



Outcome Evidence for Structured Pediatric to Adult Health Care Transition Interventions: A Systematic Review

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Objective To identify statistically significant positive outcomes in pediatric-to-adult transition studies using the triple aim framework of population health, consumer experience, and utilization and costs of care.

Study design Studies published between January 1995 and April 2016 were identified using the CINAHL, Ovid MEDLINE, PubMed, Scopus, and Web of Science databases. Included studies evaluated pre-evaluation and postevaluation data, intervention and comparison groups, and randomized clinic trials. The methodological strength of each study was assessed using the Effective Public Health Practice Project Quality Assessment Tool.

Results Out of a total of 3844 articles, 43 met our inclusion criteria. Statistically significant positive outcomes were found in 28 studies, most often related to population health (20 studies), followed by consumer experience (8 studies), and service utilization (9 studies). Among studies with moderate to strong quality assessment ratings, the most common positive outcomes were adherence to care and utilization of ambulatory care in adult settings.

Conclusions Structured transition interventions often resulted in positive outcomes. Future evaluations should consider aligning with professional transition guidance; incorporating detailed intervention descriptions about transition planning, transfer, and integration into adult care; and measuring the triple aims of population health, experience, and costs of care. (*J Pediatr* 2017;188:263-9).

Transitioning from pediatric to adult care encompasses preparation for managing one's health and needed health care, transferring to adult-centered care with current medical information, and engaging in adult health care. Establishing a continuum of transition support that is coordinated between pediatric and adult care settings can be challenging, however.

Published literature consistently shows that most youths and young adults, including those with special health care needs and their parents, receive limited or no transition preparation, transfer assistance, and facilitated integration into adult care.¹⁻³ As a result, many are at risk for lower-than-expected health literacy,⁴ discontinuity of care,^{5,6} delays in securing an adult medical home and specialty care,⁷ problems with treatment adherence,^{8,9} dissatisfaction with care,¹⁰⁻¹² excess morbidity,¹² and even mortality.¹³ To ameliorate these adverse outcomes, the American Academy of Pediatrics (AAP), the American Academy of Family Physicians (AAFP), and the American College of Physicians (ACP) developed a joint clinical report on health care transition in 2011.¹⁴ This professional consensus calls for specific transition activities beginning at age 12 years and continuing through young adulthood.

Various interventions have been used to improve the transition process, most of which have been of limited scope and generalizability. In 2014, the Agency for Healthcare Research and Quality (AHRQ) reported difficulties in determining which transition interventions are most effective because of limited evidence.¹⁵ The Institute of Medicine, also in 2014, identified transition as a persistent problem with "minimal systematic implementation and evaluation of institutional change."¹⁶

Recent systematic reviews have focused on effectiveness of health care transition interventions^{17,18} and measurable outcomes.¹⁹ Crowley et al²⁰ studied health outcomes of transition programs and found that 6 of 10 included studies showed statistically significant improvements in outcomes. These positive improvements were found only in studies of patients with diabetes; the interventions associated with significant outcomes were patient education and transition clinics.

This review, which builds on Crowley's 2012 study, examines significant outcomes of health care transition using the triple aim framework, including a quality assessment of included evaluation studies. This review also addresses evidence gaps and implications for future studies, building on previous work related to transition measures using the triple aim domains of population health, patient experience, and costs of care.²¹

AAFP	American Academy of Family Physicians
AAP	American Academy of Pediatrics
ACP	American College of Physicians
AHRQ	Agency for Healthcare Research and Quality
EPHPP	Effective Public Health Practice Project Quality Assessment Tool for Quantitative Studies
HbA1c	Hemoglobin A1c

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Methods

Following the PRISMA checklist,²² we conducted a search strategy of articles published between January 1995 and April 2016 using the CINAHL, Ovid MEDLINE, PubMed, Scopus, and Web of Science databases. Only English-language articles were included, and a combination of medical subject headings and keywords were used, as described in the **Figure** (available at www.jpeds.com).

Included studies described a transition intervention for youths transferring from pediatric to adult outpatient health care. Studies that addressed only self-care skills without reference to transition planning or transfer were excluded. The primary outcome was health care transition (not vocational or educational transition). Studies included preintervention and postintervention data, intervention and nonintervention comparisons, and randomized controlled trials. Prospective and retrospective studies were included. Excluded studies relied only on qualitative data or failed to specify the sample size, impeding quality rating.

One reviewer screened the initial identified titles and abstracts. Articles meeting the inclusion criteria were read in their entirety by 2 reviewers. When there were differences in opinion, 2 additional reviewers examined the full article in question.

The Effective Public Health Practice Project Quality Assessment Tool for Quantitative Studies (EPHPP) was used to assess methodological strength of each study.²³ This tool and its accompanying dictionary are available at <http://www.ehpp.ca>. The study components analyzed were selection bias, study design, confounders, blinding, data collection methods, withdrawals, and dropouts. Intervention integrity and analyses also were evaluated, but were not included in the global rating. Component ratings of strong, moderate, or weak were assigned along with an overall study rating based on the summation of ratings; a strong rating indicates no weak rating, a moderate rating indicates 1 weak rating, and a weak rating indicates 2 or more weak ratings (**Table I**; available at www.jpeds.com). Two assessors independently scored each included study for quality; differences were resolved by discussing the rationale for the rating and sharing information used to justify the rating. The 2 reviewers resolved all discordant ratings using this approach.

The following data were extracted from each study (**Table II**; available at www.jpeds.com): study design and population, medical condition(s) of the study population, US or international-based study, type of transition intervention, outcome measures and results, and overall quality assessment ratings. Study results are summarized in **Table II** in terms of statistically significant outcomes as an increase, a decrease, or no change, except for 1 study in which results were reported in terms of positive or negative effect sizes.⁴⁴ Special designations were assigned to outcome results with incomplete data. Statistically significant outcomes were confirmed by 2 reviewers.

Statistical Analyses

Outcomes from the included studies were categorized according to population health, experience of care, and utilization/

cost domains. This triple aim framework was used in previous work,²¹ but the categorization of results could differ in this study to align with statistically positive outcome criteria. This study also follows the framework of the Institute for Healthcare Improvement's *Guide to Measuring the Triple Aim*⁶⁵ and the AHRQ's *Early Evidence on the Patient-Centered Medical Home*.⁶⁶ In **Table II**, population health outcomes are organized according to adherence to care (including disease-specific outcomes), patient-reported health and quality of life, and self-care skills. Experience of care outcomes are organized according to satisfaction with care and barriers to care. Utilization/cost measures are classified into service utilization (including clinic, hospital, surgery, and procedures), process of care (including communications among providers and documentation of transition clinical processes), and costs of care. Only those studies with significant positive transition outcomes are reported in **Table III**.

Transition interventions were analyzed in terms of activities aligned with the AAP/AAFP/ACP Clinical Report: transition preparation, transfer of care, and integration into adult care. Article descriptions, albeit limited, were used. With respect to transition preparation, the following activities were counted when mentioned: transition process/policy, transition readiness assessment, self-care/disease education, plan of care, transition clinic in pediatric setting, and community resource linkages. With respect to transfer, the following activities were counted when mentioned: appointment scheduling assistance, preparation of a transfer package/medical summary, communication between pediatric and adult provider, and joint pediatric/adult clinic. With respect to integration into adult care, the following activities were counted when mentioned: welcome/orientation process, appointment scheduling and follow-up assistance, self-care assessment, self-care/disease education, plan of care, and young adult clinic. The presence of a designated coordinator to assist with the transition process was noted as well.

Results

This systematic review examined the evidence from 43 articles out of 3844 articles initially identified (**Figure**). **Table II** provides a summary of each study's characteristics. All but 5 studies^{26,27,35,41,52} evaluated transition interventions for youths with a single condition, most often type 1 diabetes, followed by kidney or liver transplants and juvenile idiopathic arthritis. Among the handful of multiple-condition studies, only 1 study³¹ included youths with neurodevelopmental conditions. No included study examined transition outcomes for youths with mental/behavioral health conditions or common chronic conditions, such as asthma. In addition, no study focused on youths without chronic conditions.

US studies accounted for one-third of the studies in this systematic review, with almost as many from the United Kingdom. Two of the UK studies^{11,12} were conducted with the same study population using the same intervention, but evaluating different outcomes. Study population sizes of 100 or more were found in approximately one-quarter of the 43 studies.

Table III. Summary of positively significant transition outcomes in population health, experience of care, and utilization and cost of care

Population health outcomes	Experience of care outcomes	Utilization and cost outcomes
<p>Adherence to care</p> <p>Decrease in HbA1c level^{31,39,45,50,58,62}</p> <p>Decrease in HbA1c level for males⁵⁴</p> <p>Decrease in HbA1c level for Hispanics⁵⁸</p> <p>Increase in foot examinations³¹</p> <p>Increase in microalbuminuria screenings³¹</p> <p>Increase in eye assessments³¹</p> <p>Increase in hypertension screenings³⁹</p> <p>Increase in nephropathy screenings³⁹</p> <p>Decrease in prevalence of nephropathy³⁹</p> <p>Increase in carbohydrate counting⁶²</p> <p>Increase in weight⁶²</p> <p>Decrease in number of hypoglycemic episodes⁶²</p> <p>Decrease in incidence of severe hypoglycemia⁵⁸</p> <p>Increase in insulin modification, specifically in proportion of rapid-acting insulin/day⁶²</p> <p>Decrease in tacrolimus SD levels²⁴</p> <p>Increase in medication adherence³⁴</p> <p>Decrease in self-reported nonadherence to medications⁵¹</p> <p>Lower median change in serum creatinine at 1 year post-transfer⁵¹</p> <p>Lower change in eGFR at 1 year post-transfer⁵¹</p> <p>Decrease in changes in nonsteroidal immunosuppressive therapies⁵⁵</p> <p>Lower mean decline in eGFR at 3 years after transfer⁶³</p> <p>Decrease in frequency of INR testing²⁶</p> <p>Patient-reported health and quality of life</p> <p>Increase in participation score (London Handicap Scale)²⁷</p> <p>Increase in activity limitation score (Barthel Index)²⁷</p> <p>Increase in dependency subscale score (Personal Adjustment and Role Skills Scale III)⁴</p> <p>Increase in mean score for performance (Canadian Occupational Performance Measure) with life-course goals and healthcare-related goals⁴¹</p> <p>Increase in 1-month global well-being⁵⁸</p> <p>Decrease in frequency of symptoms/poorer functions in quality of life score (Juvenile Arthritis Quality of Life Questionnaire)¹²</p> <p>Decrease in anxiety score (State/Trait Anxiety Inventory for Adults)⁶⁴</p> <p>Increase in perceived health status³³</p> <p>Self-care</p> <p>Increases in arthritis-related knowledge among parents and adolescents¹²</p> <p>Increase in diabetes-related knowledge scores (Diabetes Knowledge Questionnaire)⁶²</p> <p>Increase in proportion performing self-adjustment of insulin doses, specifically basal adjustments⁶²</p> <p>Increase in transition readiness score⁶⁴</p> <p>Increase in percentage of young people carrying self-monitoring cards⁵⁷</p> <p>Mortality</p> <p>Decrease in deaths or graft loss²⁴</p>	<p>Satisfaction</p> <p>Increase in satisfaction with structured transition³¹</p> <p>Increase in overall satisfaction with transfer in District C and District D⁴⁸</p> <p>Increase in satisfaction with transitional care scores among patients and parents (Mind The Gap Scale)^{11,12}</p> <p>Increase in opportunities for adolescents to be seen in clinic alone and decide who should be present in consultations/examinations (Mind The Gap Scale)⁵²</p> <p>Increase in satisfaction with transition process and care⁵⁵</p> <p>Increase in mean score for satisfaction (Canadian Occupational Performance Measure) with life-course goals and healthcare-related goals⁴¹</p> <p>Decrease in transfer meaning a large change in patients' life⁵⁵</p> <p>Increase in ratings for "Youth Kit" in helpfulness in developing supportive and respectful relationships with health care workers⁴¹</p> <p>Increase in ratings for "Online Mentor" in helpfulness in sharing information and communicating about your health care and in setting and working toward your goals⁴¹</p> <p>Barriers to care</p> <p>Decrease in specific bottlenecks in transition experienced by health professionals: no joint mission between pediatric and adult care, parents having trouble ceding control to adolescents, lack of coordination between pediatric and adult care, adolescents taking too little responsibility for self-care, lack of resources for joint care services, psychosocial problems of adolescents, noncompliance of adolescents with therapy, and social participation of adolescents⁵²</p> <p>Decreases in need for home physicians and social workers in home community, and in inadequate knowledge about disease status, names of prescribed medications, and dosages⁶⁴</p>	<p>Utilization</p> <p>Decrease in time between last pediatric visit and first adult visit³¹</p> <p>Increase in adult clinic attendance rates^{31,34,42}</p> <p>Increase in percent attending first clinic visit³⁸</p> <p>Increase in successful transitions (≥ 1 routine adult visit among transitioned patients)³⁸</p> <p>Increase in number seeing adult rheumatologists at least once⁴⁶</p> <p>Decrease in hospital admission rates³⁴</p> <p>Decrease in DKA hospital admission rates⁴⁵</p> <p>Decrease in length of stay of DKA readmissions⁴⁵</p> <p>Decrease in surgery rates³⁴</p> <p>Decrease in mean cumulated radiation exposure³⁴</p> <p>Process of care</p> <p>Increase in discussions with families about transition⁵³</p> <p>Increase in sending copy of transition letters to young people⁵⁷</p> <p>Increase in documentation: transitional care components, parental transition needs, aspects of adolescent readiness</p> <p>Increase in discussion of transitional issues⁵⁷</p> <p>Costs of care</p> <p>None</p>

Research designs were almost always quasi-experimental using pre-post population cohorts or retrospective cohorts. Only 2 studies used a randomized controlled study design,^{28,60} and 8 studies used a prospective cohort.^{24,26,35,37,41,43,46,58}

Structured transition interventions for youths with chronic conditions have resulted in statistically significant beneficial outcomes, as shown in **Tables II** and **III**; 28 of the 43 included studies (65%) found statistically significant positive outcomes, most often measured in terms of population health and, to a lesser extent, in terms of experience of care and service utilization. Only 1 study³¹ found positive outcomes in all 3 domains; 5 other studies^{12,37,41,55,64} reported positive outcomes in population health and experience of care, and 4 other studies^{34,45,57,58} found positive outcomes in population health and utilization of care. Statistically significant negative results were found in 2 studies, one⁴⁰ in which adult clinic attendance declined at 3 years after transfer and another⁵³ in which hemoglobin A1c (HbA1c) and International Federation of Clinical Chemistry and Laboratory Medicine mmol/mol increased 1 year after follow-up to an adult clinic.

Population health outcomes were measured in 37 of the 43 studies, as shown in **Table II**; 20 of these 37 studies (54%) found statistically positive population health outcomes. Most often these pertained to improvements in adherence to care. Positive changes also were reported in terms of patient-reported health and quality of life, self-care skills, and in 1 study, mortality reduction.

Owing to the large number of transition studies on type 1 diabetes, adherence to care was most often reported in terms of declines in HbA1c levels. Other positive diabetes outcomes pertained to increases in foot and eye examinations; screening for microalbuminuria, hypertension, and nephropathy; and carbohydrate counting and body weight. Decreases in the prevalence of nephropathy and hypoglycemic episodes were found as well. Among the transition studies related to liver or kidney failure/transplants, positive outcomes were reported as adherence to care, defined as lower tacrolimus SD levels, lower change/decline in estimated glomerular filtration rate, and lower change in serum creatinine; medication adherence was improved as well.

As a result of structured transition interventions, improvement in patient-reported quality of life and perceived health status was reported in several studies, often using validated instruments. These quality of life improvements were reported in terms of perceived health and mental health status, global well-being, functional status, stress, distress, depression, anxiety, life satisfaction, health goals, and social integration. Statistically significant positive outcomes were also found pertaining to self-care skills and measured in terms of improvements in disease-specific knowledge, self-adjustment of insulin doses, transition readiness scores, global well-being, and carrying important medical information. One liver transplant study²⁴ found a significant reduction in mortality and graft loss.

Experience of care outcomes were measured in 15 of the 43 studies. Statistically significant positive outcomes were found in 8 of these 15 studies (60%).^{11,12,31,41,48,52,55,64} Although the studies varied in terms of what consumers were asked to report

on, positive outcomes were shown related to satisfaction with transition, transfer, and life-course and health-related goals; helpfulness of a specific tool or online resource; and autonomy and increased time alone with a health care provider. Reductions in specific transition barriers were found in 2 studies.^{52,64}

Utilization and costs of care outcomes were examined in 24 of 43 studies. In 9 of these 24 studies (39%), outcomes were statistically significant and most often measured in terms of service use.^{31,34,38,42,45,46,53,57,58} Although 3 studies examined costs, none found significant cost savings; however, several studies found that having a structured transition process resulted in increased visits to the new adult provider and a reduced time lag between the last pediatric visit and the first adult visit. Studies also reported reductions in hospital admissions and length of stay for readmissions, surgery rates, and radiation exposure. Finally, improvements in the transition process of care were cited in 2 studies.^{53,57}

Analysis of transition intervention descriptions found that 35 studies described transition preparation activities. The same number mentioned transfer activities, and fewer (ie, 25) specified integration to adult care activities. Just 15 of the 43 studies referenced having all 3 transition activities. Across all transition activities, the most common was self-care/disease education (in 28 studies), typically part of transition preparation. The next most common intervention was having a transition clinic, either a separate pediatric or young adult clinic and/or a joint clinic (in 26 studies), followed by explicit communication between adult and pediatric departments (in 24 studies) and preparation of transfer/medical summary information (in 20 studies) and plans of care (in 20 studies). Mentioned somewhat less often was readiness/self-care assessment (in 16 studies, almost always as part of preparation), a welcome/orientation process for adult practice (in 15 studies), scheduling assistance (in 13 studies), and linkages to community resources (in 10 studies). Having a designated transition coordinator to assist with the transition process was noted in 18 studies.

The overall quality assessment ratings for the included studies demonstrate their variability in risk of bias, with only 7 studies rated as strong, 18 rated as moderate, and 18 rated as weak (**Table I**). With respect to selection bias, 35 studies were rated as moderate and 8 were rated as weak, mainly because of a small study population. The study design was almost always rated as moderate (n = 41) because cohort or cohort analytic studies were used; randomized clinical trials were used in only 2 studies. Confounders were not well described or controlled, with 28 studies rated as weak because of issues related to identification, stratification, matching, or analysis. Blinding scores were always moderate, either because the blinding process was not explained or because the participants or researchers were unaware of the research question. Data collection was ranked as moderate in 25 studies and weak in 16, with weaker ratings associated with the use of measures or instruments of unknown reliability or validity, sometimes designed for the study itself without previous use. With respect to withdrawal and dropouts, one-half of the studies did not report these because of

a retrospective study design or the use of one-time surveys or other data collection. The remaining studies received weak ($n = 7$) or moderate ($n = 5$) rankings, because follow-up rates were sufficiently low to pose a risk of introducing bias. Although not included in the summary results, no studies reported the percentage of participants who received the complete intervention, the consistency of the intervention measured, or whether subjects received any unintended intervention. Statistical analysis in all studies were appropriate. No studies reported intention-to-treat analysis.

Discussion

This systematic review found that almost two-thirds of transition evaluation studies (28 of 43) had statistically significant positive outcomes. Twenty studies found improvements in population health, 8 studies reported benefits in terms of consumer experience or reduction in transition barriers, and 9 studies cited positive service utilization impacts. Only 3 studies examined costs, but none found significant savings.

In an analysis of studies that received moderate to strong quality ratings and also had statistically significant positive outcomes, the most common beneficial outcome found was adherence to care, reported in 11 of the 15 studies with moderate to strong ratings. Only 1 of the 15 studies reported positive outcomes in all 3 triple aim domains.³¹

Even though almost two-thirds of the 43 transition studies included in this systematic review reported positive outcome results, the state of transition intervention research is still in its infancy. This is not surprising, given that the primary care professional organizations released their clinical algorithm in 2011,¹⁴ which called for a structured transition process for all youths starting early in adolescence and continuing into young adulthood. Incorporated into the AAP/AAFP/ACP algorithm are recommended steps for transition planning, transfer to an adult model of care, and integration into adult care. These clinical recommendations were subsequently translated into the Six Core Elements of Health Care Transition, with sample tools for pediatric, family medicine, med-peds, and internal medicine practices and measurement resources.⁶⁷ Future studies evaluating transition will benefit from providing more detailed descriptions of their interventions, preferably using the framework of the AAP/AAFP/ACP Clinical Report and the Six Core Elements to enable comparisons among studies and associations between transition processes and outcomes.

Although this systematic review uncovered a few common outcomes within the triple aim domains, the measures used to evaluate health care transition interventions were widely variable and seldom addressed all 3 domains. Population health, consumer experience, and utilization/costs provide an explicit conceptual model that can be used to guide the selection of future transition outcome evaluations.²¹

With respect to population health outcomes, several issues need to be considered in terms of measures related to adherence to care, perceived health and quality of life, and self-care skills. Few chronic conditions have disease-specific

adherence to care measures, such as HbA1c for those with diabetes or tacrolimus levels for those who have received a transplant. Probably one of the most reasonable population health measures to consider is evaluating medication adherence before and after transfer.⁶⁸ Although population outcomes measured in terms of perceived health and quality of life have the advantage of available validated health and quality of life instruments, clinicians and researchers need to consider the extent to which specific transition interventions rather than other aspects of care are likely to influence these impacts. Although quality of life measures are laudable outcomes, they may be beyond the scope of what transition interventions can reasonably expect to achieve. Self-care measures—generic or disease-specific—are another important population outcome. An issue for future transition researchers will be the selection of appropriate tools to measure self-care skills. Importantly, consideration should be given to incorporating generic self-care skills regarding health and health care, not only disease-specific skills.

With respect to experience of care, this systematic review documents positive outcomes but reveals the need for more specificity in eliciting consumer feedback on particular aspects of transition planning, transfer of care, and integration into adult care. Too often, transition evaluation studies ask broad questions about satisfaction with “transitional care” or with the “transition process,” or they focus on just a few issues, for example, “time alone with doctor,” which refers to speaking with the doctor privately without a parent in the room. More specific questions addressing particular elements of transition should be considered, such as those found in the Transition Feedback Survey in the Six Core Elements, which includes many tested questions from national surveys and Boston Children’s Hospital’s ADAPT questionnaire.⁶⁹ Obtaining anonymous youth and parent feedback will be critical for continuously refining pediatric-to-adult transition interventions.

With respect to service utilization and cost outcomes, this systematic review documented improvements in ambulatory care use among young adults with various chronic conditions and also reductions in hospitalization among those with inflammatory bowel disease and diabetes. Recognizing the vulnerability of young adults in terms of their low service utilization patterns and the finding of declining utilization at 3 years after transfer,⁴⁰ future studies may want to include attendance not only at the initial adult visit, but also at subsequent ambulatory care visits. In addition, the time between the last pediatric visit and the initial adult visit represents an important utilization marker of continuity of care. Short-term utilization results associated with a successful transfer indeed may show increased ambulatory care use, which represents a transfer success. The extent to which this added cost would offset reductions in emergency room and hospital use, particularly for young adults with chronic conditions, is an important issue worthy of investigation. The absence of evaluation studies on cost effectiveness of transition interventions represents a significant roadblock to the adoption of much-needed transition interventions among payers and large pediatric and adult systems of care.

This systematic review has several limitations. Studies often lacked detailed descriptions of their transition process. This makes categorizing similar transition interventions difficult and linking outcomes to a specific transition process impossible. It also impedes future replication efforts. Transition to adult care is a complex intervention with many steps that alone or together have the potential to influence outcomes. The small size of most studies resulted in lack of statistical power, limiting the measurement of pre-post or between-group differences and the generalizability of study findings. Similarly, several studies used data collection methods of unknown or untested validity and reliability. Characterization of studies using the EPHPP tool attempts to assist readers in understanding methodological limitations given the inclusion of all studies in presenting statistically significant positive outcomes.

Future evaluation studies are needed to examine triple aim impacts on a broader population of youths with and without chronic conditions, with special attention directed to the cost effectiveness of transition interventions aligned with the AAP/AAFP/ACP Clinical Report. ■

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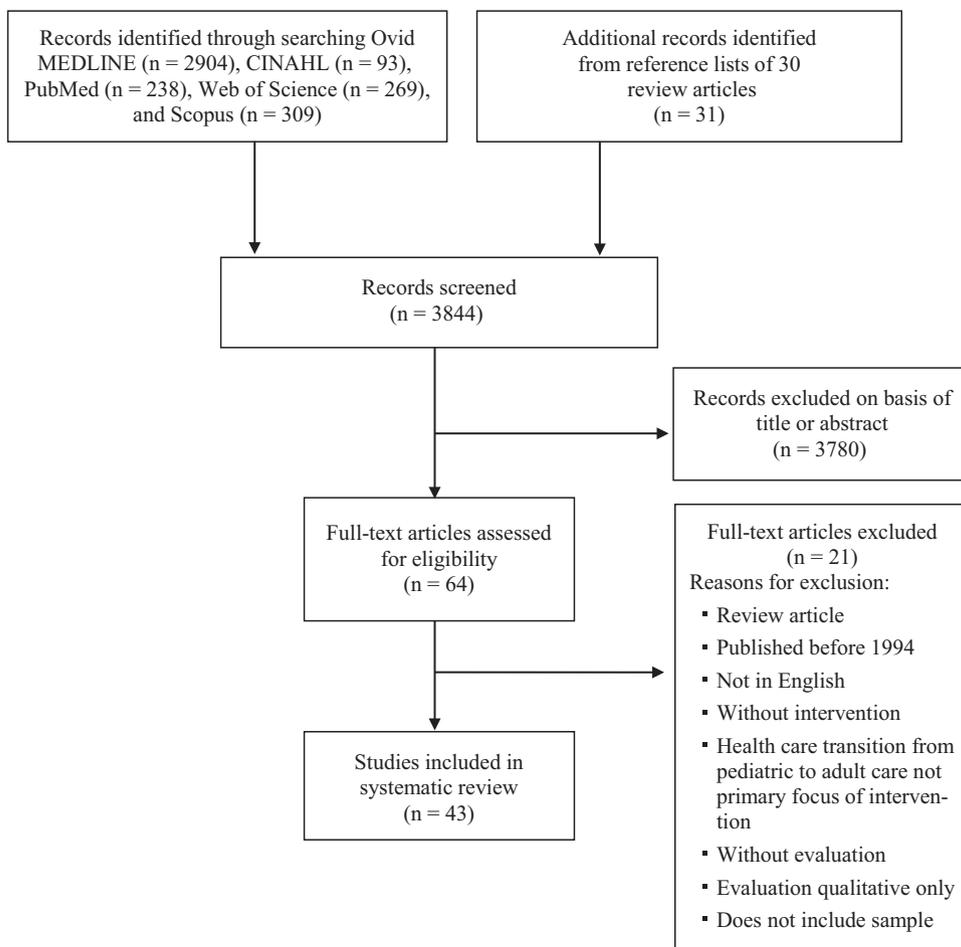


Figure. Summary of evidence search and selection. *(Continues)*

Databases Searched	Search Terms Used	Number of Results
Scopus	(TITLE (((adolescent* OR "young adult" OR teen* OR pediatric* OR paediatric* OR "young adults") AND (transition* OR transfer*) AND (adult OR adults))) AND TITLE-ABS-KEY ((evaluation OR evaluations OR outcome OR outcomes OR comparison OR assessment)))	309
Web of Science	TITLE: (((adolescent* OR young adult OR teen* OR pediatric* OR paediatric* OR young adults) AND (transition* OR transfer*) AND (adult OR adults))) AND TOPIC: ((evaluation OR evaluations OR outcome OR outcomes OR comparison OR assessment)) Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC.	269
PubMed	transition to adult care or transferring to adult care or transfer to adult care or pediatric transition to adult care AND satisfaction or barriers or needs AND cost or health care costs	238
CINAHL	transition from pediatric to adult care OR transferring to adult care OR transfer to adult care OR pediatric transition to adult care	93
Ovid Medline	#1 exp Adolescent/ (1719867) #2 exp Adolescent Health Services/ (4797) #3 exp Young Adult/ (490866) #4 1 or 2 or 3 (1942883) #5 "adolescen*".ab,ti. (198853) #6 "teen*".ab,ti. (23933) #7 (pediatric* or paediatric*).ab,ti. (206624) #8 "young adult*".ab,ti. (67004) #9 5 or 6 or 7 or 8 (456977) #10 exp Transition to Adult Care/ (515) #11 exp "Continuity of Patient Care"/ (41963) #12 (transition* or transfer*).ab,ti. (763286) #13 "adult*".ab,ti. (920926) #14 9 and 11 and 12 and 13 (704) #15 10 or 14 (908) #16 9 and 12 and 13 (5229) #17 15 or 16 (5433) #18 exp Evaluation Studies/ (215219) #19 exp Clinical Trial/ (732784) #20 exp Cohort Studies/ (1520288) #21 exp Retrospective Studies/ (573018) #22 Comparative Study/ (1735618) #23 exp Follow-Up Studies/ (540603) #24 exp "Outcome and Process Assessment (Health Care)"/ or exp "Outcome Assessment (Health Care)"/ (823378) #25 18 or 19 or 20 or 21 or 22 or 23 or 24 (3906781) #26 "evaluat*".ab,ti. (2534493) #27 "outcome*".ab,ti. (1110204) #28 "compar*".ab,ti. (4039677) #29 "assess*".ab,ti. (2065653) #30 26 or 27 or 28 or 29 (7141318) #31 25 or 30 (8674412) #32 4 or 9 (2152383) #33 17 and 31 and 32 (3276) #34 limit 33 to (abstracts and english language and yr="1995 -Current") (2904)	2904

Figure. Continued.

Table I. Quality assessment of transition studies based on criteria from the Effective Public Health Practice Project

Study	Year	Overall rating	Selection bias	Study design	Confounders	Blinding	Data collection	Withdrawals and dropouts
Annunziato et al ²⁴	2013	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	Moderate
Annunziato et al ²⁵	2015	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	NA
Bauman et al ²⁶	2016	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	Strong
Bent et al ²⁷	2002	Strong	Moderate	Moderate	Strong	Moderate	Strong	NA
Betz et al ²⁸	2010	Weak	Weak	Strong	Strong	Moderate	Weak	Strong
Blaauwbroek et al ²⁹	2008	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	Strong
Broztman et al ³⁰	2001	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	NA
Cadario et al ³¹	2009	Moderate	Moderate	Moderate	Strong	Moderate	Weak	NA
Chaturvedi et al ³²	2009	Weak	Moderate	Moderate	Weak	Moderate	Weak	NA
Chaudhry et al ³³	2013	Moderate	Moderate	Moderate	Strong	Moderate	Weak	NA
Cole et al ³⁴	2015	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	NA
Cramm et al ³⁵	2013	Moderate	Weak	Moderate	Strong	Moderate	Moderate	Strong
Dabadie et al ³⁶	2008	Weak	Moderate	Moderate	Weak	Moderate	Weak	NA
Egan et al ³⁷	2015	Weak	Moderate	Moderate	Weak	Moderate	Strong	Weak
Fredericks et al ³⁸	2015	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	NA
Gholap et al ³⁹	2006	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	NA
Glesson et al ⁴⁰	2013	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	NA
Gorter et al ⁴¹	2015	Weak	Weak	Moderate	Moderate	Moderate	Weak	Moderate
Hankins et al ⁴²	2012	Weak	Weak	Moderate	Weak	Moderate	Moderate	NA
Harden et al ⁴³	2012	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	NA
Hilderson et al ⁴⁴	2016	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Strong
Holmes-Walker et al ⁴⁵	2007	Strong	Moderate	Moderate	Moderate	Moderate	Moderate	Strong
Jensen et al ⁴⁶	2015	Weak	Weak	Moderate	Weak	Moderate	Weak	Weak
Johnston et al ⁴⁷	2006	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	NA
Kipps et al ⁴⁸	2002	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	Moderate
Lane et al ⁴⁹	2007	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	NA
Logan et al ⁵⁰	2008	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	NA
McDonagh et al ¹²	2007	Weak	Moderate	Moderate	Moderate	Moderate	Weak	Weak
McQuillan et al ⁵¹	2015	Strong	Moderate	Moderate	Strong	Moderate	Moderate	NA
Nieboer et al ⁵²	2014	Weak	Weak	Moderate	Weak	Moderate	Moderate	Weak
Okumura et al ⁵³	2014	Weak	Moderate	Moderate	Weak	Moderate	Weak	Weak
Orr et al ⁵⁴	1996	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	Strong
Pape et al ⁵⁵	2013	Weak	Weak	Moderate	Weak	Moderate	Moderate	NA
Prestidge et al ⁵⁶	2012	Strong	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Robertson et al ⁵⁷	2006	Weak	Moderate	Moderate	Weak	Moderate	Weak	NA
Sequeira et al ⁵⁸	2015	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate
Shaw et al ¹¹	2007	Weak	Moderate	Moderate	Moderate	Moderate	Weak	Weak
Smith et al ⁵⁹	2011	Weak	Moderate	Moderate	Weak	Moderate	Weak	Weak
Steinbeck et al ⁶⁰	2015	Weak	Weak	Strong	Strong	Moderate	Weak	Strong
Van Wallegem et al ⁶¹	2008	Weak	Moderate	Moderate	Weak	Moderate	Weak	NA
Vidal et al ⁶²	2004	Weak	Moderate	Moderate	Weak	Moderate	Weak	Strong
Weitz et al ⁶³	2015	Strong	Moderate	Moderate	Strong	Moderate	Moderate	NA
Wiener et al ⁶⁴	2007	Weak	Moderate	Moderate	Weak	Moderate	Weak	Strong

NA, not applicable.

Table II. Summary of studies evaluating outcomes of health care transition interventions

Study	Year	Location	Study design	Study population	Condition(s)	Transition intervention(s)	Outcome measures and results	Overall quality assessment [†]
Annunziato et al ²⁴	2013	US	Prospective cohort with historical comparison/pre-post	20 intervention group; 14 comparison group	Liver transplant	Care coordinator/preparation for transition, transfer assistance, integration into adult care	Population health: Tacrolimus SD level ↓* Deaths or graft loss ↓* Short Form 36 physical health ↑ Health care management skills ↑ Short Form 36 mental health ↓	Moderate
Annunziato et al ²⁵	2015	US	Retrospective cohort	12 intervention group; 10 comparison group	Kidney transplant	Preparation for transition, transfer assistance	Population health: GFR ↑ Tacrolimus SD level ↓ Episodes of rejection ↓ Mean arterial pressure ↑	Moderate
Bauman et al ²⁶	2016	Canada	Prospective, longitudinal cohort	19	Chronic conditions requiring warfarin therapy	Preparation for transition, transfer assistance	Population health: Frequency of INR testing ↓* Warfarin knowledge scores ↑ No median INR values <1.6 and ≥5 No adverse events (bleeding and thrombotic) Patient time in therapeutic range ↓ Utilization/cost: Number of calls to anticoagulation team for support ↓ Clinic attendance ↔	Moderate
Bent et al ²⁷	2002	England	Retrospective cohort	119 intervention group; 135 comparison group	Physical disabilities (cerebral palsy, spina bifida, traumatic brain injury, and degenerative muscular disease with mild or no learning disability)	Preparation for transition	Population health: Barthel Index ↑* London Handicap Scale ↑* Euroqol Visual Analog Scale ↑ General Self-Efficacy Scale ↑ Perceived Stress Scale ↓ Rosenberg Self-Esteem Scale ↓ Nottingham Health Profile Subscales • Pain ↓ • Sleep ↓ • Energy ↔ Proactive Attitude Scale ↔ Utilization/cost: Total and average cost ^a	Strong
Betz et al ²⁸	2010	US	Randomized controlled trial	31 intervention group; 34 comparison group	Spina bifida	Preparation for transition	Population health: Personal Adjustment and Role Skills Scale III ↑ • Dependency subscale ↑* Community Life Skills Scale ↓ • Regularity-organization-routines subscale ↓* Denyes Self-Care Practice Instrument ↑	Weak

(continued)

Table II. Continued

Study	Year	Location	Study design	Study population	Condition(s)	Transition intervention(s)	Outcome measures and results	Overall quality assessment ^f
Blaauwbroek et al ²⁹	2008	Netherlands	Pre-post	121	Cancer	Transfer assistance, integration into adult care	Population health: RAND 36-Item Health Survey <ul style="list-style-type: none"> • Social functioning^b • Physical functioning^b • Role limitation due to physical problems^b • Role limitation due to emotional problems^b • Mental health^b • Vitality^b • Bodily pain^b • General health perceptions^b Experience: Patient satisfaction with shared care follow-up ^a	Moderate
Brotzman et al ³⁰	2001	US	Pre-post and retrospective cohort	226 intervention group; 200 comparison group	Sickle cell	Preparation for transition, integration into adult care	Utilization/cost: Percentage of patients appropriately prescribed hydroxyurea ↑ Percentage of inpatients not given demerol ↑ Percentage of patients seen in ED and not given demerol ↑ Number of hospital days ↓ Number of ED visits ↓ Treatment cost per patient (excluding surgical/operation items) ↓	Moderate
Cadario et al ³¹	2009	Italy	Retrospective cohort	30 intervention group; 32 comparison group	Type 1 diabetes	Care coordinator/ preparation for transition, transfer assistance, integration into adult care	Population health: HbA1c ↓* Foot examinations ↑* Eye assessments ↑* Microalbuminuria screenings ↑* Experience: Satisfaction with structured transition ↑* Utilization/cost: Time between last pediatric visit and first adult visit ↓* Adult clinic attendance ↑*	Moderate
Chaturvedi et al ³²	2009	Australia	Pre-post and retrospective cohort	11	Kidney transplant	Preparation for transition, transfer assistance	Population health: Serum creatinine ^a Utilization/cost: Adult clinic attendance ^a Inpatient hospital days ^a	Weak
Chaudhry et al ³³	2013	US	Retrospective cohort	44 intervention group; 47 comparison group	Cystic fibrosis	Care coordinator/ preparation for transition, transfer assistance, integration into adult care	Population health: Perceived health status ↑* Independence ↑ Anxiety ↓ Experience: Satisfaction with adult care ↑	Moderate

(continued)

Table II. Continued

Study	Year	Location	Study design	Study population	Condition(s)	Transition intervention(s)	Outcome measures and results	Overall quality assessment [†]
Cole et al ³⁴	2015	UK	Retrospective cohort	44 intervention group; 28 comparison group	Inflammatory bowel disease	Preparation for transition, transfer assistance, integration into adult care	Population health: Medication adherence ↑* Radiation exposure ↓* Proportion achieving optimum level of growth and development ↑ Utilization/cost: Adult clinic attendance ↑* Hospital admission rates ↓* Surgery rates ↓*	Moderate
Cramm et al ³⁵	2013	Netherlands	Prospective cohort	138 respondents (T0); 188 respondents (T1); 123 respondents (T0 and T1)	Type 1 diabetes, juvenile idiopathic arthritis, neuromuscular disorder	Care coordinator/ preparation for transition, transfer assistance	Population health: DISABKID instrument: • Social quality of life ↑ • Physical quality of life ↑ • Emotional quality of life ↓ Experience: Mind the Gap instrument • Satisfaction with transitional care ↑	Moderate
Dabadie et al ³⁶	2008	France	Retrospective cohort	20 intervention group; 14 comparison group	Inflammatory bowel disease	Preparation for transition, transfer assistance, integration into adult care	Population health: Attendance at joint medical visit ↑	Weak
Egan et al ³⁷	2015	US	Prospective cohort	29	Type 1 diabetes	Care coordinator/ transfer assistance, integration into adult care	Population health: Parents Diabetes Distress Scale ^c HbA1c ↓ Diabetes Quality of Life ^b Experience: Health Care Climate Questionnaire ^c Utilization/cost: Adherence to follow-up visits ↔	Weak
Fredericks et al ³⁸	2015	US	Retrospective cohort	19 comparison group; 26 intervention group	Liver transplant	Preparation for transition	Population health: Percent adherent with immunosuppressant therapy posttransfer ↑ Number of posttransfer biopsy-proven rejections ↓ Number of undetectable immunosuppressant therapy values posttransfer ↓ Number of deaths posttransfer ↔ Number of participants with posttransfer graft loss ↔ Utilization/cost: Percentage attended first clinic visit ↑* Percentage of clinic adherence (≥85%) posttransfer ↓ Clinic attendance rate posttransfer ↓	Moderate

(continued)

Table II. Continued

Study	Year	Location	Study design	Study population	Condition(s)	Transition intervention(s)	Outcome measures and results	Overall quality assessment [†]
Gholap et al ³⁹	2006	England	Retrospective cohort	68 intervention group; 397 comparison group; 46 intervention (patients with diabetes ≥7 y); 266 comparison group	Type 1 diabetes	Preparation for transition, transfer assistance (Alphabet Strategy)	Population health: Screening rates for hypertension ↑* Screening rates for nephropathy ↑* Prevalence of nephropathy ↓* HbA1c ↓* Prevalence of retinopathy ↓ Prevalence of hypertension ↑ Utilization/cost: Attendance at young adult diabetes clinic ^a	Moderate
Gleeson et al ⁴⁰	2013	England	Retrospective cohort	24 intervention group; 37 comparison group	Congenital adrenal hyperplasia	Preparation for transition, transfer assistance, integration into adult care	Utilization/cost: Adult clinic attendance 3 y after transfer ↓* Loss to follow-up ^a	Moderate
Gorter et al ⁴¹	2015	Canada	Prospective cohort	50	Various chronic conditions and neurodevelopmental conditions	Preparation for transition (Youth KIT; Online Transition Mentor [TRACE])	Population health: Canadian Occupational Performance Measure: • Mean score for performance with life-course goals ↑* • Mean score for performance with healthcare-related goals ↑* Experience: Canadian Occupational Performance Measure: • Mean score for satisfaction with life-course goals ↑* • Mean score for satisfaction with healthcare-related goals ↑* Interventions' helpfulness in self-management areas: Youth KIT: • Developing supportive and respectful relationships with health care workers ↑* • Sharing information and communication about your health care ^b • Setting and working toward your goal ^b • Taking charge of your own health care ^b Online Mentor (TRACE): • Taking charge of your own health care ↑* • Sharing information and communication about your health care ↑* • Developing supportive and respectful relationships with health care workers ^b • Setting and working towards your goal ^b Ratings of utility of the Youth KIT ^a Utilization/cost: Frequency of use of Youth KIT ^a	Weak
Hankins et al ⁴²	2012	US	Pre-post and retrospective cohort	34 intervention group; 49 comparison group; 75 historical comparison group	Sickle cell	Care coordinator/transfer assistance, integration into adult care	Experience: Helpfulness of transition program ^a Utilization/cost: Adult clinic attendance ↑*	Weak
Harden et al ⁴³	2012	England	Prospective cohort with historical control	12 intervention group; 9 comparison group	Kidney failure	Transfer assistance, integration into adult care	Population health: Acute rejections ^a Graft loss ^a Number of deaths ^a	Moderate

(continued)

Table II. Continued

Study	Year	Location	Study design	Study population	Condition(s)	Transition intervention(s)	Outcome measures and results	Overall quality assessment [†]
Hilderson et al ⁴⁴	2016	Belgium	Quasi-experimental study using a 1-group pretest-posttest with a nonequivalent posttest-only comparison group	27 adolescents (longitudinal analysis); 12 adolescents; 16 parents; 23 intervention group; 23 comparison group	Juvenile idiopathic arthritis	Care coordinator/ preparation for transition, integration into adult care	<p>Population health: (Note: Refer to table key for effect size symbols)</p> <p>Longitudinal analysis:</p> <p><i>Adolescents:</i></p> <p><i>Primary outcomes:</i></p> <ul style="list-style-type: none"> • Improved psychosocial health ++ • Improved treatment ++ • Improved communication + • Improved pain and hurt + • Improved daily activities + • Improved physical health + • Improved worry = <p><i>Secondary outcomes:</i></p> <ul style="list-style-type: none"> • Improved quality of life +++ • Improved illness-related knowledge + • Increased motivation = • Reduction in mental fatigue = • Increased activity = • Reduction physical fatigue = • Reduction in general fatigue – • Medication adherence = <p><i>Parents:</i></p> <p><i>Secondary outcomes:</i></p> <ul style="list-style-type: none"> • Increased autonomy support + • Increased promotion of independence + • Reduced behavioral control + • Improved communication = • Improved daily activities = • Improved psychosocial health = • Improved worry – • Improved pain and hurt – • Reduced psychological control – • Improved treatment – • Improved physical health – <p>Comparative analysis:</p> <p><i>Adolescents:</i></p> <p><i>Primary outcomes:</i></p> <ul style="list-style-type: none"> • Improved psychosocial health ++ • Improved treatment + • Improved communication + • Improved pain and hurt = • Improved daily activities + • Improved physical health + • Improved worry = <p><i>Secondary outcomes:</i></p> <ul style="list-style-type: none"> • Improved quality of life + • Improved illness-related knowledge = • Increased motivation + • Reduced mental fatigue + • Increased activity + • Reduced physical fatigue + • Reduced general fatigue + • Medication adherence – – 	Strong

(continued)

Table II. Continued

Study	Year	Location	Study design	Study population	Condition(s)	Transition intervention(s)	Outcome measures and results	Overall quality assessment [†]
							Parents: Secondary outcomes: <ul style="list-style-type: none"> • Increased autonomy support – • Increased promotion of independence – – • Reduced behavioral control ++ • Improved communication – – – • Improved daily activities + • Improved psychosocial health – • Improved worry ++ • Improved pain and hurt = • Reduced psychological control – – • Improved treatment + • Improved physical health – 	
Holmes-Walker et al ⁴⁵	2007	Australia	Pre-post	191	Type 1 diabetes	Care coordinator/integration into adult care	Population health: HbA1c ↓* Utilization/cost: DKA hospital admission rates ↓* Length of stay of DKA readmissions ↓* DKA hospital readmission rates ^b	Strong
Jensen et al ⁴⁶	2015	US	Prospective cohort	210 intervention group; 26 comparison group	Juvenile idiopathic arthritis	Care coordinator/preparation for transition, transfer assistance	Experience: Satisfaction with transitional process ^a Utilization/cost: Saw adult rheumatologist at least once ↑*	Weak
Johnston et al ⁴⁷	2006	Northern Ireland	Retrospective cohort	18 intervention group; 15 comparison group	Type 1 diabetes	Transfer assistance, integration into adult care	Population health: HbA1c ^a Utilization/cost: Number of missed appointments ^a	Moderate
Kipps et al ⁴⁸	2002	England	Retrospective cohort	106 intervention group; 123 comparison group	Type 1 diabetes	Transfer assistance, integration into adult care. Transfer from a pediatric clinic to an adult clinic (District A); transfer from a pediatric clinic to a young adult clinic held in a diabetes center at a different hospital (District B); transfer from a pediatric clinic to a young adult clinic held in the same hospital, with patients introduced to the adult physician in the pediatric clinic before transfer (District C); initial move from a pediatric clinic to an adolescent clinic held in the same diabetes center (run jointly by the pediatrician and adult physician) before transfer to the adult clinic (District D)	Population health: Within-district HbA1c: <ul style="list-style-type: none"> • District A ↓ • District B ↓ • District C ↑ • District D ↔ Experience: Overall satisfaction with transfer in Districts C and D ↑* Utilization/cost: Clinic attendance ^a	Moderate

(continued)

Table II. Continued

Study	Year	Location	Study design	Study population	Condition(s)	Transition intervention(s)	Outcome measures and results	Overall quality assessment ^f
Lane et al ⁴⁹	2007	US	Retrospective cohort	96 intervention group; 153 comparison group	Type 1 diabetes	Integration into adult care	Population health: HbA1c ↑	Moderate
Logan et al ⁵⁰	2008	England	Pre-post	93	Type 1 diabetes	Preparation for transition, transfer assistance, integration into adult care	Population health: HbA1c ↓* Retinal screening ^a Microalbuminuria screening ^a Foot screening ^a Change in insulin regimen ^a Utilization/cost: Clinic attendance ^a	Moderate
McDonagh et al ¹²	2007	UK	Pre-post	308 adolescents; 303 parents	Juvenile idiopathic arthritis	Care coordinator/ preparation for transition, transfer assistance	Population health: Juvenile Arthritis Quality of Life Questionnaire score ↓* Parent arthritis-related knowledge ↑* Adolescent arthritis-related knowledge ↑* Independent health behaviors: • Self-medication ↑ • Independent visits ↑ Experience: Mind the Gap Scale: • Patient satisfaction with transitional care ↑* • Parent satisfaction with transitional care ↑*	Weak
McQuillan et al ⁵¹	2015	Canada	Retrospective cohort	16 intervention group; 16 comparison group	Kidney transplant	Preparation for transition, transfer assistance, integration into adult care	Population health: Self-reported nonadherence with medications ↓* Lower change in eGFR at 1 y posttransfer ↓* Lower change in eGFR at 2 y posttransfer ↓ Lower median change in serum creatinine in the first year ↓* Lower median change in serum creatinine in the second year ↓ Undetectable calcinurin inhibitor levels ↓ eGFR (first year posttransfer) ↓ eGFR (second year posttransfer) ↓ Acute rejections during first year ↔ Utilization/cost: Nonattendance for blood tests ↓ Nonattendance at clinic ↓	Strong

(continued)

Table II. Continued

Study	Year	Location	Study design	Study population	Condition(s)	Transition intervention(s)	Outcome measures and results	Overall quality assessment [†]
Nieboer et al ⁵²	2014	UK	Pre-post	128 professionals; 389 adolescents	Type 1 diabetes, juvenile idiopathic arthritis, cystic fibrosis, kidney failure/transplant, congenital urological conditions, neuromuscular disorders	Care coordinator/preparation for transition, transfer assistance (On Your Own Feet Ahead)	<p>Experience:</p> <p>Mind the Gap Scale</p> <ul style="list-style-type: none"> • Gives me opportunities to be seen in the clinic alone (if I want to) ↑* • Allows me to decide who should be in the consultation/examination room ↑* • Has staff who I can talk to about sensitive or difficult issues ↑ • Has a specific staff member who is coordinating my transitional care ↑ • Helps me to plan for my future ↑ • Helps me to prepare for my move to adult services ↑ • Treats me as an individual and understands my specific needs ↓ • Has staff who understand the realities of being a teenager ↓ • Providers work well together ↓ • Is interested in me as a person, not just the illness ↓ • Allows me to make my own decisions about health care options in my own time ↓ • Provides information to other professionals involved in my health care ↓ • Providers from pediatric and adult care arrange joint appointments/consulting hours for adolescents ↓ • Does not waste my time at the clinic ↓ • Has staff who know how to talk and listen to teenagers ↔ • Helps me to improve independence by using an action plan ↔ <p>Bottlenecks in transitional care perceived by health professionals</p> <ul style="list-style-type: none"> • No joint mission between pediatric and adult care ↓* • Parents having trouble ceding control to adolescents ↓* • Lack of coordination between pediatric and adult care ↓* • Adolescents taking too little responsibility for self-care ↓* • Lack of resources for joint care services ↓* • Psychosocial problems of adolescents ↓* • Noncompliance of adolescents with therapy ↓* • Social participation of adolescents ↓* 	Weak

(continued)

Table II. Continued

Study	Year	Location	Study design	Study population	Condition(s)	Transition intervention(s)	Outcome measures and results	Overall quality assessment [†]
Okumura et al ⁵³	2014	US	Pre-post and retrospective cohort	18 pediatric; 10 adult; 9 intervention group; 20 comparison group	Cystic fibrosis	Care coordinator/preparation for transition, transfer assistance, integration into adult care	Population health: Transition Readiness Questionnaire (TRAQ): • Self-management scores for paired-pediatric patients ↑ • Self-advocacy scores for pediatric patients compared with baseline adult center program ↑ • Self-advocacy score for unpaired-pediatric patients ↑ • Self-advocacy scores for paired-pediatric patients ↑ • Self-management scores for unpaired-pediatric patients ↓ BMI ^a Utilization: Discussions of transition with families ↑* Hospitalizations ↓	Weak
Orr et al ⁵⁴	1996	US	Pre-post	82	Type 1 diabetes	Preparation for transition, transfer assistance, integration into adult care	Population health: HbA1c ↑ • HbA1c for males ↓*	Moderate
Pape et al ⁵⁵	2013	Germany	Retrospective cohort	66	Kidney transplant	Preparation for transition, transfer assistance, integration into adult care Three adult care settings: specialized transition clinic, general transplantation clinic, and nephrologist	Population health: Changes in nonsteroidal immunosuppressive therapies ↓* Change in GFR: • Change in eGFR in setting 1 vs setting 3 ↑ • Change in eGFR in setting 1 vs setting 2 ↓ Arterial hypertension: • Blood pressure in setting 1 vs setting 3 ↓ • Blood pressure in setting 1 vs setting 2 ↑ Patient survival ^a Graft survival ^a Acute rejection episodes ^a Serum creatinine ^a Trough levels of nonsteroidal immunosuppressant drugs ^a Dose levels of nonsteroidal immunosuppressant drugs ^a Experience: Satisfaction with transition process and care ↑* Transfer means a large change in patients' life ↓* Utilization/cost: Number of antihypertensive medications ↓ Mean steroid dose ↑ Clinic attendance ^a	Weak
Prestidge et al ⁵⁶	2012	Canada	Retrospective cohort	12 intervention group; 33 comparison group	Kidney transplant	Care coordinator/preparation for transition, transfer assistance	Population health: Death or allograft loss ↓ Serum creatinine ^a Utilization/cost: Average annual cost per patient ^a	Strong

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Table II. Continued

Study	Year	Location	Study design	Study population	Condition(s)	Transition intervention(s)	Outcome measures and results	Overall quality assessment [†]
Robertson et al ⁵⁷	2006	UK	Retrospective cohort	38 intervention group; 55 control group	Juvenile idiopathic arthritis	Care coordinator/ preparation for transition, transfer assistance, integration into adult care	Utilization/cost: Sending copy of transition letters to the young person ↑* Discussion of transitional issues ^c Aspects of adolescent readiness ^c Parental transition needs ^c Preparatory visits to adult clinics ^b Addressing disease-specific educational needs ^b Patient phoning with own queries ^b Preparation for intra-articular injections done while awake ^b Items sent to adult services ^b <ul style="list-style-type: none"> • Medical summaries^c • Core outcome variables^c Self-advocacy development: <ul style="list-style-type: none"> • Age when independent visit concept introduced^b • Age when independent visits began^b • Age when self-medication discussed^b • Age when self-medicating^b • Age when making own appointments^b • Multidisciplinary involvement^a 	Weak
Sequeira et al ⁵⁸	2015	US	Prospective cohort/pre-post	51 intervention group; 30 control group	Type 1 diabetes	Care coordinator/ preparation for transition, transfer assistance, integration into adult care	Population health: 12-mo HbA1c ↓* Change in HbA1c from baseline to 12 mo ↓* Overall monthly rate of HbA1c change for Hispanic group ↓* 12-mo incidence of severe hypoglycemia ↓* 6-mo A1c ↑ 1-mo global well-being ↑* 24-h global well-being ↑ Diabetes knowledge ↑ Diabetes empowerment ↑ Life satisfaction ↑ Perceived stress ↓ Depression ↑ Utilization/cost: Successful transition (≥1 routine adult visit in study period) among those who transitioned ↑*	Strong
Shaw et al ¹¹	2007	UK	Pre-post	303 parents; 308 adolescents	Juvenile idiopathic arthritis	Care coordinator/ preparation for transition, transfer assistance	Experience: Mind the Gap Scale: <ul style="list-style-type: none"> • Adolescents' satisfaction with transitional care scores ↑* • Parents' satisfaction with transitional care scores ↑* 	Weak
Smith et al ⁵⁹	2011	US	Pre-post	33	Sickle cell	Preparation for transition, integration into adult care	Population health: Sickle Cell Disease Quiz score ↑ Sickle Cell Transfer Questionnaire score ^a	Weak

(continued)

Table II. Continued

Study	Year	Location	Study design	Study population	Condition(s)	Transition intervention(s)	Outcome measures and results	Overall quality assessment ^f
Steinbeck et al ⁶⁰	2015	Australia	Randomized clinical trial	14 intervention group; 12 comparison group	Type 1 diabetes	Care coordinator/ preparation for transition, transfer assistance, integration into adult care	Population health: HbA1c at 1-y follow-up ↑* IFCC mmol/mol at 1-y follow-up ↑* Global self-worth score ↑ Development of new microvascular complications ^a Utilization/cost: ≥1 diabetes-related hospitalization in past 12 mo ↓ Transfer from pediatric to adult diabetes service occurred ↓ Retention in original adult service referred to ↓ Time taken to transfer from pediatric to adult care ↑ Estimated adult diabetes service visits per year ↑	Weak
Van Wallegghem et al ⁶¹	2008	Canada	Pre-post and retrospective cohort	64 intervention group (younger group); 101 comparison group (older group)	Type 1 diabetes	Care coordinator/ preparation for transition, integration into adult care (Maestro Project)	Population health: Long-term DM complications ^a Utilization/cost: DKA hospital admissions ↑ Hypoglycemia hospital admissions ↑ Dropout rate for adult medical care ^a Number of medical visits ^a Number of education visits ^a Experience: Difficulties and frustration with establishing regular follow-up with adult team ^a	Weak
Vidal et al ⁶²	2004	Spain	Pre-post	72	Type 1 diabetes	Preparation for transition, transfer assistance, integration into adult care	Population health: Number of hypoglycemic episodes ↓* HbA1c ↓* Diabetes Knowledge Questionnaire 2 score ↑* Weight ↑* Carbohydrate counting ↑* Self-adjustment of insulin doses: • Basal adjustment (%) ↑* • Preprandial adjustments (%) ↑ Insulin modification: • Rapid-acting/day (IU) ↑ • NPH/day (IU) ↓ Diabetes meal plan: • Carbohydrates ↑ • Proteins ↓ • Fats ↓ Diabetes quality of life: • Social preoccupation ↑ • Satisfaction ↓ • Impact ↔ • Diabetes preoccupation ↔ Total daily insulin dose ^b	Weak

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Table II. Continued

Study	Year	Location	Study design	Study population	Condition(s)	Transition intervention(s)	Outcome measures and results	Overall quality assessment [†]
Weitz et al ⁶³	2015	Switzerland	Retrospective cohort	33 intervention group; 26 comparison group	Kidney transplant	Care coordinator/ preparation for transition, transfer assistance, integration into adult care	Population health: Change in GFR <ul style="list-style-type: none"> • Mean decline in eGFR at 3 y after transfer ↓* • Mean decline in eGFR at 1 y after transfer ↓ Number of acute rejections ↓ Mean systolic blood pressure: <ul style="list-style-type: none"> • Blood pressure at 1 y after transfer ↓ • Blood pressure at 3 y after transfer ↓ Proteinuria, g/mmol: <ul style="list-style-type: none"> • Level at 1 y after transfer ↓ • Level at 3 y after transfer ↓ 	Strong
Wiener et al ⁶⁴	2007	US	Pre-post	51	Human immunodeficiency virus	Preparation for transition, transfer assistance	Population health: Transition readiness score ↑* State/Trait Anxiety Inventory for Adults score ↓* Experience: Transition barriers: <ul style="list-style-type: none"> • Needs a physician in home community ↓* • Lacks knowledge of disease status, name of prescribed medication and dosages ↓* • Needs social worker in home community ↓* • Lacks confidence in home physician ↓ • Needs health insurance ↓ • Lacks funds to cover out-of-pocket expenses ↓ • Need for pharmacy in home community ↓ 	Weak

BMI, body mass index; CHAQ, Childhood Health Assessment Questionnaire; DKA, diabetic ketoacidosis; DM, diabetes mellitus; ED, emergency department; eGFR, estimated glomerular filtration rate; INR, international normalized ratio; NPH, neutral protamine Hagedorn; TRAQ, Transition Readiness Assessment Questionnaire.

Significance was reported as defined in each article (typically $P < .05$ or $< .01$).

[†]Quality assessment of included studies was generated from the EPHPP tool with overall ratings denoted in Table I.

Reporting statistical significance:

↑*Increase and statistically significant result.

↑Increase and not significant result.

↔No change.

↓Decrease and not significant result.

↓*Decrease and statistically significant result.

*No inferential statistics reported for a given outcome.

^bResults were not significant, however, incomplete data provided.

^cResults were statistically significant, however, incomplete data provided.

Reporting effect size for Hilderson et al 2016:

+Small positive effect size.

++Medium positive effect size.

+++Large positive effect size.

-Small negative effect size.

--Medium negative effect size.

---Large negative effect size.

=No effect size.