Implementing a community-based caregiver intervention in limited-resource settings: a focus on implementation strategies

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AUTHOR'S CONTRIBUTIONS

Dr J Combrinck (JC) conceptualised and carried out the study with supervision from Dr L Schlebusch (LS) and Dr Nola Chambers (NC). JC completed the data extraction and statistical analysis of the project data and represented these schematically. JC LS and NC contributed to coding the data and all authors contributed to writing and reviewing the manuscript.

FORMAT

This thesis is presented in a publication-ready format, as per Type I CMSA format for MMed Part III (minor dissertation), according to guidelines revised in May 2021 (Dean's Circular MED1321). This manuscript has already been submitted to a journal (Autism), who unfortunately did not support publication of the manuscript with it's specific aim. JC is currently in discussion with her supervisors to identify another suitable journal for publication.

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ABBREVIATIONS

ASD	Autism Spectrum Disorder
CARA	Centre for Autism Research in Africa
CICM	CARA Implementation Coding Manual
DD	Developmental disabilities
EBPs	Evidence-based practices
ERIC	Expert Recommendations for Implementing Change project
HREC	Human Research Ethics Committee
LMIC	Low- and middle-income countries
PRIME	Programme for Improving Mental health care
WHO CST	World Health Organisation Caregiver Skills Training programme

TITLE

Implementing a community-based caregiver intervention in low-resourced settings: a focus on implementation strategies

ABSTRACT

The systematic use of implementation strategies can enhance sustainable implementation of evidence-based interventions in real-world settings. However, there are little data on the use of implementation strategies in low-resourced settings. The World Health Organization Caregiver Skills Training Programme (WHO-CST) for families of children with developmental disabilities was piloted in a rural setting in South Africa and was called the 'Diamond Families Project'. The goal of this study was to describe systematically the implementation strategies used during the planning phase of the project. Archival project records were reviewed to identify all planning activities, which were coded into implementation strategies using a tailored manual and consensus coding approach. We identified 150 activities representing 33 unique implementation strategies across nine categories. *Developing stakeholder interrelationships* was the most frequently used category, with the largest number of actors, highest costs, and longest cumulative duration. *Developing an implementation blueprint* was the most frequently used individual strategy, while *promoting adaptability* had the longest duration. The Diamond Families Project incorporated a comprehensive set of implementation strategies with a clear focus on building stakeholder relationships. Findings contribute to an evidence-base of implementation strategies for WHO-CST in South Africa, which may inform the implementation of interventions in similar low-resourced settings.

LAY ABSTRACT

Research evidence shows that effective, evidence-based interventions are often not used or sustained in real-world settings. The thoughtful use of implementation strategies can help service organisations to implement these interventions faster and more successfully. The World Health Organization (WHO) developed a Caregiver Skills Training Programme (WHO-CST) for families of children with autism and developmental disabilities. The aim of WHO-CST is to address the huge service gap particularly for families living in low- and middle-income countries. The WHO-CST was piloted in South Africa and called it the 'Diamond Families Project'. To promote optimal implementation of WHO-CST in South Africa, we used a range of implementation strategies while planning and preparing to deliver the intervention in real-world community settings. The goal of this study was to identify and describe systematically these specific implementation strategies to understand what, how, and when they were used and how much they cost. We found that implementation strategies focused on building stakeholder relationships, training and educating stakeholders, adapting the materials to the local context, and creating an implementation plan to evaluate outcomes, were used most. We describe the costs, length of time, and the number of people involved in each implementation strategy. Our study showed that implementing a new intervention like the WHO-CST in rural South Africa is complex and that implementation strategies may need to be wide-ranging and included in research budgets for optimal outcomes.

INTRODUCTION

There are more than 50 million young children with developmental disabilities (DD) such as sensory impairment, intellectual disability, and autism spectrum disorders (ASD) in the world (Black et al., 2017; Dua et al., 2017), most of whom live in low- and middle-income countries (LMIC), where they mostly lack access to care (Olusanya et al., 2018). The number of children with DD is increasing in sub-Saharan Africa, suggesting that the support needs of these children and families are likely to increase in the future (Engle et al., 2007). Finding effective interventions to help children with DD and their families to thrive is thus a high priority (Reichow et al., 2013). However, even effective interventions may face considerable obstacles to being implemented feasibly and sustainably in real-world settings. The dissemination and implementation of evidence-based practice (EBP) is seen as one of the most significant challenges facing the global mental health community (Patel et al., 2018).

The field of implementation science emerged to help researchers understand the barriers to successful implementation of evidence-based practices (EBPs) and provide guidance to address them. It is defined as “the scientific study of methods to promote the uptake of research findings, and hence to reduce inappropriate care” in healthcare services (Foy et al., 2001, pg. 353). Implementation science supports novel strategies to define, grasp and resolve barriers to the implementation, adaptation, incorporation, scale-up (the process of expanding and dissemination) and sustainability of EBPs and recommendations (Bauer & Kirchner, 2020). The overall goal of implementation science is to shorten the period in which practitioners can successfully implement EBPs in real-world settings.

According to Seward and colleagues (2021), it is essential to account for the specific context involved during the implementation of evidence-based practices (EBPs), (Seward et al., 2021).

It is particularly essential to address 'contextual equipoise' (in other words, as per Seward and colleagues in 2020, "genuine uncertainty as to whether the implementation strategy will effectively deliver EBP in a new context") during the implementation of interventions in LMICs, to guarantee that the implementation efforts take the local population's needs and interests into account (Seward et al., 2020, pg. 3). Lund identified four major obstacles to raising the standard of mental health care specifically in LMIC settings (Lund, 2018). These included (1) the limitation of resources affecting treatment coverage and quality, (2) the shortage of standardized instruments for measuring service quality in LMICs, (3) "weak health system environment", such as issues with inadequate and occasionally malfunctioning general health management information systems, and, (4) the vast variety of cultural settings and care pathways making the evaluation of processes and outcomes of care very difficult (Lund, 2018).

Implementation strategies are the techniques used to overcome the implementation barriers and enhance existing facilitators to increase the uptake, spread (dissemination of the intervention into other areas) and sustainability of EBPs within service delivery systems (Proctor et al., 2013). They are the active ingredients of the implementation process and the 'how-to' component of improving health care.

To bring order to this rapidly growing field, Powell and colleagues (2015) conducted the Expert Recommendations for Implementing Change (ERIC) project, a structured literature review identifying 73 implementation strategies that can be used prospectively in implementation-focused studies, and retrospectively to provide comprehensive accounting of the implementation strategies employed in studies. To mention a few, for example, implementation strategies identified and defined in the ERIC project include conducting local consensus discussions (include local providers and other stakeholders in discussions that address whether the chosen problem is important and whether the clinical innovation to

address it is appropriate), developing an implementation blueprint (develop a formal implementation blueprint that includes all goals and strategies, then to use and update this plan to guide the implementation effort over time), and tailoring strategies (tailor the implementation strategies to address barriers and leverage facilitators that were identified through earlier data collection).

The 73 implementation strategies described by Powell and colleagues (2015), were grouped into nine thematic clusters of related strategies (Waltz et al., 2015). This taxonomy of strategies and categories allows researchers to choose between multiple implementation strategies during the planning of interventions (Perry et al., 2019) and thus to achieve the ultimate goal of timely and sustainable implementation of EBPs. Proctor and colleagues (2013) further provided guidelines for operationalising implementation strategies in seven domains: the actor, the action, action targets, temporality, dose, implementation outcomes addressed, and theoretical justification. Reporting implementation strategies in enough detail is important so that they can be optimised over time and replicated in research and practice (Proctor et al., 2013).

Several other taxonomies of implementation strategies have been developed, e.g., (Leeman et al., 2007; Mazza et al., 2013; Mowatt et al., 2001; Powell et al., 2012), but Powell and colleagues (2012), noted that many compilations: "are purposely narrow in scope, focusing on strategies with known evidence on effectiveness (e.g. Bero et al., 1998; Grimshaw et al., 2006; Grol & Grimshaw, 2003; Shojania et al., 2006) specific medical conditions, fields of practice, or disciplines (e.g. Cabana et al., 2002; Gilbody et al., 2003); strategies that were used in a specific setting or study (e.g. Hysong et al., 2007; Magnabosco, 2006); "exemplar" programs or strategies (e.g. Katon et al., 2006; McHugh & Barlow, 2010); focus on one target such as consumers or practitioners, (e.g. Lowe et al., 2011); or one type of strategy such as educational

or organizational strategies, (Gilbody et al., 2003; Hysong et al., 2007; Katon et al., 2006; Lowe et al., 2011; Magnabosco, 2006; McHugh & Barlow, 2010; Raghavan et al., 2008)", (Powell et al., 2012, pg. 125).

The ERIC taxonomy has been used successfully to document implementation efforts in various studies (e.g. Bunger et al., 2017; Perry et al., 2019). Bunger and colleagues described a method of monitoring implementation strategies using activity logs, making it easier for front-line workers to track their implementation activities. This study was conducted in the context of a large United States county-based child welfare agency's project to enhance children's access to behavioural health services. In the field of ASD, Broder-Fingert and colleagues used the ERIC taxonomy to identify implementation strategies used across five different studies conducted in a variety of community settings in the United States of America that aimed to enhance access to early screening, diagnosis, and treatment of ASD (Broder-Fingert et al., 2019). The two most common implementation strategy categories were (1) the development of stakeholder relationships and (2) the training and education of stakeholders (Broder-Fingert et al., 2019). However, to date, there are very few descriptions of implementation strategies that have been used in LMIC settings, which conceivably present many barriers to the implementation of EBPs.

In 2018, Baron and colleagues aimed to raise the standard of care and integrate mental health services into various low-resource primary care systems, such as Ethiopia, India, Nepal, South Africa and Uganda through the Programme for Improving Mental Health Care (PRIME) project (Baron et al., 2018). They argued that more funding is required for integrated quality improvement strategies, specifically for mental health care in low-resource environments (Lund, 2018). Further research in this area is therefore needed.

The World Health Organization Caregiver Skills Training programme (WHO-CST) and the Diamond Families Project

To meet the vast treatment gap for families with children with ASD and DD, particularly in LMIC, and to address some of the well-documented implementation barriers in these low-resourced settings (such as those identified by Lund and colleagues in 2018), the WHO developed the Caregiver Skills Training Programme (WHO-CST), aimed at empowering caregivers to support the communication and learning of their children with DD. The WHO-CST consists of evidence-informed strategies that parents can use in their daily routines to help their children reach their potential (Salomone et al., 2018, 2019). The programme was designed to address many of the implementation barriers identified in the literature (Salomone et al., 2019). For example, it is designed to be delivered to groups of parents by non-specialist facilitators in local communities and materials can be adapted to the local context. The WHO-CST is being pilot tested in over 30 countries, and evidence is emerging from a range of countries including Italy, India and Ethiopia on its feasibility, acceptability, and impact (Salomone et al., 2021; Sengupta et al., 2021; Tekola et al., 2016, 2020).

Salomone and colleagues (2019) noted that the cost associated with implementation of the WHO-CST programme is anticipated to be lower than other specialist-provided implementations, due to the delivery of the programme by trained non-specialist providers (Salomone et al., 2019). The locally tailored program in Ethiopia was deemed feasible and acceptable for caregivers according to Tekola and colleagues (2020), who proposed that these results might be applicable to low-resource settings all over the world (Tekola et al., 2020).

In South Africa, the WHO-CST was implemented and evaluated in real-world rural and low-resourced urban settings in the 'Diamond Families Project', a multi-partner project that included the academic, non-profit and governmental sectors. The Diamond Families Project

included an extended planning and preparation phase and included a range of activities designed to promote successful implementation of the programme in South Africa. These activities were mainly managed by the project manager of the Diamond Families Project (LS), in consultation with the various project partners. They were guided by the principles of implementation science to target the many implementation barriers that exist in South Africa. Barriers reported by South African parents of children with DD include a lack of social support systems, limited availability of information and practical advice on raising their children with ASD and DD, as well as concerns about the uncertainty of their child's prognosis (Guler et al., 2017; Mitchell & Holdt, 2014; Mthombeni & Nwoye, 2018; Schlebusch et al., 2017). In addition, the shortage of specialised health care professionals is one of the major barriers to scaling up service delivery for children with ASD or other DD and their families (Patel et al., 2010).

The aim of this study was to document the implementation strategies used during the planning and preparation phase of the Diamond Families Project prior to the actual delivery of the WHO-CST programme in a real-world setting in a systematic way. The following questions were posed:

- What implementation activities were completed during the planning and preparation phase?
- What implementation strategies and categories were represented by those activities?
- How many times (frequency) was each implementation strategy and category used?
- How much time did they take (duration)?
- Did the use of strategies change over time (temporality)?
- How many people were involved (actors)?
- What were the expenses involved with the use of the different implementation strategies?

This study does not focus on the outcomes or feasibility of the WHO-CST programme in South Africa (Diamond Families Project), but rather provides an in-depth analysis and description of the implementation strategies used prior to implementation. By providing detailed information on the specific implementation strategies used to implement the programme in a local context of South Africa, we aimed to generate context-specific knowledge about the Diamond Families Project that could further contribute to a foundation of implementation strategies that are well specified and conceptually clear in a low-resourced context. This information will also make it easier to identify the specific barriers involved during the implementation of an intervention in this low-resourced context, which can guide the successful implementation of other interventions in South Africa or similar low-resourced settings. Further dissemination of this EBP in more settings in South Africa will also be encouraged.

METHODOLOGY

Study design

We used a retrospective, quantitative, descriptive case study design to document and describe the implementation strategies used within a single case (i.e., the planning and preparation phase of the Diamond Families Project). Although the study used complex qualitative project records (e.g., minutes, reflections, reports), most of the measures and research questions were of a quantitative nature (frequency, duration, cost, etc.). This study design was thus particularly suitable to answer *what*, *when*, *where*, and *how* questions mentioned above (Stone III., 2004). The study was approved by the Human Research Ethics Committee at the University of Cape Town (HREC Ref: 422/2020).

Procedures

As shown in figure 1 we used four main procedures to achieve the study aim.

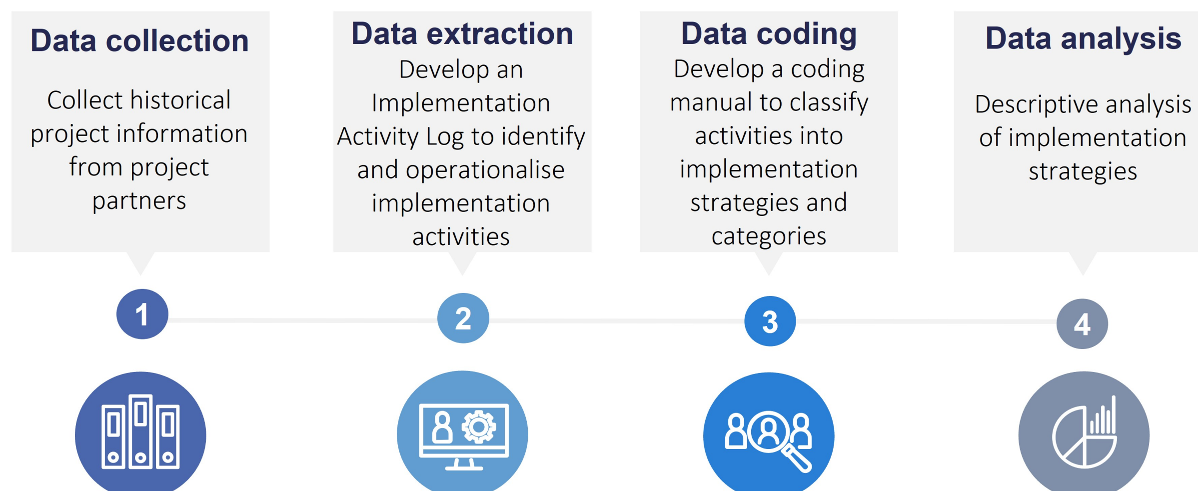

Figure 1. Overview of the four study procedures

1. Data collection

This study was a record review of activities conducted during the planning and preparation phase of the Diamond Families Project. The project leadership and management meticulously documented project information in sources such as the project calendar, progress reports and meeting minutes to monitor and report all project activities to the project funder (the Department of Social Development). These documents served as the information sources used in this study, together with all other sources available which had relevance for implementation strategies, such as financial reports, project notes and reflections of the project manager (LS) for the period 1 November 2017 to 1 April 2020. These data sources reflect a complex combination of quantitative qualitative sources, which were then coded into quantitative data. While every effort was made to access all the relevant materials documenting planning and preparation activities, we are well aware that many essential activities may not have been documented, such as those aimed at building relationships with project sites personnel, which are frequently overlooked in official documents and meeting minutes. It is therefore very likely

that the data we were able to code is still an under-representation of the activities that took place in the planning and preparation phase. The lead representative from each partner organisation received a study information letter with a consent form to permit the use of the project information. Once consent was obtained, access was given to all project information files compiled during the defined period.

2. Data extraction

The principal investigator (JC) reviewed the project records to identify all implementation activities during the planning and preparation phase and created the *Implementation Activity Log for the Planning and Preparation phases of an Implementation Study* (Appendix A) based on the work done by Proctor and colleagues (2013) and Bunger et al (2017) to capture the relevant data about each implementation activity including: (1) date, (2) type of activity, (3) number of people (actors) involved, (4) time taken for the activity, (5) temporality (when the strategy was used during the planning and preparation phase), and (6) costs involved in each activity. Three of Proctor's domains were not considered relevant for the context of this study and were excluded, since the project manager of the Diamond Families Project (LS) was able to identify in advance, that those strategies were not used. These domains were: implementation outcome affected, justification, and action target. Furthermore, an Implementation Activity Log on Google Sheets was created to extract the data for export to Excel for further coding. These activity logs can be used by project partners and management in future, to document the required information about each activity to ensure better record keeping, for future studies regarding implementation strategies, to be conducted more accurately. Duplicate activities were combined into a single entry.

3. Data Coding

Development of the Centre for Autism Research in Africa (CARA) Implementation Coding Manual (CICM). A tailored and detailed implementation coding manual was developed during the course of this study to code the activities into implementation strategies using the following steps summarised in Table 1.

Table 1. Development of the *CARA Implementation Coding Manual* (CICM) to identify and describe the implementation strategies relevant to the planning and preparation phases before implementing a community-based intervention in a low-resourced setting

Researchers (chronological order)	Authors' original tool	Excluded or modified strategies/categories for this study	Final Coding Manual
Powell et al. 2015	Refined a compilation of 73 implementation strategies: Expert Recommendations for Implementing Change (ERIC) project	Excluded 27 strategies irrelevant to the planning and preparation phases Modified five implementation strategy names Created sub-divisions for four implementation strategies Adapted definitions to 10 strategies	Included 46 implementation strategies and four adapted strategies
Walsh et al. 2015	Developed nine implementation categories for the 73 ERIC implementation strategies		Included all nine implementation categories
Bunger et al. 2017	Added three new strategies	Excluded two strategies initially	Included one implementation strategy initially. Later, this strategy was combined with one of the original ERIC strategies

Perry et al. 2019	Added three new strategies	Excluded all three strategies	None included in the final coding manual
Final CARA Implementation Coding Manual (CICM)	Combined from various researchers in the field and modified the coding manual to be relevant to the planning and preparation phases of implementation in low-resourced settings		50 implementation strategies Nine categories

Step 1: *Identification of relevant implementation strategies from existing coding manuals*. The coding manual for this study is based on existing coding schemes developed by various leaders in the field. A comparison table including the definitions of each implementation strategy as per the original ERIC definitions (Powell et al., 2015), the categories described by Walsh et al. (2015), and the amendments proposed by Bunger et al. 2017 and Perry et al. 2019 was compiled (Appendix B). The three authors used this to develop consensus about the strategies relevant to this study. We excluded 27 of the 73 ERIC strategies and the three new strategies identified by both Bunger et al. (2017) and Perry et al. (2019) as not relevant to this study, partly because the intervention was being implemented in a low resource setting in South Africa, which was somewhat independent of existing formal systems of care. Also, this study included only the planning and preparation phase and not the actual implementation phase of the Diamond Families Project. The strategy *plan for outcome evaluation,* (Bunger et al., 2017), was initially included in our coding manual. However, during the coding process, we reached a consensus that this strategy was very similar to *develop an implementation blueprint* in the context of this study and we merged it with this strategy. Our final coding manual consisted of 46 implementation strategies, categorised into nine categories (Waltz et al., 2015). Appendix C summarises the subset of strategies and categories included in this study from the larger set.

Step 2: Adaptations to selected strategy definitions. Four of the 46 ERIC strategies (Powell et al., 2015) included in our coding manual were subdivided into two strategies each to better describe the context in which these strategies were used during the Diamond Families Project, specifically, whether the strategies were used locally or globally. This included the strategy *capture and share local knowledge*, which was subdivided into *capture and share LOCAL knowledge* and *capture and share GLOBAL knowledge*. This was important for this study as the WHO-CST programme is being piloted in many settings globally, and many implementation activities were geared towards capturing and sharing this global knowledge base. Similarly, the definition for *identify early adopters* was amended to "Identify early adopters at GLOBAL sites to learn from their experiences with the practice innovation". The strategy originally named *fund and contract (and/or negotiate) with the vendors for the clinical innovation* was redefined as *conversations with potential funders*. Also, the strategy *change service sites* was changed to *identify service sites*. The adaptations are described in more detail in Appendix D. The final coding manual for this study comprised 50 discrete implementation strategies grouped into nine categories and was entitled the CARA Implementation Coding Manual (CICM) and can be viewed in Appendix E. The detailed coding definitions for each strategy are listed in Appendix F.

Step 3: Coding process. The final CICM was used to code each extracted activity from the planning and preparation phase into an implementation strategy. All three authors coded the activities independently in batches of about 20 activities during their own time, using the description of each activity extracted on the Excel spreadsheet and the definitions of each implementation strategy on the CICM coding manual. LS and NC submitted their codes independently via Google Sheets to JC who then collated and compared the codes. After each

batch of codes was compared, a virtual meeting was held to discuss discrepancies and reach consensus regarding those discrepancies. Often consensus was reached by the project manager of the Diamond Families Project (LS), providing more detail on that specific activity which assisted in selecting the most appropriate code to use. It was thus very helpful to have LS as one of the coders as she brought first-hand knowledge about the various implementation activities that could assist in making coding decisions. Certain activities were complex and encompassed more than one specific implementation strategy. According to Powell et al. (2015), these multifaceted activities can be described by combining different implementation strategies. A decision was made to code a maximum of two (most appropriate) implementation strategies for each activity in these cases to promote agreement and simplicity.Click or tap here to enter text. This consensus coding approach was used on 100% of the data to improve the quality and reliability of the coding process. This is a strength of this study and similar to the approach adopted by Hooley and colleagues (2019) who performed a narrative review in assessing Implementation Strategy Reporting in the Mental Health Literature, also using the implementation strategy reporting guidelines of Proctor et al. (2013).

4. Data Analysis

Following consensus coding, descriptive analyses were performed to explore the frequency, duration, temporality, actors, and costs for each implementation strategy and overall implementation category. Regarding the total hours spent on each specific strategy, whenever a single activity was best represented by two different implementation strategies, the time spent on that specific activity was accounted for by both relevant implementation strategies. Thus, the total time of all the implementation activities combined does not represent the total

time spent on all the implementation activities in the planning and preparation phases of the project. Findings were collated into graphs for a clear visual representation of the data.

Community Involvement

The Diamond Families Project was a multi-partner project which by definition included community involvement from research, non-profit, and governmental sectors. The planning phase of the Diamond Families Project, as discussed below, involved many activities directly targeting stakeholder engagement. The development and adaptation phases of the project therefore included significant direct community involvement. However, for this retrospective study where we documented the implementation strategies used in the Diamond Families Project, the conceptualisation and data analysis were carried out only by the authors, with permission from the project partners. One of the authors, however, was the Diamond Families Project coordinator. Analysis, interpretation and writing-up therefore did not include direct community involvement.

RESULTS

How many implementation-related activities were completed?

One hundred and fifty (150) implementation-related activities were identified in the data extraction process. These included, for example, adaptation workshops with academic partners and community champions, service providers workshops, project team meetings, stakeholder meetings, translations of intervention materials, conference presentations, and community visits. For examples of the activities representing each strategy, see Appendix G.

How many implementation strategies and implementation categories were used?

Consensus coding of the 150 activities revealed that they represented 33 unique implementation strategies. Eighty-one of the 150 activities consisted of one discrete implementation strategy, while the remaining 69 activities represented a combination of two implementation strategies. Thus, across the 150 activities, implementation strategies were used 219 times. The frequency of each implementation strategy used (n = 219), with examples of activities for each strategy is summarized in Appendix G. Not all 50 implementation strategies identified in the adapted CICM coding manual (see Appendix H) were used. However, a substantial proportion (66%) of the total strategies were used at least once. Overall, 33 implementation strategies were identified, representing all nine of the overarching categories.

What were the most frequently used implementation categories and strategies?

Figure 2 summarises the frequency of all 33 implementation strategies identified in this study according to the nine implementation categories. In this study, we aimed on documenting the frequency of the different implementation strategies used (Appendix G). Further research opportunity lies in determining the effectiveness of these specific strategies.

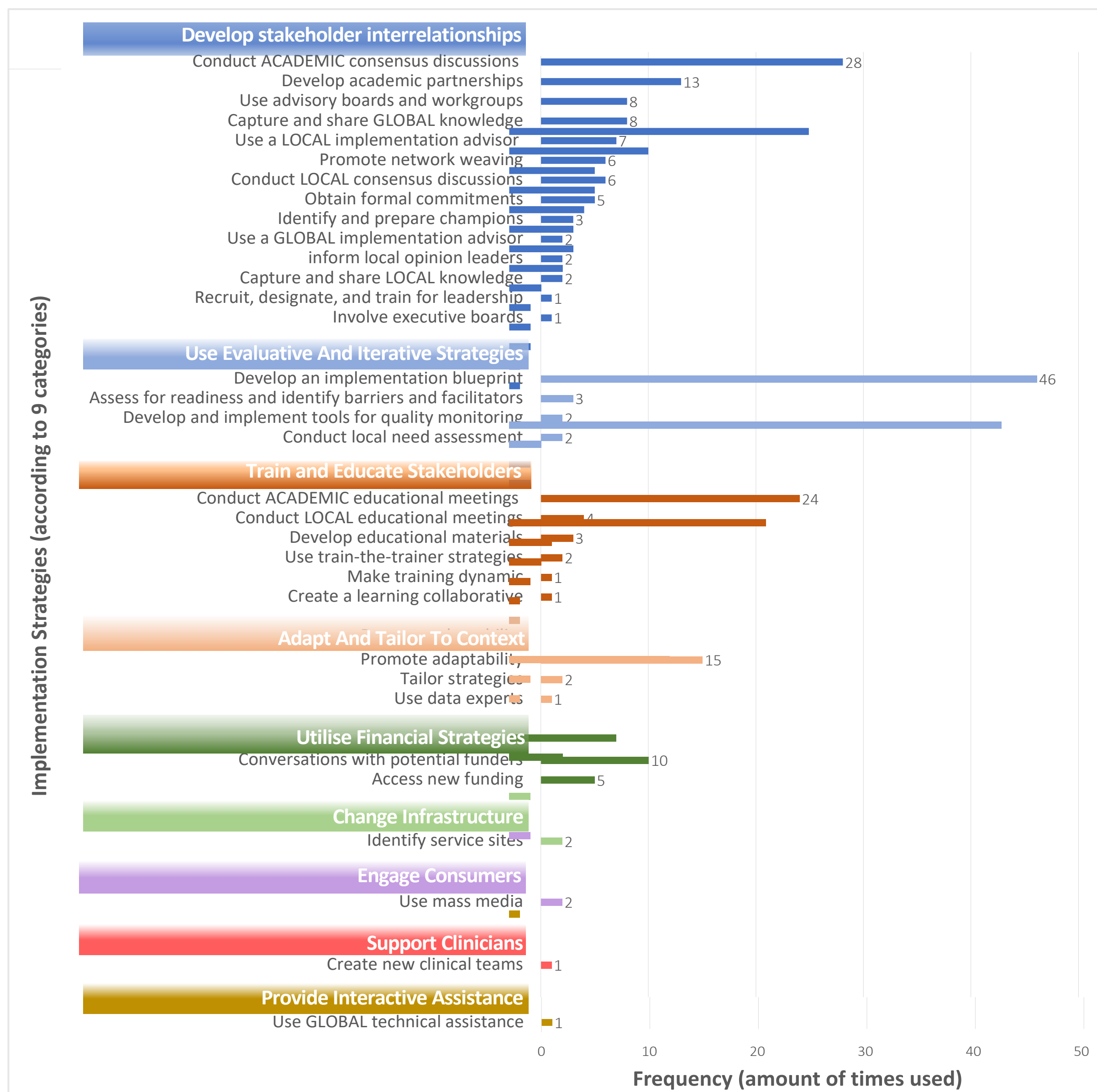

Figure 2. Summary of frequencies of implementation strategies used, in descending order, according to the nine categories (Waltz et al., 2015)

Develop stakeholder interrelationships was the most frequently used implementation category (91/219; 42%). This included implementation strategies such as *conduct academic consensus discussions* (the second most used strategy; 28/219; 13%). Activities for this strategy included meetings held with academic experts, service provider workshops, adaptation workshops with academic partners and research meetings held at a national autism symposium. The strategies of *developing academic partnerships* (e.g., meetings with the Africa Autism Treatment Network group and various stakeholder groups), *conducting local consensus discussions* (e.g., meeting

with the community-based research assistant and doing community visits), and *identifying and preparing champions* (e.g., learning and development of the community-based research assistant) were included in this category.

Use of evaluative and iterative strategies was the second most used category (53/219; 24%), primarily due to the frequent use of the *developing an implementation blueprint* strategy, which was the most frequently used individual implementation strategy (47/219; 21%). The activities related to this specific strategy focused mostly on deciding on the study design, study measures, and ethics protocol development. Research lab meetings and project team planning meetings held to inform the project scope and plan the different project phases, as well as strategic planning meetings by the project steering committee and quarterly progress report updates were activities coded under this strategy. Other strategies included: *assess for readiness and identify barriers and facilitators* (e.g., a process of needs analysis done between project partners), and *conducting local need assessment* (e.g., community mapping done by community-based research assistant).

Training and educating stakeholders was the third most common category (35/219; 16%). This included the strategy *conducting academic educational meetings*, the third most common strategy overall (24/219; 11%). Examples of activities coded under this strategy were project updates at academic symposiums and governmental audit meetings as well as university stakeholder meetings. *Developing educational materials* (e.g., developing training resources) was another strategy categorised under this overarching category.

Adapting and tailoring to context was the fourth most-used category (18/219; 8%). One of the strategies under this category was *promoting adaptability,* which amounted to the fourth most used strategy overall (15/219; 7%). Activities in this strategy included Setswana translations of the materials by a community-based research assistant, community visits to gain insight into the rural context, and adaptation workshops held with various stakeholders. Another strategy classified under this broader category was *tailoring strategies* (e.g. team meetings on adapting, implementing, and evaluating the WHO-CST in South Africa).

How much time did the implementation strategies take?

The number of hours spent on implementation activities during the planning and preparation phase in this study was about 1 672 hours (equivalent to about 209 8-hour workdays). This reflects the time spent on the 150 activities and not the total amount of implementation strategies (as certain activities were coded with two strategies, and time was not duplicated for those activities). Figure 3 shows the duration for the 15 most frequent implementation strategies (grouped according to their specific categories). The category on which the most time was spent, was *developing stakeholder interrelationships* (861 hours; 34%). The significant strategy under this category, which took the second longest of all strategies, was *using advisory boards and workgroups* with 471 hours (19%). Activities included collaborators' meetings and stakeholder workshops. The category with the second longest duration was *adapting and tailoring to context* (632 hours; 25%). The individual implementation strategy that took the most time was *promoting adaptability* (627 hours; 25%). The category with the third longest duration was *train and educate stakeholders (*475 hours; 19%). The implementation strategy *conducting local educational meetings* amounted to 227 hours (9%). Activities accounting for

this time included community visits and meetings with community experts to discuss the programme's feasibility.

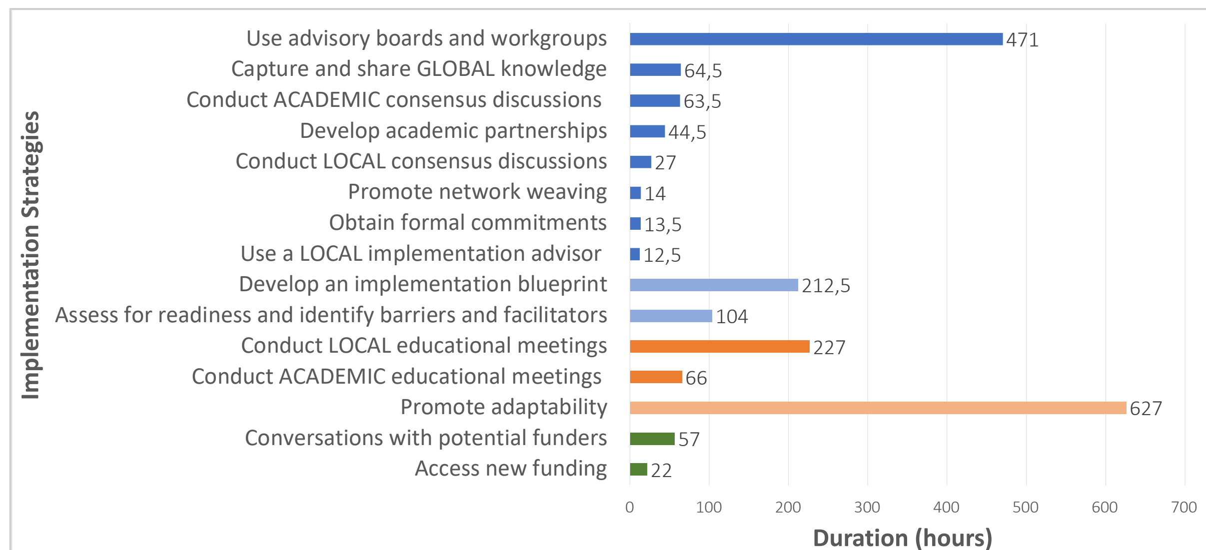

Figure 3. Duration of 15 most frequent implementation strategies, grouped according to implementation categories

When were strategies used?

The temporality of strategies describes the frequency of each strategy over time. As illustrated in Figure 4, the most frequently used strategy - *developing an implementation blueprint* - was the most used strategy at the beginning of the planning and preparation phases. The frequency decreased in the middle of the planning phase, then increased again towards the end of this period. Mid-way during the planning and the preparation phases, the frequency of the strategy *conducting academic educational meetings* peaked, while *conduct academic consensus discussions* peaked during the third quarter of the study period. In the final months leading up to the intended project launch at the end of April 2020, the most prevalent strategies were *developing an implementation blueprint* and *conducting academic discussions*.

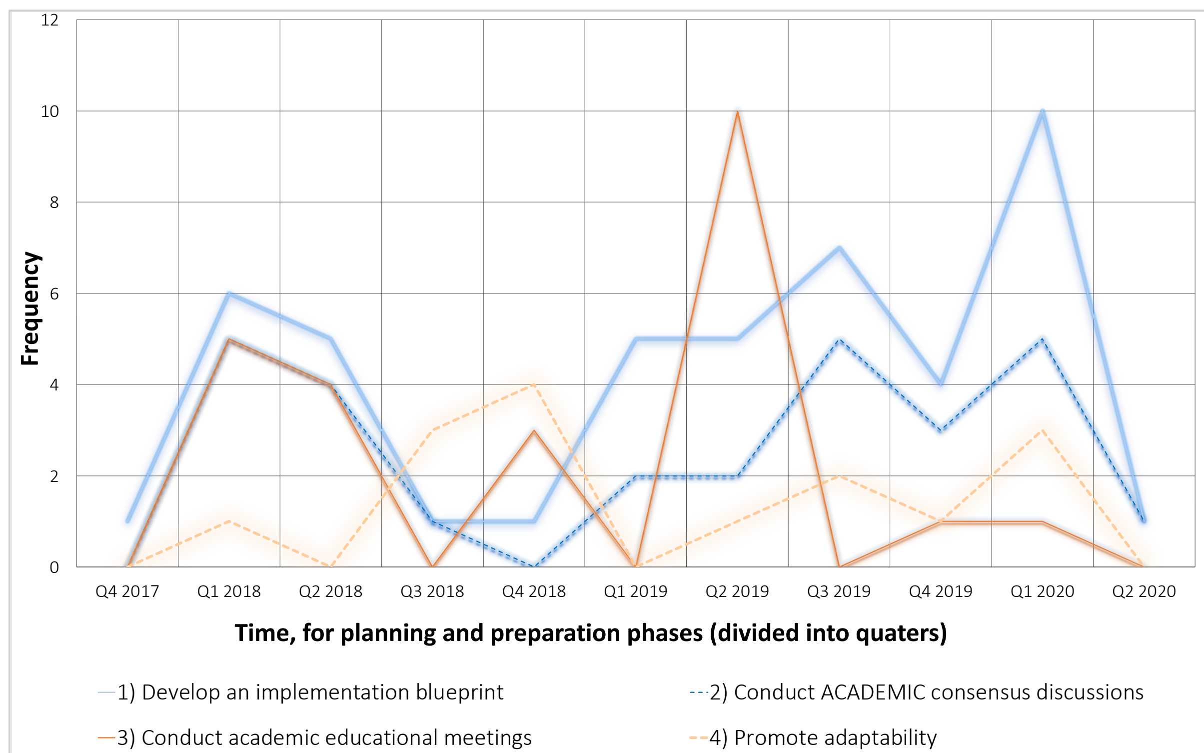

Figure 4. Frequencies of the four most frequently used strategies used over time

How many people were involved?

The majority of activities included multiple people (or actors) across most strategy types. As depicted in Figure 5, most actors were involved in the most frequent category, namely *developing stakeholder interrelationships* (demonstrated with the dark blue bars), (n=948; 42%). Included in this category was the strategy *capturing and sharing global knowledge,* that had the second most actors involved (n=259; 11%). The category *training and educating stakeholders* (n= 889; 39%) had the second most actors involved (demonstrated with the dark orange bars). The specific strategy in this category, *conducting academic educational meetings* (n=819; 36%)*,* included the most people.

The category with the third most actors was *use of evaluative and iterative strategies* (n=267; 12%), with the strategy *developing an implementation blueprint* (n=197; 9%), involving the third most actors. The different patterns observed in Figure 3 and Figure 5 indicate that the

total number of actors involved in each of the implementation categories did not relate directly to the frequencies or durations of those categories.

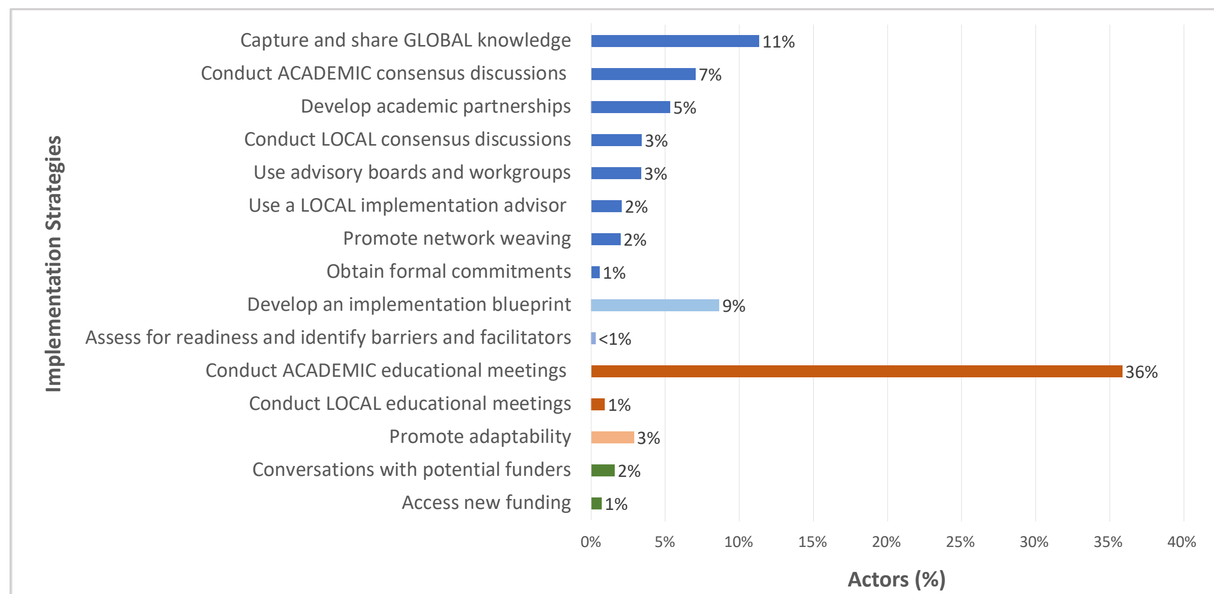

Figure 5. Percentage of actors used in 15 most frequent implementation strategies, grouped according to categories

What were the expenses involved with the use of the different implementation strategies?

The most money was spent on the most frequently used category - *developing stakeholder interrelationships* (81%), this included all expenses involved in arranging the stakeholder meetings, attending collaborators meetings at ASA, etc. The costs of the eight most expensive implementation strategies are highlighted in Figure 6, as their costs were significant, each amounting to at least more than 1% of the total costs of all activities involved in the project . *Developing academic partnerships* was the most expensive individual strategy (75%). Activities included the establishment of a community-academic partnership (i.e., non-profit disability organisation and university partnership, including the project coordination), and various planning and stakeholder meetings to find effective answers to

address our local needs and establish a community-academic partnership. The second and third highest costs categories were *training and educating stakeholders* (14%), (involving expenses incurred to present updates on the Diamond Families Project to the CARA Team, training workshops held with community experts and the 7-day training programme of the Master Trainers) and *adapting and tailoring to context* (4%), which included all expenses involved in translating the facilitator's booklets into Setswana.

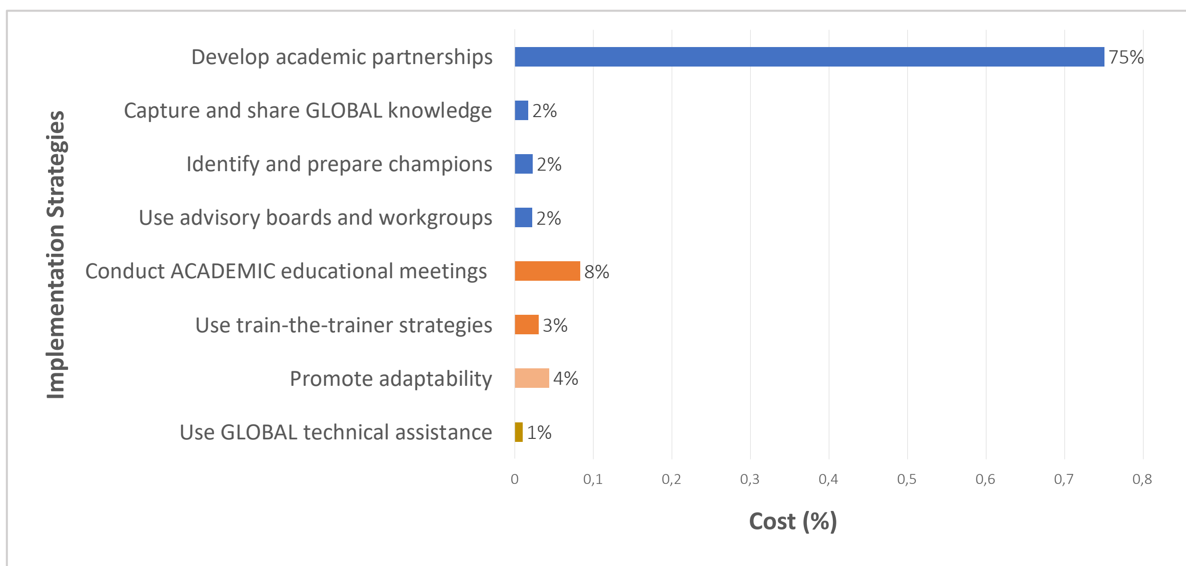

Figure 6. The eight implementation strategies with the highest costs, grouped according to their respective categories

What were the duration, number of actors and cost for the most frequent implementation strategies?

Each strategy had a unique configuration of how frequently it was used, how long it took, how many people were involved, and how much it cost. Figure 7 shows the unique combination of resources used in the eight most frequent strategies, which were selected for comparison to ensure that the three strategies with the longest duration and most actors, respectively, were included. This figure indicates that the implementation strategies that required the most actors

weren't necessarily those most frequently used or with the longest duration (Figure 7). For example, *developing academic partnerships* was costly but required relatively few actors and duration of time. However, *conducting academic educational meetings* involved many actors and a relatively short duration, while, *promoting adaptability* had a long duration and relatively higher costs, but fewer actors.

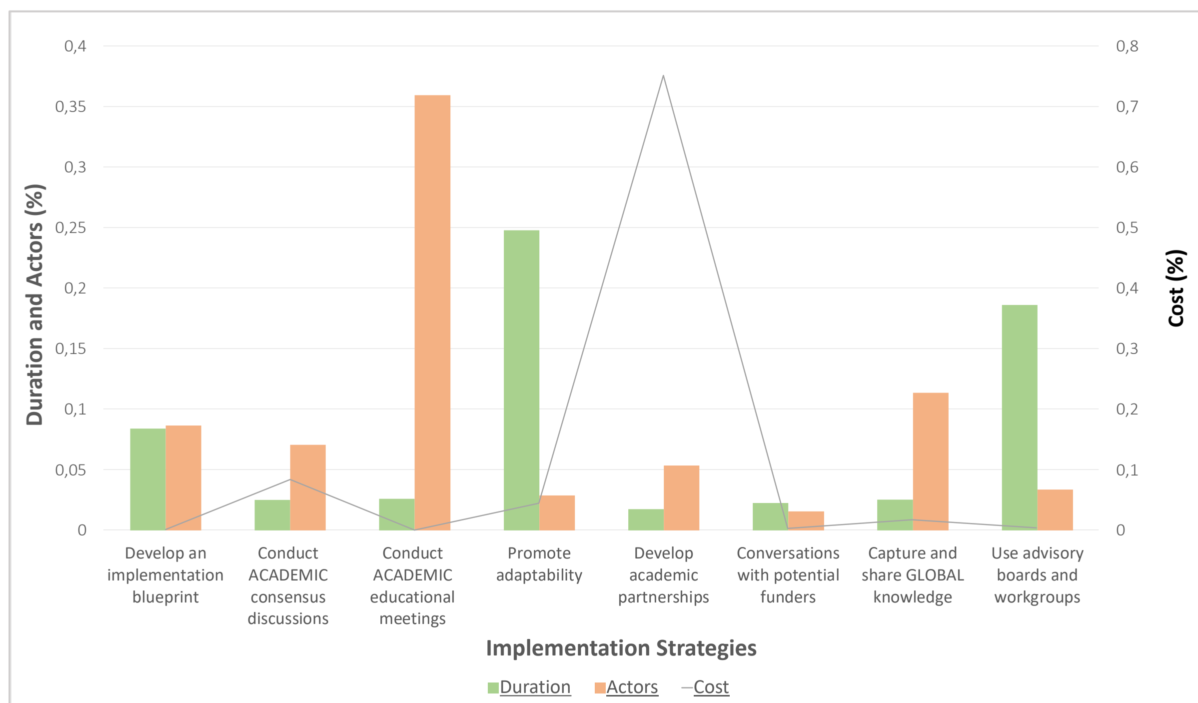

Figure 7. Unique combinations of resources involved in the eight most frequent implementation strategies, in descending order of frequency

DISCUSSION

Given the significant challenges associated with the implementation of EBPs and interventions particularly into low-resourced real-world settings (Patel et al., 2018), this study set out to document the implementation categories and strategies used during the planning and preparation phase of the Diamond Families Project, a multi-partner project evaluating the

WHO-CST programme in low-resourced settings in South Africa. After a careful review of the existing literature and nomenclature of implementation strategies, we created an implementation strategy coding manual (CICM) to record categories and strategies in a rigorous and systematic way. One hundred and fifty (150) activities were identified in the planning phase, which were coded into 33 unique implementation strategies across 9 implementation categories. These findings suggested that the Diamond Families Project was characterised by a broad and wide-ranging implementation-focused planning phase. We acknowledge that the effectiveness of the strategies identified are not yet known and have not been empirically tested. It is possible that not all strategies may be necessary or equally effective in ensuring successful implementation. Also, the frequency count results of the different implementation strategies could have been influenced by the archival records best capturing activities that fall under *developing stakeholder interrelationships* (i.e., activities driven by academics keeping detailed records) and potentially missing other implementation strategies (i.e., community based grassroot activities). Fortunately, the project manager of the Diamond Families project (LS), was personally involved in most of the activities and was helpful in understanding and interpreting some of the records during extraction of the activities. Documenting these strategies is an essential first step in understanding what it takes to implement a caregiver training programme in an LMIC context. In light of the fact that implementation of EBP remains one of the biggest identified challenges in public mental health globally, the extensive menu of strategies employed in the very low-resourced, rural setting in this project is arguably reflective of the considerable implementation barriers in this context. Here we describe the lessons learnt in this project to guide the scaling-up of WHO-CST in South Africa, with the hope that these reflections may also inform implementation of WHO-CST and other interventions in other low-resourced contexts.

Identifying implementation activities and strategies

We used an adapted version of the Bunger et al. (2017) activity log to identify and characterise the implementation activities for later coding into implementation strategies. Bunger and colleagues designed this log to be practical and straightforward, and we found it very useful to capture the necessary activity information during our data capturing process. We acknowledge that it was used retrospectively by researchers and not prospectively by the potential implementers in community settings where the WHO-CST programme was to be implemented. Also, similar to Bunger et al. (2017), we found very early on that coding the wide range of identified activities according to a manual of implementation strategies was a complex process and that a consensus coding approach was necessary to promote reliability. We also found that compiling the adapted CICM codebook was necessary to ensure that the strategies and definitions were relevant to this unique LMIC context and the global WHO-CST programme. The CICM may be a helpful tool to contribute to implementation research and practice in LMIC. During the development of our codebook (CICM), we had a similar goal to the study done by Powell and colleagues (2013), who developed a consolidated compilation of discrete implementation strategies by building on earlier studies and compilations to improve clarity within the field of implementation science. They stated that this compilation will be advantageous to several health care stakeholders by enabling them to carefully plan and conduct implementation programs, utilizing various strategies adapted to their particular setting and needs of the community (Proctor et al., 2013).

Implementation categories and strategies

A noteworthy finding was the prominence of implementation strategies related to the category *developing stakeholder interrelationships,* which was the most frequently used implementation category, involved the largest number of actors, incurred the highest costs, and its activities constituted the longest cumulative duration. This is similar to previous studies that documented implementation strategies related to caregivers of children with ASD (Broder-Fingert et al., 2019). In part, this finding may be explained by the sheer number of strategies included in this category according to the Waltz et al. (2015) classification, but it also underlines the importance of activities related to developing stakeholder relationships in a community-based and community-partnered project in an LMIC. This category was dominated by strategies involving *conducting academic consensus discussions* and *developing academic partnerships*, which accurately reflects the reality of this project as primarily an academic research endeavour. Most of the costs were associated with the latter implementation strategy; however, it was one of the strategies with the least actors required or time invested. We therefore propose that this is an important and time-effective strategy, which future interventions in LMIC should consider including, but which needs to be budgeted for carefully.

The frequent use of the *capturing and sharing GLOBAL knowledge* strategy reflects the fact that the project was related to the global implementation initiatives of the WHO-CST programme and was reflected in activities where lessons learned from international implementation efforts were shared. A new implementation strategy was added to the coding manual to capture this unique aspect of the project. The frequent activities related to the strategy of *using advisory boards and workgroups* is also a reflection of this project as a multi-partner project involving stakeholders in the academic, non-profit, and government sectors.

Intersectoral collaboration has been identified as essential to the implementation of new interventions in South Africa (Franz et al., 2018; Pillay et al., 2022). It has been proposed that focussing on developing relationships with stakeholders whenever a new intervention needs to be implemented in low-resource communities, will greatly affect the outcome and sustainability of that intervention (Stahmer, Dababnah, & Rieth, 2019), these findings suggest that this focus was paramount in the Diamond Families Project.

Using evaluative and iterative strategies was the second most frequently used category, dominated mostly by the strategy *developing an implementation blueprint*. This referred to all activities related to designing the study and evaluation procedures and writing the project proposal and ethics application. Although it was the most frequently used strategy, it was only 4th in terms of the total time spent on it relative to the other implementation strategies and incurred minimal costs (0,08% of total cost). These activities also generally required less than a quarter of the number of actors compared to the leading strategy in that domain (namely, *conducting ACADEMIC educational meetings*). These actors mainly included the project coordinator and executive leadership team and highlights the importance of a dedicated project leader who can attend to the tasks of developing an implementation blueprint, assessing for readiness, barriers or facilitators, and doing community visits to assess the local needs, when preparing to implement a new intervention. According to Bunger and colleagues, strong leadership is critical to create enthusiasm regarding new practices and of a supportive environment for implementation (Bunger et al., 2017).

Activities in the third most frequently used implementation category of *training and educating stakeholders,* went somewhat hand-in-hand with those of *developing stakeholder interrelationships* and mainly consisted of informational presentations about the Diamond

Families Project in both academic and community settings. This included the implementation strategy *conducting academic educational meetings,* which required the most actors by far, although it was not the most frequent strategy, nor did it take the longest. *Development of training materials* and *train-the-trainer strategies* were included under this category in the development of a detailed training and apprenticeship model. The first round of training master trainers was also reflected in this category, which explains the relatively large number of actors included in this category and the relatively high costs of the in-person training days.

The implementation category *adapting and tailoring to context* also deserves mention. Adaptation refers to an intervention's routine and methodical adjustment to establish its comprehensibility, acceptability, feasibility, and relevance to its target users (Bernal et al., 2009). The original ERIC definition described this implementation strategy as “the ways a clinical innovation can be tailored to meet local needs and clarify which elements of the innovation must be maintained to preserve fidelity” (Powell et al., 2015, pg. 10). Evidence shows that by adapting programmes culturally and contextually, their feasibility, acceptability, and effectiveness are improved, and foreseeable barriers to participation are reduced. This ensures that the programme is responsive to the local socio-economic, political, and cultural context and meets the needs of the participants (Kumpfer K.L., Alvarado R., Smith P., & Bellamy N., 2002). In this study, this category was the fourth most frequently used, the third most expensive, and the second longest time duration. In addition, 73 actors were identified as being part of adaptation activities. Together these indicate that *adapting and tailoring to context* formed a major part of the planning process and is consistent with the recommendations for adapting the WHO-CST programme of Salomone and colleagues (2019).

Study limitations and recommendations for future studies

We acknowledge several limitations in the study. Firstly, the project activities were identified retrospectively from archived project records, such as calendars and reports. It is therefore possible, even likely, that activities were missed if they were not documented in these sources, particularly more informal activities. Similar to Bunger et al. (2017), we therefore recommend using the activity log prospectively to track implementation activities from the very beginning of the planning phase of a study.

Secondly (and also similar to findings by Bunger and colleagues), we found coding the implementation activities challenging. The process required several iterations of refining definitions or adapting definitions to suit the context of the project. We found that we needed the "inside knowledge" of the Diamond Families Project coordinator (LS) when coding. We attempted to balance the possible bias with two coders who were not part of the project during the planning phase. We also resorted to consensus coding for 100% of the data to enhance coding reliability. Therefore, while the adapted coding manual has received extensive consideration and adaptation, further training on the manual might be needed by future teams wanting to use it, as well as sufficient time for coding teams to reach a consensus in how to apply the coding team to a particular project (Bunger et al., 2017). Community involvement could also be included in adapting the coding manual.

As mentioned, this study did not document the effectiveness of the identified implementation strategies, and they should not be viewed as a recipe for successful implementation. Further research is needed to determine the impact of these implementation strategies on the acceptability, feasibility and effectiveness of this WHO-CST intervention in South Africa. In the recent *Lancet* commission on the future of care and clinical research in ASD (Lord et al., 2022)

it was suggested that the implementation of evidence-based programmes of care in LMIC is essential to ensure the rights of people with ASD and other neurodevelopmental disorders to have their needs satisfied. It also suggests that certain barriers are tackled, such as effectiveness across age groups, developmental levels, socioeconomic and cultural backgrounds, and the implementation of essential training and system adaptations to make interventions scalable. By documenting how implementation barriers were approached during the Diamond Families Project, we hope to enable project managers of future implementation of EBPs in LMICs plan their projects in particular to anticipate which strategies would take up more of their time and to plan their budgets accordingly.

CONCLUSION

This study found that the planning and preparation phase of the Diamond Families Project, aimed at implementing the WHO-CST programme in a rural community in South Africa, involved an extensive period of implementation-focused activities which reflected a range of recognised implementation strategies. These included building stakeholder inter-relationships, training and educating stakeholders, adapting the materials to suit the local context, and creating an implementation plan to evaluate outcomes. We found the activity log of Bunger et al. (2017) to be a helpful tool to document the activities, even retrospectively, and found the ERIC taxonomy to be a useful starting point for developing an adapted coding manual (CICM) tailored to the unique characteristics of implementing a community-based intervention (WHO-CST) in a limited-resource setting. These findings contribute to the implementation research landscape in South Africa and may be helpful to guide the planning and preparation of other implementation efforts in similar settings.

SUPERVISOR DECLARATION

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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ETHICS APPROVAL

All procedures performed in the broader Diamond Families Project were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Ethics approval for the study was obtained from the University of Cape Town (HREC Ref 422/2020).

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APPENDICES

Appendix A: *Implementation Activity Log for the Planning and Preparation Phases of an Implementation Study*

Appendix B: *Comparison of Code Books: Definitions of the complete compilation of implementation strategies from existing literature*

Appendix C: *73 ERIC strategies grouped into nine categories: 46 Strategies relevant for the planning and preparation phases of an implementation project (encircled)*

Appendix D: *Adaptations and modifications to the original ERIC strategies*

Appendix E: *CARA Implementation Coding Manual (CICM): Evaluation of Planning and Preparation phases of Diamond Families Study*

Appendix F: *CARA Implementation Coding Manual (CICM) - Strategy Definitions*

Appendix G: *Frequency of implementation strategies used (n = 219), with examples of activities for each strategy*

Appendix H: *An overview of the number of implementation strategies used in planning and preparing to implement a community-based caregiver intervention*

APPENDIX A: *Implementation Activity Log for the Planning and Preparation phases of an Implementation Study*

a) DATA EXTRACTION		Activity 1	Activity *n*
Project information source			
Date			
Project event (type of activity)			
Location			
Number of attendees (actors)			
b) OPERATIONALISE THE IMPLEMENTATION STRATEGY			
Number of actors involved (and attendee categories)	Identify who enacts the strategy		
Dose (time)	Specify amount of time spent		
Temporality (phase of project)	Specify when the strategy was used		
Cost	Cost associated with the activity		
c) IDENTIFY THE IMPLEMENTATION STRATEGY			
Name the implementation strategy used, with language that is consistent with existing literature (ERIC's Taxonomy, amongst others)			
d) CLASSIFY THE IMPLEMENTATION STRATEGY			
Classify strategy into one of the nine categories (ERIC's Taxonomy – 9 clusters)			

APPENDIX B: *Definitions of the complete compilation of implementation strategies from existing literature*

Nr	Strategy name	Original ERIC definitions (Powell et al. 2015)	Amended Bunger definitions (Bunger et al. 2017)	Amended Perry definitions (Perry et al. 2019)
1	*Access new funding*	Access new or existing money to facilitate the implementation.	Access new or existing money to facilitate the implementation. This could involve new uses of existing money; accessing block grants; shifting funding from one program to another; cost sharing; passing new taxes; raising private funds; or applying for grants.	
2	*Alter incentive/allowance structures*	Work to incentivize the adoption and implementation of the clinical innovation.	Work to incent the adoption and implementation of the clinical innovation. The incentive could be in the form of an increased rate of pay to cover the incremental costs associated with implementing the clinical innovation. The incentive could be through loan reduction/forgiveness to clinicians as an incentive to learn an innovation. This category of financial strategies also includes the elimination of any perverse incentives (incentives that become a barrier to receiving appropriate care). An incentive suggests the payment is tied to performing the clinical action. An allowance suggests that the clinician is not required to perform the clinical action.	
3	*Alter patient/consumer fees*	Create fee structures where patients/consumers pay less for preferred treatments (the clinical innovation) and more for less-preferred treatments.	Create fee structures where patients/consumers pay less for preferred treatments (the clinical innovation) and more for less preferred treatments.	
4	*Assess for readiness and identify barriers and facilitators*	Assess various aspects of an organization to determine its degree of readiness to implement, barriers that may impede implementation, and strengths that can be used in the implementation effort.	Assess various aspects of an organization to determine its degree of readiness to implement, barriers that may impede implementation, and strengths that can be used in the implementation effort. The assessment may focus on agency finances, other services provided, community support, clinician attitudes and beliefs, organizational climate and culture, structure, and decision making styles. There are also specific measures created to assess readiness to change that could be helpful. The readiness assessment can be used to vet or eliminate implementation sites.	Assess various aspects of an organization to determine its degree of readiness to implement *and identify* barriers that may impede implementation and strengths that can be *leveraged to facilitate* the implementation effort.

5	*Audit and provide feedback*	Collect and summarize clinical performance data over a specified time period and give it to clinicians and administrators to monitor, evaluate, and modify provider behavior.	Collect and summarize clinical performance data over a specified time period and give it to clinicians and administrators in the hopes of changing provider behavior. The summary may include recommendations. The information may have been obtained from a variety of sources, including medical records, computerized databases, observation, or feedback from patients. A performance evaluation could also be considered as audit and feedback if it included specific information on clinical performance.	*Develop summaries of* clinical performance over a specific time period*, often including a comparator,* and give it to clinicians and*/or administrators. Summary content (e.g., nature of the data, choice of comparator) and their delivery (e.g., mode, format) are designed* to modify *specifically targeted behavior(s) or actions of individual practitioners, teams, or health care organizations*.
6	*Build a coalition*	Recruit and cultivate relationships with partners in the implementation effort..	Recruit and cultivate relationships with partners in the implementation effort. Partnerships can develop around cost-sharing, shared resources, shared training, and the division of responsibilities among partners. This work may proceed naturally from local consensus discussions.	
7	*Capture and share local knowledge*	Capture local knowledge from implementation sites on how implementers and clinicians made something work in their setting and then share it with other sites.	Capture local knowledge from implementation sites on how implementers and clinicians made something work in their setting and then share it with other sites (see centralized technical assistance and learning collaboratives).	Capture local knowledge from implementation sites on how implementers and clinicians made something work in their setting and then share it with other sites.
8	*Centralize technical assistance*	Develop and use a centralized system to deliver technical assistance focused on implementation issues.	Develop and use a system to deliver technical assistance focused on implementation issues. This could be the designation of a lead technical assistance organization (could also be responsible for training). The lead technical assistance entity can develop other mechanisms (e.g., call-in lines or websites) to share information on how to best implement the clinical innovation.	Develop and use a centralized system to deliver technical assistance focused on implementation issues.
9	*Change accreditation or membership requirements*	Strive to alter accreditation standards so that they require or encourage use of the clinical innovation. Work to alter membership organization requirements so that those who want to affiliate with the organization are encouraged or required to use the clinical innovation.	Strive to alter accreditation standards so that they require or encourage use of the clinical innovation. Work to alter membership organization requirements so that those who want to affiliate with the organization are encouraged or required to use the clinical innovation.	
10	*Change liability laws*	Participate in liability reform efforts that make clinicians more willing to deliver the clinical innovation.	Participate in liability reform efforts that make clinicians more willing to deliver the clinical innovation.	

11	*Change physical structure and equipment*	Evaluate current configurations and adapt, as needed, the physical structure and/or equipment (e.g., changing the layout of a room, adding equipment) to best accommodate the targeted innovation.	Change the physical structure and equipment (changing the layout of a room, adding equipment).	
12	*Change record systems*	Change records systems to allow better assessment of implementation or clinical outcomes.	Change records systems to allow better assessment of implementation or of outcomes of the implementation. Can include planning activities, as well as actual modifications to existing the records system.	Change clinical documentation (e.g., electronic medical records) systems to allow better assessment of implementation or clinical outcomes.
13	*Change service sites*	Change the location of clinical service sites to increase access.	Change the location of clinical service sites to increase access; includes co-locating different services in order to better implement complex clinical innovations that require multiple disciplines or services.	
14	*Conduct cyclical small tests of change*	Implement changes in a cyclical fashion using small tests of change before taking changes system-wide. Tests of change benefit from systematic measurement, and results of the tests of change are studied for insights on how to do better. This process continues serially over time, and refinement is added with each cycle.	Implement changes in a cyclical fashion using small tests of change before taking changes system-wide. Results of the tests of change are studied for insights on how to do better. This process continues serially over time and refinement is added with each cycle. Two common small tests of change cycling strategies are “Plan-Do-Study-Act” (PDSA) from Deming’s quality management work and six sigma’s Define- Measure-Analyze-Improve-Control (DCMA) sequence.	Implement changes in a cyclical fashion using small tests of change before taking changes system-wide. Tests of change benefit from systematic measurement, and results of the tests of change are studied for insights on how to do better. This process continues serially over time, and refinement is added with each cycle.
15	*Conduct educational meetings*	Hold meetings targeted toward different stakeholder groups (e.g., providers, administrators, other organizational stakeholders, and community, patient/consumer, and family stakeholders) to teach them about the clinical innovation.	Hold meetings targeted toward providers, administrators, other organizational stakeholders, and community, patient/consumer, and family stakeholders to teach them about the clinical innovation..	Hold meetings targeted toward *educating multiple* stakeholder groups (i.e. providers, administrators, other organizational stakeholders, community *members*, patients/consumers, famil*ies*) *about the clinical innovation and/or its implementation.*
16	*Conduct educational outreach visits*	Have a trained person meet with providers in their practice settings to educate providers about the clinical innovation with the intent of changing the provider’s practice.	Use a trained person who meets with providers in their practice settings to educate providers about the clinical innovation with the intent of changing the provider’s practice. The term academic detailing is often used synonymously.	Have a trained person meet with *individuals or teams* in their *work* settings to educate *them* about the clinical innovation with the intent of changing *behavior to reliably use the clinical innovation as designed*.
17	*Conduct local consensus discussions*	Include local providers and other stakeholders in discussions that address whether the chosen problem is important and whether the clinical innovation to address it is appropriate.	Include providers and other stakeholders in discussions that address whether the chosen problem is important and whether the clinical innovation to address it is appropriate.	

18	*Conduct local needs assessment*	Collect and analyze data related to the need for the innovation.	Collect and analyze data related to the need for the innovation; this assessment could be focused on the description of usual care and its distance from evidence based care, outcomes of usual care, opinions from stakeholders on the needs for an innovation, or on special considerations for delivering the innovation in the local context.	
19	*Conduct ongoing training*	Plan for and conduct training in the clinical innovation in an ongoing way.	Plan for and conduct training in the clinical innovation in an ongoing way. This can include follow-up training, advanced training, booster training, purposefully spaced training, training to competence, integration of off-the-job and on-the-job training, the introduction of concepts in a specific sequence to ensure mastery, and trainings based on the level of clinician knowledge. Trainings can be in-person, on the web, or technology-assisted.	Plan for and conduct training in the clinical innovation in an ongoing way *for all individuals involved with implementation and users of the clinical innovation e.g., clinicians, implementation staff, practice facilitators.*
20	*Create a learning collaborative*	Facilitate the formation of groups of providers or provider organizations and foster a collaborative learning environment to improve implementation of the clinical innovation.	Develop and use groups of providers or provider organizations that will implement the clinical innovation and develop ways to learn from one another to foster better implementation. This is called several things in the literature including peer consultation networks, online communities of practice, quality circles, and learning collaboratives.	Facilitate the formation of groups of providers or provider organizations and foster a collaborative learning environment to improve implementation of the clinical innovation.
21	*Create new clinical teams*	Change who serves on the clinical team, adding different disciplines and different skills to make it more likely that the clinical innovation is delivered (or is more successfully delivered).	Change who serves on the clinical team, adding different disciplines and different skills to make it more likely that the clinical innovation is delivered or more successful.	
22	*Create or change credentialing and/or licensure standards*	Create or change credentialing and/or licensure standards Create an organization that certifies clinicians in the innovation or encourage an existing organization to do so. Change governmental professional certification or licensure requirements to include delivering the innovation. Work to alter continuing education requirements to shape professional practice toward the innovation.	Create an organization that certifies clinicians in the innovation or encourages an existing organization to do so. Change governmental professional certification or licensure requirements to include delivering the innovation. Work to alter continuing education requirements to shape professional practice toward the innovation.	

23	*Develop academic partnerships*	Partner with a university or academic unit for the purposes of shared training and bringing research skills to an implementation project.	Partner with a university or academic unit for the purposes of shared training and bringing research skills to an implementation project.	
24	*Develop an implementation blueprint*	Develop a formal implementation blueprint that includes all goals and strategies. The blueprint should include the following: 1) aim/purpose of the implementation; 2) scope of the change (e.g., what organizational units are affected); 3) timeframe and milestones; and 4) appropriate performance/progress measures. Use and update this plan to guide the implementation effort over time.	Develop a formal implementation blueprint that integrates multiple strategies from multiple levels or domains (e.g., staffing, funding, monitoring) using multiple theories or the use of an explicit theoretical framework. Use and update this plan to guide the implementation effort over time.	Develop a formal implementation blueprint that includes all goals and strategies. The blueprint should include the following: 1) aim/purpose of the implementation; 2) scope of the change (e.g., what organizational units are affected); 3) timeframe and milestones; and 4) appropriate performance/progress measures. *Use and update this plan to guide the implementation effort over time*.
25	*Develop an implementation glossary*	Develop and distribute a list of terms describing the innovation, implementation, and stakeholders in the organizational change.	Develop a glossary to promote common understanding about implementation among the different stakeholders.	
26	*Develop and implement tools for quality monitoring*	Develop, test, and introduce into quality-monitoring systems the right input—the appropriate language, protocols, algorithms, standards, and measures (of processes, patient/consumer outcomes, and implementation outcomes) that are often specific to the innovation being implemented.	Develop, test, and introduce into quality-monitoring systems the right input – the appropriate language, protocols, algorithms, standards, and measures (of processes, patient/consumer outcomes, and implementation outcomes) that are often specific to the innovation being implemented.	Develop, test, and introduce into quality-monitoring systems the right input – the appropriate language, protocols, algorithms, standards, and measures (of processes, patient/consumer outcomes, and implementation outcomes) that are often specific to the innovation being implemented.
27	*Develop and organize quality monitoring systems*	Develop and organize systems and procedures that monitor clinical processes and/or outcomes for the purpose of quality assurance and improvement.	Develop and organize systems and procedures that monitor clinical processes and/or outcomes for the purpose of quality assurance and improvement. This includes developing systems for monitoring through peer reviews, collecting data from patients/consumers, clinicians, and supervisors, and using administrative and electronic record data. This category of strategies also includes the design of disease-specific clinical registries, where clinical information and tools (graphical representations, real-time report cards, comparisons to benchmarks, etc) are available to care team members. These systems may inform audit and feedback strategies.	Develop and organize systems and procedures that monitor clinical processes and/or outcomes for the purpose of quality assurance and improvement.
28	*Develop disincentives*	Provide financial disincentives for failure to implement or use the clinical innovations.		
29	*Develop educational materials*	Develop and format manuals, toolkits, and other supporting materials in ways that make it easier	Develop and format guidelines, manuals, toolkits and other supporting materials in ways that make	Develop and format manuals, toolkits, and other supporting materials *to* make it easier for

		for stakeholders to learn about the innovation and for clinicians to learn how to deliver the clinical innovation.	it easier for stakeholders to learn about the innovation and for clinicians to learn how to deliver the clinical innovation. Create eye-catching, easy to use documents. Distill complex information into easier-to-learn components. Consider teaching skills modularly. Use different forms of media. Target messages for different audiences. .	stakeholders to learn about the innovation and for clinicians to learn how to deliver the clinical innovation. *This can include technology-delivered (e.g., online/smartphone-based static or dynamic) content and health messaging.*
30	*Develop resource sharing agreements*	Develop partnerships with organizations that have resources needed to implement the innovation.	Develop partnerships with organizations that have resources needed to implement the innovation. As an example, a group of providers could strike a relationship with a microbiology lab to conduct specialized lab work needed to implement an innovation efficiently.	Develop partnerships with organizations that have resources needed to implement the innovation.
31	*Distribute educational materials*	Distribute educational materials (including guidelines, manuals, and toolkits) in person, by mail, and/or electronically.	Distribute educational materials (including guidelines, manuals and toolkits) in person, by mail, and/or electronically.	Distribute educational materials (including guidelines, manuals and toolkits) in person, by mail, and/or electronically.
32	*Facilitate relay of clinical data to providers*	Provide as close to real-time data as possible about key measures of process/outcomes using integrated modes/channels of communication in a way that promotes use of the targeted innovation.	Collect new clinical information from the patient/consumer and relay it to the provider outside of the traditional clinical encounter to prompt the provider to use the clinical innovation. Examples might include depression scores from an instrument administered in the waiting room or telephone transmission of blood pressure measurements.	
33	*Fund and contract (and/or Negotiate) with the Vendors for the clinical innovation*	Governments and other payers of services issue requests for proposals to deliver the innovation, use contracting processes to motivate providers to deliver the clinical innovation, and develop new funding formulas that make it more likely that providers will deliver the innovation.	[Governments and other payers of services] issue requests for proposals to deliver the innovation, use contracting processes to motivate providers to deliver the clinical innovation, and develop new funding formulas that make it more likely that providers will deliver the innovation.	Governments and other payers of services issue requests for proposals to deliver the innovation, use contracting processes to motivate providers to deliver the clinical innovation, and develop new funding formulas that make it more likely that providers will deliver the innovation.
34	*Identify and prepare champions*	Identify and prepare individuals who dedicate themselves to supporting, marketing, and driving through an implementation, overcoming indifference or resistance that the intervention may provoke in an organization.	Cultivate relationships with people who will champion the clinical innovation and spread the word of the need for it. This strategy includes preparing individuals for their role as champions. Champions can be internal or external to the organization.	Identify and prepare individuals who dedicate themselves to supporting, marketing, and driving through an implementation, overcoming indifference or resistance that the intervention may provoke in an organization.

35	*Identify early adopters*	Identify early adopters at the local site to learn from their experiences with the practice innovation.		
36	*Implementation Facilitation*	A process of interactive problem solving and support that occurs in a context of a recognized need for improvement and a supportive interpersonal relationship		*"[A] multi-faceted process of enabling and supporting individuals, groups and organizations in their efforts to adopt and incorporate clinical innovations into routine practices," (Ritchie et al. 2017)*
37	*Increase demand*	Attempt to influence the market for the clinical innovation to increase competition intensity and to increase the maturity of the market for the clinical innovation.	Attempt to influence the market for the clinical innovation to increase competition intensity and to increase the maturity of the market for the clinical innovation.	
38	*Inform local opinion leaders*	Inform providers identified by colleagues as opinion leaders or "educationally influential" about the clinical innovation in the hopes that they will influence colleagues to adopt it.	Inform providers identified by colleagues as opinion leaders or "educationally influential" about the clinical innovation in the hopes that they will influence colleagues to adopt it.	Supervisors play a key role in influencing their workers to adopt project components; includes efforts to keep supervisors updated and informed.
39	*Intervene with patients/consumers to enhance uptake and adherence*	Develop strategies with patients to encourage and problem solve around adherence.	Intervene with patients/consumers to increase uptake of and adherence to clinical treatments. This includes consumer/patient reminders and financial incentives to attend appointments.	Develop strategies with patients to encourage and problem solve around adherence.
40	*Involve executive boards*	Involve existing governing structures (e.g., boards of directors, medical staff boards of governance) in the implementation effort, including the review of data on implementation processes.	Involve existing governing structures (e.g., boards of directors, medical staff boards of governance) in the implementation effort, including the review of data on implementation processes.	
41	*Involve patients/consumers and family members*	Engage or include patients/consumers and families in the implementation effort.	Engage or include patients/consumers and families in all phases of the implementation effort, including training in the clinical innovation, and advocacy related to the innovation effort.	Engage or include patients/consumers and families in the implementation effort.
42	*Make billing easier*	Make it easier to bill for the clinical innovation.	Make it easier to bill for the clinical innovation. This might involve requiring less documentation; "block" funding for delivering the innovation; and creating new billing codes for the innovation.	
43	*Make training dynamic*	Vary the information delivery methods to cater to different learning styles and work contexts, and shape the training in the innovation to be interactive.	Vary the information delivery methods to cater to different learning styles and work contexts, and shape the training in the innovation to be interactive. This includes efforts to divide material into small time intervals and the use of small group breakouts, audience response systems, and other measures.	

44	*Mandate change*	Have leadership declare the priority of the innovation and their determination to have it implemented.	Declare that the innovation will be implemented.	
45	*Model and simulate change*	Model or simulate the change that will be implemented prior to implementation.	Model or simulate the change that will be implemented prior to implementation. These efforts could involve computer simulations, walk-through simulation exercises, or modeling the overall impact of clinicians' intentions to change their clinical behaviors.	
46	*Obtain and use patients/consumers and family feedback*	Develop strategies to increase patient/consumer and family feedback on the implementation effort.	Use mechanisms to increase patient/consumer and family feedback on the implementation effort. This could include complaint forms, or methods to funnel feedback to advisory boards.	Develop strategies to increase patient/consumer and family feedback on the implementation effort.
47	*Obtain formal commitments*	Obtain written commitments from key partners that state what they will do to implement the innovation.	Obtain written commitments from key partners that state what they will do to implement the innovation.	
48	*Organize implementation teams and team meetings*	Develop and support teams of clinicians who are implementing the innovation and give them protected time to reflect on the implementation effort, share lessons learned, and support one another's learning.	Develop and support teams of clinicians who are implementing the innovation and give them protected time to reflect on the implementation effort, share lessons learned, and support one another's learning.	Develop and support teams of clinicians*, staff, patients and other stakeholders* who are implementing *or may be users of* the innovation. *Provide* protected time *for teams* to reflect on the implementation *progress*, share lessons learned, *make refinements to plans,* and support one another's learning.
49	*Place innovation on fee for service lists/formularies*	Work to place the clinical innovation on lists of actions for which providers can be reimbursed (e.g., a drug is placed on a formulary, a procedure is now reimbursable).	Work to place the clinical innovation on lists of actions for which providers can be reimbursed (e.g., a drug is placed on a formulary, a procedure is now reimbursable).	
50	*Prepare patients/consumers to be active participants*	Prepare patients/consumers to be active in their care, to ask questions, and specifically to inquire about care guidelines, the evidence behind clinical decisions, or about available evidence-supported treatments.	Prepare patients/consumers to be active in their care, to ask questions, and specifically to inquire about care guidelines, the evidence behind clinical decisions, or about available evidence-supported treatments.	Prepare patients/consumers to be active in their care, to ask questions, and specifically to inquire about care guidelines, the evidence behind clinical decisions, or about available evidence-supported treatments.
51	*Promote adaptability*	Identify the ways a clinical innovation can be tailored to meet local needs and clarify which elements of the innovation must be maintained to preserve fidelity.		
52	*Promote network weaving*	Identify and build on existing high-quality working relationships and networks within and outside the organization, organizational units, teams, etc. to promote information sharing, collaborative		Identify and build on existing high quality working relationships and networks within and outside the organization, organizational units, teams, etc. to promote information sharing, collaborative

		problem-solving, and a shared vision/goal related to implementing the innovation.		problem-solving, and a shared vision/goal related to implementing the innovation.
53	*Provide clinical supervision*	Provide clinicians with ongoing supervision focusing on the innovation. Provide training for clinical supervisors who will supervise clinicians who provide the innovation.	Provide clinicians with ongoing supervision. Provide training for clinical supervisors who will supervise clinicians who provide the innovation.	
54	*Provide local technical assistance*	Develop and use a system to deliver technical assistance focused on implementation issues using local personnel.		Develop and use a system to deliver technical assistance *within local settings that is* focused on implementation issues.
55	*Provide ongoing consultation*	Provide ongoing consultation with one or more experts in the strategies used to support implementing the innovation.	Provide clinicians with continued consultation with an expert in the clinical innovation. This could include in-person or distance consultation and feedback on taped clinical encounters. This consultation is tailored to the clinician's actual practice, to differentiate it from ongoing training. This feedback may be from a consultant external to the organization, which distinguishes it from clinical supervision.	Provide ongoing consultation with one or more experts in the strategies used to support implementing the innovation.
56	*Purposely reexamine the implementation*	Monitor progress and adjust clinical practices and implementation strategies to continuously improve the quality of care.	Obtain commitment from stakeholders to use monitoring to adjust practice and strategies to continuously improve the implementation effort and delivery of the clinical innovation.	
57	*Recruit, designate, and train for leadership*	Recruit, designate, and train leaders for the change effort.	Recruit, designate, and train leaders for the change effort. Change efforts require certain types of leaders, and organizations may need to recruit accordingly, rather than assuming that their current personnel can implement the change. Designated change leaders can include an executive sponsor and a day-to-day manager of the effort.	Recruit, designate, and train leaders for the change effort.
58	*Remind clinicians*	Develop reminder systems designed to help clinicians to recall information and/or prompt them to use the clinical innovation.	Develop reminder systems designed to prompt clinicians to recall information or use the clinical innovation. The reminder could be patient or encounter specific, provided verbally, on paper, or on a computer screen. Computer-aided decision support and drug dosages are included in this strategy.	Develop reminder systems designed to help clinicians to recall information and/or prompt them to use the clinical innovation.
59	*Revise professional roles*	Shift and revise roles among professionals who provide care, and redesign job characteristics.	Shift and revise roles among professionals who provide care and redesign job characteristics. This includes the expansion of roles in order to cover	

			provision of the clinical innovation and the elimination of service barriers to care, including personnel policies.	
60	*Shadow other experts*	Provide ways for key individuals to directly observe experienced people engage with or use the targeted practice change/innovation.	Have clinicians shadow other clinicians who are expert or knowledgeable in the clinical innovation and have implemented it.	Provide ways for key individuals to directly observe experienced people engage with or use the targeted practice change/innovation.
61	*Stage implementation scale up*	Phase implementation efforts by starting with small pilots or demonstration projects and gradually move to a system wide rollout.	Phase implementation efforts by starting with small pilots or demonstration projects and gradually moving to system-wide rollout.	
62	*Start a dissemination organization*	Identify or start a separate organization that is responsible for disseminating the clinical innovation. It could be a for-profit or non-profit organization.	Start a separate organization that is responsible for disseminating the clinical innovation. It could be a for-profit or non-profit organization. It could be “licensed” by a university if the innovation was born within an academic setting.	
63	*Tailor strategies*	Tailor the implementation strategies to address barriers and leverage facilitators that were identified through earlier data collection.	Tailor the implementation effort to address barriers and to honor stakeholder preferences that were identified through earlier data collection.	
64	*Use advisory boards and workgroups*	Create and engage a formal group of multiple kinds of stakeholders to provide input and advice on implementation efforts and to elicit recommendations for improvements.	Involve multiple kinds of stakeholders in a group to oversee implementation efforts and make recommendations.	
65	*Use an implementation advisor*	Seek guidance from experts in implementation.	Seek guidance from experts in implementation. This could include consultation with outside experts such as university-affiliated faculty members, or hiring quality improvement experts or implementation professionals.	Seek guidance from experts in implementation, *including providing support and training for the implementation work force.*
66	*Use capitated payments*	Pay providers or care systems a set amount per patient/consumer for delivering clinical care.	Pay providers a set amount per patient/consumer for delivering clinical care. This is an implementation strategy to the degree that it frees the clinician to provide services that they may have been disincented to provide under a fee-for-service structure.	
67	*Use data experts*	Involve, hire, and/or consult experts to inform management on the use of data generated by implementation efforts.	Involve, hire and/or consult experts in data management to shape use of the considerable data that implementation efforts can generate.	Involve, hire, and/or consult experts to *acquire, structure, manage, report, and use* data generated by implementation efforts.
68	*Use data warehousing techniques*	Integrate clinical records across facilities and organizations to facilitate implementation across systems.	Integrate clinical records across facilities and organizations in order to facilitate implementation across systems.	Integrate clinical records across facilities and organizations to facilitate implementation across systems.
69	*Use mass media*	Use media to reach large numbers of people to spread the word about the clinical innovation.	Use media to reach large numbers of people to spread the word about the clinical innovation.	

70	*Use other payment schemes*	Introduce payment approaches (in a catch-all category).	Introduce such payment approaches as pre-payment and prospective payment for service, provider salaried service, the alignment of payment rates with the attainment of patient/consumer outcomes, and the removal or alteration of billing limits. These are implementation strategies to the degree that they free the clinician to provide the clinical innovation.	
71	*Use train-the-trainer strategies*	Train designated clinicians or organizations to train others in the clinical innovation.	Train designated clinicians or organizations to train others in the clinical innovation. Determine whether clinicians trained as trainers are eligible to train others as train the trainers.	
72	*Visit other sites*	Visit sites where a similar implementation effort has been considered successful.	Visit sites where a similar implementation effort has been considered successful.	Visit sites where a similar implementation effort has been considered successful.
73	*Work with educational institutions*	Encourage educational institutions to train clinicians in the innovation.	Encourage educational institutions to train clinicians in the innovation.	

NEW STRATEGIES: Perry et al. 2019		
74	*Assess and redesign workflow*	Observe and map current work processes and plan for desired work processes, identifying changes necessary to accommodate, encourage, or incentivize use of the clinical innovation as designed. (Strongwater et al.1996)
75	*Create online learning communities*	Create an online portal for clinical staff members to share and access resources, webinars, and FAQs related to the specific evidenced-based intervention, and provide interactive features to encourage learning across settings and teams, e.g., regular blogs, facilitated discussion boards, access to experts, and networking opportunities.
76	*Engage community resources*	Connect practices and their patients to community resources outside the practice (e.g., state and county health departments; non-profit organizations; resources related to addressing the social determinants of health; and organizations focused on self-management techniques and support).
NEW STRATEGIES: Bunger et al. 2017		
77	*Penalize*	Penalize providers financially for failure to implement or use the clinical innovation.
78	*Plan for outcome evaluation*	Efforts related to collaborative design and preparation for the evaluation of intervention outcomes; work with partners to inform and tailor evaluation methods, indicators, and procedures to project context.
79	*Obtain and use worker feedback*	Use mechanisms to solicit front-line worker and supervisor feedback on the implementation effort. Includes surveys, focus groups, participatory meetings, or other methods for funneling feedback to the advisory board.

APPENDIX C: *73 ERIC strategies grouped into nine categories: 46 Strategies relevant for the planning and preparation phases of an implementation project (encircled)*

Adapt and tailor to context	Change infrastructure	Develop stakeholder interrelationships	Engage consumers	Provide interactive assistance	Support clinicians	Train and educate stakeholders	Use evaluative and iterative strategies	Utilize financial strategies
* Promote adaptability * Tailor strategies * Use data experts * Use data warehousing techniques	* Change service sites * Change physical structure and equipment	* Capture and share local knowledge * Conduct local consensus discussions * Develop academic partnerships * Identify and prepare champions * Inform local opinion leaders * Involve executive boards * Obtain formal commitments * Promote network weaving * Recruit, designate, and train for leadership * Use advisory boards and workgroups * Use an implementation advisor * Build a coalition * Develop an implementation glossary * Identify early adopters * Organize implementation teams and team meetings	* Use mass media * Involve patients/consumers and family members	* Centralize technical assistance * Implementation Facilitation * Provide clinical supervision * Provide local technical assistance	* Create new clinical teams * Develop resource sharing agreements	* Conduct educational meetings * Create a learning collaborative * Develop educational materials * Make training dynamic * Use train-the-trainer strategies * Conduct ongoing training * Distribute educational materials * Work with educational institutions	* Assess for readiness and identify barriers and facilitators * Conduct local need assessment * Develop an implementation blueprint * Develop and implement tools for quality monitoring * Audit and provide feedback * Stage implementation scale up	* Access new funding * Fund and contract (and/or Negotiate) with Vendors for the clinical innovation * Make billing easier
	* Change accreditation or membership requirements * Change record systems * Create or change credentialing and/or licensure standards * Mandate change * Start a dissemination organization	* Visit other sites * Model and simulate change	* Increase demand * Intervene with patients/consumers to enhance uptake and adherence * Prepare patients/consumers to be active participants		* Facilitate relay of clinical data to providers * Remind clinicians * Revise professional roles	* Conduct educational outreach visits * Provide ongoing consultation * Shadow other experts	* Conduct cyclical small tests of change * Develop and organize quality monitoring systems * Obtain and use patients/consumers and family feedback * Purposefully re-examine the implementation	* Alter incentive/allowance structures * Alter patient/consumer fees * Develop disincentives * Place innovation on fee for service lists/formularies * Use other payment schemes * Use capitated payments

APPENDIX D: *Adaptations and modifications to the original ERIC strategies*

ORIGINAL STRATEGY NAMES	AMENDED STRATEGY NAMES	ORIGINAL ERIC DEFINITION	CHANGES TO DEFINITIONS
Capture and share local knowledge	*Capture and share GLOBAL knowledge* *Capture and share LOCAL knowledge*	Capture local knowledge from implementation sites on how implementers and clinicians made something work in their setting and then share it with other sites.	Capture global OR local knowledge from implementation sites on how implementers and clinicians made something work in their setting and then share it with other sites.
Centralize technical assistance	*Use GLOBAL technical assistance*	Develop and use a centralized system to deliver technical assistance focused on implementation issues.	Use a global system to deliver technical assistance focused on implementation issues.
Change physical structure and equipment	*Develop physical structure and equipment*	Evaluate current configurations and adapt, as needed, the physical structure and/or equipment (e.g., changing the layout of a room, adding equipment) to best accommodate the targeted innovation.	Develop new configurations and physical structures and/or equipment (e.g., changing the layout of a room, deciding on equipment to be used) to best accommodate the targeted innovation.
Change service sites	*Identify service sites*	Change the location of clinical service sites to increase access.	Identify the location of clinical service sites to increase access.
Conduct educational meetings	*Conduct ACADEMIC educational meetings* *Conduct LOCAL educational meetings*	Hold meetings targeted toward different stakeholder groups (e.g., providers, administrators, other organizational stakeholders, and community, patient/consumer, and family stakeholders) to teach them about the clinical innovation.	Hold meetings (either in an academic setup OR in the local community) targeted toward different stakeholder groups (e.g., providers, administrators, other organizational stakeholders, and community stakeholders) to teach them about the clinical innovation.
Conduct local consensus discussions	*Conduct ACADEMIC consensus discussions* *Conduct LOCAL consensus discussions*	Include local providers and other stakeholders in discussions that address whether the chosen problem is important and whether the clinical innovation to address it is appropriate.	Include ACADEMIC or LOCAL providers and other stakeholders in discussions that address whether the chosen problem is important and whether the clinical innovation to address it is appropriate.
Fund and contract (and/or Negotiate) with the Vendors for the clinical innovation	*Conversations with potential funders*	Governments and other payers of services issue requests for proposals to deliver the innovation, use contracting processes to motivate providers to deliver the clinical innovation, and develop new funding formulas that make it more likely that providers will deliver the innovation.	Conversations with potential funders of services such as government.
Identify early adopters	*Identify early adopters*	Identify early adopters at the local site to learn from their experiences with the practice innovation.	Identify early adopters at the GLOBAL site to learn from their experiences with the practice innovation.
Make billing easier	*Manage project finances*	Make it easier to bill for the clinical innovation.	Managing the project finances, to make it easier to budget for the clinical innovation and report to the funders.
Use an implementation advisor	*Use a GLOBAL implementation advisor* *Use a LOCAL implementation advisor*	Seek guidance from experts in implementation.	Seek guidance from either global OR local experts in implementation.

APPENDIX E: *CARA Implementation Coding Manual (CICM): Evaluation of Planning and Preparation phases of Diamond Families Study*

Adapt and tailor to context	Change infrastructure	Develop stakeholder interrelationships	Engage consumers	Provide interactive assistance	Support clinicians	Train and educate stakeholders	Use evaluative and iterative strategies	Utilize financial strategies
* Promote adaptability * Tailor strategies * Use data experts * Use data warehousing techniques	* Develop physical structure and equipment * Identify service sites	* Build a coalition * Capture and share LOCAL knowledge * Capture and share GLOBAL knowledge * Conduct ACADEMIC consensus discussions * Conduct LOCAL consensus discussions * Develop academic partnerships * Develop an implementation glossary * Identify and prepare champions * Identify early adopters * Inform local opinion leaders * Involve executive boards * Obtain formal commitments * Organize implementation teams and team meetings * Promote network weaving * Recruit, designate, and train for leadership * Use advisory boards and workgroups * Use a GLOBAL implementation advisor * Use a LOCAL implementation advisor	* Use mass media * Involve patients/ consumers and family members	* Implementation Facilitation * Provide clinical supervision * Provide local technical assistance * Use GLOBAL technical assistance	* Create new clinical teams * Develop resource sharing agreements	* Conduct ACADEMIC educational meetings * Conduct LOCAL educational meetings * Conduct ongoing training * Create a learning collaborative * Develop educational materials * Distribute educational materials * Make training dynamic * Use train-the-trainer strategies * Work with educational institutions	* Assess for readiness and identify barriers and facilitators * Audit and provide feedback * Conduct local need assessment * Develop an implementation blueprint * Develop and implement tools for quality monitoring * Stage implementation scale up	* Access new funding * Conversations with potential funders * Manage Project Finances

APPENDIX F: *CARA Implementation Coding Manual (CICM) - Strategy Definitions*

STRATEGY NAMING	DEFINITIONS
Access new funding	Access new or existing money to facilitate the implementation.
Assess for readiness and identify barriers and facilitators	Assess various aspects of an organization to determine its degree of readiness to implement, barriers that may impede implementation, and strengths that can be used in the implementation effort.
Audit and provide feedback	Collect and summarize clinical performance data over a specified time period and give it to clinicians and administrators to monitor, evaluate, and modify provider behaviour.
Build a coalition	Recruit and cultivate relationships with partners in the implementation effort.
Capture and share GLOBAL knowledge OR	Capture global OR local knowledge from implementation sites on how implementers and clinicians made something work in their setting and then share it with other sites.
Capture and share LOCAL knowledge	
Conduct ACADEMIC educational meetings OR	Hold meetings (either in an academic setup OR in the local community) targeted toward different stakeholder groups (e.g., providers, administrators, other organizational stakeholders, and community stakeholders) to teach them about the clinical innovation.
Conduct LOCAL educational meetings	
Conduct ACADEMIC consensus discussions OR	Include ACADEMIC or LOCAL providers and other stakeholders in discussions that address whether the chosen problem is important and whether the clinical innovation to address it is appropriate.
Conduct LOCAL consensus discussions	
Conduct local needs assessment	Collect and analyse data related to the need for the innovation.
Conduct ongoing training	Plan for and conduct training in the clinical innovation in an ongoing way.
Conversations with potential funders	Conversations with potential funders of services such as government.
Create a learning collaborative	Facilitate the formation of groups of providers or provider organizations and foster a collaborative learning environment to improve implementation of the clinical innovation.
Create new clinical teams	Change who serves on the clinical team, adding different disciplines and different skills to make it more likely that the clinical innovation is delivered (or is more successfully delivered).
Develop academic partnerships	Partner with a university or academic unit for the purposes of shared training and bringing research skills to an implementation project.
Develop an implementation blueprint	Develop a formal implementation blueprint that includes all goals and strategies. The blueprint should include the following: 1) aim/purpose of the implementation; 2) scope of the change (e.g., what organizational units are affected); 3) timeframe and milestones; and 4) appropriate performance/progress measures. Use and update this plan to guide the implementation effort over time.
Develop an implementation glossary	Develop and distribute a list of terms describing the innovation, implementation, and stakeholders in the organizational change.
Develop and implement tools for quality monitoring	Develop, test, and introduce into quality-monitoring systems the right input—the appropriate language, protocols, algorithms, standards, and measures (of processes, patient/consumer outcomes, and implementation outcomes) that are often specific to the innovation being implemented.
Develop educational materials	Develop and format manuals, toolkits, and other supporting materials in ways that make it easier for stakeholders to learn about the innovation and for clinicians to learn how to deliver the clinical innovation.
Develop physical structure and equipment	Develop new configurations and physical structures and/or equipment (e.g., changing the layout of a room, deciding on equipment to be used) to best accommodate the targeted innovation.
Develop resource sharing agreements	Develop partnerships with organizations that have resources needed to implement the innovation.
Distribute educational materials	Distribute educational materials (including guidelines, manuals, and toolkits) in person, by mail, and/or electronically.

Identify and prepare champions	Identify and prepare individuals who dedicate themselves to supporting, marketing, and driving through an implementation, overcoming indifference or resistance that the intervention may provoke in an organization.
Identify early adopters	Identify early adopters at the local site to learn from their experiences with the practice innovation.
Identify service sites	Identify the location of clinical service sites to increase access
Implementation Facilitation	A process of interactive problem solving and support that occurs in a context of a recognized need for improvement and a supportive interpersonal relationship
Inform local opinion leaders	Inform providers identified by colleagues as opinion leaders or "educationally influential" about the clinical innovation in the hopes that they will influence colleagues to adopt it.
Involve executive boards	Involve existing governing structures (e.g., boards of directors, medical staff boards of governance) in the implementation effort, including the review of data on implementation processes.
Involve patients/consumers and family members	Engage or include patients/consumers and families in the implementation effort.
Manage Project finances	Managing the project finances, to make it easier to budget for the clinical innovation and report to the funders.
Make training dynamic	Vary the information delivery methods to cater to different learning styles and work contexts and shape the training in the innovation to be interactive.
Obtain formal commitments	Obtain written commitments from key partners that state what they will do to implement the innovation.
Organize implementation teams and team meetings	Develop and support teams of clinicians who are implementing the innovation and give them protected time to reflect on the implementation effort, share lessons learned, and support one another's learning.
Promote adaptability	Identify the ways a clinical innovation can be tailored to meet local needs and clarify which elements of the innovation must be maintained to preserve fidelity.
Promote network weaving	Identify and build on existing high-quality working relationships and networks within and outside the organization, organizational units, teams, etc. to promote information sharing, collaborative problem-solving, and a shared vision/goal related to implementing the innovation.
Provide clinical supervision	Provide clinicians with ongoing supervision focusing on the innovation. Provide training for clinical supervisors who will supervise clinicians who provide the innovation.
Provide local technical assistance	Develop and use a system to deliver technical assistance focused on implementation issues using local personnel.
Recruit, designate, and train for leadership	Recruit, designate, and train leaders for the change effort.
Stage implementation scale up	Phase implementation efforts by starting with small pilots or demonstration projects and gradually move to a system wide rollout.
Tailor strategies	Tailor the implementation strategies to address barriers and leverage facilitators that were identified through earlier data collection.
Use advisory boards and workgroups	Create and engage a formal group of multiple kinds of stakeholders to provide input and advice on implementation efforts and to elicit recommendations for improvements.
Use a GLOBAL implementation advisor OR	Seek guidance from either global OR local experts in implementation.
Use a LOCAL implementation advisor	
Use data experts	Involve, hire, and/or consult experts to inform management on the use of data generated by implementation efforts.
Use data warehousing techniques	Integrate clinical records across facilities and organizations to facilitate implementation across systems.
Use GLOBAL technical assistance	Use a global system to deliver technical assistance focused on implementation issues
Use mass media	Use media to reach large numbers of people to spread the word about the clinical innovation.
Use train-the-trainer strategies	Train designated clinicians or organizations to train others in the clinical innovation.
Work with educational institutions	Encourage educational institutions to train clinicians in the innovation.

APPENDIX G: *Frequency of implementation strategies used (n = 219), with examples of activities for each strategy*

Categories and Strategies	Example Activities	N	%
Develop stakeholder interrelationships		**91**	**41.74%**
Conduct ACADEMIC consensus discussions	• Meetings held with academic experts, where health information / health- and visual communication were discussed, and ideas were brainstormed around the project • Adaptations workshops with academic partners: To get input from local stakeholders to ensure CST is acceptable, feasible, relevant	28	12,73%
Develop academic partnerships	• CST meetings with Africa Autism Treatment Network • Discussions with the Service Systems Stakeholder group, to co-create a path towards positive change for children with DD and their families in South Africa (building on stakeholders' knowledge and experience to help find suitable and effective answers that address our local needs)	13	5,91%
Capture and share GLOBAL knowledge	• WHO-CST Adaptation and Implementation Technical Meeting: where countries learned from one another on different stages of the project implementation journey • WHO CST Meeting, by Autism Speaks: Update on CST project given plus learning from global CST community	8	3,64%
Use advisory boards and workgroups	• CST Collaborators meeting at ASA with Representatives from China Women's Developmental Fund, DSD, ASA, UCT • Presentation on CST pilot project in South Africa at Western cape Intellectual Disability Forum	8	3,64%
Use a LOCAL implementation advisor	• Project team and community champion attended Research Methods Course by the Dissemination and Implementation team • Project update with ASA representatives, responded to questions from CST South Africa team. Planned on putting South Africa CST team in touch with other teams that are interested in/have worked on developing a Theory of Change/Logic Model for CST	7	3,18%
Conduct LOCAL consensus discussions	• Community champion arranged meeting with leaders (Day Care Centre staff) at the school, where the project is going to be implemented, while adaptability was promoted. • Community visit to find out about mental health services in North West province, together with North West Mental Health	6	2,73%
Promote network weaving	• UCT Future funding discussion: UK/SA Joint initiative on mental health. Brainstormed ideas regarding: Ethiopia, SA, bolt onto CST project • Community introductions in Ikagheng: First Introductions made with leaders (Day Care Centre staff) at the school, where the project is going to be implemented	6	2,73%
Obtain formal commitments	• Project coordinator appointed • Official UCT meeting with HR and EE representatives	5	2,27%
Identify and prepare champions	• Learning and development of community champion by online courses on developmental delays and working through facilitators guides • Appointment of a part-time CST training coordinator	3	1,36%

Capture and share LOCAL knowledge	• Discussions with South African experts at stakeholder meetings, to get guidance in terms of implementing the CST programme • Submission of a Book Chapter "Challenges and opportunities of implementing early interventions for autism spectrum disorders in resource limited settings: A South African example". An Africa Autism Treatment Network Initiative that includes references and examples of the WHO CST Project in South Africa	2	0.91%
Inform local opinion leaders	• Barolong Boora Tribal Authority Meeting where the WHO-CST project was introduced • Doctors evening in Mahikeng: Master trainers presented to a group of local doctors, pharmacists, and therapists	2	0,91%
Use a GLOBAL implementation advisor	• International CST multi-stakeholders meeting – Shared ideas with China Women's Development Forum and representatives from Autism Speaks • African Positive Psychology Conference: the role of participatory methods for community-based programmes & The Mmogo method	2	0,91%
Involve executive boards	• National Department of Social Development Progress Report submitted	1	0,45%
Recruit, designate, and train for leadership	• Meetings with project coordinator meetings to complete administration procedures regarding appointment, signing of all documents, discussing salary back payments	1	0,45%
Use of evaluative and iterative strategies		53	24,31%
Develop an implementation blueprint	• CARA seminar: it was discussed, what research has been done on autism in South Africa. Planning meeting at UCT to initiate next steps for the project • UCT CST planning meeting: planning how to adapt, implement and evaluate the WHO CST intervention in SA. Identify what are the next steps. Compiled Draft Planning Document -suggestions on who to involve in the programme locally.	46	21,46%
Assess for readiness and identify barriers and facilitators	• Provincial research site identification: research sites were determined through a process of needs analysis in terms of services available for children with developmental disorders/delays and other known child and family socio-demographic indicators. A consensus building process between Autism South Africa and the research team at UCT	3	1,36%
Conduct local need assessment	• Community mapping: Ipopeng School & Caregivers and field reports by community champion • Prepare for 12-session CST training and intervention in Mahikeng	2	0,91%
Develop and implement tools for quality monitoring	• WHO CST technical meeting: The Monitoring and Evaluation Process. Became familiar with the different Monitoring and Evaluation strategies used in countries and the lessons learned • ASA presented: Autism Stigma Questionnaire - validate in South Africa research study	2	0,91%
Train and educate stakeholders		35	16,06%
Conduct ACADEMIC educational meetings	• Presentation to the Centre for Autism Research in Africa Team about the CST Pilot project in South Africa. Topic: Dissemination and Implementation Science Training Course	24	10,91%

	• Department of Child and Adolescent Psychiatry (DCAP) seminar: sharing information about the WHO CST programme with 5th year medical students and DCAP Personnel		
Conduct LOCAL educational meetings	• Meeting with community experts: discussed computer training workshop for community researchers • North West Pre-Kickoff Meeting: presentation about the 1st site identified, overall aim of the CST, group sessions & home visits structure, programme overview	4	1,82%
Develop educational materials	• Planning and preparing for 12-session CST training	3	1,36%
Use train-the-trainer strategies	• 7-day CST Training of Master Trainers: train the trainers by global WHO trainers • CST Master Trainers Meeting: Update given from each WHO CST sites in South Africa and ideas for the training of facilitators discussed	2	0,91%
Create a learning collaborative	• UFS Research meeting: discussions on how to implement CST in Free State with support from UFS	1	0,45%
Make training dynamic	• Project- and clinical teams involved in Master Trainers Training in Mahikeng	1	0,45%
Adapt and tailor to context		**18**	**8,26%**
Promote adaptability	• Setswana translations of the facilitator's booklets with help from a community champion, community visits to gain insight into the rural context • Adaptation workshops held with the project team, community leaders and caregivers	15	6,82%
Tailor strategies	• UCT and CST team planning meeting on how to adapt, implement and evaluate the WHO CST intervention in SA • Input from ASA on how to adapt the brochure to make it an easy-to-read document	2	0,91%
Use data experts	• Consultation at Statistical Consultation services of NWU, to determine statistical procedures for project data	1	0,45%
Utilize financial strategies		**15**	**6,88%**
Conversations with potential funders	• CST Finances & Operations Meeting at ASA: project scope and processes involved discussed. Discussed financial record keeping • CST Future Funding Discussions: brainstormed ideas - UK/SA MRC funding application	10	4,55%
Access new funding	• Received additional funding from National Department of Social Development: signed addendum - updated contract between ASA and NDSD to reflect the additional funding • CST Core Team Monthly Management Meeting: planned allocation of additional funding received from NDSD	5	2,27%
Engage consumers		**2**	**0,92%**
Use mass media	• Radio interview to talk about the WHO CST project in South Africa • Project branding: Launched Diamond Families Logo	2	0,91%
Develop infrastructure		**2**	**0,92%**
Identify service sites	• Project planning meetings where the process of selecting a location for research sites was discussed • Provincial research site identification by Autism South Africa and the research team at UCT, through a process of needs analysis in terms of services available for children with	2	0,91%

	developmental disorders/delays and other known child and family socio-demographic indicator		
Support clinicians		**1**	**0,46%**
Create new clinical teams	• Project coordinator appointed	1	0,45%
Provide interactive assistance		**1**	**0,46%**
Use GLOBAL technical assistance	• WHO-CST Adaptation and Implementation Technical Meeting: the outcome of these planning meetings helped to inform the project scope; planning the different phases of the project. This meeting enabled countries to learn from one another on different stages of the project implementation journey, i.e., planning phase; adaptation phase; training phase; pre-pilot field testing phase; and finally, pilot testing phase	1	0,45%

APPENDIX H: *An overview of the number of implementation strategies used in planning and preparing to implement a community-based caregiver intervention in a limited-resource setting*

Adapt and tailor to context	Change infrastructure	Develop stakeholder interrelationships	Engage consumers	Provide interactive assistance	Support clinicians	Train and educate stakeholders	Use evaluative and iterative strategies	Utilize financial strategies
* Promote adaptability * Tailor strategies * Use data experts * Use data warehousing techniques	* Identify service sites * Develop physical structure and equipment	* Capture and share LOCAL knowledge * Capture and share GLOBAL knowledge * Conduct LOCAL consensus discussions * Conduct ACADEMIC consensus discussions * Develop academic partnerships * Identify and prepare champions * Inform local opinion leaders * Involve executive boards * Obtain formal commitments * Promote network weaving * Recruit, designate, and train for leadership * Use advisory boards and workgroups * Use a GLOBAL implementation advisor * Use a LOCAL implementation advisor * Build a coalition * Develop an implementation glossary * Identify early adopters * Organize implementation teams and team meetings	* Use mass media * Involve patients/consumers and family members	* Use GLOBAL technical assistance * Implementation Facilitation * Provide clinical supervision * Provide local technical assistance	* Create new clinical teams * Develop resource sharing agreements	* Conduct ACADEMIC educational meetings * Conduct LOCAL educational meetings * Create a learning collaborative * Develop educational materials * Make training dynamic * Use train-the-trainer strategies * Conduct ongoing training * Distribute educational materials * Work with educational institutions	* Assess for readiness and identify barriers and facilitators * Conduct local need assessment * Develop an implementation blueprint * Develop and implement tools for quality monitoring * Audit and provide feedback * Stage implementation scale up	* Access new funding * Conversations with potential funders * Manage Project Finances