IMPROVING DIET AND PHYSICAL ACTIVITY THROUGH URBAN AGRICULTURE:

A PILOT STUDY IN CARACAS, VENEZUELA.

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1. Background

As urbanisation has increased; so too, a dietary transformation has taken place (1). With a massive increase in processed food consumption and the rates of obesity well documented, finding new ways to improve nutritional intake and diversity is essential (2). One option is the introduction of urban agriculture: a method of utilising available space within the urban environment to efficiently produce no-waste fruit and vegetables (3). Systems of urban agriculture have only recently come to the forefront in high-income settings such as the United States and Australia, yet they have been operating in Cuba for over twenty years (3). Indeed, they are now a major provider of produce to the Cuban population, as well as being a major employer (4).

Though there is conflicting evidence as to the full interaction between obesity and fruit and vegetables, urban agriculture offers possible improvements in most markers associated with non-communicable diseases (NCDs) through increased dietary diversity (1, 5, 6). Dietary diversity has been linked with improved general health such as reduced blood pressure, risk of cardiovascular disease, cancers, diabetes and even depression (5, 7). Many of the vegetables cultivated are rich sources of vital micronutrients such as iron and vitamin A and one would, therefore, hope to see a reduction in micronutrient deficiencies (including anaemia and vitamin A-linked vision impairment) by improving access to them (5, 6, 8). Furthermore, the creation of gardens within the urban environment provides the opportunity for increased physical activity among the agricultural workers. At the very least, urban agriculture provides interesting possibilities as an environmentally friendly, sustainable and secure food source.

2. Current situation

In Cuba, a system of urban agriculture has arisen — partly as a result of necessity in response to a tense political situation — and now provides the urban population with fresh produce at heavily state-subsidised prices (9). These gardens were constructed in previously derelict industrial sites — which, in the Cuban context, were particularly abundant. Due to the limited space of these gardens, they have become increasingly efficient and now produce significantly higher yields than traditional rural agriculture (4). It is estimated that urban agriculture in Havana provides enough fruit and vegetables to supply each citizen of Havana with a 290g serving per day (4).

The successes of the Cuban health system are well documented and, in particular, preventative primary health care in the country is hailed as a model example to be exported (10). The Cuban population display lower BMIs, cholesterol levels and blood pressure — all recognised as risk factors for health — than many of their neighbours and it is possible that easy access to fresh produce has something to do with this (11). Additionally, the *organopónicos*, as they are known, also provide employment for an estimated 44,000 people throughout Cuba and reduce 'food miles' emissions (4).

Relatively nearby, the Venezuelan government has outlined its interest and commitment to urban agriculture following similar lines to the Cuban system of *organopónicos* (12). Indeed, Venezuela can boast a proximity and similarity to Cuba in politics, climate and diet that would make the export of the *organopónico* model potentially smoother than elsewhere.

In other countries also, urban agriculture is being implemented as a means to improve food security (2, 3). These other projects have been shown to improve nutritional health measures — particular those focused on under nutrition (13-15). However, there is a research gap when focusing on the potential benefits urban agriculture offers for combatting NCDs through an increase in dietary diversity, micronutrients, and physical activity (1, 16).

3. Problem statement

Given the fact that the increasing NCD epidemic is partly a result of poor access to high quality fresh produce; the feasibility and effect of urban agriculture projects on dietary diversity and physical activity should be investigated further.

4. Research questions

Do NCD rates, and their associated risk factors, decrease with the introduction of urban agriculture projects? This can be broken down into the following sub-questions:

a. Does dietary diversity increase in the intervention group?

b. Is there a reduction in obesity levels in the intervention group?

c. Is there a reduction in rates of iron-deficiency anaemia in the intervention group?

d. Is there an increase in physical activity in the intervention group?

5. SUGGESTED STUDY

We will design and implement a pilot urban agriculture project, loosely following the Cuban model, in Caracas, Venezuela over the course of five years. Caracas provides a suitable setting for this type of project as it shares a relatively similar climate, diet, population size and proximity, yet posses a higher BMI and obesity rate, despite have more resources at its disposal (11).

An intervention cohort from the surrounding community will be compared to a control group of similar socioeconomic and health markers. Given the obvious advantage of access to potential participants, it is suggested that primary health care facilities be used as a possible recruitment centre. In order to establish a statistically significant analysis, a cohort of at least 370 participants are required to provide a confidence level of 95% with a 5% margin of error for a localised population of 10,000 (17). This will need to be compared to a control group of the same size in order to draw any inferences that can be extrapolated. A different primary health care facility will act as a recruitment centre for this sample.

Land acquisition is an issue that is potentially problematic, due to the bureaucracy of urban planning. However, the stated Venezuelan interest in urban agriculture would suggest an environment potentially sympathetic to the project (12). Additionally, there have been cases of similar projects that have leased vacant land to cultivate, which is another potential option (18). Considering the current economic difficulties in Venezuela, it is likely that there will be land available, plus a need for jobs and cheap produce — factors this project hopes to utilise to the advantage of the local population.

The raw materials required do not constitute a significant outgoing cost, though sufficient water to irrigate the crops might do (3). It is hoped that an agreement might be reached between the project and the municipality's water supply given the government's interest in urban agriculture.

The labour force for the project will come from the community surrounding the vegetable garden and will be included in the surveys and assessments as it is hoped that the manual work required in the garden will increase the relative amount of physical activity for participants. While we hope to enlist the help of volunteers from the local community, there is a requirement for a core group of paid agriculture

workers taking care of overall management of crop cultivation, who's salaries are included in the project's finance allocation. These individuals will need to have strong experience of agriculture in a similar climate and enlisting the help of experts in Venezuelan crop growing is essential, as is integrating advice from those working on the Cuban *organopónicos*.

After the first year, it is hoped that the project will be producing enough crops to start to sell to the local community on a small scale, and that productivity will increase until year three, when the project will undergo its first evaluation from a productivity and operative standpoint. The results of this evaluation will aim to improve the operational aspects of the garden and provide a feedback loop with which improved access, efficiency and management can be facilitated.

Baseline health data will be collected using the WHO STEPS instrument at all three steps (questionnaire, anthropomorphic measurement and biochemical measurements) to measure the risk factors of both cohorts before the commencement of the project and then annually from then until the project's completion. This instrument will enable analysis to be carried out for all four research sub-questions and, in line with the WHO guidelines, the instrument may be added to for context-specific questions. In particular, dietary-diversity questions, as well as ensuring the haemoglobin is measured in at the third stage.

6. EXPECTED RESULTS

From the data provided (at least 3,700 measurement points when accounting for annual measurements of both cohorts), all four hypotheses can be tested from the intervention against control group.

One predicts that as the availability of cheap, fresh produce increases, so too will the dietary diversity within the local community as measured by the dietary questionnaires. With this, it is hoped that prevalence of obesity will decrease through the health measurements taken and that cases of anaemia will decrease as haemoglobin levels increase with the intake of iron-rich vegetables. The amount of physical activity will also be measured to see if it has increased. If local community members are involved in the cultivation of that land, this should increase the rate of physical activity and it is possible that a reduction in lethargy could result from a healthier diet/reduction in weight.

7. Implications for policy and practice

If significant progress is made on all four sub-questions, a model for larger scale urban agriculture projects can be created and implemented at a city-governance level as a public health intervention. However, success is not reliant on all four sub-questions showing positive results. Indeed, positive results for any single sub-question will be enough to provide a strong footing for further projects as all four health aspects are important in the battle against NCDs.

In the event of all four research questions showing negative results, the project will still provide valuable information for the public health arena as all results will be combined with a comprehensive final evaluation. This evaluation, we hope, will uncover unforeseen aspects of the project, such as the effect it has had on the local community and its ability to self-sustain. Indeed, the final cost-assessment will need to provide information on productivity as well as which crops flourished in the specific climatic environment.

Finally, this pilot study will provide interesting and essential data on many aspects of the NCD epidemic. Not only, will it act as a large cohort study of NCD risk factors, it will provide genuine insight into the resources, management and feasibility of urban agriculture in their non-traditional settings. If, as we are sure it will, the project proves to be a success, we hope to be able to create a framework that can be incorporated in to policy for settings in which the risk factors of NCDs and the very basic requirements of urban agriculture exist.

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