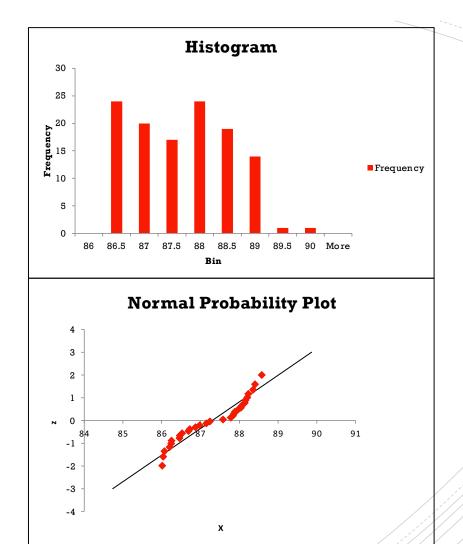
- To track my daily calories, I input all the food I ate on the Lose It! app on my iPhone. It does a decent job of estimating calories for different food items, and it does it most accurately when I eat out at popular chain restaurants such as Chipotle for instance
- I was then able to track my calorie intake and compare it with the calories expended through the Garmin Connect app.
- This is how I was able to estimate the net calories column in my Data Collection Form.



Measure Phase: Baseline Data & Situation

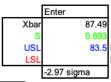
Average	87.44067
St Dev	0.893027
n	120
Median	87.49
S	-14550.1
AD	1.251
AD*	1.259
p Value	0.002842
Min	86.01
Max	89.65
p Value Calculations	
р	0.002842

- My data failed the Normality test as the p-value was found to be less than 0.05.
- The Normal Probability Plot also seems to follow an S-Curve.
- Therefore, I used the median of the data (87.49 kg)



Calculating Process Sigma: Method 2

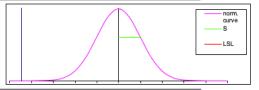
1. Enter average, standard deviation, and spec limits



2. Label a Normal curve

Average

- Standard deviation
- USL (and shade to LEFT for Area 1)
- LSL (and shade to LEFT for Area 2)



5. Calculate Yield

3.94615E-06 0.0003946%

Yield (percentage) = Yield x 100% =

6. Look up Yield in Process Sigma Table

Process Sigma = Look up in Sigma Table :

-2.97

- Currently, less than 0.000395% of my measured weight (in kg) were found to be lower than my Upper Specification Limit (USL) goal of 83.5 kg.
 - This was understandable since I knew I was heavier than I normally was, and it would have been miraculous if I suddenly dropped multiple kilograms when weighing myself. Weight loss, as we all know, is a gradual process and rarely does the weight drop suddenly.
- The USL was deemed to be 83.5 kg as this
 is the weight needed to get my BMI to
 24.9 kg/m² which is at the edge of the
 healthy range.
- The Process Sigma currently is -2.97.
 Hence, there is considerable room for improvement here!

Analyze Phase

Key Insights

- 1. Very little physical activity over the course of the day as shown by the number of days I reached my 10,000 steps target. (Refer to the next slide for more details)
- 2. Ate plenty of processed food and junk food, especially at night. Upon analysis, I ate these with my room-mates. My room-mates don't live a healthy lifestyle and are overweight. Instead of going to bed early or going for a peaceful evening walk, I would sit in front of the TV with them and eat take-out food or snacks.
 - This was revealed through data from Lose It! where I noticed that I had a lot of processed sugary and salty food such as chips, store-bought cookies and ultra-processed food such as pizza logged in

Analyze Phase: Garmin Connect App – Analyzing difference in physical activity for same time period in 2021 & 2022









2021

In the first 4
months of 2021, I
attained my
target of 10,000
steps on 108 days
out of 120 days
(missing just 12
days)

2022

 In 2022 however, just in the month of January I missed 12 days. Overall, during the first 4 months of this year, I missed a total of 43 days (77 days completed out of 120 days)

Analyze Phase:

Potential Xs:

- 1. Sleeping too late and/or waking late
- 2. Maintaining a strict 8-12 hour eating window
- 3. Aim to complete at least 7500 steps daily
- 4. Cook more at home with strictly no processed or junk foods

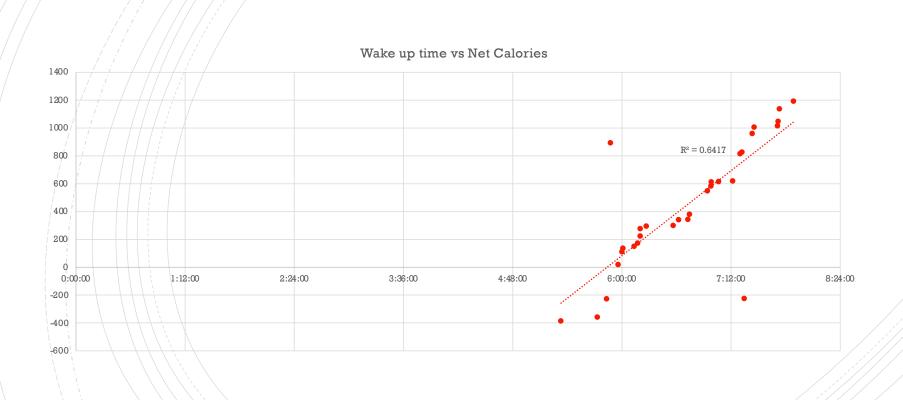
I identified the Xs above by researching and reading countless highly-rated books on self-improvement and diet. The three books listed below were my main sources of inspiration for identifying the Xs that were contributing to my weight gain.

- 1. Morning Routine by Hal Elrod
- 2. How Not to Die by Dr. Michael Greger
- 3. The Circadian Code by Dr. Satchin Panda

X1 – Waking up too late (Poor sleep pattern)

- Benjamin Franklin is to have said "early to bed and early to rise makes a person healthy, wealthy and wise."
- Research* has shown that disrupting our body's natural circadian rhythm can have an adverse impact on our body's natural ability to digest, fight off diseases, maintain our weight and increase our healthy lifespan.
- It is quite clear that by sleeping late and waking late, I end up eating more than usual and having lesser time for exercise. For instance, my Excel data shows that on days I woke up later than usual, I end up consuming more net calories as I eat convenience/fast-food to make up for lost time and these food items typically are calorie-dense.
- Please see the graph on the next page which demonstrates this.

Based on research by Circadian Biologist, Satchin Panda, in his book, The Circardian Code



X2 – Not maintaining a strict 8 – 12 hour eating window

- We live in an age of abundance. Unlike our huntergatherer ancestors, it is possible for us to find food to eat any time during the day. Our bodies however was not built for this level of abundance.
- In the same book, The Circadian Code, one of the top recommendations Dr. Panda gives for losing weight is Time Restricted Feeding (TRF). TRF means a strict eating window of between 8 to 12 hours.
- Data for the first 4 months of the year showed that I had eating windows greater than 12 hours about 78.3% of the time (94 days out of 120 days).
 - This was possibly a significant reason for my weight gain and difficulty losing weight during this time period.

X3 – Not completing at least 7500 steps daily

- During my first winter in Canada earlier this year, I
 averaged 5882 steps a day from January to April 2022.
- Physical activity is necessary for expending calories and losing weight in the long-run. Therefore, I have set myself a goal of hitting 7500 steps daily.
 - Although this is a decrease from my usual 10,000 steps, I have decided to set myself an achievable goal to ensure that I make physical activity a habit before choosing to increase this steps goal.

X4 – Eating a lot more ultraprocessed & junk food

- Based on data from the Lose It! app, after my move to Canada this year, I have largely eaten out or bought pre-cooked meals. Furthermore, because of the bad eating habits of my room-mates, I had started eating a lot of junk food at home in front of the television such as potato chips, chocolate bars and pizzas. For instance, my room-mates and I had pizza night (from Costco) twice a week.
- I have been assiduously tracking this and it shows that I broke my diet (i.e., eating ultra-processed or junk food*) about 73 days in that 120-day period. That is a lot of excess calories, sugar and fat!

*I define "Ultra-processed or junk food" as food that has had its core raw ingredients transformed into a state that is unrecognizable from what it was at the start.

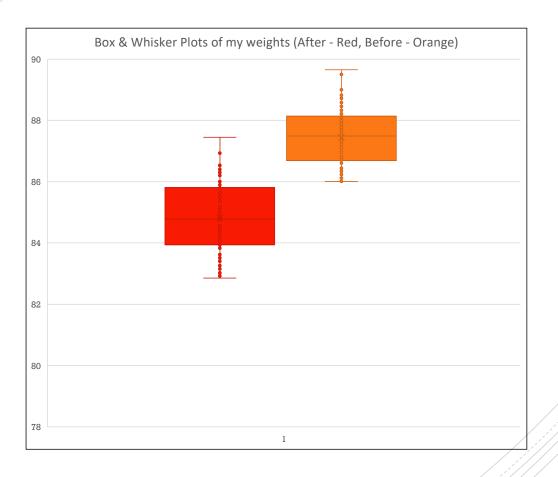
Solutions Implementation

- For the past 3 months, from May to July 2022, I have been doing my best to follow the 4 Xs I have identified.
- The next few slides will detail the results of my new program.

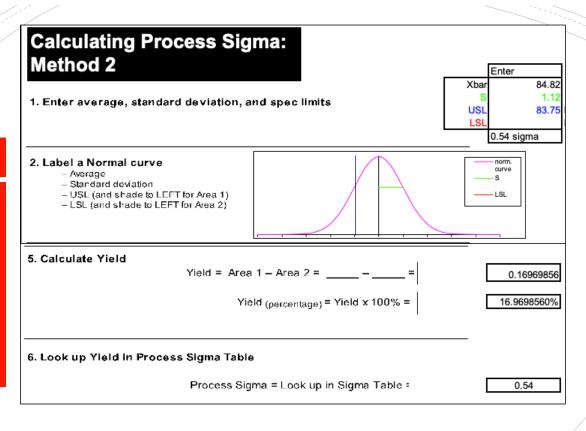
My Current Weight

- As of 31 July 2022, I weighed 83.35 kg. This means that I did reach my goal of weighing less than 83.5 kg.
- However, as any person who has ever tried to lose weight will know, it's equally hard to put off the pounds once you've lost them. Therefore, I will discuss my strategies, in the Control Phase, to prevent my weight from "yo-yo-ing" in the next few months and to continue my current trajectory of becoming leaner and healthier.

Box & Whisker Plots







- My process sigma has now improved from -2.97 to +0.54. Though still a long way before I am within the upper bounds of my healthy weight limit of 83.5 kg, I am happy of the progress I have made from where I was just at the start of the year.
- My yield is nearly 17%, which describes how often I am falling within my target of being in the healthy weight zone.
- With continued effort in the coming months of tracking my 4Xs, I am confident of making greater improvements.



- Given how much healthier and happier I feel, I am confident that I will continue implementing many of the strategies I have outlined in this presentation.
- To ensure that I do not return to my bad habits and especially as the winter season will begin in Canada in just a few months, I am putting together a few strategies to ensure that I keep myself healthy during this period of shorter days and colder nights.

Control Phase:
Strategy #1: Change
my Environment
(Change Roommates)

- I have decided to move out and live closer to my cousin in Montreal, Canada. My previous room-mates didn't prioritize their health and would often eat take-out and junk foods while binging on television shows.
- One of the biggest ways to change myself is to change my environment. And I've done just that. I will move into a single studio apartment and create a living space that is true to what I stand for.
 - 1. I will not keep any junk foods (such as chips and candy) at home. By eliminating this, it gives me the benefit of not having to control it.
 - 2. I will also follow my new rule of **not doing grocery shopping while hungry.** I have noticed I have a higher propensity of impulsively buying junk foods while shopping when I tend to be hungry.

Control Phase:
Strategy #2:
Publish my own
weight-loss
journey online

- I am thinking of starting a blog where I can share my weight-loss journey along with other ideas, such as healthy recipes.
- Publishing online or simply telling others about my plans is a great way to ensure that I stick to what I have said by leveraging multiple accountability partners. Hence, I am more likely to follow what I preach this way.
- Furthermore, simply documenting my weight-loss journey here as a Lean Six Sigma presentation has done wonders. I have not only reaffirmed knowledge about Lean Six Sigma concepts but also the Xs that lead to the Y of losing weight.



- Part of the reason I was so sedentary during the winter months in Canada was because of the snow and dangerous sidewalks. I realize that I also lacked knowledge about winter sports.
- By choosing to learn winter sports, I can instead go snowshoeing or skiing at the many nature parks around me. Once again, by learning the things that I will help me remain active during winter, I can overcome the friction of choosing to stay at home and be sedentary.
- Furthermore, if I were to pay for skiing classes, I am far more likely to stick with it. If I were learning it for free online for instance, my mind would find ways to give it up. The act of paying for something is a strong motivator for me to keep up with it.

