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Challenges in Real-life Diabetes Translation Research: Early Lessons from BRiDGES Projects

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Degree to be awarded: MSPH

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2003

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Abstract

Challenges in Real-life Diabetes Translation Research: Early Lessons from BRiDGES Projects

By Isabel García de Quevedo Landa

Efficacious interventions for prevention of diabetes and its complications exist; however, their implementation is woefully inadequate. Translational research, a means to bridge the gap between knowledge and its implementation, has received increasing recognition recently. BRiDGES, an International Diabetes Federation program, incentivizes researchers globally to conduct translational research. As part of its first round of funding, BRiDGES supported 11 projects in 10 countries. The purpose of this project is to qualitatively assess the early lessons learnt from implementing translational research.

We conducted semi-structured in-depth interviews with 10 researchers, seeking their views on factors relating to success and barriers to implementation. Data were collected from June-September 2010 by a trained interviewer; information was recorded, transcribed and analyzed according to predefined themes and concepts using MAXQDA software.

Patient recruitment and retention were reported as challenges, a factor which directly impacted the quality of the project outcomes. The lack of availability of local multidisciplinary teams was highlighted as having a negative effect on the project. Grassroots and community participation were emphasized to have beneficial effects by several researchers. Flexibility was recognized as a challenge for the successful execution of the projects. A key recommendation for the next round of grants would be to include feedback from previous grantees, in the form of pre-submission workshops, as well as mentoring from experienced investigators along with emphasizing the differences between traditional and translational research.

This evaluation underscores the main contingencies to be considered for successful implementation of translational research projects. Furthermore, it emphasizes the importance of having the three stakeholders: patients, providers, and health systems, acting together in a flexible environment within real life settings.

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1. BACKGROUND

Translational research is an area that has had increasing recognition in the past years and plays a central role bridging the gap between traditional knowledge and practical implementation strategies in the clinical and public health settings[1-4]. The value of generating new knowledge and disseminating it at a large scale is a concept widely spread in public health practice, but there are always limitations to the success of the diffusion of the information.

Diabetes affects more than 6.6 percent of the world's population (285 million people) and in 2004, an estimated of 3.4 million people died from the consequences of having high blood glucose[5, 6]. Additionally, the global prevalence of diabetes is estimated to rise to 366 million in 2030[7]. The global healthcare costs for the disease and its co-morbidities are estimated to rise up to 376 billion US dollars in 2010 and exceed some 490 billion by 2030, making it a huge financial and public health burden for governments worldwide and a particularly challenging disease for low and middle income countries and minority groups[5, 8]. It is relevant to point out that almost 80 percent of diabetes cases could have been prevented by only avoiding overweight and obesity[9].

When it comes to chronic diseases, especially the case of diabetes, there has been an increasing number of evidence-based research, however the effect seen in reaching the populations that need the intervention is small, without an observed impact in clinical

practice, institutional decision-making and policy implementation[10]. Large scale studies like the Diabetes Prevention Program (DPP) in the U.S. [11, 12] and the Da Qing Diabetes Prevention Study in China[13] show how, in subjects that are at high risk of diabetes, either by impaired fasting glucose (IFG) or impaired glucose tolerance (IGT), diabetes can be slowed down and even prevented by simply changing lifestyle behaviors such as controlling blood pressure and glycemia, nutrition education and weight control, increase of physical activity and, in some studies, medication. All of this research has advanced tremendously in the past decade with a large amount of interventions showing how the disease and its complications could be prevented [11, 14-18]. Each of these prevention trials has showed what the problem is as well as what needs to be done in a clinical setting to efficiently prevent diabetes; however there remains a huge gap between knowledge and action.

Based on this, and in order link action to scientific findings, we must understand what the differences are between traditional clinical research and translational research. Firstly, translational research seeks to solve a particular problem using previous proven research, instead of just describing it; secondly, it must be cost-effective, meaning it should prove that it works, but also know how to best deliver the program while reducing the costs, thirdly it should be able to be scaled up and maintained as a sustainable long-term intervention; and lastly, it has to be accessible and reach everyone who needs it [2, 19]. Altogether, it is not easy to link the stakeholders: the patient, the providers and the system; and consequently, a multilevel approach is needed [1-4, 10, 19, 20]. The challenge today is to bridge this gap and be able to deliver this knowledge into a real life setting. Given the rising

burden that diabetes has on both industrialized and industrializing nations, it has never been a more important time to begin understanding what will actually work in a day-to-day setting and begin the adoption and dissemination of these findings.

This thesis seeks to identify the barriers and lessons learnt from BRiDGES[1] first round of grants in order to improve efficiency in the implementation of further translational research projects.

1.1 Objective

The present study seeks to discuss and analyze the experiences that 10 investigators had while implementing a translation research study supported by BRiDGES by identifying barriers, issues, opportunities and strengths encountered in the delivery of each of the 10 projects.

1.2 Aims

1. Identify the experiences and lessons learned from the financial and logistic point of view.
2. Evaluate the acceptability and implementation of these projects in different settings of a community.

[1] BRiDGES: Bringing Research in Diabetes to Global Environments and Systems is a program initiated by the International Diabetes Federation which supports translational research projects in diabetes around the world.

3. Determine the constraints in terms of time, space, training and staff and what could be done to improve the unforeseen events in this type of studies.
4. Analyze the political and cultural barriers with regards to the developed and developing countries.
5. Describe the communication process between the research staff and BRiDGES in order to learn what could be improved.
6. Use the qualitative information gathered by this study as a framework to facilitate the development and implementation of future projects in Translation Research funded by BRiDGES.

1.3 Study Context

BRiDGES is a program initiated by the International Diabetes Federation and supported by an educational grant from Lilly Diabetes[21]. This is a competitive program which incentivizes researchers around the world to promote sustainable and cost effective programs in diabetes and provides the opportunity to translate the clinical evidence into practice. BRiDGES seeks requests for proposals (RFP) in order to support sustainable interventions that can help the prevention and control of diabetes around the world. Starting in 2008, BRiDGES awarded the first round of funding in translational research for eleven short and long term projects. The short-term projects can last for a maximum of 2 years and long-term projects are defined to have a maximum of 3 years. Table 1 and 2 show

the characteristics of the short- and long-term projects respectively. Since its inception, two more rounds of projects have been supported.

Maximum amount allocated per project

Short term projects: up to USD 65,000

Long term projects: up to USD 400,000

1.3.1 BRiDGES eligibility to select a RFP

The relevant topics that BRiDGES is seeking to fund include (but are not limited to):

- Methods to improve health care delivery for patients with or at risk of diabetes
- Strategies to enhance diabetes self management
- Methods to develop strategies to promote healthy lifestyles to reduce the risk of diabetes
- New cost effective ways to identify people with pre-diabetes and treat diabetes

BRiDGES encourages proposals that focus on high risk and underserved populations disproportionately affected by diabetes.

According to BRiDGES guidelines for their RFPs, the projects should have the following criteria in order to be considered:

- Goals/hypothesis/procedure
- Research value/ significance of the project

- Investigator qualifications and demonstration of competence for conducting work in the area
- Suitable and operational facilities
- Participants welfare/ ethical approval and practice/potential benefits for the participants
- Budget appropriateness and justification
- Regional/cultural appropriateness, local support

Table 1: Description of short-term projects funded by BRiDGES first round of grants

	Location of the project	Title	Objectives	Sustainability plan
Short-term projects	Philippines	Effectiveness of a Community-Based Self-management education (DSME) Program: A pilot study in San Juan Bartangas, Philippines	To assess the effectiveness of a community-based Diabetes Self-Management Education program in improving physiologic measures (HbA1c, lipid profile, blood pressure, BMI) and health behaviors (regular exercise, smoking cessation, foot examination, and self-efficacy) among diabetic patients with metabolic syndrome	This pilot study is part of a long-term, self-sustaining diabetes program which aims at reducing the burden of diabetes by improving physiologic and behavioral parameters. It aspires to be a "model of community diabetes care" throughout the country, ultimately attenuating disparities in health outcomes for underserved Filipinos in the rural community.
	USA	Feasibility of developing a training program for peer leaders in diabetes	To develop a theoretically driven program for training peer educators to lead empowerment-based interventions that, when led by health care professionals, have been associated with improved diabetes-related health and psychosocial outcomes	The goal is to provide a new generation of self-management support designed to be ongoing, patient-driven, and flexible to the dynamic and evolving conditions of patients "real world" environment and life circumstances. If successful, this intervention could be easily adapted for use in other at-risk populations
	USA	Tailored intervention for inpatients: transitional diabetes care coordinator versus conventional care.	To improve access to the outpatient diabetes clinic and actively facilitate continuity in care between the inpatient and outpatient settings.	UMDNJ will seek additional funding upon completion of this Pilot Program to fund the Diabetes Care Coordinator as a permanent position and to increase the number of patients followed by the DCC.
	Vietnam	Program for detection and prevention of diabetes in people at high risk in a medium size city in Vietnam	The project aims to evaluate measures motivating people at risk to do screening tests for the detection of high risk for pre-diabetes and diabetes, and to evaluate lifestyle intervention in people at high risk in the community of a medium size city in Vietnam.	If successful, the project could be replicated in urban areas in all over the country.
	USA	Motivational Interviewing to maximize utilization and effectiveness of self management education for adults with type 2 diabetes	The project will examine if adding a motivational interviewing (MI) component to Diabetes Self Management Education will improve program completion rates and help people with diabetes better manage their diabetes for a sustained period of time.	If MI is proven to be an effective tool, MI will be incorporated into DSME programs and will result in improved quality of care for persons with diabetes.

Table 2: Description of long-term projects funded by BRiDGES first round of grants

	Location of the project	Title	Objectives	Sustainability plan
Long-term projects	Sri Lanka	Evaluation of Risk Factors in the development of Type 2 Diabetes and Cardiovascular disease in a Young Urban Population in Sri Lanka.	This study consists of 25,000 10 - 40 year old persons randomly selected from an urban population where 5000 persons with two or more risk factors will be identified by a simple questionnaire. They will receive biochemical and physical assessments and divided into a low intensity and high intensity life style modification and followed up for 3 years	Develop a low cost Primary Prevention tool that could be effectively used in the South East Asian region where the illness is high in prevalence with restricted finances.
	India	A Translation Randomized Trial of a Culturally Specific Lifestyle Intervention for Diabetes Prevention in India	This project describes a randomized trial of culturally specific, community-based lifestyle intervention for the prevention of type 2 diabetes in men and women living in Chennai, India. Lifestyle interventions are programmed to seek to prevent diseases by promoting changes in health behaviors, improved diet, increased physical activity and weight loss.	The results of this program will be used to make policy and public health recommendations, which will result in broader diabetes prevention efforts.
	Australia	STOP Diabetes: Health related behavior and risk perception in women with lifestyle related metabolic diseases at high risk of diabetes.	Identify key determinants of health related behaviors in high risk groups of women such as women with polycystic ovary syndrome and gestational diabetes mellitus	This project will follow the key lessons learnt from the successful public health initiative – The Sunsmart campain.
	Guinea/Cameroon	Improving access to HbA1c measurement in sub Saharan Africa	HbA1c measurement is unavailable in most parts of Africa, a continent with one of the highest burden of diabetes. To translate these evidences, we will provide affordable access to HbA1c measurement and relevant education in 2 African countries, aiming at a significant improvement in diabetes control.	Develop a training and cost-recovery scheme with local health authorities for long-term sustainability.
	Jordan	The Jordan Diabetes Micro-Clinic Project: Community Ownership and Awareness	The project will develop and implement a plan that will serve as a basis for a comprehensive approach for managing and treating diabetes in the country.	If successful, our intention is to implement this project in other areas of the Middle East and South East Asia, where the health and economic burden of diabetes is expected to grow dramatically.

2. COMPREHENSIVE REVIEW OF THE LITERATURE

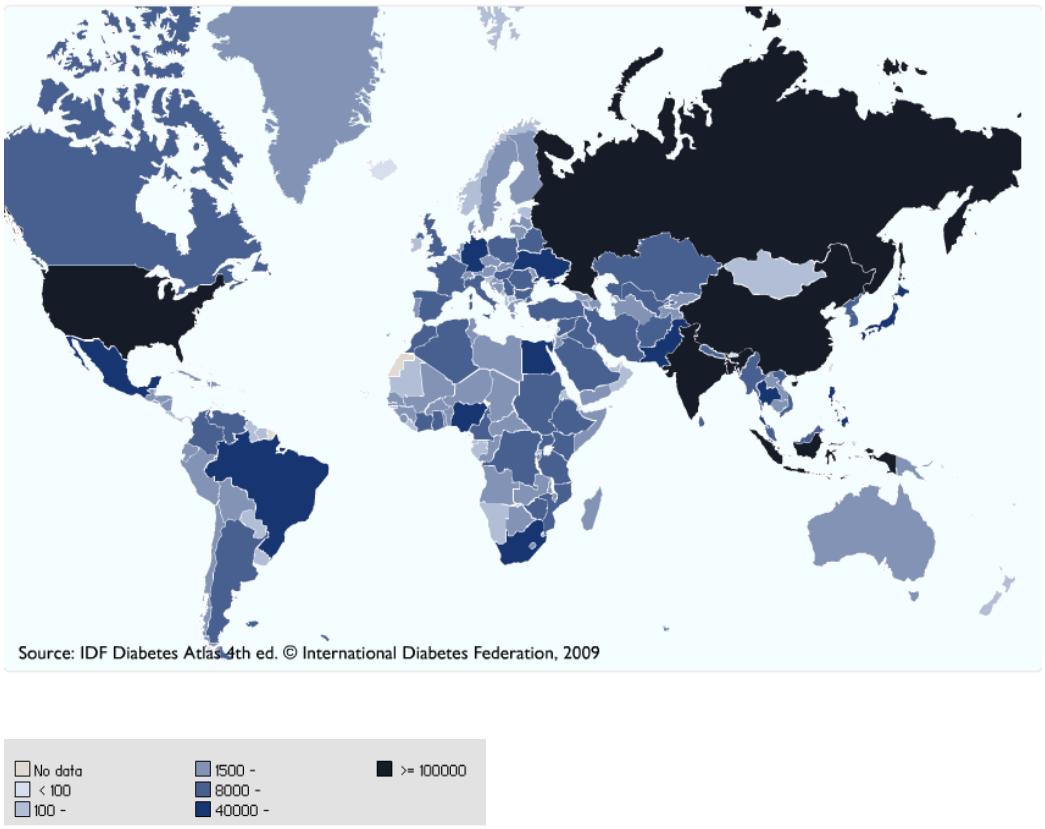
2.1 Non-Communicable diseases: Diabetes burden around the world

2.1.1 Epidemiology and etiology of diabetes

Diabetes mellitus is a leading cause of death worldwide, it is recognized to be the fourth or fifth cause of death in high-income countries but also it carries the most burden for developing nations with more than 80% of the deaths occurring in them[6]. Diabetes, along with other five non-communicable diseases (NCDs): high blood pressure, tobacco use, physical inactivity, obesity and high cholesterol, account for 19% of the global deaths and 7% of global DALYs[22].

In 2010, the World Health Organization reported that 220 million people worldwide had diabetes[6]. According to the International Diabetes Federation (IDF), it is estimated that more than 285 million people have the disease, representing 6.6% of the world's adult population[5]. This numbers have doubled in less than a decade and by 2030 the estimated prevalence is supposed to grow to 438 million cases[7, 23].

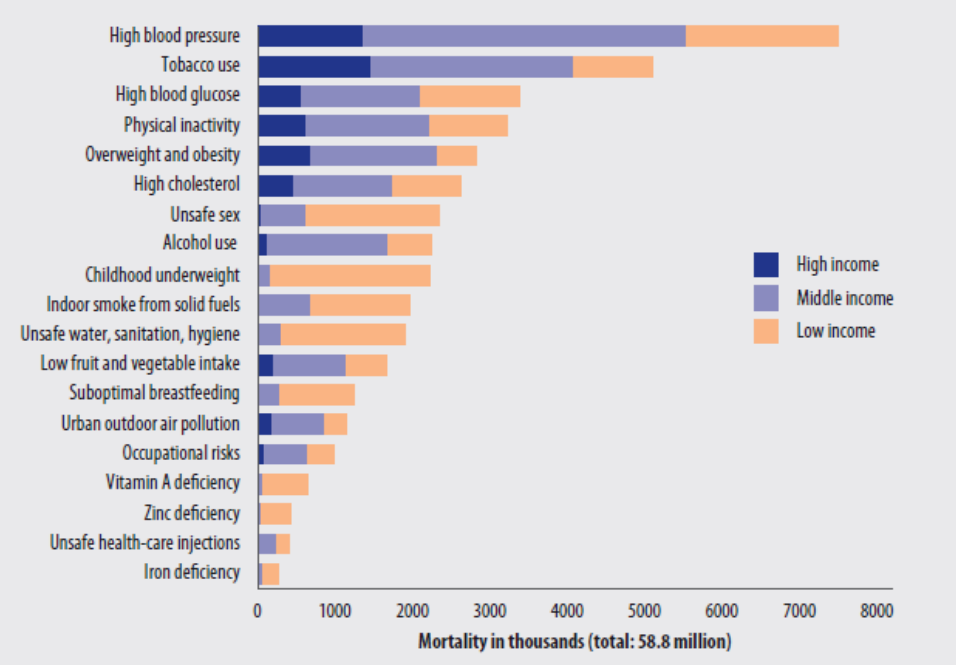
Figure 1: Diabetes world prevalence



Overall, the estimated risk of death among people with diabetes is double the risk of people without the disease[5, 6]. There are also sex disparities, as seen in previous studies showing how women are more prone to die from diabetes-related deaths than men[5]. The number of estimated deaths from the disease could be compared to the magnitude of deaths from many infectious diseases around the world[22]. Figure 2 shows the 19 causes of death world-wide in low, middle and high income countries. High blood pressure, tobacco use, high blood glucose, physical inactivity and obesity and overweight are the 5 leading risk factors for deaths in the world[22]. The World Economic Forum has identified NCDs as the second most severe threat to the global

economy in terms of likelihood and potential economic loss[24]. Additionally, less than 3% of the budget spent on health by international agencies in low and middle-income countries is spent on NCDs[24]. Reports show how 65% of the world's population live in countries where obesity and overweight kill more people than underweight[22]. Yet, the United Nations Millenium Development Goals (MDGs), international health aid agencies and local governments still don't focus their attention on NCDs. This is why it is imperative to develop mechanisms to address these immense needs for the implementation of guidelines and prevention strategies at a policy level.

Figure 2: Deaths attributed to 19 leading risk factors, by income level, 2004



Source: WHO Global Health risks report.

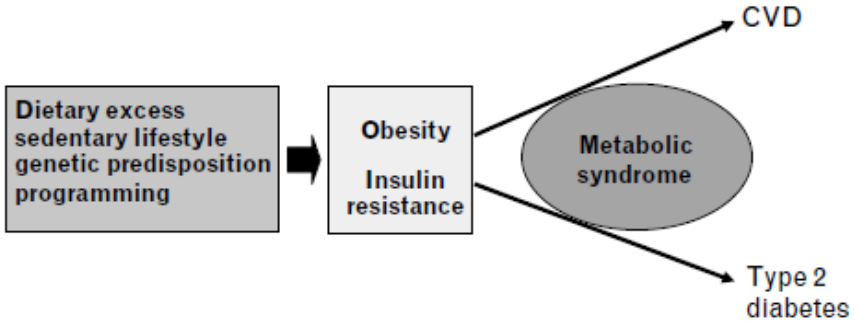
2.1.2 Etiology

Diabetes is characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action or both[25]. Its pathogenesis affects multiple tissues and organs and its long-term complications make it a chronic condition. Diabetes is classified in 4 types, and among them, type 2 accounts for approximately 90% of all the cases[25]. Additionally, the trends seen in some population-based diabetes studies have consistently shown that a large proportion of cases found are undiagnosed making it problematic as these people do not develop symptoms at earlier stages and therefore will not seek appropriate medical attention[5, 26, 27]. Undiagnosed diabetes carries a huge public health burden, because such patients are still at risk for developing complications.

The large prevalence of people with abnormal glucose levels but that do not have been yet diagnosed with diabetes is critical as well. People with impaired glucose tolerance (IGT) or impaired fasting glucose (IFG) are recognized as an intermediate group between normoglycemic and people with diabetes. Some studies describe there is a higher risk of developing diabetes in people with IGT than people that have normal glucose levels[5]. Also, their risk of developing other chronic conditions, such as cardiovascular disease, is higher than the normoglycemic population[22, 25]. According to IDF data, almost 8% of the world's population (344 million) has IGT.

Additionally, diabetes etiology could be better understood by addressing the metabolic syndrome. This syndrome comprises a clustering of different risk factors[ii] which at the end can predict diabetes.[28] It has been demonstrated that people that have metabolic syndrome have a five-fold greater risk of developing diabetes as well as three times as likely to have cardiovascular disease compared with people without the syndrome. Figure 3 incorporates the accumulation of all the risk factors that could develop in diabetes and cardiovascular disease. IDF reports almost one quarter of the world's population have metabolic syndrome[29].

Figure 3: Metabolic syndrome



Source: Sattar, Curr Opin Lipidiol, 2006:17:401-411

Diabetes is a multi-causal disease which has been explained by many factors. A number of studies show evidence of genetic susceptibility for type 2 diabetes[30, 31] however, the value of genetic testing for prediction of type 2 diabetes in the general

[ii] According to the IDF definition, for a person to be defined to have metabolic syndrome they must have: Central obesity (defined as waist circumference with ethnicity specific values) or if BMI >30 central obesity can be assumed) PLUS any two of the following: raised triglycerides (> 150 mg/dL) or treatment, reduced HDL cholesterol (< 40 mg/dL males, <50 mg/dL females) or treatment, raised blood pressure (systolic >130 mm/Hg or diastolic >85 mm/Hg) or treatment, raised fasting plasma blood glucose (FPG > 100 mg/dL) or previously diagnosed with diabetes.

population remains unclear. Furthermore, lifestyle interventions in large randomized trials have showed to have a consistent effect across age, gender, and race/ethnicity which resulted in better cardiovascular outcomes[32]. A large scale study demonstrated how in Pima Indians from Mexico and the U.S., which share a genetic background, the differences in lifestyle behaviors from the Mexican population made them less susceptible to develop diabetes than their U.S. counterparts[33]. Some other risk factors for diabetes have been described such as: age, race and ethnicity, gender, and family history have been demonstrated to contribute to the development of the disease [34, 35]. Table 3 summarizes all the risk factors that have been shown to be strong predictors in the development of diabetes. This risk factors show how a large portion of them are modifiable, making diabetes highly preventable. Up to 80% of non-communicable diseases such as stroke and type 2 diabetes could be prevented by eliminating shared risk factors such as unhealthy diets, physical inactivity, and tobacco use[24].

Table 3: Environmental risk factors accounting for the development of diabetes.

Age > 45 years
Overweight (BMI >25 kg/m2)
First degree relative with diabetes
Physical inactivity
High risk ethnic population
IFG or IGT
Gestational diabetes or baby weighting > 9 lbs
Hypertension (>140/90 mm/Hg)
HDL < 35 mg/dL or tryglicerides > 250 mg/dL
Polycystic Ovary Syndrome
History of vascular disease

2.1.3 Complications

Diabetes and its major complications including cardiovascular disease, nephropathy, neuropathy, amputation and retinopathy are a huge challenge for public health and the economic development of the world[5]. Reports estimate that the risk of developing heart disease and stroke are increasing, approximately 50% of the deaths from people with diabetes are due to CVDs[6]. Amputation is another cause of disability as diabetes reduces the blood flow in the extremities increasing the probability of foot ulcers and eventual amputation. Additionally, and as the disease advances, approximately 10% of people with diabetes develop retinopathy and nephropathy[5].

2.2 Economic impact of diabetes

The economic burden that diabetes imposes on the healthcare system is enormous. Global trends of diabetes show that there is a tendency to have an onset at younger ages, and in addition to this, the prevalence is increasing among the elderly, who are the ones that consume higher amounts of resources in terms of healthcare costs[9]. Likewise, all the behavioral and lifestyle interventions that are being put into place are increasing the life expectancy of people with diabetes, extending their lifespan. In sum of all of these, the screening and early detection of undiagnosed cases of diabetes are increasing the proportion of people that newly are diagnosed. All of these situations are adding up to the increased pool of prevalent cases with

diabetes, therefore increasing the costs that diabetes present for a healthcare system[9].

According to 2010 data, on average a person will spend on diabetes USD703 (ID878)[iii] [5]. Global healthcare expenditure for diabetes and its co-morbidities accounted for more than 11% of the total healthcare expenditures totaling USD376 billion (ID418 billion) in 2010. By 2030 it is projected to exceed USD490 billion (ID561 billion)[36]. This translates in expenditures of 13 per cent of the world's healthcare budget on diabetes care in 2025, and almost 40% of the healthcare budget from countries with a high prevalence, making it a huge financial and public health threat [5, 8]. As of today, more than 80% of the healthcare expenditures are made on high income countries, paradoxically having more than 80% of people that die from diabetes in low and middle-income countries.

There is an uneven distribution of how all this costs will be used across age and gender groups, as more than 75% of them will be used by persons between 50-80 years of age and it is expected to spend more in women than in men[5].

All of this economic impact on governments has led to the research of interventions and policies that can be implemented in an inexpensive, easy and cost-effective way. However, there have been some economic studies[37, 38] which have shown how the

[iii] ID: International dollars correct for differences in purchasing power. It is a hypothetical unit of currency that has the same purchasing power that the U.S. dollar had in the United States at a given point in time.

prevention of diabetes with lifestyle interventions (DPP trial[iv]), will not automatically save costs. One of the studies[38] showed how the healthcare immediate cost would rise $2.60 per person/month which would increase the overall healthcare expenditures. Nevertheless, both studies emphasize the need to have additional, less expensive methods to implement and reduce the risk like the DPP trial has done.

2.3 Lifestyle interventions

Diabetes research has advanced tremendously in the past decade with multiple studies consistently showing how the disease can be prevented or delayed in subjects that are at high risk -either by impaired fasting glucose (IFG) or impaired glucose tolerance (IGT)- by simply modifying lifestyle behaviors such as improving diet, increasing physical activity and reducing weight [11, 14-17].

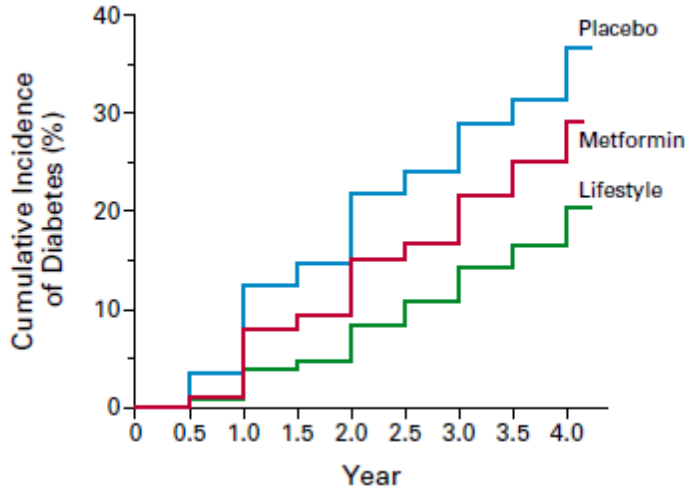
The Diabetes Prevention Program (DPP) in the U.S. [11, 12] is one of the largest and most important randomized clinical trials that assigned either one of three treatments to pre-diabetic persons. The randomization assigned participants to either placebo, metformin (850 mg/twice daily) or lifestyle modification, which included 150 minutes of physical activity per week with a goal of 7% weight loss.

[iv] DPP Trial: Diabetes Prevention Program

The study was multi-centric in 27 clinics in the United States and included more than 3, 000 adults having pre-diabetes[11].

The results from the intervention (Figure 4) show that, after a 2.8 year follow-up, the lifestyle intervention reduced the incidence of diabetes by 58% while metformin reduced it by 31% comparing them to placebo. This suggests how lifestyle intervention could be the most effective in reducing the incidence of diabetes in people at risk[11].

Figure 4: Cumulative incidence of diabetes according to study group: DPP Trial.



Source: Knowler NEJM 2002;346(6):393-403

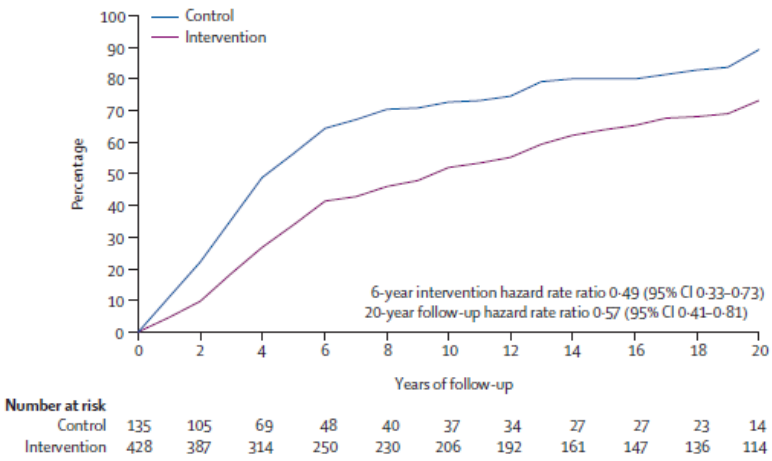
Another large randomized clinical trial that showed consistent results with the US-DPP, was the Finish Diabetes Prevention Study (DPS) [39, 40]. The study randomized

522 individuals with IGT[v] who were assigned to an intervention or a control group. The intervention included moderate-to-vigorous exercise for at least 30 minutes per day, a reduction in body weight of 5% or more and reduction in total fat and energy consumed[40]. Results from this study show that after a 4-year follow-up, adherence to physical activity recommendations in the intervention group reduced the incidence of diabetes in 57%[40].

The Da Qing study in China, achieved a similar result with a reduction of type 2 diabetes with either diet, exercise, or diet plus exercise compared to a control group[13]. The active intervention took place for 6 years. The distinction in this trial was that the population was followed up to 20 years in order to evaluate –beside the incidence of diabetes–complications from diabetes and mortality[13]. The combined lifestyle intervention groups had a 51% reduction in the incidence of diabetes during the first 6 years of active intervention. Over the 20 year-period, the results showed a 43% reduction in the incidence of diabetes (Figure 5). In terms of CVD events, CVD mortality and all-cause mortality, the results didn't show any statistical difference between intervention and control groups. The authors of this study justify this lack of significance due to limited statistical power to detect these outcomes.

[v] Plasma glucose concentration of 7.8 –11.0 mmol/l 2 h after a 75-g oral glucose challenge in subjects whose fasting glucose concentration was 7.8 mmol/l

Figure 5: Cumulative incidence of diabetes mellitus during follow-up in the China Da Qing Diabetes prevention study



Source: Li, Lancet 2008;371:1783-1789

Additional studies like the India Diabetes Prevention Program (IDPP)[41], Japan Diabetes Prevention Program (JDPP)[42] and the Sweden Vasterbotten Intervention Program (VIP)[43] also showed similar findings by the same core components of lifestyle interventions. It is important to recognize that these trials have been done in pre-diabetic population. There have been some studies with the same type of lifestyle interventions in normoglycemic population, yet these studies have not found a decrease in the incidence of diabetes [44-46]. Nevertheless, all of these interventions recognize the importance of lifestyle behavior changes and encourage patients to adopt these new lifestyles along with healthcare providers to implement them into their clinical practice. It additionally helps policy and public health practitioners to advocate at a government level and make recommendations. Each of these prevention trials has showed what the problem is as well as what needs to

be done to efficiently prevent diabetes; however there remains a huge gap between knowledge and action and that is where translational research needs to incorporate mechanisms to put all this evidence into practice.

2.4 Translational research

Globally there has been a recent need inside the healthcare systems to improve the quality of care and decrease the risks in the population with some kind of disease[47].

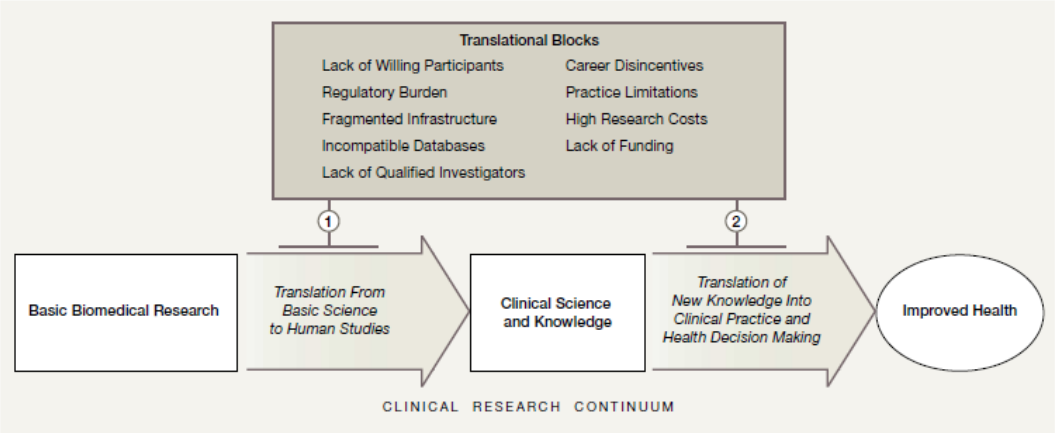
The term translational research (TR) is a broad term utilized in recent years to address the gaps between the large volume of research data and the implementation of this knowledge into a real life setting. Many terms have been used to describe this process such as: knowledge translation, implementation science, research utilization, dissemination, diffusion, research use, knowledge transfer and uptake are the most used terms in the literature. For the purposes of this thesis, we will use them interchangeably referring to the same definition: "Translational research transforms currently available knowledge into useful measures for everyday clinical and public health practice. Translation research aims to assess implementation of standards of care, understand the barriers to their implementation, and intervene throughout all levels of health care delivery and public health to improve quality of care and health outcomes, including quality of life"[2].

Diffusion of information is a complex process and involves a multilevel approach at the individual level, the provider and the system[2]. At the individual level as it has to reach those people who need the intervention, yet sometimes this does not happen due to poverty, lack of tailored programs and poor dissemination strategies. At the provider level -the medical community and healthcare providers- there could be a gap due to lack of training and knowledge, limited time, and cultural barriers. And at a system level the main barriers that could be found is decreased capacity to undertake an intervention because of financial constraints, insufficient human resources or ineffective policies[48].

Translational research occurs in separate but sequential phases (Figure 6): the first phase of translation is called from "bench to bedside" and relies on basic science discoveries into clinical studies or clinical medical practice[49]. This phase of translation research receives, of course, much attention and funding. Phase two is considered the implementation from a clinical setting to a real life setting in which the knowledge becomes available and disseminated among the people who need it, generally under non controlled situations [1, 4].

It is important to address that these 2 phases are not separated from each other and require constant input between them in order to have the practitioners that deliver the interventions in communication with the academic and research sectors developing such interventions.

Figure 6: The 2 translational blocks in the clinical research continuum: Phase 1 and Phase 2 of Translational research



Source: Sung et. al. *JAMA.* 2003;289(10):1278-1287

2.5 Models used to explain translational research

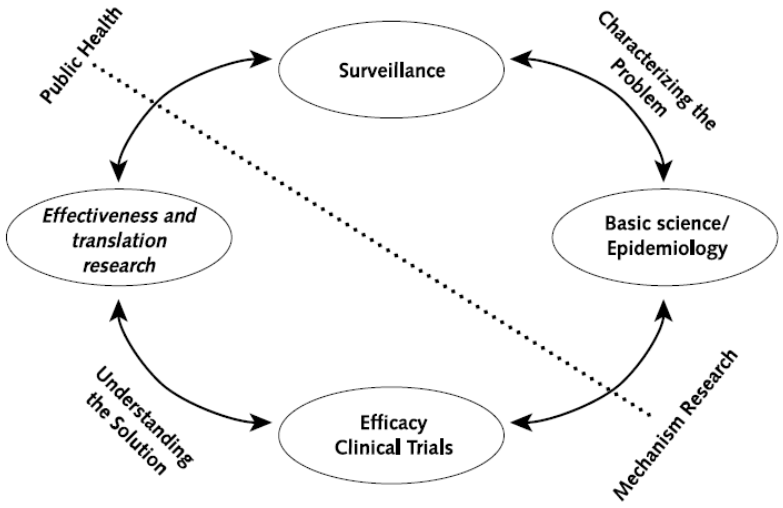
TR models exist to guide and explain aspects and processes in the translation of programs practices and policies. Many of these models and frameworks have been used for program planning in diabetes and are further described.

2.5.1 Translation Research in the context of other models

Figure 7 exemplifies translational research in the context of other types of research and public health assessments[2]. In this model, the authors show how TR has a different approach from basic science and surveillance methods as they only seek to

characterize the problem; in contrast the target of TR is to understand the real-world problems and implement solutions for them. Additionally, TR delves into understanding how to generalize and transfer the results to the general population, and not to a randomized controlled population. TR needs also to be effective, thus it has to work in a real life situation, but also has to prove to be the lowest cost possible and be able to be maintained for a long period of time[2]. The same model addresses 3 key levels that interplay together and while incorporating them into an intervention they can work together to improve the quality in care settings. These three levels are the patient, the provider and the system level[2]. At the patient level the model shows how patient-oriented interventions are efficacious to improve the adherence and the motivation of the community. In the case of diabetes, many studies have shown how setting up reminders, phone calls and education techniques, help the interventions to have a favorable outcome[2]. At the provider level, the authors describe how a multiple approach has to be done, using not only defined clinical guidelines but improving the feedback for healthcare practitioners, having a reminder system, and motivation. Finally, the system level has to incorporate these two previous levels by having quality assurance feedback from both: the provider and the patients to succeed[2].

Figure 7: Translation Research in context of other types of research



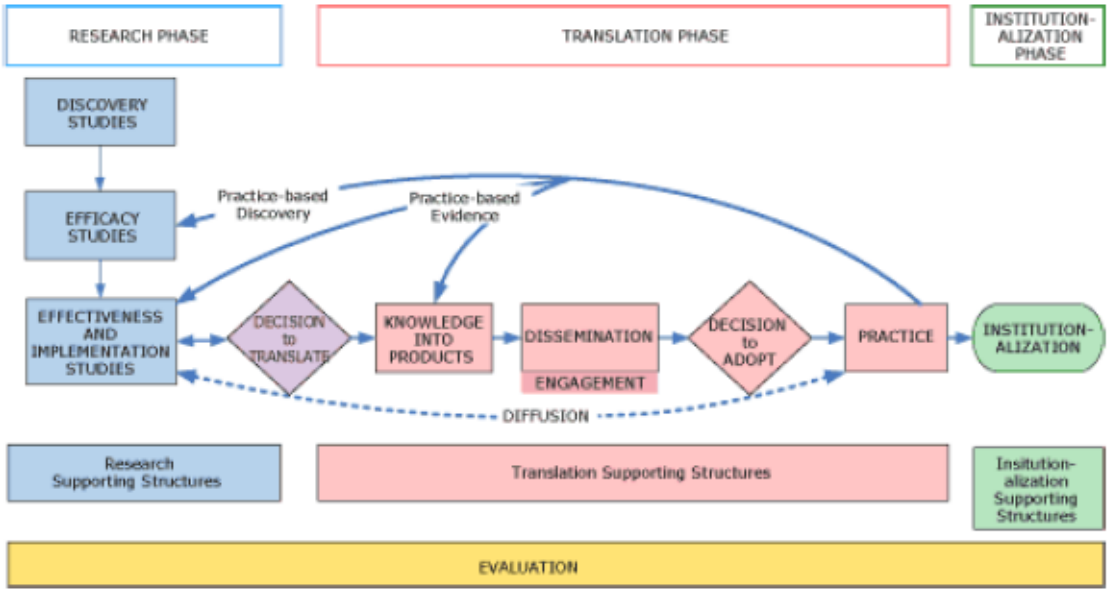
Source: Narayan *Ann Intern Med.* 2004;140:958-963.

2.5.2 Knowledge-to-action (K2A) framework

The knowledge to action framework is a more institutionalized one. It was created to facilitate understanding of critical translation processes within CDC's National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP)[50]. This framework identifies 3 phases in the process: research, translation and institutionalization. By identifying these three processes this framework recognizes that they are interconnected and require multiple stakeholders and decisions to be taken. At the research phase, the authors address the need to have sound scientific knowledge to determine how appropriate it is to translate. Additionally, the translation phase in the model addresses the processes to develop and disseminate the evidence to potential adopters. It also finds sufficient supporting structures that can effectively move the resources into action. The maintenance of the program

emerges at the institutionalization phase, in which it is an established activity or norm inside a community or organization.

Figure 8: Knowledge-to action framework for public health



Source: Wilson *Prev Chron Dis.* 2011;8(2):1-7

2.5.3 RE-AIM Framework

This framework was developed by a group of researchers funded by Kaiser Permanente Colorado Research and could be used as a method to systematically evaluate chronic disease interventions and guide it's planning[19]. The acronym RE-AIM means reach, effectiveness, adoption, implementation and maintenance. In its approach, the framework has two dimensions of reach: the individual level and the setting level. At the individual level, *reach* refers to the factors that determine the

target population and the barriers that can be encountered. *Efficacy* is also addressed at the individual level and evaluates if the intervention that is being put in place has the desired outcome.

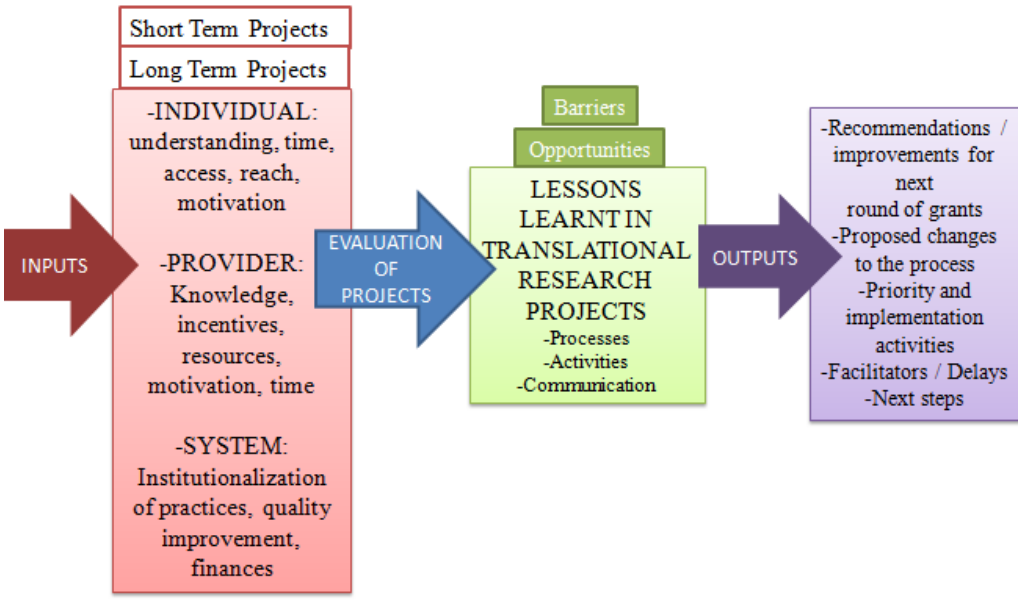
Furthermore, at the setting level the authors describe how the organizations support the intervention and thus, the *adoption* dimension can be accomplished. The *implementation* of the program requires further evaluation of the times and costs, integrating all the knowledge that is already consistent and putting it into real life settings. Finally, the *maintenance* refers to the sustainability and long-term uptake of the intervention.

2.5.4 Barriers to uptake and utilization: revised framework

All of these frameworks have a broad significance and a huge impact for public health practitioners, as they help to address the most pressing needs of a society in which the system, the providers and the community are interconnected and need to survive in a dynamic process. Furthermore, the global perspective that we have from chronic diseases and in this particular case from diabetes, is that the gap between health innovations and the delivery of them to the community has become even more challenging, especially in low- and middle-income countries. Some of the barriers encountered in the literature that have been hazardous for interventions and have compromised the translation of these interventions could be described

with all these three models. Based on the previous theory to analyze these interventions, we have developed a framework in order to evaluate the projects and develop a guide to obtain the lessons learnt from the researchers in this study. It incorporates the three stakeholders and incorporates the theory of the RE-AIM model to analyze barriers in implementing translational research projects.

Figure 9: Proposed framework to evaluate barriers to implementation in translational research projects in diabetes



3. MANUSCRIPT

3.1 Title Page for Manuscript

Challenges in Real-life Diabetes Translation Research: Early Lessons from BRiDGES Projects

3.2 Contribution of student

This project was funded by BRiDGES, which is a program that works under the umbrella of the International Diabetes Federation. As of today, BRiDGES has given grants to 20 short- and long-term projects in 2008 and 2010 and is now evaluating a third round of grants. BRiDGES has had many barriers in their first projects and that is why they are currently evaluating the barriers that the projects face.

Along with assisting BRiDGES with the project and a final report, I developed the interview guide with the support from Dr. Venkat Narayan at Emory University, Ronan L'heveder at BRiDGES, and Dr. Linda Simminerio at the University of Pittsburgh.

After developing the guide, I contacted the researchers and scheduled interviews with them. Additionally I recorded and transcribed the interviews. Finally, I developed a report for BRiDGES, use in future RFP, analyzed the data and developed the thesis with the advice from my advisor Dr. Venkat Narayan.

3.3 Abstract

Efficacious interventions for prevention of diabetes and its complications exist; however, their implementation is woefully inadequate. Translational research, a means to bridge the gap between knowledge and its implementation, has received increasing recognition recently. BRiDGES, an International Diabetes Federation program, incentivizes researchers globally to conduct translational research. As part of its first round of funding, BRiDGES supported 11 projects in 10 countries. The purpose of this project is to qualitatively assess the early lessons learnt from implementing translational research.

We conducted semi-structured in-depth interviews with 10 researchers, seeking their views on factors relating to success and barriers to implementation. Data were collected from June-September 2010 by a trained interviewer; information was recorded, transcribed and analyzed according to predefined themes and concepts using MAXQDA software.

Patient recruitment and retention were reported as challenges, a factor which directly impacted the quality of the project outcomes. The lack of availability of local multidisciplinary teams was highlighted as having a negative effect on the project. Grassroots and community participation were emphasized to have beneficial effects by several researchers. Flexibility was recognized as a challenge for the successful execution of the projects. A key recommendation for the next round of grants would be to include feedback from previous grantees, in the form of pre-submission workshops, as well as mentoring from experienced investigators along with emphasizing the differences between traditional and translational research.

This evaluation underscores the main contingencies to be considered for successful implementation of translational research projects. Furthermore, it emphasizes the

importance of having the three stakeholders: patients, providers, and health systems, acting together in a flexible environment within real life settings.

3.4 Introduction

Preventing diabetes and its complications is a global public health challenge: 285 million people (6% of the world's population) were estimated to have diabetes in 2010 and it is projected to grow to 438 million by 2030[5]. Diabetes and its major complications have made this disease a huge financial burden for governments: the global healthcare costs in 2010 were calculated to be around 376 billion US dollars [3]. On the bright side, evidence-based research in diabetes is responding to this challenge with several studies consistently showing how we can prevent or delay diabetes in individuals that are at high risk for the disease by modifying lifestyle behaviors such as improving diet, increasing physical activity and maintaining a healthy body weight [11-17, 19, 39-43, 51, 52]. Similarly, knowledge about the prevention of diabetes complications has also improved, demonstrating that controlling glucose levels, blood pressure, lipids, and regular screening for foot and kidney complications are all proven efficacious methods of prevetion[1, 4].

However, despite of all this knowledge, morbidity and mortality of diabetes has not improved sufficiently[2]. In response to these stagnate rates researchers continue to strive to find better solutions to encourage the use of available evidence and to translate these into sustainable measures. By bridging the gap between knowledge

and action, translational research, plays a central role in bringing current scientific knowledge and public health actions [1-4, 50, 52-55], a process which requires collective efforts and a multilevel approach[56].

In response to this growing need for translational research, the International Diabetes Federation established BRiDGES (Bringing Research in Diabetes to Global Environments and Systems), a program which incentivizes researchers around the world to support cost-effective and sustainable interventions that can be adopted and disseminated in real world settings for the prevention of diabetes and its complications. In 2008, BRiDGES awarded the first round of funding for 11 projects across 9 countries.

Given the novelty of translational research, we need to understand the many challenges related to the process of implementing this type of projects. This paper explores the barriers, experiences and lessons learnt from the point of view of researchers who implemented diabetes translational research studies supported by BRDGES.

3.5 Methods

We used qualitative methods to learn about the experiences, practices and lessons learnt from researchers and staff members facilitating diabetes translational

research projects supported by BRiDGES. The information was collected via semi-structured conversational in-depth interviews[57].

3.5.1.Sample

The sample was identified from the first round of projects funded by BRiDGES, consisting of eleven studies: six of which were long-term (maximum of 3 years) and five of which were short-term (maximum of 2 years).

Non-probabilistic sampling was used to determine sample size and according to this technique, we reached data saturation with 10 interviews[58, 59]. The projects evaluated were being conducted in Australia, Philippines, Sri Lanka, India, Guinea, Cameroon, Jordan, USA and Vietnam. A description of each project's location, duration and objectives is shown in Table 1. The interviewee was the principal investigator, or a staff member with relevant activities in the study such as: coordinating the selection, recruitment or training of participants and/or staff, communication and logistics of the study, and knowledge of accountability aspects of the project.

3.5.2 Data collection

An email describing the nature of the study was sent to each investigator. All of the investigators responded except one.

Information was collected via in-depth interviews using a semi-structured discussion guide. The guide was developed based on prevalent issues found in the literature and incorporating feedback from the funders' perspective. The guide can be obtained by writing to the first author.

The topics covered in the interview included: main experiences with the project, barriers and facilitators, finances, staffing, subject participation, internal and external communication, aids for the study, institutional support and recommendations. Probing was used to verify interpretations and follow up when appropriate. Emerging ideas and themes not anticipated in the initial guide were included in subsequent interviews[57, 60].

All the interviews were performed over the phone recorded and fully transcribed by a trained interviewer. Notes and memos were kept in order to identify main themes and concepts relevant to analysis.

3.5.3 Data analysis

The data were analyzed using the principles of the responsive interviewing model described by Rubin[57]. With this model, transcripts were prepared and then coded with emerging themes from the interviews and also building on published literature[2, 19]. The data were examined by sorting, ranking and comparing the codes[57] using MAXQDA© V10.

3.6 Results

The results are categorized according to specific barriers and facilitators reported in each interview and are summarized in Table 4. The table highlights the main barriers expressed by all respondents as well as the positive experiences. Table 5 shows the solutions suggested by a portion of the researchers along with lessons learnt from all the projects.

Overall researchers had challenging experiences as well as positive ones which helped with the project execution. They all reported it was a learning experience and they were interested in future grants for these types of projects. Figure 10 presents a graph with the frequencies of the major themes which were reported by researchers during the interviews. In the graph we can see how the there is an even distribution among the barriers and facilitators that were reported by the

researchers suggesting that during the implementation of the project they had both types of experiences. We can also observe in Figure 11 the amount of times researchers reported solutions to the problems they encountered categorized by the most frequent narrative themes.

An overarching theme that was common along all the interviews was the flexibility needed for a translational research project. Real life situations are hard to control and many researchers referred to the plasticity that the projects needed throughout the implementation in order to obtain a fruitful outcome. Results are reported below for each one of the barriers encountered.

a) Access and reach to the community

Recruitment and retention of the participants was one of the largest barriers that researchers reported in the interviews. The range of strategies to increase recruitment and adherence with the intervention varied from one project to another. One junior researcher reported having repeated contacts and creating online groups to have a positive effect on the recruitment and motivation of participants, as it develops a sense of belonging among them. In order to have a better recruitment, another suggestion by researchers was to have reminders through phone calls or emails. Other researchers reported giving a small stipend to the participants or peer supporters. The stipend and reminders were a highly debated issue; while many researchers referred to them as a good investment to

keep the participants motivated; others felt they conflicted with the principles of translational research, as it would have limited application in real life settings:

> "…addressing this problem in translation research is difficult because you have to be in real life format, therefore theoretically in real life you don't send reminders to the patients to attend the clinics. This is why it is difficult to know if you are still in pure translational research or if there has been an infringement of the principles of translational research" (Researcher 4)

Several investigators identified challenges and barriers related to the reach and access of their interventions mainly due to a high proportion of uninsured and underserved population. Additionally, mistrust towards healthcare providers along with the belief of having no perceived benefits, often resulted in lack of sustainable recruitment and adherence to project implementation. These researchers working in highly underserved populations were the ones that reported more challenges with the recruitment and adherence. The representativeness of the population was a major concern for some of the researchers because mid-SES participants were most easily accessible and therefore the ones that remained in the interventions. The extract below highlights the difficulty to have access and reach underserved communities:

> "….the system is broken, the system is really what is not working to keep the people to come to the clinic, in this underserved poor communities, I think it

> would be easier for a staff member to go to the address of the participant and try to reach them, but I know in practice is not actually feasible…." (Researcher 2)

The incorporation of peer supporters was suggested by most of the researchers, as it is an opportunity to foster a link to the community, create empathy among the group members and build trust. Additionally, all the researchers that had peer-led interventions referred to them as the sustainable part of the project. Researchers agreed that the community motivation can also be achieved by having focus groups before and after the interventions in order to: 1) assess their needs, 2) establish clear mutual expectations and 3) make the program culturally appropriate.

b) Planning resources

Many of the barriers were related to poor human and financial resource allocation proposing to have a pilot test for future studies. Those researchers that conducted a pilot test before were the ones that had better outcomes in terms of recruitment and retention and deviated less from their budget.

One critical issue for researchers regarding funds was that planning for the budget was not sufficient creating a hassle to the project and having to look for other sources:

> "If I were to change something in my project it would be to increase the budget because had to search for more funds in other places so that took time, instead of devoting it for the study." (Researcher 2)

The areas in which researchers reported to have the largest underestimation of expenses were: staff (mainly trainers), materials and tests, such as HBA1c tests, printed materials for educational purposes, and, in some cases, transportation.

All the researchers positively perceived the flexibility shown by BRiDGES regarding finances and budgeting. Macroeconomic issues such as the slow-down of the economy, short-sightedness in budgetary planning as well as expected uncertainties related to new researchers engaging in translational research, resulted in request for additional funding. Several research projects received supplemental funds from BRiDGES so researchers felt well-supported in this area. Nevertheless, most researchers also stated to have had an external source of funds for their project, besides the grant from BRiDGES.

Researchers found that the time allocated for each activity was insufficient. For some researchers, this was their first translational research project, requiring more time to familiarize with the internal procedures of their own institution and BRiDGES requirements, so the time planned for many of the activities was not realistic.

Training was highly time consuming and many of the researchers expressed a desire for better planning and feedback from BRiDGES specifically in terms of project

schedules and time allocation for certain activities. Additionally, the time scheduled for the recruitment was underestimated, in turn delaying the development of the intervention as a whole.

c) Capacity building

Individual level

Whilst all the researchers reported that staff was fully capable to carry on a traditional research project, several felt that translation research requires a slightly different set of skills representing a move away from traditional methods of training used for research. Technical and clinical skills were present in many of the cases, but researchers referred the need to be aware of softer skills such as communication and interpersonal skills, willingness to learn and listen, and ability to manage constant change. In combination with this, researchers suggested to define clearer roles for each team member.

> "It is important to be able to translate the messages. We need to have skilled staff in all the areas: research and translation. Plus, it has to be a multidisciplinary staff " (Researcher 6)

Due to the shortage of physicians in several of the countries, a number of researchers expressed the need of a multidisciplinary non-medical team in order for successful delivery and dissemination of the intervention. This was a controversial issue as other researchers with a more traditional view recognized otherwise,

expressing the importance of having a strong medical and clinical team to deliver these interventions.

Institutional level

By developing pilot interventions, researchers recognized the benefit of having previous strong networks with the community, NGO's, other organizations and institutions, and with the government. This was pointed out by the researchers as an enhancer for implementing and disseminating the interventions.

> "…you have to develop a strong relationship in the community you want to have impact on. Without the connections it is more superficial and it is not going to be sustainable" (Researcher 5)

> "If you want to do effective translational research, you can't rely only on grassroots, you have to have a collaborative organization that include people that can infiltrate the government sector, academic sector, clinic sector… a lot of crossover and simply having grassroots is not going to translate into that component" (Researcher 6)

Researchers recognized their institution and the government to be neutral in terms of support of the projects. While being supportive and not standing in the way of the projects but without any direct involvement or participation. This identified

challenge is important if researchers want to institutionalize a program or translate it into a policy.

3.7 Discussion

The primary goal of this study was to identify the main challenges and strengths from researchers implementing translational research projects in diabetes and present solutions and lessons learnt from them. The findings of the study highlight some of the barriers faced in healthcare settings which are consistent with those reported by other authors[2, 54]. This results can be attributed to the nature of the health system, as it is designed for acute care and do not incorporate the view of a chronic care model[2]. Our results highlight that prevention-oriented interventions in diabetes are difficult to implement, time-consuming and require a large amount of flexibility.

Diabetes is a complex disease and therefore a single solution is not sufficient to achieve favorable outcomes[1-3, 61]. The solutions need to involve a multilevel intervention at the patient, the provider and the system level[2]. Our findings show how researchers encountered challenges at all these three levels, suggesting a more holistic approach in the future: 1) individual challenges were found such as behavioral and cultural impediments, along with poor access from participants, 2) from the point of view of the providers, there was a lack of dissemination and diffusion strategies, poor human resource planning and high turnover, and 3) finally

at the system level, there was lack of community focus and collaboration among other academic, government and non-government sectors.

Some differences were found based on the location of each project due to the different political, social and structural contexts. While developing countries reported more issues with the recruitment of the participants, maybe because of lack networking with authorities or other institutions; the developed countries addressed a further need to reach underserved communities and increase the trust in the healthcare providers to maintain these populations.

The challenges found by long-term and short-term projects were similar; however, budget related issues were more frequent in the long-term projects, and recruitment issues were emphasized more in the short-term projects. This makes sense, as the implicit characteristics of short term projects make time a limitation and this may have constrained the recruitment. This is a good opportunity for future projects to emphasize the importance of time allocation and money to both types of projects.

Almost all the researchers interviewed had problems with allocating time and budgeting money for project activities. For many researchers this was their first translational research project so the planning in this two areas was not realistic, suggesting a more detailed evaluation of the feasibility of the project. This finding proposes the need be more emphatic about practical ground-level issues and find

better mechanisms to train researchers before the start of the interventions. Lindstrom et. al[62], have developed a set of guidelines for implementing a successful diabetes prevention intervention which include all the possible areas for budgeting. By developing a realistic budget, future projects will have a better performance without having a great deviation from what was originally allocated.

Our findings address how translational research in diabetes needs to reach the underserved, understudied populations. Several studies have demonstrated how challenging it is to incorporate a successful intervention that addresses minorities and disadvantaged communities, limiting with this, the representativeness of the results[63, 64]. Additionally, it is the minorities and lower socioeconomic classes the ones that suffer the highest burden from diabetes[5] creating an urgent need to increase research mechanisms to address these minorities. Simultaneously, the healthcare system remains very ineffective to support delivery of this type of interventions and a mechanism is needed to make these interventions sustainable.

The importance of fostering community participation was an emphasized topic by all the researchers, even though is an area that hasn't had the adequate emphasis in diabetes and has had many contradictory results[65, 66]. It was recognized during the interviews that much of the research has been done without involving the community and it is, often times, the members of a community the ones that have a better understanding of what needs to be done[1]. Community participatory research has been observed to identify the needs of a community while having a culturally

appropriate and sustainable project and giving the intervention the grass-roots needed[66]. Our findings show how in the peer-led interventions that also had pre- and post-focus groups, the researchers felt much more satisfied with the outcomes. Researchers recognized the help from peer leaders in the project which provided social support, created a sense of belonging and helped to have culturally appropriate interventions.

Translational research should be by definition: cost-effective, generalizable and sustainable, this means that at the same time the intervention needs to reduce the costs while obtaining the desirable outcomes, reach as many people as possible and be able to be maintained in the long term[4]. Our findings showed that a part of the researchers were concerned with the number of patients reached by the intervention while others were more involved in the quality and sustainability of their projects. Future studies need to emphasize the complexity of translational research and further mechanisms have to be developed to understand and address the whole spectrum that translational research encompasses.

Limitations

A limitation of this study is the potential bias in the sample selection because we used BRiDGES projects exclusively, thus caution must be used in generalizing these findings to other settings.

Although the interviewer was not part of BRiDGES and confidentiality was addressed before the interview, many could have not reflected their perceptions or views due to self-preservation of their relationship with BRiDGES. Also, the location of the projects made it impossible to have face-to-face interviews, and as a result the interviews were performed over the phone limiting the interaction between the interviewer and interviewee.

Additionally, only views from one side of the research process were obtained. Richer information may be acquired by interviewing not only researchers, but all the interested parties in the process, including BRiDGES members as well as study participants.

Strengths

Being a study with a qualitative approach, it allowed the consideration of perspectives of researchers currently engaged in carrying out the interventions.

Additionally, the diversity of an international group of researchers with a diverse set of backgrounds and different countries strengthened the analysis ensuring multiple perspectives and understanding of the problems. In addition to this, the qualitative nature of the study allowed for the discovery of newly emerging themes and concepts embedded in the interviews.

Conclusion

Diabetes is one of the greatest global health burdens today. There is an underlying need of improving the quality of care of people who have the disease, however the mechanisms of dissemination are often inadequate and inefficient[67]. Additional to this know-do gap, there is also a lack of effective dissemination of these findings to policymakers, making all this research unworthy if it is not communicated correctly[53]. A successful intervention is defined as the one that has the ability to be communicated to policy and decision makers in an effective way[68]. Hence, further research is needed to develop the appropriate mechanisms of dissemination between researchers and policymakers, in order to have strong public policy initiatives and put the evidence found into concrete practice.

3.8 References

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Table 4: Barriers and facilitators reported by BRiDGES researchers

Theme	Barriers	Facilitators
1. Access and reach to the community	Lack of access channels to healthcare facilities Large amount of underserved/uninsured population (no internet, transport issues, numbers change, no permanent address) Low SES harder to recruit Lack of motivation to come back (due to economical expectations from participants) Lack of awareness Lack of trust in healthcare providers Lack of health literacy Political instability/ unrest	Repeated contact with people (phone calls, visits, emails) to improve communication and increase attendance Creation of motivational study aids to improve adherence such as list-serves, internet groups to share information and connect with other members, Organize focus groups with participants at the beginning and at the end to learn about their needs (community based participatory research) Tailored interventions / culturally appropriate Delivery of the interventions by nonmedical staff because increases patient motivation and trust
2. Planning of resources		
Staff	High turnover of personnel Staff shortage (administrative, non-medical staff) Shortage of doctors/physicians Lack of staff capabilities to develop translation research (training in research, but not in translation research) Lack of time for training staff members Staff attitudes toward change	Multidisciplinary team and nonmedical staff could help develop trust in the community Peer supporters, as they strengthen the project outreach and sustainability, increase trust and empowerment. Training manuals and aids for staff Training on a rolling basis for the staff and peer leaders
Time management	Underestimated time for training and recruitment Inappropriately estimated time for activities/processes involved in translation	Extensive planning ahead of time Realistic goal setting Pilot studies to help preview the possible delays
Finances	Underestimated budget on : - Staff- basically trainers - Tests (HBA1C) - Materials (printing, development of materials for the study, etc) - Transportation in some cases Unpredicted down turn of economy world wide	BRiDGES flexibility towards the budget Mentoring from researchers in the previous grants Availability of an alternate sources of funds
3. Capacity building	Lack of links from all the stake holders - No grassroots of some researchers - No institutional or government support	Relationship with outside organizations such as NGOs and the government gave support to some projects

Table 5: Lessons learnt from BRiDGES first round of grants

Theme	Lessons learnt
1. Access and reach to the community	To have a previous relationship with the community through peer leaders or previous pilot studies. Needs assessment through structured feedback from participants: Learn through community participation Understand that the recruitment is different in traditional research than in translation research Use of conceptual models and frameworks to understand the complexity of behavior change Incentives for participants, in the form of stipends, may enhance recruitment and retention rates Additional aids such as internet, email, texts, house visits, peer leaders may be beneficial in some cases.
2. Planning of resources	
Staff	Diabetes is a complex disease requiring a multidisciplinary approach The staff training and recruitment has to be a thoughtful and detailed process Pilot studies to enable anticipation of the unforeseen events
Time	Emerging research models in which there has to be a certain amount of flexibility in timelines. Avoid a rigid schedule. Previous orientation before the start of the project for new researchers Simplification of processes (internal to the project and BRiGES) Have flexibility in all the steps of the intervention
Finances	Having another funding source besides BRiDGES helped when facing unexpected challenges such as staff cut downs. Mentorship for all the areas in the project, (not only finances) could help develop stronger plans
3. Capacity building	Have a recognized team (either physicians, nurses, nonmedical staff or peer leaders) that are trusted and recognized by the community. Identify potential collaborators in other fields related to diabetes (CVD, depression, obesity) Community involvement and social support in the form of peer educators and community health workers Dissemination of the findings to all the levels in the system, first to facilitate implementation and also to help uptake Dissemination and advocacy to appropriate audiences: policy and decision makers, medical community, industry, general public.

Figure 10: Number of Times researchers reported a barrier or a positive experience in the project

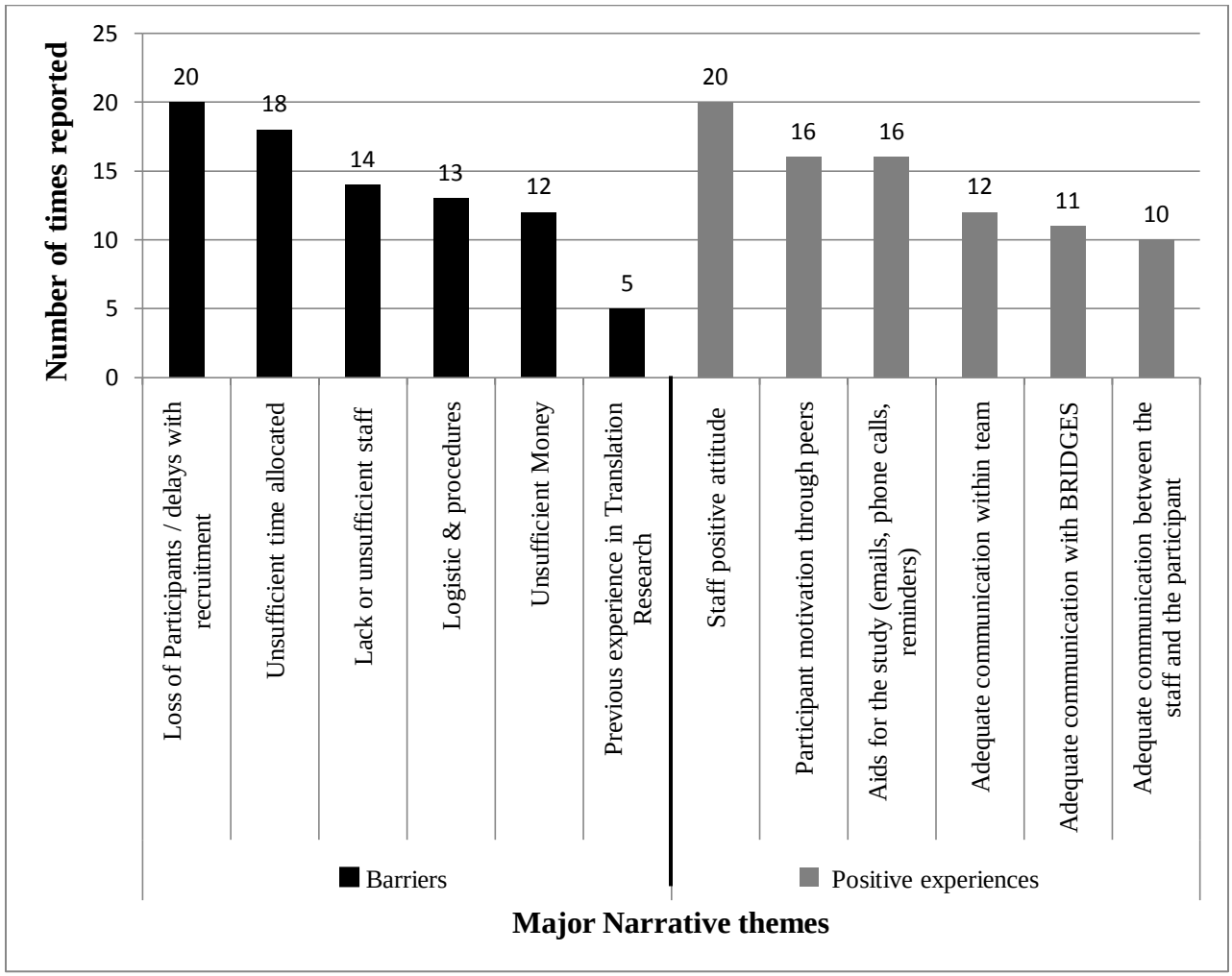
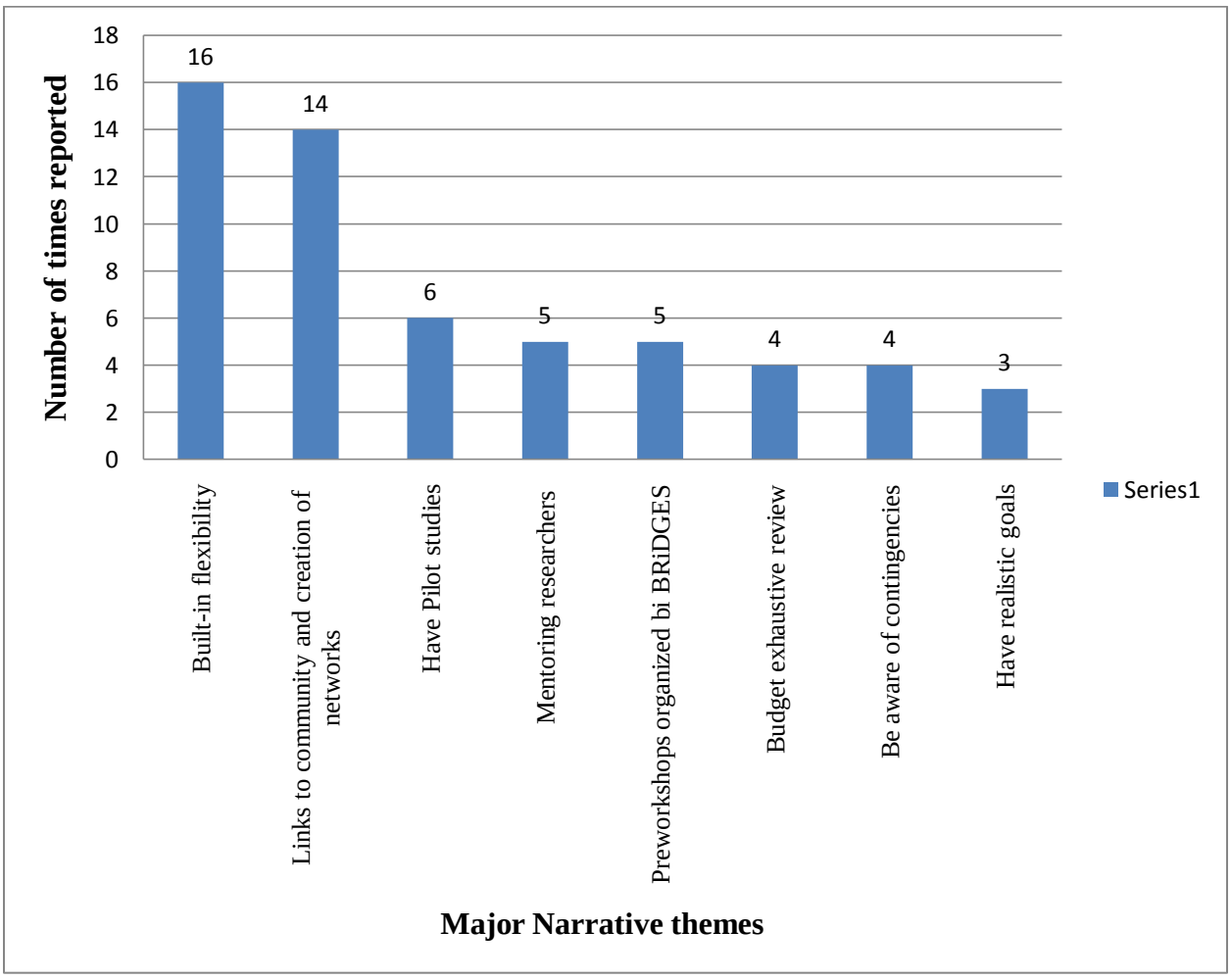


Figure 11: Number of times researchers reported a solution for a specific barrier or challenge in their project



Appendix: SEMISTRUCTURED CONVERSATIONAL IN-DEPTH INTERVIEW GUIDE

KEY EXPERIENCES IN BRIDGES 1ST ROUND OF GRANTS

INTRODUCTION

Thank you for agreeing to an interview today. My name is Isabel Garcia and I am studying for a Master in Science in Public Health at Emory University in Atlanta. As you know from my email, I am working with Ronan L'Heveder and Dr. Linda Siminerio on the International Diabetes Federation (IDF) BRIDGES project and Dr. Venkat Narayan at Emory University.

The aim of the survey is to discuss and analyze the experiences you have had until now with the progress and implementation of your project supported by BRIDGES. Translation research is a relatively new area of study. We want to learn more about translation research from the investigators facilitating these projects. We specifically want to identify the barriers, issues, opportunities and strengths you may have faced and you may still encounter in the delivery of the study. This information is essential for IDF and for the future of translational research as it will be extremely helpful for the implementation of future translation research projects. These findings will be used to develop a manuscript which will serve as a guide for future rounds of funding.

I would like to record this conversation so that I don't miss anything that you say. This conversation will be kept confidential and no information will be published without your approval. Is it OK if I record our conversation?

The interview will last approximately an hour; do you have any questions before starting?

- Firstly I would like to begin by asking you what has been your experience thus far with this project?
- In terms of conducting this project,
  a) Can you tell me all the positive experiences you have had in the project? Why?
  b) Have you encountered barriers or issues? Which?
  c) Have you had any unforeseen delays? Which?
  d) In terms of this last challenge(s)/ barrier(s), what do you consider would be a possible solution for further projects like this? (what recommendations would you give BRIDGES Committee, or any other investigators who apply for this grant)

Resource allocation and logistics

- How do you think the planning for resource allocation has been? In terms of:
  a) Staff
  b) money
  c) equipment
  d) facilities
- What was your experience in terms of a scheduled timeframe and time devoted to the study (How much time do you and your staff allocate for this specific study, was it enough?)
- What was your experience when implementing the project (was the implementation easy or hard?)
- What has your experience been with funding/ economical resources in this project?
- Experience with accounting requirements
- In terms of logistics, what was your experience with IRB (delays, attitudes of IRB staff)

Participants

- What has been your experience in recruiting participants?
- Was it difficult? Would you have done anything differently in preparing for recruitment?
- What has been your experience maintaining recruitment and participant adherence in the study?
- What was your feedback from the participants in the study? Participant response
  a) They found it easy/hard to be part of the study?
  b) What did they think about the time spent on the project
  c) Did they had any comments on how was the transportation to the site for the project
  d) How was the compliance with the procedures / study visits

Training

- In terms of training participants or staff, what was your experience for this project? (Did you need to train a lot of people, who trained them?)
- Do you consider the materials, space, time and human resources appropriate for the study in terms of training participants and/or staff? Why or why not?
- Do you think the staff in your institution is well trained for doing a translation research project?

Perceptions/ attitudes towards the study

- Have you encountered any cultural barriers while developing your project?
- How do your peers in the medical community perceive the project? Community buy-in/perceptions?
- Do you think political decisions (government/institution) have influenced in any matter your project? (External factors- political support)

Communication

- How has been your communication with IDF-Bridges? Would you improve something in terms of communication, funds, time, and resources?

CONCLUSIONS / CLOSURE

Now we are approaching the end of the interview. I only have a few more questions to ask regarding what recommendations you would have for BRIDGES and your future plans.

- Could you tell me what do you think facilitated the progress of your project? (What would you change if you could do it again, what would you leave the same)
- What is your recommendation for investigators who plan to develop a project in translation research?
- What are your future plans in terms of translation research?
- Is there anything else you think might be important to point out?
- Do you have any questions?

Thank you very much for your time and contribution to this research

Letter of approval from the IRB

HUBERT DEPARTMENT OF GLOBAL HEALTH

Signature form for Non-Research Projects

This form is to be used for students who have chosen to write a Literature Review or Special Project and are not required to apply for IRB approval.

Attach a one to two page description of the project including general subject, hypothesis to be tested or question(s) to be answered, and lay summary.

Efficacious interventions for prevention of diabetes and its complications exist; however, their implementation is woefully inadequate. Translational research, a means to bridge the gap between knowledge and its implementation, has received increasing recognition recently. BRiDGES, an International Diabetes Federation program, incentivizes researchers globally to conduct translational research. As part of its first round of funding, BRiDGES supported 11 projects in 10 countries. The purpose of this project is to qualitatively assess the early lessons learnt from implementing translational research.

We conducted semi-structured in-depth interviews with 10 researchers, seeking their views on factors relating to success and barriers to implementation. Data were collected from June-September 2010 by a trained interviewer; information was recorded, transcribed and analyzed according to predefined themes and concepts using MAXQDA software.

Patient recruitment and retention were reported as challenges, a factor which directly impacted the quality of the project outcomes. The lack of availability of local multidisciplinary teams was highlighted as having a negative effect on the project. Grassroots and community participation were emphasized to have beneficial effects by several researchers. Flexibility was recognized as a challenge for the successful execution of the projects. A key recommendation for the next round of grants would be to include feedback from previous grantees, in the form of pre-submission workshops, as well as mentoring from experienced investigators along with emphasizing the differences between traditional and translational research.

This evaluation underscores the main contingencies to be considered for successful implementation of translational research projects. Furthermore, it emphasizes the importance of having the three stakeholders: patients, providers, and health systems, acting together in a flexible environment within real life settings.

I have read the attached information and verify that this project is not research and therefore <u>does not</u> need to be submitted to the Emory University Institutional Review Board.

_____ _____

Signature of Thesis Advisor **Date**