

UNIVERSITY OF TWENTE.

Urban Agriculture in Cochabamba: Does it improve mental health?

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For minor Crossing Borders

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Summary

In Bolivia, pesticide and poor water quality severely influence the availability of fresh and safe to eat vegetables. This issue does not present itself in wealthy parts of the country, but for those who are economically struggling, the water and vegetable problem has a severe impact on families regarding stress levels and illnesses.

A possible solution to these problems is offered in the form of urban agriculture. In so called “square foot gardens” vegetables are produced for domestic consumption in an organic manner. This means families can enjoy good quality vegetables, without having to worry about pesticide.

This paper regards the influence of urban agriculture on the physical and, primarily, mental health of families in the poverty-stricken suburbs of Cochabamba, Bolivia, known as “la zona sud”. This area is the poorest region of the county. The region suffers from lack of water, due to seclusion from the water network, and tends to be far away from the markets selling high quality vegetables. This means vegetables eaten in this region are generally low quality, dirty, contain high levels of pesticide and cannot be cleaned sufficiently due to the lack of water. This, of course, has a negative effect on the health of families living in the region.

Families in this region growing and eating organic vegetables tend to see positive changes in both mental and physical health, in terms of relaxation, stress levels, energy levels, sleep quality and illness levels. This is due to the consumption of organic vegetables, which have not been sprayed with pesticide, or watered with very poor-quality water, as well as the physical act of working in urban agriculture. This work tends to relax and destress families involved, which improves mental health and domestic atmosphere to the point that some families chose to involve themselves in urban agriculture projects solely for the mental health benefits, rather than the yield.

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1. Introduction

In this chapter the aim of this field study is presented. The chapter is divided into three sections: The global problem, the Bolivia specific problem and the research question.

1.1. The global problem

The main topic of this paper is mental health. Mental health is considered to be important to general and satisfaction. Poor mental health influences the urge of self-care, which can result in irregular sleeping, poor eating habits and difficulties with addictions. On the contrary, people with good mental health are generally more stable in their self-care and personal relations (Hart, 2021).

In addition to this, mental health has a direct influence on physical health and vice versa. As mentioned, a poor mental health generally leads to a higher risk of addiction. According to Ohrnberger et al, people with poor mental health are double as likely to smoke than people with good mental health. Furthermore, poor mental health influences dietary choices and social interactions negatively, which also has a negative effect on physical health (Ohrnberger et al., 2017). In addition, poor mental health has a negative influence on the nervous system and hormonal balance of the human body. Lastly, people experiencing long-lasting poor mental health are less likely to seek medical aid, which potentially worsens the physical health situation.

The effects of poor physical health on mental health mostly involve the mental load of long-term disease, possible side-effects of medication and the hormonal effects of physical health on mental health (Das et al., 2016). According to this data, the mental health of a person is very important.

Globally, mental health is an increasing concern, with the prevalence of mental health issues growing from 416 million cases in 1990 to 615 million cases in 2013 (Smith, 2022), then rising further to 792 million in 2017 (Dettani et al., 2021). Some of the reasons for this increase are the increased life expectancy, which means the body can outlast the mind. Furthermore, the shift to technology and the overall global commercialisation have a negative effect on global

mental health (Brundtland, 1999). This increase is noticed in both rich and poor countries (Brundtland, 1999).

Mental health related deaths are as high as 8 million per year globally. This is around 14% of all global deaths (Smith, 2022). Furthermore, individuals with mental disorders are believed to have two times higher mortality rates than those without mental disorders, translating to an average decrease of 10 years in life expectancy. Causes of deaths are not always direct symptoms of the mental health disorders, but rather due to suicide, infections, and chronic diseases like heart disease (Walker et al., 2014).

Lastly, there is a strong relation between poverty and mental health. Poverty, and specifically income inequality can increase stress levels through social comparison, which can make poorer individuals feel like failures. Not only this, but people who live in a situation of scarcity, often experience a phenomenon called “tunnelling”, which means focussing solely on the scarcity. This eventually leads to a cycle of scarcity (Mullainathan & Shafir, 2013). Furthermore, poverty tends to reduce the social capital, which makes individuals more vulnerable for psychosocial stressors (Burns, 2015).

Mental health and well-being is also considered a global challenge. The United Nations mention it in their sustainable development goal 3, which states: “To ensure healthy lives and promote well-being for all at all ages”. This SDG is divided into nine sub-targets. Two of which regard mental health. These are the fourth and fifth sub-targets, as set by the United Nations. Sub-target four, called “Noncommunicable diseases” aims to reduce premature mortality due to noncommunicable disease by one third by 2030, as well as promoting mental health and well-being.

Sub-target five, called “Substance abuse” aims to strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol.

Worldwide, these problems are far from solved, with no countries meeting the goals set in SDG3 (Sustainable Development Report, 2022). However, lowest scores are concentrated in developing countries, as visualised in Figure 1. These countries generally have more unsafe roads, lower air quality and higher child mortality rates. Furthermore, when looking at the

predicted trends, which indicate whether a country is on track to meet SDG3, it becomes clear that developing countries generally are not on track to meet the goals set. This is visualised in Figure 2 (Sustainable Development Report Trends, 2022).

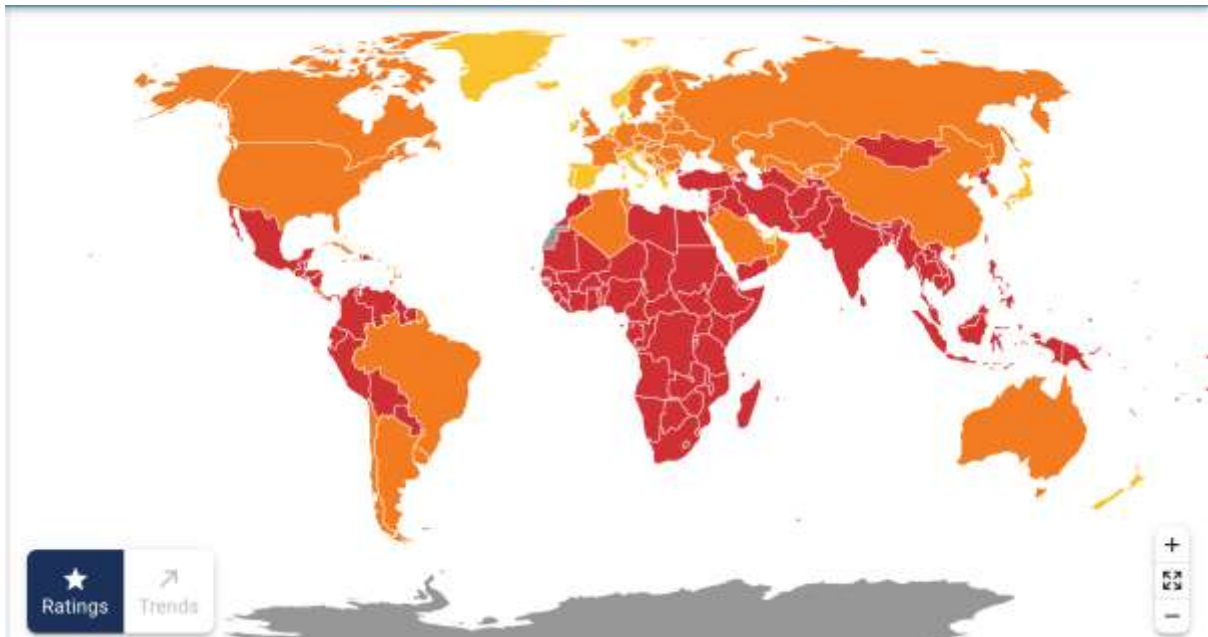


Figure 1: SDG3 scores globally (Sustainable Development Report, 2022).

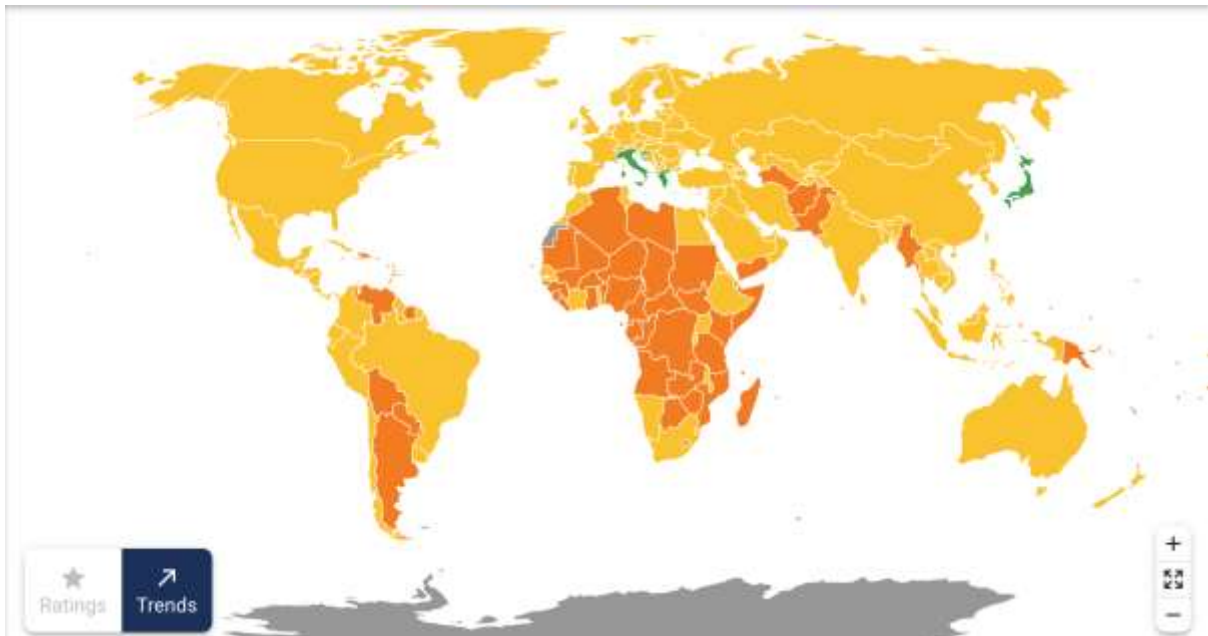


Figure 2: SDG3 predictions for meeting the goals (sustainable Development Report Trends, 2022).

One of the countries regarded as a developing country is Bolivia. This country has poor air and water quality, as well as low water availability (Sustainable Development Report, 2022).

1.2. The Bolivia specific problem

1.2.1. Introduction

In this sub-chapter the specific problems in Bolivia are discussed. These problems all relate to SDG3. Firstly, the problem of low air quality is explained. Secondly, the poor water quality is explained and lastly the excessive use of pesticide is explained.

All of these problems, although not directly related, affect in the overall low SDG3 score Bolivia has according to the United Nations.

1.2.2. Poor air quality

According to Soledad Delgadillo in an interview with the Guardian, the overall air pollution in Bolivia has decreased with 60 to 70 percent after the introduction of car-free days several times per year, as cars are the primary source of pollution, especially in cities (Linda Farthing, 2017). Furthermore, there are many brick factories in Bolivia. Due to the urbanisation the demand for bricks is high. In La Paz, an estimated 3 million bricks are produced annually (Gallegos, 2006). This makes that the overall score for air pollution in Bolivia, according to AccuWeather, is 'Fair', with larger cities scoring lower in terms of air pollution (Accuweather, 2022).

1.2.3. Poor quality and availability of water

The availability of clean water and sanitation also is a problem in Bolivia. Currently, the country is showing poor scores on SDG6, as shown in Figure 3. Though there is overall improvement, there is more work to be done to meet the goals for SDG6 in 2030. (Sustainable Development Report Trends, 2022).

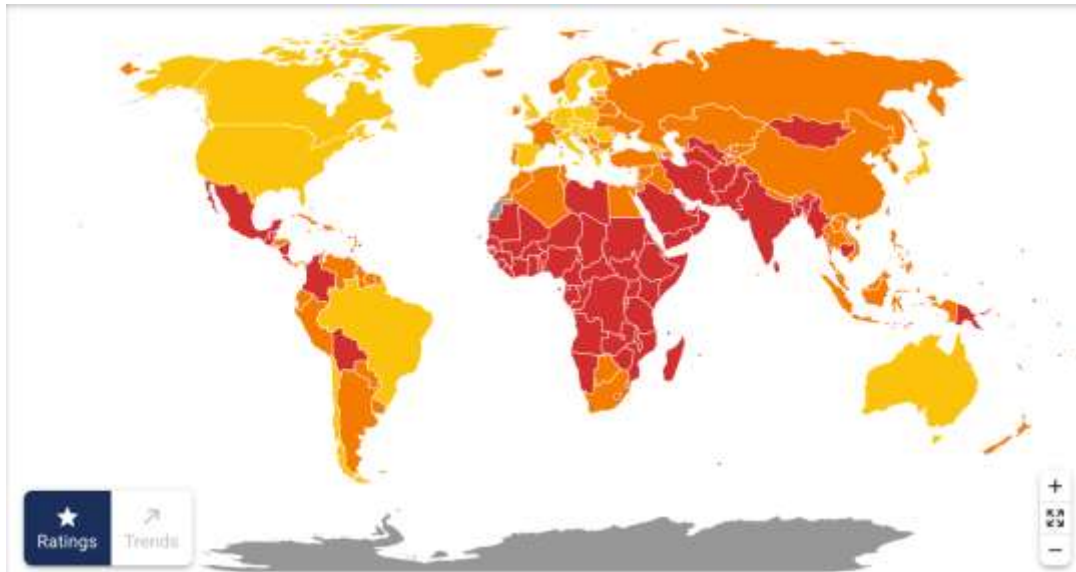


Figure 3: Availability of water and sanitation worldwide, as indicated by SDG6.

There appear to be several reasons for the water supply issues in Bolivia. This, however, is not a recent problem. In 1999, the government of Bolivia decided to privatise the water network in the country, which took away the water supply from 500.000 people across the country, which was around 6% of population at the time. After this decision, the so called “Water Wars”, a series of protests in Cochabamba specifically, broke out (Evans, 2017). Then, in 2016 and 2017, Bolivia suffered extreme draughts, effecting as many as 125.000 people (Stockholm Institute, 2018).

One of the largest causes is believed to be climate change. In Figure 4 it is visible how the average yearly rain in Cochabamba has steadily decreased over the last 13 years. This, of course, means less availability of rainwater.

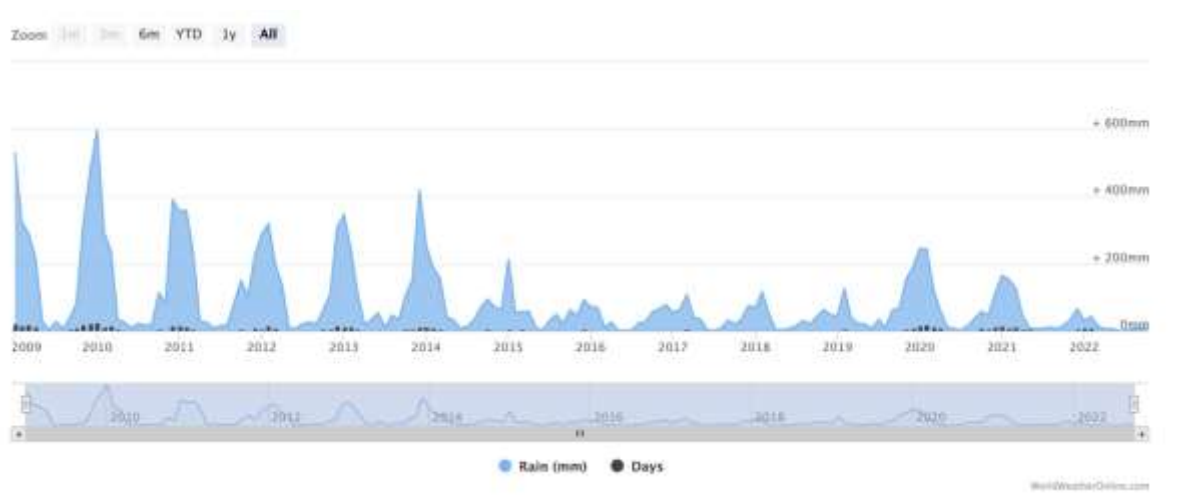


Figure 4: Average yearly rain in Cochabamba 2009-2022 (Cochabamba Annual Weather Averages. 2022).

Furthermore, due to the rising average temperatures worldwide, the glaciers in the Andes mountains are shrinking rapidly, which causes a further decline in the availability of fresh water in Bolivia (Moens, 2020). In 2016, an estimated 86% of households Bolivia were connected to a fresh and dependable water supply. With 46% having access to sanitation as well. However, in rural areas of the country these numbers appear to be lower.

In addition to the supply issues of water, the quality of water is poor as well. One of the causes of this problem are factories and mines dumping their waste into nearby rivers, as well as the sewers being dumped in the rivers. These rivers usually dry out in winter, or dry, seasons, which leaves a large amount of waste exposed in the riverbeds (Evans, 2017).

Another large issue in Bolivia is the poor availability of healthcare. In 2019 the ministry of health in Bolivia announced plans for the implementation of free universal healthcare for those who do not have health insurance, which is estimated to be around 70 percent of the population (Booth, 2020). Until now the program has helped around 35.000 people (Expat Financial, 2022).

1.2.4. Pesticide

Lastly, a large issue in Bolivia is the excessive use of pesticide on vegetables. The use of pesticide has rapidly increased over the last 20 years, for Bolivia to become competitive on the international vegetable market (Cuenca, 2019). Pesticide is a general name for chemicals used in the process of growing vegetables, to eliminate any pests. This could be insects, as well as illnesses in the plant itself (EPA, 2022). Pesticide, however, generally is toxic and therefore bad for a person's health. Eating these vegetables then, can have a negative effect on health. Frequent symptoms of the pesticide in vegetables are nausea, diarrhoea, irritation of eyes and skin, as well as insomnia (Kauvery Hospital, 2021). Eating organic vegetables, then, would have a beneficial effect on physical health and reduce these symptoms.

1.2.5. Possible solution?

Host organisation Alerta Verde has been providing the chances of eating fresh, organic vegetables to underprivileged families and schools in Cochabamba through what is known as urban agriculture. The foundation does this by building, sowing, and maintaining what is

called a “square foot garden”. These gardens can contain between 16 and 144 fruit and vegetable plants, which should provide enough organic food to significantly reduce the need to purchase and eat vegetables treated with pesticide. This, in turn, should improve physical health by reducing the symptoms mentioned before.

Furthermore, after being involved in the project for 1,5 years, the participants of the program can opt for a rainwater collection system, which can be used for irrigation purposes, as well as cleaning. Reports from families have been positive, as they have been able to wash several items, such as bedsheets, with water collected from the rain by these systems, all whilst reducing the amount of water purchased from water trucks.

Both these programs offered by Alerta Verde to poverty-stricken areas of Cochabamba help improve physical health directly, which then has a positive effect on mental health. In addition, an article by Clatworthy et al (2013) also suggests the act of gardening can have a beneficial effect on mental health, by reducing stress, anxiety, and depression directly.

1.3. Research question

When taking into consideration the beforementioned problems of poor physical health due to poor air quality, poor water quality and the consumption of pesticide, and their influence on mental health, the following research question can be formulated:

To what extent and in what timespan can urban agriculture improve physical health and reduce stress and anxiety, in turn improving the mental health of poverty-stricken families in Cochabamba?

To help effectively answer this research question, sub-questions can be formulated. These sub-questions each specify a causal aspect of the research. Furthermore, these sub-questions help include all relevant information and data into the results, which makes the research more thorough, and reduces possible biases.

1. What effect does eating organic vegetables have on physical health?
2. What impact does physical health have on mental health?
3. Does working in urban agriculture effectively reduce stress and anxiety levels?
4. In what timespan do noticeable changes in physical and mental health occur?

2. Theory

This chapter will include the main topics, theories, and concepts of the conducted research, as well as the analytical framework needed for the research.

2.1. Main topics

The main topics of this research are mental health and physical health, and their relation to urban agriculture. To conduct a suitable and specific research, these aspects have to be defined clearly.

2.2. Urban agriculture

Though there is no real, legal definition for urban agriculture, the general aspects are widely accepted. According to the United States government, urban agriculture is the cultivation, processing, and distribution of agricultural products in urban and suburban areas (USDA, 2018). Though Medici et al. (2021, page 11) define urban agriculture as “small areas (e.g., vacant plots, gardens, verges, balconies, containers) within the city for growing crops and raising small livestock or milk cows for own consumption or sale in neighborhood markets”.

2.3. Physical health

Physical health is a very broad subject containing anything physical of the human body. For this study, it is necessary to specify aspects of physical health relevant to the study and related to the consumption of organic vegetables. In general, organic foods contain higher levels of vitamin C, iron, magnesium and phosphorus, with lower levels of nitrates (Chen, 2005).

- Vitamin C is an acid needed by the body to protect cells and maintain healthy skin, bones and blood vessels (NHS, 2021). Furthermore, poor vitamin C status was linked to higher depression chance in elderly people (Gariballa, 2014). Symptoms of a low vitamin C intake include ease of bruising, dry hair and skin and flu-like symptoms (HealthDirect, NA).
- Iron is a major component of hemoglobin, which is a protein needed to transport oxygen in the red blood cells (The nutrition source, 2020). Symptoms of a low intake include extreme fatigue, pale skin and headaches, among other symptoms (Mayoclinic, 2022).

- Magnesium supports muscle and nerve function, as well as energy production. Though the symptoms of low magnesium levels are usually not noticeable, a dangerously low level can lead to high blood pressure and heart disease (Zeratsky, 2021).
- Phosphorus is needed for growth, maintenance and repair of body cells. Furthermore, it helps manage and stabilise other minerals in the body, including vitamin D. Symptoms of low phosphorus intake include weakness, loss of appetite and anxiety (Mount Sinai, NA).

Another benefit of eating organic vegetables is the reduction of pesticide consumption, as mentioned before. The consumption of pesticide can lead to diarrhoea, insomnia and nausea (Kauvery Hospital, 2021).

For the field study the symptoms mentioned are important, since they could indicate a difference between the regular consumption of organic vegetables and non-organic vegetables.

2.4. Mental health

Mental health, like physical health, involves many aspects and is a very broad subject to investigate. The aim of this research is to investigate the impact of urban agriculture on mental health. In order to effectively do this, the subjects of mental health which are expected to be influenced should be explained.

According to Das *et al.* (2016) poor physical health has a negative effect on mental health, due to possible long-term exposure to disease, side-effects of medication and hormonal influences on mental health. The key aspects affected by physical health, as mentioned in the article, are mild depression and anxiety.

Then there is the effect of the act of gardening on mental health. The physical act of gardening has shown decreased levels of depression and anxiety (Clatworthy et al., 2013).

Symptoms of anxiety include increased heart rate, the sense of impending danger, rapid breathing, sweating, trembling, and feeling restless and tense, among others (Mayoclinic, 2018).

Symptoms of depression include the feeling of sadness, emptiness and hopelessness, angry outbursts, tiredness, loss of interest in normal activities and hobbies, and unexpected physical issues, among others (Mayoclinic, 2022).

Some of these symptoms are difficult to notice, which is why the focus for this paper should be on tiredness, level of energy, interest in normal activities and feeling of sadness for depression.

2.5. Operationalisation

Taking into consideration the causal path of the factors mentioned above, there are two paths to investigate to answer the research question. Both, however, originate from the same activity, which is producing organic vegetables via urban agriculture. A flow diagram of the two paths is included in Figure 5.

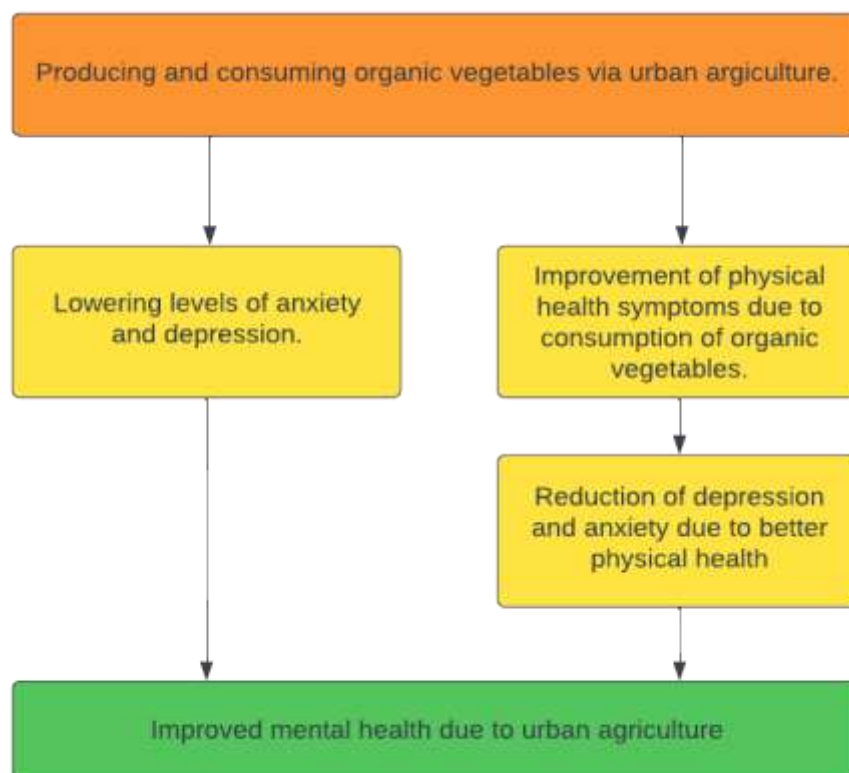


Figure 5: Flow diagram of causes

One of the two paths regards the lowering of levels of anxiety and depression via the production and consumption of organic vegetables. A decrease of these specific aspects of mental health would mean a direct increase in the overall mental health of people involved in urban agriculture.

The other path regards the lowering of depression of anxiety levels as well. However, this path considers the change in these aspects as results of the consumption of organic vegetables having a positive influence on physical health.

In order to measure the relevant data, several key aspects were included in the interview questions. For mental health, the main variables needed for the research were depression and anxiety.

As can be read in Chapter 2, depression has several noticeable symptoms. For depression quality of sleep, stress level and overall happiness were added into the interview questions. These variables were chosen since they are easy to notice symptoms of depression, which occur in most of the cases. Also, these variables are thought to be the easiest to change.

For anxiety scaredness levels and relaxation levels were included in the interview questions. These variables were chosen since they are the most likely to change, and the most noticeable. Furthermore, anxiety differs widely depending on the case, and these variables seem to be the most common.

For physical health, the main variables for the research were level of illness and level of energy.

Level of illness was deemed to be a variable simple and direct enough to include in the interview questions. For this, the family was asked to think back and compare the frequency of illness they experienced in the past to the frequency they experience now.

Energy level was included because it can indicate several variables at once. Firstly, energy levels experienced are an indication of general physical health. Secondly, more energy could indicate a healthier sleep pattern and better sleep quality, which is an indicator of mental health.

With these aspects and variables included in the interview an analysis concerning both paths of the analytical framework can be conducted. This, in turn will provide insight into mental health, physical health, and the potential causal relation between them. This will then answer the research question and its sub-questions.

3. Methodology

In this chapter the methodology of the research will be discussed, including the method of collecting data, and the method of analysing the results.

3.1. Method of collecting data

The data needed to answer the research question was collected via direct questioning of the participants. This was done by interviewing seven participating families in a location comfortable for them, regarding the impact the gardens have had on direct physical health, stress, anxiety, and depression. These families were selected because they were willing to explain their situation and experience. Furthermore, these families have been working with Alerta Verde for different periods of time. Also, the families had to speak the Spanish language adequately, which was needed for successful interviews. The selection of fitting families has been made by combining personal experience and input from engineers Rosalia and Ramiro. The families involved in the interviewing process were in different stages of the Alerta Verde program, with all stages being represented by at least three families. This gave the widespread data needed for analysis and gave an indication if the mental health improved further, when further in the program.

The choice of interviewing has been made since it offers the opportunity to elaborate on certain questions and get more detailed information than a questionnaire.

3.2. Method of analysing data

The conducted interviews aimed to collect qualitative data from participants. The choice of quantitative data has been made due to the complex nature of mental health and well-being. Furthermore, qualitative data collection via interviews gives participants the opportunity to elaborate on the situation and create a more detailed overview of the situation.

The conducted interviews were constructed of an explanation of the research, followed by four questions, with several sub-questions. Also, an opportunity was given towards the end of the interview to give more examples on specific situations or elaborate more on what had been said earlier. The specific questions have been included in Annex 1.

The questions regarded both mental and physical health. Mental health has been broken down into anxiety levels, stress levels, sleep quality, and overall happiness. Physical health has been broken down into frequency of illness and energy levels.

For all these variables it was important to know whether there were noted changes, how large these changes were and in which timespan the changes were noted.

In addition to the interviews conducted with the families, there were interviews conducted with staff. The relevant staff for this study are those who work and have worked with these families for more than five years, which makes it possible to see trends. The staff meeting these requirements totals 2 people, however, only one was interviewed.

The staff interviews were held to receive insight into trends and to get more examples outside the used dataset of families.

All conducted interviews were recorded, transcribed, and translated into English.

The analysis was done by an analytical matrix. In this matrix all answers collected were put side by side to provide a clear overview of trends and popular answers. The matrix used can be seen in Table 1.

	Do you enjoy working in the garden?	What made you get the garden?	Does the garden have a positive influence on physical health?	Does the garden have a positive influence on mental health?	Would you recommend the garden to others? Why?
Family 1	Answer	Answer	Answer	Answer	Answer
Family 2	Answer	Answer	Answer	Answer	Answer
Family 3	Answer	Answer	Answer	Answer	Answer
Family 4	Answer	Answer	Answer	Answer	Answer
Family 5	Answer	Answer	Answer	Answer	Answer
Family 6	Answer	Answer	Answer	Answer	Answer
Family 7	Answer	Answer	Answer	Answer	Answer

Table 1: Analytical matrix

4. Results

In this chapter the results of the research are presented. For each question asked in the interviews a result is given per family. Where possible these answers have been categorised in responses ranging from very positive to negative, to give a more structured overview. Furthermore, for each question a short analysis of trends and patterns is given to further explain the results. The full answers to the interview questions can be found in Annex 7.3.

The order of the families is based on their time working in urban agriculture. For family 1 this period is 6 months, for family 2 this is 1 year, for family 3 this is 1 year, for family 4 this is 1,5 years, for family 5 this is 2 years, for family 6 this is 2,5 years and for family 7 this is 3 years. After the individual analysis of all questions, an analysis of all sub-categories will be given.

4.1. Question 1

The first question of the interview read: “How is the garden? Do you enjoy working in the garden?”

Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7
Very positive	Very positive	Positive	Positive	Very positive	Positive	Positive

This question was chosen to open the interview and quickly get a general impression whether the family gets a sense of fulfilment out of the garden. The results show positive to very positive responses across all families. There does not seem to be an increase in enjoyment with time.

4.2. Question 2

The second question of the interview read: “What made you get the garden initially?”

Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7
Physical health	Economical/ physical health	Passed down	Hobby	Hobby	Physical health	Hobby

This question was included to get an idea as to why families got involved with the urban agriculture project initially. This gives an indication of the intentions with the garden and gives more interesting insights when combined with the results of question 3 and 4.

Overall, the families gave three strong reasons as to why the garden was installed, with one outlier, family 3. For family 3 it was not possible to fully determine the reasons behind initial installation of the garden, since the person involved at the time was not available for questioning.

The reasons for installation mentioned by the other families were economical (mentioned once), physical health (mentioned three times) and hobby (mentioned three times).

4.3. Question 3

Question 3 of the interview was divided into four sub-questions. These will all be analysed separately.

4.3.1. Illness

The first sub-question read: “Do you experience less illness in the family since the garden?”

Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7
Very positive	Very positive	Very positive	Indifferent	Indifferent	Positive	Positive

This question was included since illness, especially regarding stomach and the digestive system, can indicate an over-consumption of pesticide, as well as consumption of dirty vegetables.

The overall results of this question ranged from very positive to indifferent. Families stating indifference in illness did mention not to be prone to illness, which is why they did not feel a change.

The results also show there is no noticeable negative effect to growing and eating the vegetables produced in urban agriculture. There seems to be no decrease in illness over time.

4.3.2. Energy level

The second sub-question read: “Do you have more energy since installation of the garden?”

Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7
Positive	Positive	Very positive	Positive	Positive	Positive	Very positive

This question was included since energy levels can be an indication of magnesium intake, general physical health, and sleep quality, even when families might not notice direct changes in this.

Generally the results are positive, with some families reporting very positive changes in their energy levels. However, there seems to be no increase in energy levels over time.

4.3.3. General feeling

The last sub-question read: “are you generally feeling better because of the garden?”

Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7
Positive	Very positive	Positive	Indifferent	Positive	Positive	Positive

This question was added because it gives an indication of both physical and mental health in the family.

The general results are positive, with family 2 stating to experience very positive changes and family 4 not feeling a difference. There does not seem to be an increase in general feeling over time.

4.4. Question 4

Like question 3, question 4 was divided into 5 sub-questions. These sub-questions will be analysed separately.

4.4.1. Stress level

The first sub-question of question 4 read: “Are you less stressed after installation of the garden?”

Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7
Very positive	Positive	Positive	Neutral	Positive	Positive	Very positive

This question was included because stress levels directly relate to mental health. Lower stress levels due to urban agriculture would mean improved mental health due to urban agriculture. The overall results of the questions are positive, with family 1 and 7 reporting very positive results, and family 4 reporting neutral results. Family 4 did experience a decrease of stress levels initially, but since there are several families relying on produce from the garden, there were added stress levels due to that.

Though there seem to be no changes in stress levels over time, the reports do show that the lower stress levels seem to sustain in families working in urban agriculture for longer. These families experience less stress in general, whereas newer families only experience this during, or directly after working in the garden.

4.4.2. Anxiety

The second sub-question of question 4 read: “Do you generally feel less scared and less anxiety since the garden?”

Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7
Indifferent	Indifferent	Indifferent	Indifferent	Positive	Indifferent	Indifferent

This question was added since anxiety and scaredness are indicators of depression. A reduction of this factors then, would improve overall mental health and lower chances of depression.

The results of this question were generally indifferent, apart from family 5. Family 5 mentioned to be less scared about the whereabouts of the children, since they would be working in the garden too. Though this is a change in scaredness levels, it does not influence anxiety.

Since there generally were no noted changes, there are not differences in anxiety levels over time.

4.4.3. Happiness

The third sub-question of question 4 read: “Do you generally feel happier since installation of the garden?”

Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7
Positive	Neutral	Positive	Positive	Positive	Positive	Very positive

This question was included since more happiness is a result of good mental health. If these levels were to change, it could be a sign of a generally better mental health.

The results of this question were positive overall, with family 2 stating no changes and family 7 stating very positive changes.

These results do show an increase in happiness levels over time, with older families stating more positive change.

4.4.4. Sleep quality

The fourth sub-question of question 4 read: “Do you sleep better since the installation of the garden?”

Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7
Indifferent	Positive	Indifferent	Indifferent	Indifferent	Positive	Indifferent

This question was included since good sleep quality is a direct indication of mental health. As mentioned in Chapter 2, people with poor mental health or depression experience restlessness, which strongly influences their sleep quality.

The results of this question are indifferent, with family 2 and family 6 reporting positive change in sleep quality. Furthermore, family 5 mentioned the sleeping pattern generally gets disturbed due to the children living in the household, which makes it difficult to notice any changes due to the garden.

Since the general results were indifferent, there are no changes in sleep quality over time.

4.4.5. Relaxation

The fifth and final sub-question of question 4 read: “Do you generally feel more relaxed?”

Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7
Positive	Positive	Positive	Very positive	Positive	Positive	Very positive

This question was included since people suffering from poor mental health generally feel tense and twitchy. A sense of relaxation then, would indicate better mental health.

The general results for this question were positive, with family 4 and family 7 reporting very positive changes in their relaxation levels. There does not, however, seem to be a difference in relaxation over time.

4.5. Time span

For both question 3 and question 4, the families were asked in what time span the noticed changes occurred. This was done to get an indication of how long the changes due to urban agriculture take, and to see if the time span is related to any other activities.

Families	Changes Q3	Changes Q4	Initial goal
Family 1	Quickly after installation	After first plants grew	Physical health
Family 2	After first consumption	After first consumption	Economic/physical health
Family 3	No recollection	Directly from the start	Passed down
Family 4	No change noticed	Directly from the start	Hobby
Family 5	After first consumption	After first consumption	Hobby
Family 6	After first consumption	After first consumption	Physical health
Family 7	From early on. Not clear	From early on. Not clear	Hobby

The results of this question were interesting, since all families noticed the changes after a different period. However, some trends became apparent, which is why the initial goal of the families has been included in the table.

The trend noticeable from this table is that families who initially wanted a garden for their physical health, noticed strong changes after consumption of the vegetables, whereas the families who initially wanted a garden for enjoyment, or as a hobby, noticed changes much earlier in the project.

4.6. Family recommendation

Towards the end of the interview, in the last question, families were asked if they would recommend urban agriculture to other families, and if so, for what reason.

Families	Would you recommend?	Why?
Family 1	Yes	It is a fun hobby, it helps people and you learn interesting things
Family 2	Yes	It is fun and it has economic benefits
Family 3	Yes	It is fun, it has economic benefits and makes you eat more vegetables
Family 4	Depends on the family	I would recommend it, but only for families interested in gardening and agriculture. You get help, but it is your garden, so you have to take care of it
Family 5	Yes	It is fun, a nice family activity and makes you eat more vegetables
Family 6	Yes	It is good for your health and fun
Family 7	Yes	The work is fun, there are economic benefits, the vegetables are organic and better for you than from the market

The results of this question show that all families would recommend urban agriculture to others, with family 4 adding a condition into the answer. Furthermore, these results show what aspects of urban agriculture and the work that goes with it, are seen as beneficial and enjoyable by the different families.

4.7. Summary of results

To give a clear overview of the positive and negative changes in the relevant variables, a summary is shown below.

Relevant variables for this research are physical health and mental health, which are divided into three and five indicators respectively.

Column1	Family 1	Family 2	Family 3	Family 4	Family 5	Family 6	Family 7
Physical health							
Illness	++	++	++	+-	+-	+	+
Energy level	+	+	++	+	+	+	++
Feeling better	+	++	+	+-	+	+	+
Mental health							
Stress level	++	+	+	+-	+	+	+
Anxiety level	+-	+-	+-	+-	+	+-	+-
Happiness	+	+-	+	+	+	+	++
Sleep quality	+-	+	+-	+-	+-	+	+-
Relaxation level	+	+	+	++	+	+	++

Clearly visible in this table are the generally positive results to most questions, with only anxiety levels and sleep quality resulting in indifferent results. Furthermore, it becomes apparent that there are no noticed negative changes due to urban agriculture in this group of families.

Overall, the results do not seem to differ between newer and older families.

4.8. Observations by staff

To get a better overview of the trends within the urban agriculture project initiated by Alerta Verde, an interview with staff member Rosalia was conducted. Rosalia has been a staff member for Alerta Verde for over ten years and her daily tasks contain visiting the families and assisting them in the installation and maintenance of the gardens. The specific questions and answers of this interview can be seen in Annex 7.4.

Results from this interview are more generalised, and regard all 150+ families working with Alerta Verde in urban agriculture.

According to Rosalia, families generally seem happy to be working in the garden. Furthermore, they always seem interested in learning more about plants or garden maintenance. It is, however, difficult to tell according to Rosalia, since the visits are only done between once every two weeks, and once a month, depending on the family.

The mental health of the families in general is regarded difficult to observe, even though this information is also important to Alerta Verde. There is, however, a group of families with children with disabilities working with Alerta Verde. These families use the gardens as a form of therapy, rather than for the yield of the garden. According to Rosalia the feedback coming from these families is very positive.

Rosalia also stated that there is a large group of families working with Alerta Verde in which family members use the garden as a method to reduce stress after a day of working. This is believed to improve the domestic atmosphere and the overall quality of living in the households.

This combined with the general feedback coming from the families, which is mostly positive regarding mental health influences of the garden, means the mental health of families generally improves after starting the project with Alerta Verde, according to Rosalia.

5. Conclusion and discussion

In this chapter the research question and sub-questions are answered and discussed. In addition, the limitations of this research are presented and explained.

5.1. Conclusion

The main purpose of this field study was to find out to what extent and in what timespan urban agriculture can improve physical health and stress and anxiety, in turn improving mental health of participating families. For this, four sub-questions were formulated to structure the research. These sub-questions regarded the effect of organic vegetables on physical health, the impact of physical health on mental health, the impact of urban agriculture on stress and anxiety, and the timespan in which any changes occur.

Eating organic vegetables is considered to have a positive effect on physical health. Not only is this predicted in theory, but out of the seven interviewed families, five families have mentioned positive changes in their physical health since eating the organic vegetables produced in their gardens, confirming the prediction. Furthermore, both families who did not notice significant change in physical health due to eating organic vegetables, did mention changes in mental health.

Even though in theory mental health and physical health are strongly related, as can be read in Chapter 2, the results from the interviews do not include hard evidence that this is the case. From seven interviewed families, four families mentioned the changes in mental health to occur at the same time, or later than physical health changes.

Though there is little theoretical literature supporting the influence of gardening on stress and anxiety, the results of the interviews do show that there is a positive change in stress and anxiety levels. This change is mostly in the levels of stress, with work in the garden lowering stress levels and helping with relaxation. However, anxiety levels have not increased in any of the interviewed families, and those noticing change mentioned this change to be positive.

Changes in mental health occurred in different time spans for all families. However, it is noticeable that families who initially wanted a garden to improve their physical health by eating organic vegetables, generally noticed changes after harvest and consumption of the first batch of vegetables from the garden, whereas the families initially wanting the garden as a hobby noticed changes earlier in the project, sometimes even right from the start.

This does mean, however, that generally families notice the first mental health benefits after achieving the goal which initiated their participation in the project. This seems to be consistent in all families except one.

With the sub-questions answered, it is safe to conclude that urban agriculture in “la zona sud” in Cochabamba, Bolivia, has a positive effect on physical health and mental health levels, in turn improving the mental health of participating families. However, it is not safe to conclude that anxiety levels decrease, since this has not been shown by the results of the interviews.

5.2. Discussion

The results of this study are mainly applicable to Bolivian families, specifically in Cochabamba. This is not only because the study was conducted here, but also because of the specific circumstances under which the urban agriculture of this study is done. In other countries, working in a garden might be more stressful due to different climates in which it is harder to grow vegetables, or the installation of the gardens might be more expensive. This introduces more stressful factors into the study, which might not be overcome by the benefits mentioned in Chapter 4.

However, the results can be interesting for countries all over the world, since it shows the influence of gardens on mental and physical health of families. Even though the gardens might differ around the globe, the work in the gardens will generally be relatively equal. This means results to that respect could be similar in other countries and climates.

Social Development Goal 3, as set by the United Nations, aims to improve both mental and physical health worldwide. In this paper, the focus is on the improvement of mental health and physical health through urban agriculture. The results show an increase in mental and

physical health in all families partaking in the research. This would mean that urban agriculture provides a positive change in SDG3. However, this does not mean that urban agriculture is the sole solution to the problems that need addressing. As mentioned, most families partaking in the urban agriculture projects in la zona sud are already interested in plants and gardening, which could mean their mental health improves more through gardening than others. So, urban agriculture does have a positive effect on SDG3, but it will not nearly be enough to achieve the goals set globally. For this, different and more impactful means will be needed.

The analytical model mentioned in Chapter 2.5 shows two potential paths to improving mental health through urban agriculture. One path shows the improvement of mental health via relaxation due to working in the garden, while the other path shows improvement of mental health because of the improvement of physical health, because of eating organic vegetables.

Both these paths have been mentioned in the interviews by the involved families, however, after the interviews another path was noticed. This would be the path of economic benefits providing less stress and more relaxation.

However, with the results and conclusions, there are some other factors to take into consideration.

Firstly, it is very difficult to say whether the changes in mental health were in any way influenced by changes in physical health, since there are many other influences on mental health regarding the gardens. Furthermore, only slightly more than half the families interviewed mentioned changes in mental health to be at the same time or after the changes in physical health. This leads to believe that if the physical health benefits would have an influence on mental health, this would only occur in half the cases. In addition, since there has not been an initial measurement in the past, the families could have mixed up time periods, as, in some cases, the changes would have occurred over two years ago.

With all this taken into consideration, the influence of physical health on mental health cannot be seen as a concrete result of the study.

Secondly, though the results show a positive change in both stress levels and relaxation, it is not to say that this change would be the same for all families. Families involved in the urban agriculture projects in “la zona sud” have initiated this themselves. This means the families had interest in urban agriculture and gardening from the beginning of the project, and it is generally seen as a hobby. This could mean these families experience more benefits in terms of stress reduction and relaxation than less interested families.

5.3. Limitations

While this research was conducted, some issues and limitations occurred, which should be mentioned.

The first limitation to be considered in this research is the fact that there have not been any prior observations to ensure a base line, or base level of the aspects researched. This means the results are fully based on a family’s ability to recall past mental health, physical health and situations. This could mean the data collected is not fully accurate, due to recall bias. Furthermore, the starting level of mental and physical health will have differed between families, which gives different starting points. These factors also made it very difficult to accurately determine the periods in which changes occurred, or any difference between families who have been working in urban agriculture for different periods of time. For these aspects to be more accurate and usable, above mentioned limitations have to be addressed.

Secondly, even though efforts were made to involve families with different backgrounds, all families involved and interviewed have initially approached Fundación Alerta Verde, which means there is an interest in gardening and urban agriculture from the family itself.

Though not necessarily the case, one could argue that a person interested in gardening would benefit more from working in a garden than those who have less interest in the matter.

Lastly, the families were interviewed in the presence of Rosalia, who is a full-time employee of the foundation. Initially, this was not the plan, but since there were challenges due to language barriers, which meant some families had difficulty understanding the questions, it was decided that it would be better if she was present.

This, however, could mean families were afraid to speak negatively about the foundation, meaning the results could be altered slightly to sound more positive about the foundation's work. This was made very clear in the eighth and final interview held, which later turned out to involve a person employed by the foundation. This interview was deemed to be biased and was therefore not used in the final results.

5.4. Recommendations

The overall performance of Alerta Verde is positive. However, the foundation does have aspects which could be improved.

Firstly, several times a day, families would not be present in their homes when employees would come to visit. This costs time and fuel, both of which can be used more efficiently elsewhere. Furthermore, some visits seem to be overly lengthy, with the employees of the foundation doing work the families should have done themselves.

Secondly, the projects by Alerta Verde seem to be poorly documented. There are photos and explanations of the work, which are also used for promotional work, but there are very little documented stories by participating families or schools, which would be very helpful. In addition, the marketing seems to be aimed very specifically at funding, rather than the inclusion of more families in the project. Of course, the funding is very important, but the growth of the foundation also means more families have to be included.

So, with the experience from three months of working with the foundation, it would be recommended to invest into the documentation of the project, for example positive stories from families involved, which can be used for both funding and inclusion of new families. Also, it would be recommended to market the gardens more specifically in the areas in which Alerta Verde is present, for example in shops or markets.

Furthermore, it is recommended that the planning of the work with families is improved, to reduce unsuccessful visits. This could be done by introducing a set day in the month or week on which the visit will be scheduled, or by calling the family in advance, so there is no need to drive to the house, when nobody is present.

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Annex

Interview questions for families

Questions for families:

1. Explanation: For my university I have to investigate the effect of gardens on health. I would like to ask some questions and I would like you to answer truthfully. I do not work of the foundation, so there will be no change in the relationship you have with the foundation. Everything you say is confidential and will be anonymous in the paper I will write. The paper will not be shared outside my university and Alerta Verde. Is that okay?
2. How is the garden doing? Do you enjoy working in it? What do you like and dislike?
3. What made you get the garden? Was it health benefits? Or other reasons?
4. Has the garden had an influence on your physical health?
 - a. Have you experienced less sickness?
 - b. Do you have more energy now?
 - c. Do you generally feel better?
 - d. Do you have any examples of the changes?
 - e. After how much time did you notice the changes?
5. Has the garden had an influence on your mental health?
 - a. Do you feel less stressed?
 - b. Do you feel less scared?
 - c. Do you feel happier?
 - d. Are you sleeping better?
 - e. Do you feel more relaxed?
 - f. Do you feel like you are more interested in your hobbies?
 - g. Do you have any examples of these changes?
 - h. After how long did you notice differences?
6. Would you recommend the garden to other families? Why?
7. Would you like to share anything else regarding the gardens or the subjects we have talked about?

Interview questions for staff

Questions to ask staff:

1. How often do you visit a family?
 - a. Does it differ between families?
 - b. On what do you base the visiting frequency?
 - c. Do you visit a family more often if signs of depression or anxiety are present?
2. Do you feel your visits have a positive effect on the overall happiness of the participant? If so can you give examples?
3. Overall, can you see a positive change in the physical and mental health of participants since they are involved in the garden project?
 - a. Do you have examples?
 - b. Why do you think this change is?
 - c. In what aspects do you notice the change? Examples?
4. You mentioned families who use the garden as therapy? How many families do this? And why do they use the gardens in this way?
 - a. Do you see a reduction of stress in these families?
 - b. In your eyes, are these families doing better since the garden? In terms of productivity, involvement, depression etc.?
5. For the other families, do you feel like the physical health has improved?
 - a. Do you notice a reduction in sickness?
 - b. Do participants get more open, easier to talk to and less stressed?
 - c. Do you have examples of this?
6. Does the length of the project have an influence on health benefits?
 - a. Do families you are involved with longer have less sickness?
 - b. Do stress levels go down more the longer the project lasts?
 - c. Do you feel like the families get happier the longer they are involved?
 - d. Do you have examples of these situations?
7. What aspects of working in the garden do you think have the most influence on mental health, for example depression? Why?
 - a. Eating the organic vegetables?
 - b. The physical act of working in the garden?
 - c. Examples?
8. Is there anything else worth noting? Any patterns, examples or situations?