Journal of Adolescent Health 60 (2017) 133–146

ELSEVIER

JOURNAL OF ADOLESCENT HEALTH

www.jahonline.org

Review article

Components of Interventions That Improve Transitions to Adult Care for Adolescents With Type 1 Diabetes

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Article history: Received June 30, 2016; Accepted October 6, 2016
Keywords: Transition; Type 1 diabetes; Systematic review; Young adults

A B S T R A C T

Adolescents with type 1 diabetes struggle with glycemic control with decline further exacerbated by transfer from pediatric to adult care. The purpose of this systematic review/meta-analysis was to examine which components of transition programs are effective in improving outcomes following transfer. We searched six databases for studies that assessed the efficacy of a transition program on diabetes outcomes. Studies reporting hemoglobin A1c (HbA1c) or its change for the intervention versus control group pretransition and posttransition were pooled using a random effects meta-analysis model. Of 4,689 studies identified, 18 (1 randomized control trial, 6 quasi-experimental, 1 prospective, and 10 retrospective cohort) met inclusion criteria. Findings represent data from 3,382 youth with type 1 diabetes (52% male, age 16–23 years) undergoing transition. Programs varied and included transition coordinators (n = 7), transition clinics (n = 10), and group education meetings (n = 5). Average age of transfer was 17.7 years. All but one study reported improvement/maintenance of HbA1c posttransition. However, pooling data from four studies with a control group (418 youth), there were no differences in HbA1c at 12 months (−.11 [95% confidence interval: −.31, .08]). Of other outcomes studied (clinic attendance [n = 12], severe hypoglycemia [n = 8], and diabetic ketoacidosis [n = 7]), transition programs showed greatest consistency in reducing diabetic ketoacidosis episodes. Findings suggest that transition interventions may be effective in maintaining glycemic control and reducing diabetic ketoacidosis episodes posttransition. Further research is needed to determine which program types are most effective.

IMPLICATIONS AND CONTRIBUTION

Transition programs may maintain glycemic control and reduce diabetic ketoacidosis events for youth with type 1 diabetes transferring to adult care. Few high-quality studies assessing transition interventions exist. Future research should compare individual transition components to determine which are most effective in improving outcomes.

The number of youth with type 1 diabetes is increasing throughout North America [1] and across the globe [2]. This rise in children with diabetes will escalate the already large burden of diabetes [3]. Across chronic health conditions, rates of successful transfer from pediatric to adult care are low. Only a minority (21.6%) of 19–23 year olds with special health care needs (n = 1,865) who participated in the 2007 national Survey of Adult Transition and Health reported having a smooth transition to adult services [4]. Risk for deterioration in glycemic control for those with type 1 diabetes is highest during adolescence and young adulthood [5]. Lotstein et al. [6] reported that youth who abruptly transferred from pediatric to adult care were 2.5 times more likely to have poor glycemic control than those who stayed with their pediatric provider. The need for effective programs to support transition of care from pediatric to adult providers is critical.

Conflicts of interest: The authors have no conflicts of interest to disclose.
Disclaimer: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.
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1054-139X/
http://dx.doi.org/10.1016/j.jadohealth.2016.10.002

Both youth and health care providers encounter barriers that impede successful transition [7]. Garvey et al. [8,9] surveyed 258 young adults and 418 adult endocrinologists regarding their respective experiences during transition to adult diabetes care. For young adults, the most commonly reported barriers were lack of referral to a specific provider, lack of adult provider contact information, and individual competing life priorities, whereas endocrinologists reported limited access to pediatric records or lack of receipt of summaries from pediatric providers and poor access to mental health services for their transitioning patients. To address these barriers, numerous professional organizations [10–13] have published recommendations with the common theme of implementation of a structured transition rather than an abrupt transfer in care. When a structured program exists, clinic attendance, rates of hospitalizations, and rates of loss to follow-up have been shown to improve [14]. However, recommendations differ on what should be part of a structured transition program.

While prior systematic reviews have assessed the impact of transition programs [14–16], individual transition components such as a joint transition clinic, transition coordinator, or telephone support that have the greatest impact on improving glycemic control during transition have not been systematically examined. The goal of this systematic review and meta-analysis was to determine the effect of specific transition interventions, compared with standard care, on hemoglobin A1c (HbA1c), visit attendance, and adverse events in adolescents with type 1 diabetes.

Methods

Search

Following an a priori protocol [17] and the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines [18], we searched six databases: Cumulative Index to Nursing and Allied Health Literature, Cochrane, Embase, MEDLINE, PsycINFO, and PubMed. Search terms addressed the population ([adolescent or young adult or pediatrics] and [type 1 diabetes]) undergoing transition (transition to adult care or health transition) measuring specific outcomes (hemoglobin A, glycosylated or blood glucose or clinic attendance) and rates of adverse events (diabetic ketoacidosis or hypoglycemia). Medical subject headings were used when available. The full search strategy is available in the Appendix. Reference lists of included studies were searched for additional studies meeting our inclusion criteria. For inclusion, a study needed to focus on youth with type 1 diabetes aged 11–26 years, their transition from pediatric to adult care, and report one or more outcomes before and after transition. Studies were not excluded based on study design because transition programs are in their infancy and data are lacking as to which are most effective. Including studies of all designs allows for the building of a platform for further research. Studies were also not excluded based on language or year of publication.

Records retrieved in our search were imported to an Endnote database, and duplicates were removed. First, studies were excluded based on titles that did not relate to transition or diabetes. For the remaining studies, abstracts were then assessed and were excluded if they did not meet one or more inclusion criteria. Finally, full text of the remaining studies was screened to determine which met our search criteria. When there was uncertainty about a study's eligibility, a second reviewer was consulted and a decision was made through a discussion until consensus was reached.

The primary outcome of interest was HbA1c before and after transition from pediatric to adult providers. Secondary outcomes included clinic visit attendance, adverse events (severe hypoglycemia, diabetic ketoacidosis episodes (DKAs), diabetes-related hospital admissions), self-esteem level, and self-monitoring of blood glucose (SMBG) before and after transition.

Data extracted from each study included sample characteristics, transition components and process, and study outcomes. Sample characteristics included sample size, study location, study interval, age, sex, race, and diabetes duration. Transition components (transition coordinator, transition clinic, joint clinic) and process of transition (age at transfer, percentage of patients transitioned, time between last pediatric clinic visit and first adult clinic visit) were also included. Outcomes and their measurement were also extracted. All data were entered into an Excel (Microsoft Corp., Redmond, WA) document and synthesized across studies.

To distinguish between transfer versus transition of care, criteria for transition were defined. Interventions in which participants either attended a dedicated transition clinic or participated in a transition process of 3-month duration or greater were considered transition programs. Further, interventions were categorized as having multiple components if they contained more than one of the following: transition coordinator, joint visits, transition clinic, or group education.

Quality appraisal process

Studies were appraised using the Downs and Black checklist [19], designed for appraisal of both randomized and nonrandomized studies. The tool has high internal consistency (Kuder–Richardson Formula 20 = .89), high test–retest reliability (r = .88), and good interrater reliability (r = .75). The 27-item checklist covers five domains (reporting [10 items], external validity [3 items], internal validity—bias [7 items], internal validity—cofounding [6 items], and power [1 item]) [19]. Each item receives 1 point, except for one item in the reporting domain that can receive a maximum of 2 points with a maximum possible score of 28 points. The authors collaboratively appraised one study to determine consensus of definition of items. The remaining studies were assessed independently with differences resolved through discussion until consensus was achieved.

Quantitative synthesis

Studies reporting either mean HbA1c pretransition and posttransition or mean change in HbA1c with its standard deviation or standard error of the mean for the intervention and control groups were eligible for inclusion in the meta-analysis. Where HbA1c was reported in International Federation of Clinical Chemistry units [20], data were converted to National Glycohemoglobin Standardization Program units [21]. Where HbA1c was reported as median and range [20], data were converted to mean and standard deviation [22]. Authors of studies were contacted for additional information as needed [23–25]. A standardized effect size for each study and a pooled effect of improvement in glycemic control was computed across studies using a random effects meta-analysis model. For calculation of effect size, we estimated a moderate (.6) pre/post-HbA1c correlation based on published reports of correlation of physiologic parameters [26] and considered a negative effect