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Evaluating the effectiveness of peer-based intervention in managing type I diabetes mellitus among children and adolescents: A systematic review

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Abstract

Background: Type 1 diabetes is one of the chronic metabolic disorders among children and adolescents. Peers are also important units in diabetes management through adolescence. This study aimed to evaluate the effectiveness of peer-based intervention in managing type 1 diabetes mellitus among children and adolescents.

Methods: Searching articles published prior to December 2013 in PubMed, Web of Science, Cochrane library, Science Direct, Google scholar, CINAHL and Scopus, we found 8,548 publications. The first reviewer critically appraised the retrieved articles, using the CONSORT and the TREND checklists and then the second-assessor checked them. All abstracts were screened, and only eight full text articles remained for evaluation based on inclusion criteria

Results: Eight studies, including five randomized controlled trials, one controlled trial, and two pre-post trials were critically appraised based on CONSORT and the TREND checklists. The outcomes of these studies were as follows: knowledge (three studies), attitude (two studies), performance (one study), clinical parameters—exclusively HbA1c—(four studies), and psychosocial parameters—such as quality of life, coping, self-care, self-confidence, satisfaction with the perceived social support, social skills, and diabetes-related conflicts

Conclusion: The findings of this systematic review revealed that peer-based interventions could help to manage diabetes. While there is a lack of professional or family-based interventions and education, peers can be involved in the process of patient education. As there are few studies in the area of peer-based diabetes management, conducting further interventional studies with robust methodology is highly recommended.

Keywords: Peer-Based Interventions, Type I Diabetes, Diabetes Management, Children, Adolescents.

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Introduction

Type 1 diabetes mellitus (henceforth referred to as T1DM) is one of the chronic metabolic disorders among children and adolescents. Managing this disease is done in settings other than home, such as schools and the society (1), and it includes a broad range of activities such as insulin injection, balancing regimen, physical activity and controlling blood sugar. Hence, individuals with T1DM are always in need of support (2).

Family is literally the first and the most influential supportive resource in managing children and adolescents' diabetes. In addition to the family as the supportive resource for the patient, another effective supportive resource is peer support (1). The term "peer" has been defined in Cambridge Dictionary as "A person of the same age, the same social position or having the same abilities as other people in a group".

As the age of children and adolescents increases, their dependence on family reduces

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and they become more influenced by their peers and the community (3). Peer support is one of the most important aspects of nursing care with respect to the structure of social relationships (4). Numerous studies indicate that children and adolescents who received family support had a better metabolic control; however, family support is not enough on its own for managing children and adolescents' disease. Therefore, considering the age of the suffering individual, his/her peers are considered a good resource of support. Increasing the participation rate of peers and friends leads to raising self-confidence and social acceptance in children and adolescents and finally results in sticking to prescribed regimen (2). Furthermore, diabetes outcomes could be affected varyingly through peer relationship. According to available resources, health can be boosted by social support and reduce unpleasant effects, harnessing individuals' self-esteem and social control (5).

Systematic reviews are necessary for directing policies and decision-makings to organize and present psycho-social care, especially considering the fact that this type of study is carried out when there is no certainty over the potential advantages or disadvantages of an intervention or when there are various performances. Systematic reviews provide practical answers for questions through gathering and combining the observations in initial studies. Furthermore, such reviews help researchers plan for conducting new studies by specifying what we already know and do not know (6).

Only one systematic-review study was found in this field, which was carried out as a review over qualitative studies concerning the effect of peers on self-care and metabolic control (5). Moreover, we found other systematic studies on type 2 diabetes mellitus (henceforth referred to as T2DM), which positively emphasized the effect of peers in managing diabetes.

Therefore, this systematic study was conducted to identify the effectiveness of peer-based clinical trial interventions in managing T1DM among children and adolescents.

Methods

Design

We embarked on a systemic review through this research according to "The Cochrane Handbook for Systematic Review of the Interventions" (7). For this aim, the following steps were followed: Defining the review question, developing study inclusion criteria, searching for and selecting studies, collecting data, assessing risk of bias, summarizing the findings in tables, interpreting the results, and drawing a conclusion. Three types of studies were included: Randomized Control Trial (RCT), Non-randomized Control Trial (CT), and pre-post.

The heterogeneous nature of participants' age, outcomes and interventions hampered the researchers to invest on meta-analysis for data analysis, because when data are dispersed or studies are so heterogeneous that they cannot be combined**,** conducting meta-analysis will not be appropriate (6).

To increase the validity of the selected studies, the first two authors (Kazemi, S and Parvizy, S) independently assessed the papers that had been selected from the databases. Moreover, any disagreement concerning their judgments was discussed by another reviewer (Baradaran HR).

Search Method

To work within a certain timeframe, the searching process was set up to December 2012.

Two subcategories were assessed in this study, which included friends suffering from T1DM, and friends not suffering from T1DM.

Search Strategy

The corpus of this study was retrieved from the following electronic databases: CINAHL, Cochrane, Pubmed, Google scholar, science direct, web of science and Scopus. In addition, we examined any related websites along with the list of references for all papers.

We also made use of keywords as well as controlled vocabulary search for MeSH (medical subject heading). The key words that were included in our search were as follows: Peer, friend, group, team, class, school, diabetes Type 1, diabetes mellitus, diabetes Type 2, diabetes complication, children, adolescents, teen, boy, son, girl, daughter, kids, juvenile, pediatric, youth, management, adherence, support, adjustment, education, train, participation, evolve, involve, interaction, learn, teach, function, confirm, knowledge, advocate, collaborate.

Inclusion Criteria

1- All English papers, which had been done through peer-based intervention studies on managing T1DM, suffering children and adolescents, with/without comparison groups

2- A maximum age of 20 years for individuals at the time of conducting the study

3- Measuring at least one outcome related to the disease, using a reliable instrument

Search Outcome

As an effort to ascertain whether the inclusion criteria were met, abstracts and full-text papers, which had been identified in the electronic and manual searching were reviewed. The inclusion/exclusion process is demonstrated in Figure 1, modeled on the PRISMA 2009 Flow Diagram.

After omitting the repetitious results, the number of results (irrespective of Google Scholar database) came to 8,548. Accordingly, the titles, keywords, abstracts and full texts of 19 studies were investigated, and 11 studies were excluded from the study due to the following reasons:

- The qualitative method of study: Eight studies
- Preventing T1DM: one study
- Age above 20 years: two studies

Eight studies met the inclusion criteria, and were included in the review.

Data Abstraction

To abstract the data in this research, the following features were taken into account: Study design, setting, sample size, assessment tool, variable, intervention domain, delivery intervention, intervention, theory, peer characteristics, follow up and outcomes (Table 1).

Synthesis

Conducting meta-analysis of the data was hampered due to the existence of heterogeneity in the employed design, intervention and outcome measures, which led to the presentation of the results in the form of narrative summaries (Table 1-5).

Quality Appraisal

Validating the quality of the method used in this research was carried out based on CONSORT for RCTs, TREND for CTs. Methodological quality did not result in the omission of studies from being reviewed by the researchers.

Table 1. Major Characteristics of Peer-based Interventions Managing Type I Diabetes Mellitus among Children and Adolescents

Author	Design	Setting	Theory
Pendley 2002	RCT	Home	Social support
Gilbert 1982	RCT	Camp	
Greco 2001	Pre-post	Children Clinic	Group-based problem solving
Daley 1992	RCT	Community	Social support
Anderson 1989	RCT	Clinic	
Kaplan 1985	RCT	School	social learning & self-efficacy
Bekesi 2011	CT	Camp	
Loding 2007	Pre-post	Clinic	Problem solving

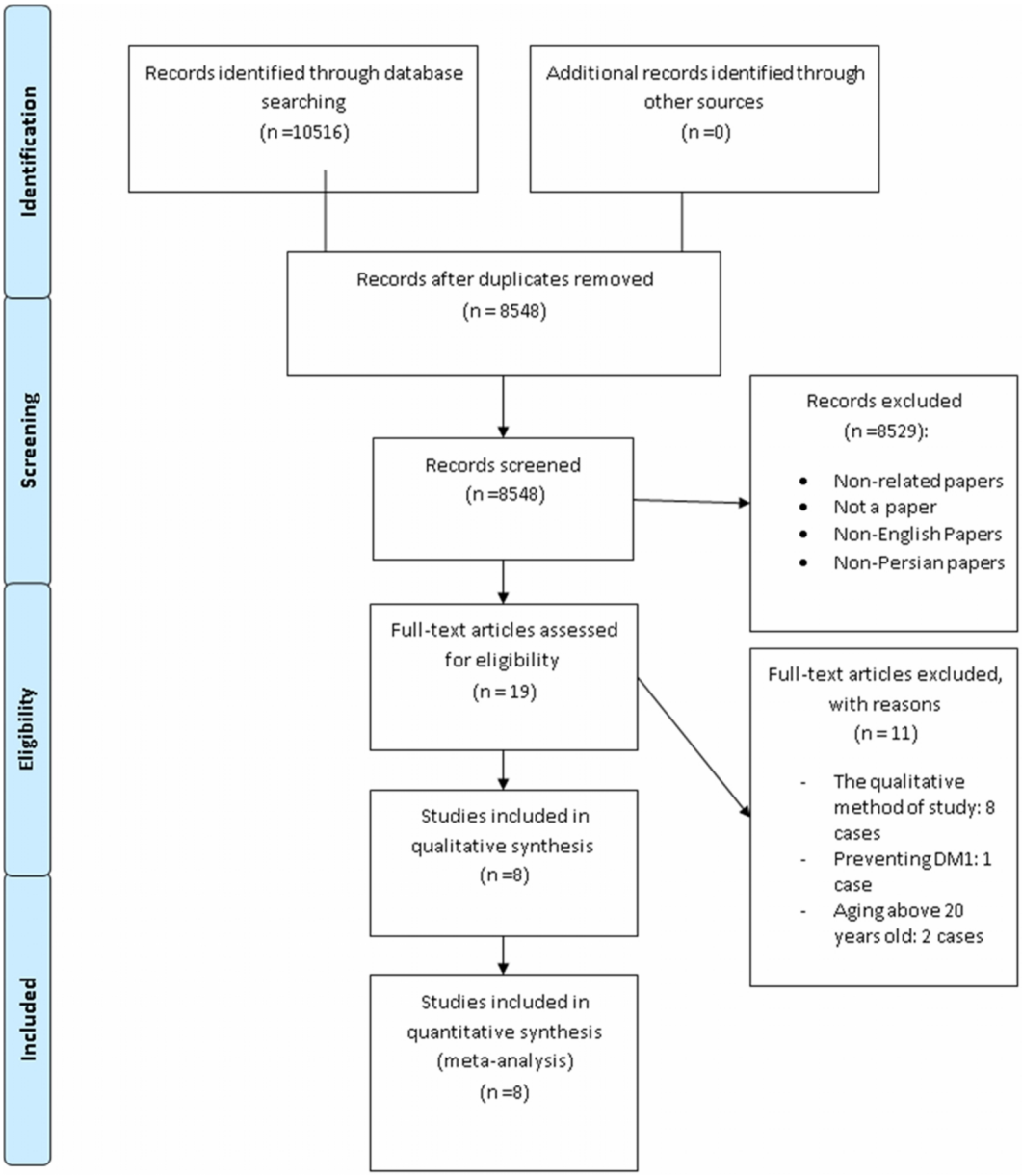

Fig. 1. Flowchart of systematic review

The risk of bias was assessed for five RCT studies, using Cochrane Checklist (2,8-10,11). The quality assessment of the studies revealed several potential risks of bias. These studies had a high risk of bias in terms of blinding, randomization and allocation concealment. None of the studies had explained allocation concealment, and it seems that it had not been carried out in practice. Blinding had been done only in one study at three levels of participants, care providers and outcome assessors. Similarly, only two studies explained the drop-out rate, which was more than 80% and did not explain the co-interventions that might have affected the results (Figs. 1-3).

Among the eight studies, five were RCT, two were trials (pre-post) and one was CT. This study was heterogeneous with respect to the target population, employed interventions, evaluated results and transferability.

Study outcomes focused on five topics of health promotion: Knowledge, attitude, practice, psychosocial and clinical (Figs. 1 and 2).

Knowledge

Knowledge was assessed in two studies.

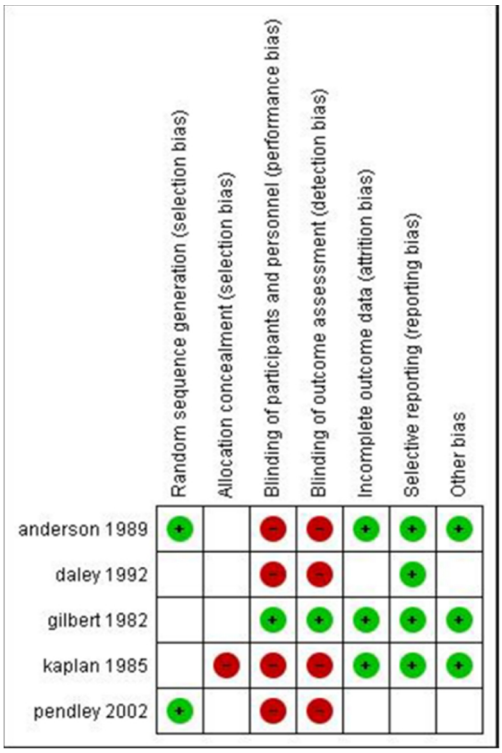

Fig. 2. The Risk of Bias

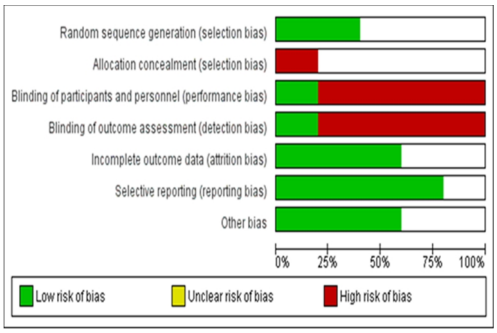

Fig. 3. Risk of Bias

One of them reported a positive effect while another, which had assessed the interactive correlation between knowledge growth and metabolic control, had concluded that there was no correlation (2). In addition, another study explored the correlation between the perception of peer support and knowledge, which ended in a linear correlation. It explicated that as the knowledge of the peers and families about the condition of the individual's disease increases, s/he will receive more support and will have a better metabolic control (3). This result is in contrast with that of the previous study. It can be generally concluded that peer interventions can increase knowledge, but due to varying results, it cannot be inferred whether it results in a better metabolic control or not.

Attitude

Two studies assessed attitude, and both reported a positive effect (9,11). Both were RCT and one of them, which was RCT, examined attitude.

Practice

Among the eight studies, only one examined practice (10) and reported positive and effective results. This was a RCT study, but it assessed practice (insulin injection) to gain a more reliable and accurate results besides having a control group and randomized and pre-post intervention. The results of the study indicated that older girls and children had a better skill.

Clinical Outcome

Among the items related to metabolic control, HbA1c were examined in these studies. Four studies examined this item, and while the reduction of HbA1c was found in two of them (8,11), no change was observed in one of them (11), and the change in the last one was not statistically significant (12). Three studies were RCT, and one was pre-post. One of the studies, which was RCT, did not report any changes. Furthermore, two other RCT studies stated that their experimental group had a better HbA1c than the control group, while one of them reported no difference between the control and experiment groups.

Psychosocial Outcome

Among the eight studies, two examined quality of life and both of them were pre-post. One of the studies did not report any changes (12), and another reported positive results (13), with higher scores in subcategories of social support and peer, school environment and social acceptance. Two of the studies examined anxiety (9,10) and both did not report any changes before or after the study. They were RCT studies and investigated their required issues before and after intervention.

Table 2. Characteristics of the Peer-Based Interventions (included studies)

Study	Duration of diabetes (Mean)	Demographic and Clinical Characteristic	Peer Characteristics
Pendley 2002	At least 15 months 5/5 years	8-17 yrs. Diagnosed for min 15 months 88%: European - American 7%: African - American 75%: Living with both biological parents 16%: Single parent 75%: Using insulin pump basic HbA1c: 9/20	3 persons selected by the participants: At least one non family child / adolescent (peer): called (support team)
Gilbert 1982	2/9 years	6-9 Y Average of 2/9 years of diagnose 80%: white, 20% : black	A black boy and a white girl in a self-injection film whose teaching self-injection
Greco 2001	< 18 months 8/43 months	10-18 yrs. 81% adolescents and 71% peers living with their both parents	A chosen peer BY ADOLESCENTSS: From 2 clinics in Delaware & Florida 10-18 y: Spending time average 17/44 h together per week Same gender, same race except One pair : 17 pair : Caucasian 3 pair : African- American 1 pair : Caucasian- African 81% adolescents & 71% peer : two parents family
Daley 1992	Intervention group : 4/9 Control group: 5/1	12-16 yrs. 35% Hispanic 11% African -American	A diabetic adult (IDDM) 25- 43 yrs. : As a sponsor for adolescents (peer) with same gender, interest and geographic area The sponsors were selected by an internist or endocrinologist & confirmed by clinical social workers during an interview. All sponsors were white except one of them Participating in two sessions for training sponsors about the importance of role expectation and unavoidable difficulties conducted by a social worker They had to attend to group sessions in a six- week intervals to discuss their improvement and difficulties.
Anderson 1989	8 years	11-14 yrs. Diagnosed for at least 1 year , equal in age , duration of diabetes , HbA1c in baseline (because of stratified random sampling) Five families in each group were lost to follow up. 83% in c group % 91% in I group: Two parents Female: C & I: 53/3% Mean age C: 12/5 I:12/9 No significant differences in the mean grade in school , father's occupational status , number of parents at home & clinical characteristics Average age of diagnose : I: 4/9 c: 5/1 HbA1c in I: 10/47% C: 10/42%	
Kaplan 1985	Not mentioned	13-18 yrs. All participants were white. Mean age at the diagnosis: 8 y 90% having experience of using SMBG Equal distribution of sexes in the two groups Basic HbA1c in intervention group: 12/6 Control group: 13/5	
Bekesi 2011	Not mentioned	10-18 yrs, DM: 55, JIA: 28, Oncology: 32 In control group: There was no significant differences between the respondents & non respondents in age, gender, mother's education, disease group, pervious camp experience & KIDSCREEN	
Loding 2007	6/6 years	13-17y, Mean age: 14/9 16 persons (84/2%) living with two parents Two sets of siblings were included 17 adol: multiple insulin injection (4 or more /day) 2 adol : insulin pump Mean HbA1c: 9/2% 1 adol: HbA1C< 8% (5/3%) 15 ADOL: 8-9 % (78/9%) 3 adol: > 9/5% (15/8%)	

Adherence to treatment was examined in four studies. Among them, two studies finally reported a positive result (8,11), one reported no change (3) and one assessed the correlation between perception of social support and different items (2), which concluded that there was an inverse correlation among perceiving social support, adherence to treatment, metabolic control and contradictions related to diabetes. As the perception of support goes up, the individual will have a better adherence to treatment and metabolic control. Only one of the studies specified that the individuals had progressed in three fields of insulin injection, nutrition, and physical activity (8).

Table 3. Characteristics of the Interventions in Peer-based Included Studies in Managing Type I Diabetes Mellitus among Children and Adolescents

Study	Variable	Assessments Tools	Intervention Domain	Intervention
Pendley 2002	1) HbA1c, 2) Age, 3) Self-care, 4) Family conflict, 5) Social support, 6) Knowledge	1) SCI : self-care inventory 2) DRC: diabetes responsibility and conflict scale 3) DSSI : diabetes social support interview 4) DPKT : diabetes patient knowledge test	Attitude: perception & knowledge about support	Five sessions – multisystem, home- based intervention Each participant assigned to the intervention was asked to identify at least three individuals from his/her extended family, peer-group, neighborhood or school who might be willing to participate in the study. Inclusion of at least one nonfamily child/adolescent was strongly encouraged.(The intervention and educational content was not explained.)
Gilbert 1982	1) Anxiety , 2) Anxiety behavior 3) Behavioral skill (performance)	1) STAIC : state Trait anxiety inventory of children 2) PSI : palmar sweet index 3) BPRS: behavior profile rating scale 4) BST : behavioral skill test	Skill: self-injection	Peer modeling film divided into 2 groups : I: Peer modeling self-injection film C: Diet film Before watching the film, state trait anxiety inventory of children (STAIC) & Palmar sweat index (PSI) were measured. Behavioral profile rating scale (BPRS) was measured during the film. BPRS & behavioral skill tests (BST) were measured after four days at the follow up phase again.
Greco 2001	1) Social support : 2) Adjustment to diabetes 3)Family conflict 4) Self-care 5) Adolescent's social interaction 6) Self-perception 7) Social demographic variable	1) DSSI : diabetes social support interview 2) DSSI - P: peer version 3) DEAST : diabetes education & support assessment tool 4) TADS: teen adjustment to diabetes scale 5) DCR : diabetes responsibility & conflict scale 6) SCI : self-care inventory 7) PIR : peer interaction record 8) SPP: self-perception profile 9) GIF: general information form	Knowledge: - Diabetes - Problem- solving: {General , diabetes related } - Stress management	A 4- week intervention, group -based problem- solving , four sessions Focusing on four topics in each session : 1. Diabetes Type 1 2. Problem- solving with parents and peers 3. Problem- solving applied to diabetes related situation 4. Stress management The format of each session were games , exercises and homework
Daley 1992	1) Adherence to medical regimen 2) Adjustment to diabetes 3) Feeling of competence 4) Behavior problem, 5) Anxiety, 6) HbA1c	1) Adherence to medical regimen 2) Adjustment to diabetes 3)Feeling of competence 4) Behavior problem, 5) Anxiety, 6) HbA1c	Attitude	Face to face by role modeling & self-disclosure by the sponsors 10- Month sponsor- teen intervention included a range of social activity, sport activity and educational activity. During these activities(e.g., going to a restaurant), the sponsor had to demonstrate a positive adherence behavior (e.g., choosing healthy food in a restaurant)

Table 3. Cntd

Anderson 1989	HbA1c	HbA1c	Skill & knowledge: 1) Solving management problems with SMBG 2) Self-care behavior	18- month program Measuring HbA1c in baseline and every subsequent clinic visit. Both groups attend the clinic every 3-4 months for 3H each visit. doing clinical & self-care assessment at baseline & 18 months later Standard care group (c): Receiving a routine clinic care for both groups like same treatment goals, consultation with the nurse educator, physician, dietitian, social worker & asked to monitor their BG twice a day. Intervention group: + standard care, 1/5 h before their routine care, families & adolescents had a separate session. During the sessions, the nurse educator called the adolescents and the family routinely responded to the questions.
Kaplan 1985	1) HbA1c, 2) Diabetes knowledge 3) Attitude & behavior, 4) Social support , 5) Problem- solving, 6) Age 7) Behavior or social skills	1) HbA1c, 2) Diabetes knowledge 3) Attitude & behavior, 4) Social support , 5) Problem- solving, 6) Age 7) Behavior or social skills	Skills: Problem- solving related to peer influence & social situation	A three- week summer school program: 3h in 3 consecutive weeks Intervention: Participating in rehearsal exercises for identifying and solving social problems with their peers. At the end, a series of video tapes were created. Control group: Discussing diabetes, watching educational films, receiving information through a computer, a series of video tapes were created from their discussions.
Bekesi 2011	Quality of life	Hungarian version of kidscreen- 52	- Attitude - Skills (performance & traditional camping skill)	Adventure based program , therapeutic recreation : Providing opportunities to acquire new skills & improve performance of rational camping skill & in the evening activities like camp fire, beach party ...to confront the campers with an unknown situation & step over their real or imagined limitations, using Hungarian version of KIDSCREEN to assess HRQOL & revised illness perception Questionnaire (IPQ-R).
Loding 2007	1) HbA1c 2) DQOL 3) Satisfaction	- DQOL: diabetes specific QOL - Self reported questionnaire - HbA1c - patient satisfaction questionnaire (specific for the study)	Knowledge	Three groups 1-2th groups : 5 & 6 person attended to 10 sessions 3rd group: 8 person and 6 sessions because of distance once a month & lasting one hour each session (adolescents and parents separately) Sharing experience & talking freely with peers In the first 4 sessions focusing on education and another sessions focusing on problem-solving individuals helped the peers to look closely for the problems and find a new way and help themselves to deal with similar problems. Also, the leader group began sessions with games and exercises to break the ice.

Two studies examined adaptation to the disease. One of them did not find any changes between the two groups before or after the intervention (9), while the other study reported a positive change (3).

Two studies explored the contradictions related to diabetes and found that increasing knowledge and the administered intervention reduced the contradictions of individual with his/her family (2). In another study, in which adaptation was not changed, cognitive adaptation was explored through interviewing teenagers, and positive changes were reported (9). Only one study explored self-confidence and social acceptance and detected no changes in social acceptance before and after the study, while self-confidence was increased (9);

and one study examined the ability for problem- solving and indicated positive results (11).

One study investigated the relationship between HbA1c and satisfaction with social support and social skills, and concluded that children and adolescents who enjoy a wider social network might be negatively

Table 4. The Outcomes of Peer-based Interventions in Managing Type I Diabetes Mellitus among Children and Adolescents

Study	Follow up	Clinical outcomes	Knowledge & behavioral outcomes	Psychosocial outcomes
Pendley 2002	Yes but not mentioned when	Higher adherence = lower HbA1C Higher diabetes related conflict = higher HbA1C peer support was not correlated with metabolic control & adherence parent reported adherence only effected on HbA1C	Perceived peer support correlated with youth knowledge & age older age & knowledge = higher peer support friend : ad > chi family : ad < chi	Lower HbA1C = more support team peer friend : ad > chi Older age = higher Peer support
Gilbert 1982	4 days later	Not measured	No significant Differences between the experimental group on the PSI & STAIC & BPRS before and after watching the film was not significant and the overall effect of the treatment on anxiety behavior Significant interaction between three variables: Sex, age , experimental group : Older girls in the experimental group had higher scores in BST and boys with more previous experience had higher scores than boys with less experience	No significant differences on global anxiety rating & global cooperation rating
Greco 2001	4 weeks later	Not measured	Significant increase in knowledge about diabetes & support in both peers & adolescents Scores of peer support had decries in the score but in overall peer > family No improvement in adherence, conflicts & adjustment in adolescents	No changes in self-perception in adolescents but significant differences in peers No significant changes in peer activities (PIR)
Daley 1992	10 months later	No significant differences between I & C group in adolescents Adherence to diabetes regimen although there was a decline in HbA1c in I & increase in C group in the mean value	Some teenagers showed that they enjoyed having an adult friend & some sponsors reported that their teenager changed some of their behaviors. The intervention altered their attitudes about life expectancy & teen's potential to achieve. At the end they reported that they learned to cope with their problem more than the past	Using Diabetic Adjustment Questionnaire (DAQ) to measure emotional adjustment : No significant differences between I & C group, but the intervention group was better in some items: A significant increase in self-steam with regards to social acceptance and romantic appeal No significant differences between I & C group on social competence or level of anxiety
Anderson 1989	18 months later	Mean HbA1c in the intervention group: Significantly lower having increase in the control group 76% of the adolescents in the intervention group exhibited stable or improved metabolic control 23% showed > 1% deterioration in control group 50% have deterioration	Had a positive impact on adolescents who reported about their self-care practices including : Diet, exercise, insulin dosage	Not measured
Kaplan 1985	3 weeks later	Significantly low HbA1c in intervention group : better in metabolic control The control group had a slight increase	Appropriate self-care behavior was associated with better control Significant positive correlation between HbA1c & Mean Ends Problem Solving (MEPS): Less change in knowledge: Lower HbA1c Improving self-care behavior : Better metabolic control	Not measured

Table 4. Cntd

Bekesi 2011	8 weeks later	Reliable Charge Index (RCI) was used for clinically significant change. According to the results 32 children (27.8%) showed clinically significant improvement on at least one subscale of KIDSCREEN-52 instrument. Specifically 17 children increased on one scale, scores of 10 children improved on two scales, 3 children showed improvement on three subscales, scores of 1 child increased on four scales and scores of 1 child on six scales.	Not measured	Significant differences were found among disease groups on two KIDSCREEN scales: Physical well-being & self-perception. Diabetes group had a higher score than oncology & JIA. From T1 (pre camp) to T2 (post camp), self-perception & school environment scores increased but autonomy decreased. Male scores increased from T1 to T2, but female scores did not change. Autonomy in younger children decreases but it did not change in the older children. Parent relation for younger children did not change & it increased in the older children. This program had positive effects on HRQOL in children with chronic disease. having + effect on: Self-perception & self-efficacy Self-perception scores in diabetes group showed higher scores.
Loding 2007	12 & 24 months later	Non-significant reduction in HbA1c value from baseline to 24 months later (9/2 to 8/7) There was a great reduction in the girls (9/4 to 8/4)	Not measured	Mean score of DQOL : 75/5 Changing the score from the baseline to the end of the study was minor (-2/3 to 5/6). Adolescents were satisfied with the intervention, but parents needed longer sessions and had to find a way to involve the fathers.

Table 5. The Main Results & Comments of Peer-based Interventions in Managing Type I Diabetes Mellitus among Children and Adolescents

Study	Main results	comments
Pendley 2002	Adolescents reported significantly more peer support, but it did not correlate with metabolic control. With age, perception of peer support increased	The intervention was not explained in full detail and was unclear. The place where data collection was done was not clear. The participants have been initially divided into control and intervention groups but no report was available about comparing the two groups with each other. Due to small sample size, the analyses related to two variables of family and peer group were excluded in two different stages and the reader of the paper was unable to compare the two groups. Because the average period of diabetes diagnosis is 5/51 years, there is no possibility for generalizing the results of this study to individuals newly diagnosed. It was better to do a comparison before and after the intervention to make it possible to compare both groups with each other.
Gilbert 1982	Not effective	The method of randomization was not clear. The follow-up period was short. Within the four days remaining from the stay in the camp, children were given instruction on how to inject insulin under the supervision of a trainer, which reduced the initial effect of the film. The validity of BPRS was under question. This intervention might have had a better effect on decreasing anxiety among children and teenagers who have newly been diagnosed.
Greco 2001	The intervention was effective at improving peer's knowledge about diabetes & ways to offer support. Global support did not increase. - Positive peer involvement increased in adolescents care.	A longer follow-up period was preferred. Some of the examined items have become negative such as peer support-adolescent report or family support-adolescent report, which can be attributed to an increase in teenagers' awareness over the issue of support. No control group was available. Sample size was small. This study did not have control group and prevents readers from making a comparison.

affected by their friends and consequently might have a weaker metabolic control (11).

Discussion

According to these eight studies, in which numerous parameters had been investigated, it was found that peers' effect is profound and they are able to influence the outcomes and skills from the elementary stages of knowledge. Besides, peers had a broader effect in schools, camps and different places where the studies had been carried out. Nonetheless, no unified result could be achieved and the conducted studies could not be statistically analyzed. Some other studies had altered their subjects' knowledge and attitude while others had changed their quality of life and brought about changes on their psychoso-

Table 5. Cntd

Daley 1992	Positive effect in attitude Slight reduction in HbA1c in the intervention group	The method of randomization was not clear. The inclusion criteria for admitting adolescents into the study were not clear. No explanation was given about the control group. Sample size was small. Since behavioral changes occur gradually and through the passage of time, we could have witnessed long-term changes and effects in case the intervention had been longer. It was mentioned at the beginning of the study that adolescents were randomly assigned into two groups of control and intervention; however, no explanation is given about the control group. In addition, no explanation was given in the statistical analysis and the discussion sections regarding the control group and no comparison was made.
Anderson 1989	Positive effect on HbA1c	The reliability of self-report behavior instrument was unclear. It cannot be generalized to newly diagnosed individuals since the average age of diagnosis in both groups was high. It is not clear whether exchange of information has been carried out between the two groups or not (contamination). It has not been clarified if the participants in this study (control and intervention) had a prior record of using SMBG because the reliability of the study would have been reduced if they have had any awareness.
Kaplan 1985	Positive effect: Self-reported compliance with diabetes regimen & attitude toward self-care Negative effect: Problem- solving ability & satisfaction with social support	The method of randomization was not clear. Social situations and tackling them have been discussed within the intervention group; however, it was not clearly and aptly explained what the details of these situations were; in other words, the content of sessions related to experiment group was unclear. It is not clear if there has been information transaction between the two groups (contamination). It was better to classify individuals into two sub-groups with respect to gender to clarify the differences between the two genders. The sample size was too small and the participants sought participation voluntarily, which hampers generalizability.
Bekesi 2011	Positive effect on QOL	The control group was omitted from the study due to low rate of responsiveness, which reduced the reliability of the study. The questionnaires were sent to an uncontrollable environment (participants' homes), which reduced the reliability of responses and results. There was no data on the socio- demographic characteristics of the families and the events, which had been influential throughout children's life (loss of a significant person)
Loding 2007	Positive effect on QOL	The sample size was small and low scores on quality of life could have been due to the small sample size. It is better to conduct this study using an RCT method with a larger sample size. Cooperation between two groups of diabetic children and psychology and classification of participants into two sub-categories of boys and girls were among the advantages of this study. Low response rate (19 adol of 60) was another limitation of this study.

cial condition and still others had changed their metabolic control.

Compared with the studies conducted on T1DM, peer-based studies, which have been done on T2DM, are more consistent and systematic. In these studies, peers are individuals suffering from diabetes who receive education from therapeutic-medical personnel. This method is commonly applied in systems, which lack therapeutic-medical personnel (13). Moreover, the programs directed by peers have more flexibility toward individuals who receive education and are more cost-effective. Using peers can be beneficial in self-management programs related to diabetes in which there is no possibility for long-term follow-up by therapeutic personnel (13). The contrast between peer-based and therapeutic cadre-based programs can be observed in these studies. In a research that compared peer-based and therapeutic cadre-based interventions, Heister, et al. found that the group, which had received education and support from peers, achieved improvement in clinical and psychosocial outcomes (14). These results by no means imply that peers can replace therapeutic cadre, and can help improve and develop disease management (13).

However, through this systematic study, we found a discrepancy within peer-based studies; only one study among the eight studies resembled peer-based approach to-

ward T2DM. In this study, a group of trained adult peers were used which was perhaps due to the fact that in this model we needed trained peers who have already attained a thorough management over their own disease to function as a model for an individual or a group. Peers must have certain capabilities such as problem- solving, effective communication, decision- making, identifying and accessing therapeutic care resources, complete perception over diabetes management rules, giving proper psychological response to conditions, being flexible and dependable and having the ability to communicate self-confidence to others (15). Children and adolescents are at a stage in their life that is the most critical of all periods and it is difficult for them to act as role models to achieve proper self-management and set up independent groups. Consequently, most studies are professional-led.

Among the eight studies, only two used non-diabetes friends as a supportive group (2,3). It has been shown that non-diabetes friends increase emotional support in the suffering individual (3,16). Increasing knowledge among friends would consequently increase their understanding about their suffering friend, decreasing social stigma. Moreover, one of the concerns among diabetic children and adolescents was the fear of being rejected by their friends (17). In fact, they tend to be concerned about being rejected by the society and friends. On the other hand, they are more influenced by their friends and might be affected by behaviors that could be destructive for their disease management. For instance, in a study on the effect of peers on choosing vague and risky options, researchers found that individuals tend to change their options in case of seeing dissimilar options selected by their peers and teammates. Researchers also found that this issue is also true for choosing risky and wrong behaviors. In other words, children and adolescents tended to opt for risky options when they saw that most of their peers had also chosen the risky option (18). Considering the fact that a child or an adolescent spends most of his/her time at the kindergarten or school, engaging non-suffering friends and increasing their knowledge and support can prevent destructive effects and could have a significant effect on disease management. Still, what non-suffering friends do not appreciate is the condition in which the suffering individual is stuck; friends understand their diabetic friend's conditions, but they do not have a thorough perception over the issue. Consequently, they provide informational and emotional support for each other. Since they have the same challenges and experience the same conditions, they are able to assist each other. Therefore, both diabetic and non-diabetic friends can have positive effects on managing diabetes in children and adolescents despite having varying effects.

Another contrast that can be dealt with in these studies is comparing children and adolescents with each other: As a child enters school or the society, his/her dependence on parents decreases and instead relies more on friends. This trend grows more as his/her age increases so much so that a teenager communicates more with friends and is affected more by them (3). Children accept their parents' advices to manage their disease and this enables the parents to control them. However, the advantage of the relationship between a teenager and his/her friends is the amount of intimacy that exists among the teenagers (2). Teenagers tend to speak over their own issues with each other, receive a part of their social approval from their peers, spend more time together, cooperate more with each other in different fields, such as sports and education and can consequently speak about their disease with their friends and share their information. As a result, teenagers' friends provide more emotional support than a baby's friends (2).

Application in Research

Peer-based studies on T1DM are not noticeable. Both quantitative and qualitative studies are scarce in this field while qualita-

tive studies can provide us with rich data. To obtain information about the process of participation and experience of using peers, grounded theory, phenomenology and action research should be employed to gain a precise and deep perception over this phenomenon and present localized and appropriate models to determine the incorporation of the peers more suitably.

Furthermore, it is suggested to embark on a research to compare professional-led and peer-led intervention, specifically for T1DM among children and adolescents.

In a study in which parents sided with non-diabetic peers in giving support (2), the rate of peer's perception of support and the support provided by peers and parents were examined. However, we are in need of a study, which could objectively measure and compare the amount of effect for friends and peers' support in clinical results.

Parameters like nutrition, physical activity and responsibilities related to diabetes such as insulin injection, daily monitoring of BG, etc. could be provided to a diabetic peer through a peer-led intervention.

In addition, conducting similar studies on T2DM in terms of both preventing and educating the suffering individuals is needed.

The investigated studies in this research had many methodological weaknesses and this could be due to their old nature. Therefore, it is suggested that researchers use Trend and Consort checklists in their studies to minimize the risk of bias.

The results obtained in this systematic review indicated that peer-based interventions could provide emotional support and improve disease management among children and adolescents suffering from diabetes. Nevertheless, these results can be beneficial for the nurses or physicians when educating diabetic children or teenagers and their families. In the modern community, centralized families, mothers working outside home and single parent families have reduced the involvement of parents in managing their children or teenagers' disease. Therefore, educating peers and school personnel can be an alternative solution for improving children and teenagers' disease.

Conclusion

The range of peer's effect on diabetes is extensive and influential in different fields and dimensions. Each of the peer-based interventions was effective on managing T1DM in children and teenagers. Nonetheless, due to the obsolete and old nature of the studies and their low frequency on both T1DM and T2DM, conducting more studies and researches is highly recommended.

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