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Factors determining diabetes care outcomes in patients with type 1 diabetes after transition from pediatric to adult health care: a systematic review

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Factors determining diabetes care outcomes in patients with type 1 diabetes after transition from pediatric to adult health care: a systematic review

Abstract

Background The transition of young adults with type 1 diabetes from pediatric to adult health care usually takes place at the end of secondary schooling, at a time when they are also experiencing multiple life transitions. Diabetes self-care management will often be of low priority for young people as they adjust to new routines involved with further study, employment and relationships. Failure to transition successfully may result in loss to medical follow-up, deterioration in diabetes control and development of short and long term diabetes complications. **Objectives** The primary focus of this systematic review was to identify the best available evidence of factors that determine diabetes care outcomes for young adults with type 1 diabetes after transition from pediatric to adult health care services. **Data synthesis** Where data were available, it has been pooled and presented as a forest plot in the review results. Studies with textual data results or where synthesis is inappropriate are presented as a narrative summary. **Results** Forty-one studies that potentially met the criteria for inclusion in the review were identified by the search strategy, of which 13 met the inclusion criteria. **Factors identified to assist transition in the review studies** related to either structured or unstructured interventions. The results of this review demonstrate that when a structured program is in place to assist the transition from pediatric to adult diabetes services, young people are less likely to require hospitalization for acute diabetes complications and more likely to attend appointments at the adult diabetes service. **Conclusions** The evidence identified from this review is suggestive that a structured transition intervention employing a dedicated health professional to support and coordinate the process is more likely to prevent loss to follow-up, maintain clinic attendance, have a positive impact on diabetes control, reduce hospital admissions, and be a more cost effective and positive experience for patients than an unstructured or usual care model.

Disciplines

Medicine and Health Sciences | Social and Behavioral Sciences

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Factors determining diabetes care outcomes in patients with type 1 diabetes after transition from pediatric to adult health care: a systematic review

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Executive summary

Background

The transition of young adults with type 1 diabetes from pediatric to adult health care usually takes place at the end of secondary schooling, at a time when they are also experiencing multiple life transitions. Diabetes self-care management will often be of low priority for young people as they adjust to new routines involved with further study, employment and relationships. Failure to transition successfully may result in loss to medical follow-up, deterioration in diabetes control and development of short and long term diabetes complications.

Objectives

The primary focus of this systematic review was to identify the best available evidence of factors that determine diabetes care outcomes for young adults with type 1 diabetes after transition from pediatric to adult health care services.

Inclusion criteria***Types of participants***

Studies involving people aged 15-19 years inclusive with a diagnosis of type 1 diabetes who have transitioned from pediatric to adult health care services.

Types of intervention(s)

Any intervention which identified factors that influenced the transition of young people with type 1 diabetes from pediatric to adult health care.

Types of studies

All clustered trials, descriptive studies, pre-and post-test studies, and other designs with a control group and case studies evaluating factors which influence the transition from pediatric to adult health care of patients with type 1 diabetes were included in the review.

Types of outcomes

Primary outcomes: Diabetes control as measured by HbA_{1c} at follow-up, loss to follow-up, adherence to insulin therapy, incidence of hospital admission for acute complications, and frequency and regularity of clinic attendance

Secondary outcomes: Uptake of screening for long term diabetes complications, cost effectiveness of intervention, health-related quality of life and patient satisfaction

Search strategy

Seven databases were searched and the reference list of all included studies was searched for additional studies. There was no time limitation to the search.

Methodological quality

The methodological quality of eligible trials was assessed independently by two reviewers using the Joanna Briggs Institute (JBI) quality assessment tool.

Data collection

Data extraction from the included trials was undertaken and summarized independently by two reviewers using the JBI data extraction tool which was modified in order to extract detailed data from the study.

Data synthesis

Where data were available, it has been pooled and presented as a forest plot in the review results. Studies with textual data results or where synthesis is inappropriate are presented as a narrative summary.

Results

Forty-one studies that potentially met the criteria for inclusion in the review were identified by the search strategy, of which 13 met the inclusion criteria. Factors identified to assist transition in the review studies related to either structured or unstructured interventions. The results of

this review demonstrate that when a structured program is in place to assist the transition from pediatric to adult diabetes services, young people are less likely to require hospitalization for acute diabetes complications and more likely to attend appointments at the adult diabetes service.

Conclusions

The evidence identified from this review is suggestive that a structured transition intervention employing a dedicated health professional to support and coordinate the process is more likely to prevent loss to follow-up, maintain clinic attendance, have a positive impact on diabetes control, reduce hospital admissions, and be a more cost effective and positive experience for patients than an unstructured or usual care model.

Implications for practice

The unique needs of these patients demand services distinctly different to the general adult patient with diabetes and adult clinicians should take an active role in ensuring follow-up in this vulnerable group.

Implications for research

Due to the relatively small numbers in this patient cohort one suggestion for future research would be to conduct multi-center randomized controlled trials which may then provide more meaningful evidence of diabetes transition and outcome measures.

Keywords

transition; type 1 diabetes; young adults; diabetes control; systematic review

Background

Health care delivery to people with diabetes has traditionally been based on two distinct paradigms – pediatric health service or adult health service.¹ Psychology researchers now recognize the unique developmental stage of the young person immediately post high school as distinct from the young adult period, which was traditionally said to begin after adolescence but is now thought to begin in the late twenties or early thirties.² It is during this post-adolescent phase that most young people with diabetes are transitioned to adult care, and this is a time when they have competing the demands of diabetes management and the chaotic life style of those of that age, making them vulnerable to acute diabetes complications such as diabetic ketoacidosis (DKA) or severe recurrent hypoglycaemia.¹ Also, during this phase, receptiveness to change is limited and as a means to asserting independence the young adult may reject adult control and adult authority figures.² It has been suggested³ that the adult health system is less attuned to the developmental and behavioral struggles of the young adult and this may be unsettling for both them and their family. A disorganized transfer from pediatric health services to adult care may lead to loss to follow-up, which increases risk of developing diabetes complications.⁴

There have been no published randomized controlled trials (RCTs) addressing the transition of adolescents and young adults with type 1 diabetes from pediatric to adult health care, so meaningful conclusions about factors determining the success of transition are limited.⁵ The current models of

care for adolescents focus on the importance of pediatric support while still at school, when the majority of young people will still be supported and influenced by family. As a consequence young people who leave school early, for example, to undertake trade apprenticeships at age 15 to 16 will often be transitioned to adult services at a time when there are multiple changes to routine, when they have already been exposed to a number of adult influences outside of family and are not linked to adult health care providers.⁶

Historically, pediatric health care professionals have identified significant obstacles that impede the transfer of patients into adult care, largely arising from the inadequacy of appropriate available services.⁷ The Australian national evidence-based clinical care guidelines for type 1 diabetes in children, adolescents and adults⁸ recommend that transition from pediatric to adult services takes place between the ages of 16 and 18 years, although current practice is to transition young people at completion of schooling or after 18 years of age. A later age may not be the ideal time for transition given a number of major adolescent developmental changes occurring at this stage² and the demands of study, work and relationships which compete with the young adult's commitment to diabetes management.⁶ The general consensus is that transition should not be concurrent with a medical crisis;⁹ however this is occurring with increased frequency as admission to pediatric health care facilities is being denied on the basis of age.

Anderson¹⁰ has suggested that the transition period provides a window of opportunity to promote and support adult self-care behaviors which is frequently lost as young adults (18-22 years) are distracted by study, financial self-support and social demands. The aim of this review is to identify factors that may assist young adults in achieving a successful transition from pediatric to adult health care.

Objectives

What factors determine diabetes care outcomes for young adults with type 1 diabetes after transition from pediatric to adult health care services?

Inclusion criteria

Types of participants

Studies involving people aged 15-19 years inclusive with a diagnosis of type 1 diabetes who have been transitioned from pediatric to adult health care services.

Types of intervention

Any intervention which identified factors that influenced the transition of young people with type 1 diabetes from pediatric to adult health care.

Types of studies

All clustered trials, descriptive studies, pre- and post-test studies, and other designs with a control group and case studies evaluating factors which influence the transition from pediatric to adult health care of patients with type 1 diabetes were included in the review. Studies involving participants who have not transferred to adult care, are older than 19 years (as traditionally transition occurs around 18 years of age) and people with type 2 diabetes were excluded.

Types of outcomes

Primary outcomes:

1. Diabetes control as measured by HbA1c at follow-up.
2. Loss to medical follow-up as defined by Frank¹¹ occurs when the patient fails to connect with the adult health service within a 12-month period after referral and/or fails to attend at least one medical appointment within a 12-month period.
3. Adherence to insulin therapy.
4. Incidence of hospital admission for acute complications.
5. Frequency and regularity of clinic attendance.

Secondary outcomes:

1. Uptake of screening for long term diabetes complications.
2. Cost effectiveness of intervention.
3. Health-related quality of life.
4. Patient satisfaction.

Search strategy

In consultation with a librarian, databases were searched to identify keywords used in the titles and abstracts as well as subject listings, such as MeSH terms. As each database has its own indexing terms, individual search strategies were developed for each database. During the development of the search strategy, consideration was given to the diverse terminology used and the spelling of keywords as these influence the identification of relevant trials. Search strategies can be found in Appendix I.

In addition, the reference lists of all identified articles and reports were searched for other articles based on their titles. A search for unpublished studies and relevant conference abstracts was conducted across appropriate sources. Hand searching of conference proceedings, theses and any other relevant articles was undertaken.

There was no time limitation to the search and the following databases were searched: CINAHL (1966-2012), MEDLINE (1946-2012), PsycInfo (1967-2012), EMBASE (1974-2012), BioMed Central (2000-2012), Current Cochrane Central Register of Controlled Trials – Cochrane Library to Volume 6 2012 and Web of Knowledge. The search for unpublished studies or grey literature included: MEDNAR, OpenSige, ProQuest Dissertations and Theses (1980-2012), Index to Theses, Networked Digital Library of Theses and Dissertations and Proceedings, First New York Academy of Medicine's Grey Literature Report.

Method of the review

Two reviewers independently assessed the titles and abstracts identified from the search against the inclusion/exclusion criteria (Appendix II). In any study where the title and abstract were inconclusive, full text was obtained for further assessment. Full text copies of articles, which were identified as

meeting the inclusion criteria, were obtained for critical appraisal and data synthesis. All references were entered into the bibliographic software program Endnote Version 14™. Studies that were reported in more than one publication were included only once. Reviewers jointly determined articles to be included.

Assessment of methodological quality

The methodological quality of eligible trials was assessed independently by two reviewers using the Joanna Briggs Institute Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MASARI) checklists (Appendix III). Any discrepancies in opinion were resolved with discussion.

Each study was critically appraised and methodological quality assessed for (Appendix V):

1. Selection of sample
2. Detailed description of the inclusion and exclusion criteria used to obtain the sample
3. Evidence of dealing with confounding factors
4. Validity of methods of outcome assessment
5. Description of withdrawals and dropouts
6. Use of appropriate statistical analysis.

In order to include only high quality studies, a cut-off value of 7.3 (SD 1.03) was used.

Data collection

Data extraction from the included trials was undertaken and summarized independently by two reviewers using a data extraction tool which was modified in order to extract detailed data from the study (Appendix IV). Discrepancies between reviewers were resolved by discussion. Data were collected relating to:

- Patient demographics
- Patient inclusion/exclusion criteria
- Description of factors identified as influencing transition
- Age at transition
- Description of outcomes
- Number of and reasons for withdrawal and dropouts.

Data synthesis

Due to the heterogeneity of the included studies, the majority of the data could not be pooled in statistical meta-analysis. The data that were pooled are presented as a forest plot in the review results. Clinical heterogeneity was assessed by considering the populations, interventions and outcomes between the studies. Studies with textual data results or where synthesis was inappropriate are presented as a narrative summary.

Results

The search strategy identified 74 studies that potentially met the criteria for inclusion in the review, with two further papers identified from other sources. After a review of title, abstract and removal of duplicates, 41 papers were retrieved. On review of full text of these 41 studies, 28 papers were excluded as they failed to meet inclusion criteria. Appendix VII outlines the reasons for exclusion of these studies. A final total of 13 studies were included in the review for critical appraisal (Figure 1).

Figure 1: Identification and evaluation of systematic review studies

Description of studies

Thirteen studies were included in the review and involved a total of 1486 participants with sample sizes ranging from 33¹² to 249.¹³ All were descriptive studies and were conducted in Canada,^{11,14-16} United States of America,^{13,17} Australia,⁵ United Kingdom,⁴ Northern Ireland,¹² Germany,¹⁸ Finland,¹⁹ Italy²⁰ and Spain.²¹ There were no RCTs among the included papers. A summary of the participants, study method or intervention used and results of each of the studies can be found in Appendix VI.

Methodological quality

There was no disagreement between reviewers when assessing the 13 studies for methodological quality. Based on the criteria for quality assessment the calculated mean quality score was 7.3 (SD 1.03), hence all studies were included in the review. While the included studies were of variable quality and rigor, 13 studies^{4,5,11-21} provided a clear description of the included sample. More than 80% of the participants were followed up in 12 trials.^{4,5,12-21} and the duration of follow-up ranged from one to five years.

Types of interventions

A clear description of the types of interventions was stated in all studies. Factors identified to assist transition in the review studies related to either structured or unstructured interventions. The structured strategies included using the services of a transition coordinator to initiate and oversee the transition process,^{5,16} transferring patients within the same facility thus eliminating the anxiety and disruption caused by transfers to an unfamiliar environment,^{4,17,19} transition that is coordinated with an education program,^{16,21} a structured transition planned with the adult endocrinologist,^{4,12,20} and the provision of specific Young Adult Clinics within adult health care facilities to accommodate the transitioning young adult.^{4,5,13}

The studies which reported on unstructured strategies or usual care^{11,14,15,18} were those that involved direct transfer to an adult diabetes clinic or endocrinologist without assistance, apart from the letter of referral and/or an appointment.

Outcome assessment

Outcomes were measured in a reliable way in all studies. Diabetes control was measured using HbA_{1c},^{4,5,12,13,17-21} and hospital admissions were identified from medical records.^{5,11,16} Frequency and regularity of clinic attendance were obtained through clinic records,^{4,5,12,16,20} mailed questionnaires or telephone interviews.^{11,14,15,18} Patient satisfaction was measured using a patient questionnaire,^{5,18,20} and cost effectiveness was calculated using hospital admission data.⁵

Findings of the review

The included studies used varied methods, interventions and outcomes; therefore meta-analysis for all outcomes could not be undertaken, rather data are presented as a narrative summary organized according to the primary and secondary outcomes of the review.

Primary outcomes

Diabetes control as measured by HbA_{1c} at follow-up

Effect of structured strategies:

Of nine studies^{4,5,12,13,17-21} reporting on diabetes control as measured by HbA_{1c} after transition, eight studies^{4,5,12,13,17,19-21} employed a structured transition process. Of these, three studies^{5,19,21} reported statistically significant improvements in HbA_{1c} post transition. Utilizing an intervention consisting of a transition coordinator, phone support and a follow-up period of five years, Holmes-Walker⁵ reported a decrease in HbA_{1c} of 0.13% ($p=0.01$) per visit for the first four visits to the young adult clinic. The intensive education program requiring monthly visits initiated by Vidal²¹ for transitioning patients resulted in a statistically significant decrease in HbA_{1c} from baseline, (68 mmol/mol, $8.5\pm1.7\%$), to one year post transition (57mmol/mol, $7.4\pm1.5\%$); $p<0.001$. In a single arm study, Johnston¹² compared transfer methods between four health districts with young adults transitioned to either an adult clinic, a young adult clinic (YAC) in same or different hospital or a co-joint clinic in the same hospital, but found no inter-district or group difference at two years post transfer. Kipps⁴ compared transfer methods between four health districts with young adults transitioned to either an adult clinic, a YAC in same or different hospital or a co-joint clinic in the same hospital, but found no inter-district or group difference at two years post transfer. Orr¹⁷ found no difference in pre- and post-transition diabetes control at two years after transition to a YAC within the pediatric hospital. Young people followed by Lane¹³ for three years after being transferred to either a YAC or general endocrine clinic (GEC) found that diabetes control did not differ at either baseline or at three years. Cadario²⁰ followed two groups of patients for one to three years but not concurrently. While one group had a structured transfer and the other usual care, diabetes control was not different at three years for either group. Salmi¹⁹ reported a statistically significant difference in HbA_{1c} from baseline, (99mmol/mol, $11.2\pm2.3\%$), to (85mmol/mol, $9.9\pm1.7\%$); $p<0.001$ at one year post-transition. Pooled data from two studies^{17,19} undertaken before 2000 which transferred patients within the same facility demonstrated no statistically significant difference in HbA_{1c} levels between pre- and one year post-transfer (Figure 2).

Figure 2: Effect of intervention on HbA_{1c}

Effect of unstructured strategies:

Busse¹⁸ audited both pediatric and adult medical records to validate patient self-reports obtained from a structured questionnaire conducted by telephone interview, and found no significant difference between pre- and post-transition diabetes control as measured by HbA_{1c} at baseline (69mmol/mol, $8.5\pm1.5\%$) and follow-up (68mmol/mol, $8.4\pm1.7\%$); $p=0.441$.

Loss to medical follow-up

Effect of structured strategies:

Comparison of loss to medical follow-up rates between two groups was reported in one study.²⁰ The group that received a structured transition developed in consultation with an endocrinologist specializing in adult diabetes care had a loss to follow-up of 3% at one year and 0% at three years, compared to the group with the unstructured transition consisting of a referral letter and appointment with an adult endocrinologist (69% at one year and 27% at three years). Johnston et al.¹² reported moderate (18%) but not statistically significant loss to follow-up in the group attending the general adult clinic but did not report loss to follow-up among those who attended a dedicated Saturday young person's clinic.

Effect of unstructured strategies:

Three studies^{11,14,15} that used unstructured strategies reported participant loss to follow-up between 13-25% at the one- to five-year follow-up.

Incidence of hospital admission for acute complications

Hospital admission post-transition was described in three studies,^{5,11,16} and was reported to be strongly linked to loss to follow-up and clinic attendance after transition.

Effect of structured strategies:

Holmes-Walker⁵ reported that hospital admission rates decreased significantly ($p=0.05$) after the introduction of a transition intervention and were maintained for the study duration. This intervention provided phone support for sick day management. Van Wallegghem¹⁶ found no difference in hospital admission rates between groups even with the provision of telephone and email support for assistance in navigating adult health care services.

Effect of unstructured strategies:

As reported by Frank,¹¹ hospitalization rates were significantly higher ($p < 0.01$) in those lost to medical follow-up compared to those with regular clinic attendance post-transition. Seventy percent of people who were lost to medical follow-up had a hospital admission compared to 45% of those who were regular attendees at the clinic.

Frequency and regularity of clinic attendance

The frequency and regularity of clinic attendance were reported in seven studies.^{4,5,11,12,16,18,20}

Effect of structured strategies:

The effect of a structured transition on clinic attendance was described in five reports.^{4, 5,12,16,20} Services providing dedicated young adult clinics report the highest clinic attendance rates post transition. Holmes-Walker⁵ reported 94% of patients had attended a clinic during the last 12 months of the five-year study, while Cadari²⁰ also reported significant increase ($p=0.05$) in clinic attendance at end of study for the program group with structured transition ($80\% \pm 12.5\%$) compared to the unstructured group ($57\% \pm 5\%$). While reporting a decline in clinic attendance from 98% to 61% following transition across all groups, Kipps⁴ indicated that attendance rates were higher at the young adult or co-joint clinics within the same hospital and that those who transitioned to different hospitals or adults clinics were least likely to attend clinics. Even though patients attending the Saturday morning clinic were twice as likely to attend, Johnston¹² reported that there was no significant difference between their attendance rates and that of those attending a week day adult clinic. Van

Wallegghem¹⁶ commented, without providing a statistical data analysis, that the group who were initially transferred to adult care without support subsequently enrolled in the structured program and thereafter had increased medical surveillance.

Effect of unstructured strategies:

Busse¹⁸ reported a statistically significant difference ($p < 0.001$) in clinic attendance pre- and post-transition (8.5 ± 2.3 vs 6.7 ± 3.2 per year) but no significant correlation between diabetes control and attendance. Frank¹¹ reported 76% (31/41) of participants attended at least one follow-up assessment per year following transition.

Secondary outcomes

Uptake of screening for long term diabetes complications

This outcome was reported in three studies^{13,16,20}

Effect of structured strategies:

Cardario²⁰ reported data collected by phone interviews with participants on the uptake of screening for diabetes complications. In the structured group, annual uptake of eye assessment was significantly greater ($p = < 0.006$), as was uptake for micro albuminuria screening and feet examination ($p = < 0.0001$), than that in the usual care group. Even though there was no data on annual complications screening rates, Lane¹³ commented that there was no difference in incidence of micro albuminuria in either the YAC or GEC group. He also reported that a higher percentage of patients in the GEC group were treated for hypertension while no YAC patients had hypertension. In Van Wallegghem,¹⁶ there were no long term diabetes complications in the younger group whereas the older group reported pregnancy loss of 38%, one case each of heart failure, legal blindness and amputation along with four cases of proliferative diabetic retinopathy – actual screening rates were not described.

Patient satisfaction

This outcome was reported in three studies.^{5,18,20}

Effect of structured strategies:

Cadario et al.²⁰ compared transition outcomes between structured transition and the control groups. The entire intervention group reported a positive transition experience compared to the control group in which 70% reported a negative experience. Of participants surveyed by Holmes-Walker,⁵ 90% felt well supported by the program after transition to adult care.

Effect of unstructured strategies:

Busse¹⁸ reported retrospective data collected by structured questionnaires from 101 young adults with 58/101 reporting a negative experience and 32/101 seeing transitions as a positive experience. Negative experiences included difficulty in finding a new doctor, not enough time with doctors, different doctor at each visit to clinic, abrupt transfer, feeling alone, no other young patients and deterioration in HbA_{1c}.

Cost effectiveness of intervention

This outcome was reported in one study.⁵

Effect of structured strategies:

Holmes-Walker et al.⁵ compared pre- and post-intervention DKA admission rates and reported reduction in acute care bed days for DKA admission and readmission of program participants. Reduction in DKA readmissions by eight per annum and 3.6 bed days mean reduction in length of stay per patient resulted in a saving of 26.4 acute bed days/year which offset the intervention costs.

Discussion

Concerns remain in the diabetes community about the vulnerability of young people during transition; however there has been no consensus on the most appropriate transition method. The aim of this review therefore was to identify the best available evidence relating to the effect of various strategies for transition from pediatric to adult health care for young people with type 1 diabetes. Despite the extensive literature on diabetes, only 13 studies were eligible for this review.

As the recognized measure for diabetes control, HbA_{1c} was the primary outcome of transition interventions in nine studies.^{4,5,12,13,17-21} Three of these studies^{5,19,21} reported significant improvement in diabetes control following transition to adult care. These positive results were achieved in studies that involved either rigorous preparations prior to transition to adult services¹⁹ or rigorous follow-up by clinical personnel who provided active support for young people post-transition. These strategies included appointment reminders to encourage clinic attendance, phone support for sick day management,⁵ and an intensive education program,²¹ all of which provided the opportunity for young people to build resilience while increasing knowledge in self-management of type 1 diabetes. Conversely, the studies^{4,12,13,17,20} which showed no effect on diabetes control applied passive strategies such as transfer to adult clinics in familiar pediatric facilities.

Structured interventions were also more effective in supporting diabetes clinic attendance as young people move from pediatric to adult health care, which is critical to the long term health of the young person. In this review, a structured intervention,²⁰ where the transition was planned in consultation with the endocrinologist specializing in adult diabetes, demonstrated no significant loss to medical follow-up at both one and three years, while those unsupported at transition^{11,14,15} lost 13-25% of young people to medical follow-up. These results have implications for clinical practice as without regular medical surveillance young people are at increased risk of acute diabetes complications such as diabetic ketoacidosis or severe hypoglycaemia and increased hospital admissions.^{5,11} The present review supports the notion that most hospital admissions are preventable if young people are supported and linked to appropriate services.⁵ This intervention was shown to significantly reduce DKA admissions by actively providing phone support for sick day management while a study adopting an unstructured intervention,¹¹ which reported high rates (25%) of lost to follow-up for diabetes care, also had hospital admission rates of 70%.

Not surprisingly, all reports on screening for long term diabetes complications were in studies^{13,16,20} undertaking structured strategies for transitions. Lack of complications screening is of great concern, as the main indicator for development of eye and renal disease is continued poor diabetes control, which in this review has been shown to be strongly linked to loss to medical follow-up. If these long term complications are to be prevented in young people, regular monitoring and treatment for existing conditions are required so that progression to vision impairment, blindness or end stage renal disease

is reduced. For this to be achieved, young people require assistance to make a successful transition to adult care and to not become lost to medical follow-up.

Patient satisfaction was measured in one study²⁰ as a qualitative judgement (good, sufficient or bad) and as such this outcome was subjective and at risk of recall bias. Notwithstanding, more patients in structured transition groups reported positive experiences^{5,20} while those in usual care¹⁸ were more likely to have had negative experiences. Collectively, these data suggest that the additional support provided by a structured intervention is more acceptable to young people during the transition to adult care. As the ultimate driver for service provision in health care, cost effectiveness of interventions must be demonstrated by achieving clinical outcomes and ongoing evaluation of the service. The study reporting cost effectiveness in this review was able to demonstrate that by providing phone support for sick day management, the reduction in hospital admissions offset the cost of the program.⁵ Interventions which improve clinical outcomes in this population may require extra funding to establish services; however consideration must be given not only to both short and long term health benefits for young people if they transition successfully and remain under medical care but also to the potential for long term cost benefits in reducing diabetes complications as young people age.

Limitations of included studies

The results were limited by the sample size (33-101 participants) in nine studies,^{5,11,12,15,17-21} and retrospective data collection by telephone interview^{11,14,15,18} which introduces the risk of recall bias. Selection bias due to low response rates was reported in six studies,^{11,12,14,15,20} which further reduces available data for analysis. These studies either audited medical records or used a mailed questionnaire to gather retrospective data from patients who transitioned from between one to five years prior to the study. Notwithstanding the small sample size, interventions were described in detail and outcome measures were meaningful and appropriate to the aims of the studies and sample characteristics, and while the findings will be useful to providers of diabetes transition services, clinicians should recognize that small participant numbers and variable follow-up periods do reduce the rigor of the studies.

Conclusion

Transition from pediatric to adult health care is inevitable for all children diagnosed with type 1 diabetes and usually occurs during a period of multiple life transitions when diabetes self-care is often a low priority in their lives. The evidence identified from this review suggests that structured transition interventions that are actively involved with pre-transition preparation, education, rigorous follow-up in adult care and a dedicated health professional to support and coordinate the transition process will be beneficial for young adults. Provision of specific clinics and services designed to assist transition from pediatric to adult services is more likely to prevent loss to medical follow-up, maintain clinic attendance, have a positive impact on diabetes control, reduce hospital admissions, and be a cost effective and positive experience for patients compared with an unstructured or usual care model.

Implications for practice

Young adult clinics were reported to be effective in maintaining clinic attendance and in reducing diabetes complications. Successful transition requires good communication processes between pediatric and adult services; therefore it is critical that transition preparation and self-care education of

young people and families in pediatric services start early and include strategies demonstrated to avoid transition failure. Adult health services and adult clinicians must have greater involvement in appropriate transition service development. The unique needs of these patients demand services distinctly different to the general adult patient with diabetes and clinicians should take an active role in ensuring follow-up in this vulnerable group.

Implications for research

The review demonstrates the paucity of RCTs to assess the effects of transition strategies on young adults with diabetes; therefore large scale multi centre RCTs are urgently needed. Developments in transition strategies must take into account changing technology and the use of telematics among young adults. Formal economic appraisal of transition strategies should be an integral part of further research.

Conflict of interest

The authors have no known conflicts of interest to declare.

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Appendix I: Search strategy

Medline (OVID) Search strategy

1. Diabetes Mellitus, Type 1/ or type 1 diabetes.mp.
2. limit 1 to "adolescent (13 to 18 years)"
3. Outpatients/
4. "Delivery of Health Care"/
5. Social Support/
6. Financial Support/
7. self care/ or blood glucose self-monitoring/ or self administration/ or self medication/
8. Health Knowledge, Attitudes, Practice/
9. Adaptation, Psychological/ or Stress, Psychological/
10. developmental changes.mp.
11. "delivery of health care"/ or "delivery of health care, integrated"/ or health services accessibility/
12. communication barriers/ or interdisciplinary communication/
13. age factors/ and health transition/
14. 5 or 10 or 6 or 11 or 13 or 7 or 3 or 9 or 12 or 4
15. Hemoglobin A, Glycosylated/ or diabetes control.mp.
16. Patient Dropouts/
17. loss to follow-up.mp.
18. 17 or 16
19. hospitalization/ or "length of stay"/ or patient admission/ or patient readmission/
20. "patient acceptance of health care"/ or patient participation/
21. Patient Compliance/
22. Diabetic Ketoacidosis/
23. Diabetes Complications/
24. 21 or 20 or 23 or 22 or 18 or 15 or 19
25. 24 and 2 and 14
26. transition or transfer\$. mp.
27. 25 and 26

EMBASE (OVID) search strategy

1. Insulin Dependent Diabetes Mellitus/
2. limit 1 to adolescent <13 to 17 years>
3. interpersonal communication/ or nonverbal communication/ or verbal communication
4. self care/ or psychosocial care/ or social support/
5. diabetes education/
6. doctor patient relation/ or outpatient care/
7. 3 or 4 or 5 or 6
8. diabetes control/
9. clinic attendance.mp.
10. loss to follow-up.mp.
11. Hospital Admission/
12. Diabetic Ketoacidosis/
13. Diabetic Nephropathy/ or Diabetic Retinopathy/ or diabetes complication screening rates.mp.
14. patient compliance/
15. 14 or 13 or 12 or 11 or 10 or 9 or 8
16. 7 and 15
17. 16 and 2
18. transition.mp.
19. 18 and 17

CINAHL (EBSCO) search strategy

MH "Diabetes Mellitus, Insulin-Dependent"

outpatient service or ambulatory care

health care delivery

social support or financial support

health knowledge or attitudes

MH "Stress, Psychological"

adaptation, psychological" or MH "Adaptation" or MH " Psychological"

MH "Behavioral Changes"

MH "Communication Barriers"

MH "Communication Barriers" or interdisciplinary communication

"self care behaviors"

S2 or S3 or S4 or S5 or S6 or S8 or S9 or S10 or S11

MH "Hemoglobin A, Glycosylated"

patient dropouts

MH "After Care"

MH "Diabetic Ketoacidosis"

"hospital admission"

"patient participation"

MH "Medication Compliance" or MH "Patient Compliance"

"diabetes complication screening"

"diabetes complication screening" or long term diabetes complications

S13 or S14 or S15 or S16 or S17 or S18 or S19 or S20 or S21

transition or transfer to adult health care

transition or transfer from pediatric or paediatric to adult health care or transitional care

S23 or S24

S12 and S22

MH "Adolescence"

S25 and S1 and S26 and S27

PsychINFO (OVID) search strategy

1. type 1 diabetes.mp.
2. limit 1 to 200 adolescence
3. treatment/ or "medical treatment (general)"/
4. exp Health Care Delivery/ or outpatient service.mp.
5. ambulatory care.mp.
6. exp Social Support/
7. parental involvement/

8. emotional adjustment/ or adjustment/
9. exp Psychological Stress/
10. health knowledge/
11. adolescent development/ or psychological development/
12. 6 or 11 or 3 or 7 or 9 or 8 or 4 or 10 or 5
13. continuity of patient care.mp.
14. exp Communication Barriers/ or communication.mp.
15. exp Treatment Dropouts/
16. treatment outcomes/
17. 16 or 13 or 15 or 14
18. transition or transfer from pediatric or paediatric to adult health care.mp.
19. 17 and 12 and 2

Appendix II: Verification of study eligibility

Author and Year: _____

Journal: _____

Title: _____

Study Design		
Randomised control trial	Yes ☐	No ☐
Clustered trial	Yes ☐	No ☐
Descriptive study	Yes ☐	No ☐
Pre-and post-test study	Yes ☐	No ☐
Case control study	Yes ☐	No ☐
Case study	Yes ☐	No ☐
Subjects		
Human	Yes ☐	No ☐
Setting		
Hospital	Yes ☐	No ☐
Community	Yes ☐	No ☐
Intervention		
Does the study describe an intervention	Yes ☐	No ☐
Outcome		
Diabetes control as measured by HbA1c	Yes ☐	No ☐
Loss to follow-up	Yes ☐	No ☐
Adherence to therapy	Yes ☐	No ☐
Incidence of hospital admission (for acute complications)	Yes ☐	No ☐
Clinic attendance rates	Yes ☐	No ☐
Uptake of screening	Yes ☐	No ☐

You should answer YES to at least 1 question in ALL the above groups for the study to be eligible for inclusion.

Appendix III: JBI critical appraisal checklist for descriptive/case series

Reviewer _____ Date _____

Author _____ Year _____ Record Number _____

	Yes	No	Unclear	Not Applicable
1. Was study based on a random or pseudo-random sample?	☐	☐	☐	☐
2. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
3. Were confounding factors identified and strategies to deal with them stated?	☐	☐	☐	☐
4. Were outcomes assessed using objective criteria?	☐	☐	☐	☐
5. If comparisons are being made, was there sufficient descriptions of the groups?	☐	☐	☐	☐
6. Was follow up carried out over a sufficient time period?	☐	☐	☐	☐
7. Were the outcomes of people who withdrew described and included in the analysis?	☐	☐	☐	☐
8. Were outcomes measured in a reliable way?	☐	☐	☐	☐
9. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

Appendix IV: Data extraction tool

Author/s: _____

Year: _____

Journal: _____

Title: _____

Reviewer: _____

Record Number: _____

Study Method: _____

Setting: _____

Inclusion Criteria: _____

	Group 1	Group 2
Participants		
Number in each group		
Mean age		
Gender		
Principal diagnosis		
Participants excluded from study	Number: Reason:	Number: Reason:
Intervention		
Description of intervention		
Intervention delivery (eg Nurse, Dr, Psychologist)		
Duration of intervention		

Method of delivery (eg. face to face, telephone, website)		
Frequency of follow-up		
Outcomes		
Diabetes control as measured by HbA1c		
Loss to follow-up		
Adherence to therapy		
Incidence of hospital admission for acute diabetes complications		
Clinic attendance rates		
Others		
Uptake of screening for long term diabetes complications		
Cost effectiveness of intervention		
Health related quality of life		
Patient satisfaction		

Author's Conclusions:

Reviewer's Conclusions:

Appendix V: Quality assessment scale

Table 1: Legend: 0=no, 1=yes

Author	Assignment random or pseudo-random	Participant inclusion criteria clearly defined	Outcomes of people who withdrew described and included in final analysis	Confounding factors identified & strategies to address stated	Groups comparisons sufficient	Outcomes measured in the same way for all groups using objective criteria	Outcomes measured in a reliable way	Adequate follow-up over sufficient time period	Appropriate statistical analysis used	Sample size stated	TOTAL
Busse ¹⁸	0	1	1	1	0	1	1	1	1	1	8
Cardario ²⁰	0	1	0	1	1	1	1	1	1	1	8
Frank ¹¹	0	1	1	1	0	1	1	0	1	1	7
Holmes-Walker ⁵	0	1	1	1	0	1	1	1	1	1	8
Johnston ¹²	0	1	0	1	0	1	1	1	0	1	7
Kipps ⁴	0	1	1	1	1	1	1	1	1	1	9

Author	Assignment random or pseudo-random	Participant inclusion criteria clearly defined	Outcomes of people who withdrew described and included in final analysis	Confounding factors identified & strategies to address stated	Groups comparisons sufficient	Outcomes measured in the same way for all groups using objective criteria	Outcomes measured in a reliable way	Adequate follow-up over sufficient time period	Appropriate statistical analysis used	Sample size stated	TOTAL
Lane ¹³	0	1	1	1	1	1	1	1	1	1	9
Orr ¹⁷	0	1	0	0	1	1	1	1	1	1	7
Pacaud ¹⁴	0	1	0	0	1	1	0	1	1	1	6
Pacaud ¹⁵	0	1	0	1	1	1	0	1	1	1	7
Salmi ¹⁹	0	1	0	0	0	1	1	1	1	1	6
Van Walleghe ¹⁶	0	1	0	1	1	1	1	1	0	1	7
Vidal ²¹	0	1	0	0	1	1	1	1	1	1	7

Appendix VI: Table of included studies

Reference/ country	Participants	Method	Intervention	Results	Notes
Busse et al., 2007 Germany Descriptive study	101 young adults with type 1 diabetes Mean age - Pre –transfer 17.8 ± 0.9 Post-transfer 22.1 ± 2.4	Telephone interview/medical record audit to validate patient self-report Follow-up 1-3 years	Usual care – direct transfer to adult endocrinologist	1) HbA1C (n=44) Pre-transfer 69mmol/mol, 8.5 ± 1.5% Post-transfer 68mmol/mol, 8.4 ± 1.7%, p=0.441 2) Clinic attendance per year. Pre-transfer 8.5 ±2.3 Post-transfer 6.7 ± 3.2 3) Patient satisfaction Positive experience 32/101 No comment 11/101 Negative experience 58/101 No significant correlation between HbA1c levels and	Small sample size Patient perceptions were retrospective and may have altered over time

				clinic attendance post-transfer p=0.65	
Cadario et al., 2009 Italy Comparative study	62 young adults with type 1 diabetes Mean age at transition 19 ± 2.8		Group A: (n=32) Unstructured transition. Referral letter and appointment in adult service Group B: (n=30) Structured transition planned with adult endocrinologist Follow-up 1-3 years	1) HbA1c 1yr Group A: 74mmol/mol, 8.9±0.5% vs Group B: 62mmol/mol, 7.8± 0.5% p=<0.01 3yrs Group A: 64mmol/mol, 8.0±0.3% vs Group B: 61mmol/mol, 7.7± 0.3% p=ns 2) Loss to follow-up at 1yr Group A: 69%(22/32) Group B: 3% (1/30) At 3yrs Group A: 27%(10/32) Group B: 0% (0/30)	Small sample size Potential bias due to different time periods retrospectively investigated for each group

				<p>3) Clinic attendance at 3yrs</p> <p>Group A 57±5.0% vs Group B 80.0±12.5%,p<0.05</p> <p>4) Patient satisfaction</p> <p>Group A: Negative experience 19/27</p> <p>Group B: Positive experience 30/30</p> <p>Group A had longer interval to first adult appointment (p<0.001), fewer clinic appointments, larger number lost to follow-up, more negative transfer experience and worsening of HbA1c at 1yr</p> <p>Group B had shorter interval to first adult appointment, small number lost to follow-up, positive transition experience and improved HbA1c post transfer</p>	
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				HbA1c at 3yrs was not significantly different	
Frank, 1996 Canada Descriptive study	41 young adults with type 1 diabetes Mean age at transition 17.7± .38yrs	Telephone questionnaire Follow-up 3-4years	Usual care – direct transfer to adult endocrinologist	1) Loss to follow-up = 10/41 2) Clinic attendance 31/41 reported at least 1 follow-up assessment per year post transition 3) Hospital admissions post transition 7/10 (70%) cf 14/31 (45%) Significant difference (p<0.01) in hospital admissions in those lost to follow-up compared to those with regular clinic attendance	Small sample size Potential interviewer and patient recall bias in data collection
Holmes-Walker et al., 2007 Australia	91 young adults with type 1 diabetes Mean age at		Transition Care Coordinator After hours phone support service	1) HbA1c 78mmol/mol, 9.3 ±2.0% at baseline 0.13% (p=0.01) decrease per visit for first 4 visits	Small sample size

Descriptive Study	transition 18.1±1.52		Follow-up 5 years	<p>2) Clinic attendance – 94% seen in last 12months</p> <p>3) Hospital Admission – statistically significant reduction in DKA admission rates by 1/3 (p=0.05).</p> <p>4) Reduction in DKA admissions covered intervention cost</p> <p>5) Patient satisfaction – 90% of those surveyed felt well supported by program</p>	
<p>Johnston et al., 2006</p> <p>Northern Ireland</p> <p>Descriptive study</p>	<p>33 young adults with type 1 diabetes</p> <p>Mean age at transition 17yrs</p>		<p>Transition to either Saturday Young Persons' clinic (n=18) or weekday adult clinic (n=15)</p> <p>Follow-up 15-18 months</p>	<p>1) Clinic attendance</p> <p>Good – 36%</p> <p>Moderate – 33%</p> <p>Poor- 30%</p> <p>2) Loss to follow-up – 18%</p>	<p>Small sample size</p> <p>Statistical analysis of relationship between clinic attendance and HbA1c not undertaken</p> <p>No comparison of</p>

				<p>3) HbA1c (n=27)</p> <p><60mmol/mol, 7.6% (37%)</p> <p>60-75mmol/mol, 7.6-9.0% (37%)</p> <p>>75mmol/mol, 9.0% (26%)</p> <p>Saturday morning clinic twice as likely to have better attendance than weekday clinic but not statistically significant different ($\chi^2=3.15$, p=ns)</p>	outcomes between groups
<p>Kipps et al, 2002</p> <p>United Kingdom</p> <p>Descriptive study</p>	<p>222 (medical record audit)</p> <p>164 (interview)</p> <p>young adults with type 1 diabetes</p> <p>Mean age at transition 17.9yrs</p>		<p>Comparison of transfer methods between 4 health districts</p> <p>A) to adult clinic</p> <p>B) to young adult clinic in different hospital</p> <p>C) young adult clinic in same hospital with prior introduction to adult clinician</p> <p>D) co-joint clinic in same hospital before</p>	<p>1) HbA1c</p> <p>No Inter- district difference at 2yrs post transfer</p> <p>84-86mmol/mol, 9.8 -10.0%</p> <p>2) Clinic attendance</p> <p>Decrease in clinic attendance from 98% pre transfer to 61% post transfer</p> <p>Highest decline in districts</p>	<p>Analysis of data compromised due to large numbers lost to follow-up in districts</p> <p>A & B</p>

			transfer to A) Follow-up 2 years	A and B	
Lane et al., 2007 United States Comparative study	249 young adults with type 1 diabetes Mean age at transfer Young Adult Clinic (YAC): 19±2yrs General Endocrine Clinic (GEC): 21±3yrs	Retrospective audit of electronic medical record	Comparison of diabetes control of patients transferred to YAC (n=96) and GEC (n=153) Follow-up 3 years	1) HbA1c Baseline YAC: 75mmol/mol, 9.0±2.3% (n=96; 100%) GEC: 73mmol/mol, 8.8±2.3% (n=153; 100%) 36months YAC – 70mmol/mol, 8.6±2.1% (n=45; 47%) GEC – 68mmol/mol, 8.4±2.3% (n=66; 43%) HbA1c did not differ between YAC and GEC at any time point	Potential data bias due to decrease in patient numbers at 36months

Orr et al., 1996 United States Descriptive study	82 young adults with type 1 diabetes Mean age at transfer 17.3±0.8yrs		Transfer from pediatric to young adult clinic in same pediatric facility Follow-up 2 year	1) HbA1c - Comparison 1-year pre- and 1-year post-transfer HbA1c (n=77) unchanged following transfer 85mmol/mol,9.9±1.8% - 88mmol/mol,10.2±1.9% (p=0.125)	Selection bias (5 patients with 1 visit post transfer excluded from study)
Pacaud et al., 1996 Canada Survey	135 young adults with type 1 diabetes Mean age at transfer 18.5±0.1yrs	Mailed questionnaire to young adults transferred from 2 pediatric clinics to adult clinics in same city Follow-up 5years	Usual care – direct transfer to adult endocrinologist	1) Loss to follow-up 13% total group 17% - >12months between last pediatric and first adult visit	No difference in outcome between clinics Potential patient recall bias in data collection Response rate 44% - potential selection bias
Pacaud et al., 2005 Canada	81 young adults with type 1 diabetes Mean age at	Mailed questionnaire to young adults transferred from pediatric clinic to adult clinic	Usual care – direct transfer to adult endocrinologist	1) Loss to follow-up -14% Comparison of loss to follow-up in 2 different regional diabetes care delivery models – no difference	Potential patient recall bias in data collection Usable data from 51% of surveys – response rate 62%. Potential selection

Survey	transfer 17.2±1.1yrs	Follow-up 2-4 years			bias.
Salmi et al., 1986 Finland Descriptive study	61 young adults with type 1 diabetes		Transition from pediatric clinic to adult clinic in same hospital Follow-up 1year	1) Hba1c (n=49) at transfer and 1 year post transfer Statistically significant improvement 99mmol/mol, 11.2±2.3% – 85mmol/mol, 9.9±1.7% (p<0.001)	Small sample size
Van Wallegghem et al., 2008 Canada Comparative study with concurrent control	165 young adults with type 1 diabetes Maestro group(M) – age 18yrs (n=64) Older group(OG)- age 19-25		Transition Care Coordinator Telephone and email support Education events Follow-up 2 years	1) Clinic attendance – visits per year ≥ 1 (M) Pre-transfer – 95% Post-transfer – 89.1% (OG) Pre transfer – 59.4% Post-transfer – 73.3% 2) Hospital admissions- DKA – (M) 7.9/100 vs 3/100 (OG)	Short report of preliminary findings without analysis of statistical data

	(n=101)			<p>Hypo – (M)4.7/100vs2.4/100(OG)</p> <p>Increased medical surveillance in older group after enrolling in Maestro program</p>	
<p>Vidal et al., 2004</p> <p>Spain</p> <p>Descriptive study</p>	<p>80 young adults with type 1 diabetes</p> <p>Mean age at transition 19.0±1.3yrs</p>		<p>Coordinated transition</p> <p>Transition education program (TEP)</p> <p>Follow-up 1 year</p>	<p>1) Hba1c (n=72) at transfer and 1 year post transfer</p> <p>69mmol/mol,8.5±1.7% – 57mmol/mol, 7.4±1.5%, p<0.001</p> <p>Statistically significant improvement</p>	<p>Intensive intervention requiring monthly visits.</p> <p>No comparison group</p>

Appendix VII: List of excluded studies

Allen O, Gregory J. The transition from children's to adult diabetes services: understanding the 'problem'. *Diabetic Medicine*. 2009;26(2):162-6.

Reason for exclusion: Opinion piece

Beskine D, Owen P. Review of transitional care for young people with diabetes. *Journal of Diabetes Nursing*. 2008;12(1):4p.

Reason for exclusion: Study did not meet inclusion criteria

Bryden KS, Dunger DB, Mayou RA, Peveler RC, Neil HAW. Poor prognosis of young adults with type I diabetes, a longitudinal study. *Diabetes Care*. 2003;26:1052 - 7.

Reason for exclusion: Study did not meet inclusion criteria

Cooke E. Transitional care for young people with diabetes: policy and practice. *Paediatric Nursing*. 2007;19(6):19-22.

Reason for exclusion: Discussion paper

Court J. Issues of Transition to adult diabetes services. *Journal of Paediatrics*. 1993;29(Supplement 1):28-30.

Reason for exclusion: Opinion piece

Datta J. Adolescence and the role of the DSN. *Journal of Diabetes Nursing*. 2003;7(6):228-31.

Reason for exclusion: Study did not meet inclusion criteria

Doherty Y, Dovey-Pearce G. Understanding the developmental and psychological needs of young people with diabetes: implications for providing engaging and effective services. *Practical Diabetes International*. 2005;22(2):59-64.

Reason for exclusion: Study did not meet inclusion criteria

Dovey-Pearce G, Hurrell R, May C, Walker C, Doherty Y. Young adults' (16-25 years) suggestions for providing developmentally appropriate diabetes services: a qualitative study. *Health & Social Care in the Community*. 2005; 13(5):409-19.

Reason for exclusion: Study did not meet inclusion criteria

Eiser C, Flynn M, Green E, Havermans T, Kirby R, Sandeman D, et al. Coming of age with diabetes: patients' views of a clinic for under-25 year olds. *Diabetic Medicine*. 1993; 10:285-9.

Reason for exclusion: Study met inclusion criteria but failed critical appraisal

Fleming E, Carter B, Gillibrand W. The transition of adolescents with diabetes from the children's health care service into the adult health care service: a review of the literature. *Journal of Clinical Nursing*. 2002;11(5):560-7.

Reason for exclusion: Literature review

Frank M. Rights to passage: transition from paediatric to adult diabetes care. *Beta Release*. 1992;16(3):85-9.

Reason for exclusion: Discussion paper

Frank M, Perlman K, Hamilton A, al e. Evaluation of a transition from pediatric to adult care program. Canadian Journal of Diabetes. [Abstract]. 2002;26(suppl 1):254.

Reason for exclusion: Conference presentation abstract

Greene S, Greene A. Changing from the paediatric to the adult service: guidance on the transition of care. Practical Diabetes International. 2005;22(2):41-5.

Reason for exclusion: Discussion paper

Jones K, Hammersley S, Shepherd M. Meeting the needs of young people with diabetes: an ongoing challenge. Journal of Diabetes Nursing. 2003;7(9):345-50.

Reason for exclusion: Study did not meet inclusion criteria

Jones SE, Hamilton S. The missing link: paediatric to adult transition in diabetes services. British Journal of Nursing (BJN). 2008;17(13):842-7.

Reason for exclusion: Study did not meet inclusion criteria

Kollipara S, Kaufman FR. Diabetes. Transition of diabetes care from pediatrics to adulthood. School Nurse News. 2008;25(1):27-9.

Reason for exclusion: Study did not meet inclusion criteria

Lundin CS. Living with diabetes during transition to adult life - Relationships, support of self-management, diabetes control and diabetes care. International Journal of Integrated Care (IJIC). 2008;8:e71-e.

Reason for exclusion: Research Thesis

McGill M. How Do We Organize Smooth, Effective Transfer from Paediatric to Adult Diabetes Care? Hormone Research. 2002;57:66-8.

Reason for exclusion: Opinion piece

Owen P, Beskine D. Factors affecting transition of young people with diabetes. Paediatric Nursing. 2008;20(7):33-8.

Reason for exclusion: Discussion paper

Parfitt G. Improving the young person's experience of transition: lessons from Wales. Paediatric Nursing. 2008;20(9):27-30.

Reason for exclusion: Discussion paper

Scott L, Vallis M, Charette M, Murray A, Latta R. Transition of Care: Researching the Need of Young Adults WITH Type 1 Diabetes. Canadian Journal of Diabetes. 2005;29(3):203-10.

Reason for exclusion: Research Thesis paper

Tsamasiros J, Bartsocas C. Transition of the adolescent from the children's to the adult's diabetes clinic. J Pediatr Endocrinol Metab. 2002;15:363-7.

Reason for exclusion: Opinion piece

Van Wallegghem N. Editorial commentary. Bridging the gap: transition from pediatric to adult diabetes care. Canadian Journal of Diabetes. 2005;29(1):10-1.

Reason for exclusion: Editorial commentary

Van Wallegghem N, MacDonald CA, Dean HJ. Building connections for young adults with type 1 diabetes mellitus in Manitoba: feasibility and acceptability of a transition initiative. *Chronic Disease Canada*. 2006;27:130-4.

Reason for exclusion: Study did not meet inclusion criteria

Vanelli M, Caronna S, Adinolfi B, Chiari G, Guliotta M, Arsenio L. Effectiveness of an uninterrupted procedure to transfer adolescents with type 1 diabetes from the Paediatric to the Adult Clinic held in the same hospital: eight-year experience with the Parma protocol . *Diabetes Nutr Metab*. 2004;17:304-8.

Reason for exclusion: Study did not meet inclusion criteria

Visentin K, Koch T, Kralik D. Adolescents with type 1 diabetes: transition between diabetes services. *Journal Clinical Nursing*. 2006;15:761-9.

Reason for exclusion: Study did not meet inclusion criteria

Weissberg-Benchell J, Wolpert H, Anderson BJ. Transitioning from pediatric to adult care: a new approach to the post-adolescent young person with type 1 diabetes. *Diabetes Care*. 2007;30(10):2441-6.

Reason for exclusion: Study did not meet inclusion criteria

Van Wallegghem N MC, Dean HJ. The Maestro Project: A Patient Navigator for Transition of Care for Youth With Type 1 Diabetes. *Diabetes Spectrum*. 2011;24(1):9-13

Reason for exclusion: Study did not meet inclusion criteria