

BMJ Open Methodology used in comparative studies assessing programmes of transition from paediatrics to adult care programmes: a systematic review

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ABSTRACT

Objective: To explore the methodologies employed in studies assessing transition of care interventions, with the aim of defining goals for the improvement of future studies.

Design: Systematic review of comparative studies assessing transition to adult care interventions for young people with chronic conditions.

Data sources: MEDLINE, EMBASE, ClinicalTrial.gov.

Eligibility criteria for selecting studies: 2 reviewers screened comparative studies with experimental and quasi-experimental designs, published or registered before July 2015. Eligible studies evaluate transition interventions at least in part after transfer to adult care of young people with chronic conditions with at least one outcome assessed quantitatively.

Results: 39 studies were reviewed, 26/39 (67%) published their final results and 13/39 (33%) were in progress. In 9 studies (9/39, 23%) comparisons were made between preintervention and postintervention in a single group. Randomised control groups were used in 9/39 (23%) studies. 2 (2/39, 5%) reported blinding strategies. Use of validated questionnaires was reported in 28% (11/39) of studies. In terms of reporting in published studies 15/26 (58%) did not report age at transfer, and 6/26 (23%) did not report the time of collection of each outcome.

Conclusions: Few evaluative studies exist and their level of methodological quality is variable. The complexity of interventions, multiplicity of outcomes, difficulty of blinding and the small groups of patients have consequences on concluding on the effectiveness of interventions. The evaluation of the transition interventions requires an appropriate and common methodology which will provide access to a better level of evidence. We identified areas for improvement in terms of randomisation, recruitment and external validity, blinding, measurement validity, standardised assessment and reporting. Improvements will increase our capacity to determine effective interventions for transition care.

Strengths and limitations of this study

- This is the first study focusing on the methodological issues of studies assessing transition of care interventions.
- An extensive review of the published literature and new research was achieved.
- Original methodological recommendations were proposed to advance the quality of future research designs.
- Qualitative studies were excluded; studies in progress were included but may not represent the full range of such studies
- A specific risk of bias assessment tool is missing to evaluate the level of bias of non-randomised studies in the field of complex intervention. We discussed the various sources of bias without using a specific tool.

INTRODUCTION

In the course of their care, young people with chronic conditions undergo a transition from paediatric to adult care services. The goal of transition is to ‘maximise lifelong functioning and potential through the provision of high-quality, developmentally appropriate healthcare services that continue uninterrupted as the individual moves from adolescence to adulthood’.¹ It is recommended to plan a longitudinal process to prepare young people to become autonomous, enabling them to assume responsibility for their chronic care management after transfer to adult services.² Dysfunctions in adaptation to adult care have been identified,^{3 4} which lead to significant adverse health consequences through lack of continuity of care or resort to emergency services.^{5 6} Many studies have highlighted these consequences of transition failure for different chronic conditions, such as increased

organ rejection,^{7 8} the rise of glycated haemoglobin in young people with type 1 diabetes mellitus (T1DM)⁹ or the increase of disease activity in chronic rheumatic disease.¹⁰ From the perspective of psychosocial impact, it has been reported that poor metabolic control at transition is associated with higher risk of drop-out and psychosocial morbidity in T1DM,¹¹ and that satisfaction with transitional care is related to social and emotional quality of life (QOL) over time.¹²

In light of these issues, the past 20 years have seen many programmes that attempted to improve the transfer of young people to adult medicine. However, in the absence of a reliable methodology, evidence-based data are rare.^{13 14} Recently, systematic reviews have shown the diversity of transition interventions¹⁵ and the heterogeneity of the criteria¹⁶ used to evaluate them. These are complex interventions, defined as those which include several interacting components, have variable outcomes and present problems for evaluators, in addition to practical and methodological difficulties.¹⁷ In 2011, significant international groups were formed to work on the problems posed by transition, and to make recommendations for interventions,^{2 18–20} while other groups argued for the need for improved assessment.^{21 22} In view of the increasing number of publications on transition interventions we decided to review methodological problems in transition research. Our aim was to look at the methodology used in these studies, and to highlight achievements and areas of focus for efforts to build up a body of literature based on a high level of evidence in the field of healthcare transition.

METHODS

The review is reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement.²³ The systematic review followed the PRISMA guidelines (see online supplementary appendix 1: Completed PRISMA 2009 Checklist).

Literature search: MEDLINE, EMBASE and ClinicalTrials.gov were searched without any language restriction to identify studies published up to the 1 July 2015. The electronic search strategies are described in online supplementary appendix 2. The last update was on 1 July 2015.

Inclusion and non-inclusion criteria: Studies were included if they evaluated a health service intervention involving transition from paediatric to adult care, collected data at least in part after the transfer to adult care and compared outcomes either between an intervention and control group or between preintervention and post-intervention in a single group. We did not include studies with exclusively qualitative assessments.

Study selection: Reports were assessed by two reviewers (ELR and HM), who screened the titles and abstracts to identify relevant studies. Full texts were read when abstracts met inclusion criteria, and when abstracts were not clear enough to ensure eligibility. When full text was

not available online, authors were contacted by email; all the contacted authors responded favourably and shared their articles with us.

Data extraction: A standardised data collection form was developed. The two reviewers independently extracted data from studies and disagreements were resolved by discussion. For each study the following were noted: general information, population, characteristics of study methodology (blind, sample size, comparison group and intervention), data collection, analysis characteristics and results as reported by the authors. Our extraction grid has been developed using the PICOTS (populations, interventions, comparators, outcomes, timing and setting) elements. Studies were classified as 'completed and published' or 'in progress, no final results published' for those registered on ClinicalTrials.gov but without publication yet on PubMed (or solely a protocol publication).

Data definition and analysis: The transition outcomes of each study were categorised into three groups: patients' perspectives (satisfaction with care or with intervention, psychological well-being, health knowledge, self-management, social or relational issues, QOL/perceived health status); healthcare providers' perspectives (clinical and biological data, adherence to medical treatment); policymakers' perspectives (health service usage, cost).

Most components of transition interventions were reported as recorded in articles, but we collected under the generic terms 'AYAC': adolescents and/or young adults clinics; 'transition file': all written summaries or files comprising a set of data about the paediatric history of the young patient (therapeutic, ±educational, ±environmental); 'paramedical transition': a transfer of files between paramedical professionals of paediatric and adult teams; 'joint consultation': a consultation with at least one member of the paediatric team, one member of the adult care team and the young patient. Parents were considered as involved if special attention was addressed to them in the description of the intervention; their mere opinion on decisions about transfer timing was not treated as an involvement in the intervention. Depending on the data reported, we calculated ages of participants at recruitment and age at transfer. If not reported (NR), characteristics of the care structure in which intervention took place (paediatric care only, adult care only or both in the same structure) were checked on the internet. We classified tools used for outcome assessment as 'validated' when an evaluation of their properties was previously published. We considered that there was a statistical evaluation when a difference in outcomes of the interventional group and the comparative group was reported using a statistical test; otherwise it was considered as a qualitative difference. All analyses were carried out with SAS V.9.4 software. Qualitative data were expressed as numbers (percentage) and quantitative data as median (minimum–maximum).

RESULTS

Literature search: The electronic search strategies used identified a total of 2592 references: 106 were selected based on the titles and abstracts. Thirty-nine studies met the inclusion criteria and were selected for the review. The flow diagram is presented in [figure 1](#). Full description of studies included is provided in online supplementary appendix 3.

Study characteristics: Among the 39 included studies: 26/39 (67%) published their final results and 13/39 (33%) were in progress (no final results published yet). Among these 13 studies, 5 (38%) published their protocols or first data in scientific journals, the others were found on the registry database.

Interventions were carried out between 1980 and 2015 (median 2007, NR=6). They mostly began before the last paediatric consultation (26/39, 67%) and were mainly conducted with young people with a single specific chronic disease (32/39, 82%). Evaluation of intervention effect was measured either in the same group before and after the intervention (9/39, 23%) or with one (25/39, 64%) or several comparison groups (5/39, 13%; [table 1](#)).

Evaluation methodology and reporting

Comparison and blinding: In nine studies (23%), a real comparative group was lacking: comparison between preintervention and postintervention in a single group of young people was used. Over time, historical data were most commonly used as a comparison (11/39, 37%). In studies in progress, control groups constituted by individual randomisation of patients are the most used (8/13, 67%). There is no blinding strategy described in complete studies but 2/13 (15%) studies are in progress^{24 25} ([table 1](#)).

Outcomes: Over all periods, 87% (34/39) of studies used several outcomes for intervention assessment. Before 2011 there was no distinction between primary and secondary outcomes.

Criteria reflecting the clinical condition were heavily used to evaluate the effect of transition interventions (27/39, 69%), in one-third of the cases as secondary criteria (9/24, 37%).

Health services usage is a criterion consistently and frequently used (26/39, 67%). Only one study used an assessment of costs as a primary criterion.²⁶

Patients' perspectives outcomes are increasingly considered. Autonomy (6/13, 46%) and QOL (7/13, 64%) particularly emerged in studies in progress. New evaluation criteria relating to social and familial relationships appear in recent studies ([table 2](#)).

Assessment: Among the 23 studies which used questionnaires, 11 (48%) employed at least one validated questionnaire. Four studies (4/39, 10%) reported exclusively qualitative analysis of outcomes ([table 2](#)).

Quality of reporting: In terms of reporting quality, when judged against reporting guidelines^{27 28} there are some gaps in published studies. Fifteen (15/26, 58%) did not report the ages of young people at transfer, and 6/26 (23%) did not mention the time of collection of at least one outcome. Of the 12 studies which included a transition coordinator, 3 (25%) did not specify his or her educational background or profession.

Intervention methodology

Intervention characteristics: In all studies completed or in progress, the most common components of interventions are education (20/39, 51%) and presence of a transition coordinator (16/39, 41%).

Study population: Most studies focused on a unique chronic disease (32/39, 82%) which was mainly T1DM (15/39, 38%). Several studies in progress concerned a set of pathologies (4/13, 31%), and one study was evaluating an intervention dedicated to all types of chronic illness or cognitive disabilities.²⁹

Regarding non-inclusion criteria, 7 studies (7/39, 18%) did not include young people with intellectual

Figure 1 Flow chart of the literature reviewing process.

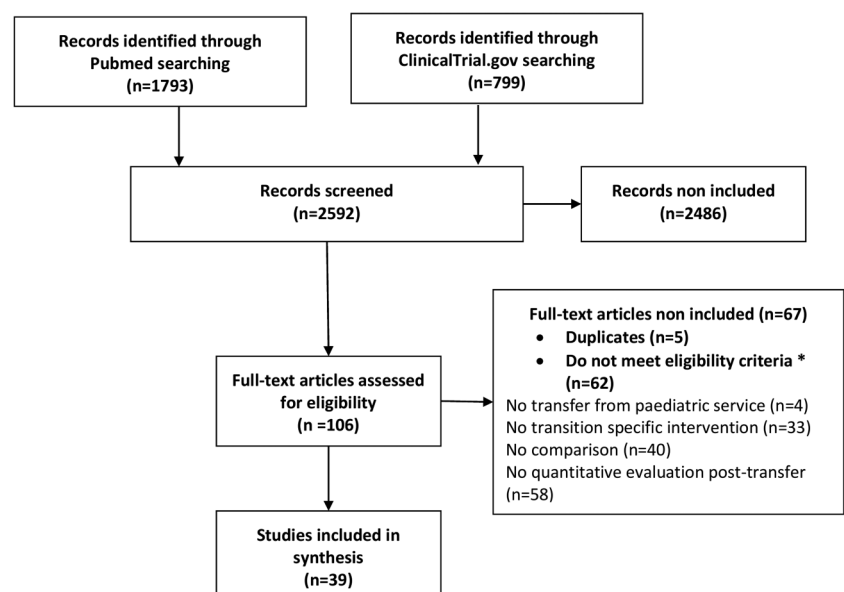


Table 1 Summary characteristics of the 39 included studies

	Global N=39		Studies with published results n=26		Studies in progress n=13		
	Number	(%)	NR	Number	(%)	Number	(%)
Study diffusion							
Registry database only	8	(20)	0	0	(0)	8	(61)
Journals	31	(79)	26	26	(100)	5	(38)
Specialist medical journals	16	(51)	15	15	(58)	1	(3)
Paediatric and adolescent medical journals	12	(39)	10	10	(38)	2	(5)
General medical journals	3	(10)	1	1	(4)	2	(5)
Eligible diseases							
Unique	32	(82)	23	23	(88)	9	(69)
Set of conditions	7	(18)	3	3	(12)	4	(31)
Time of intervention			1				
Before the last paediatric consultation	26	(68)	17	17	(65)	9	(69)
Between the last paediatric and the first adult consultation	11	(29)	9	9	(35)	2	(15)
After the first adult consultation	1	(3)	0	0	(0)	1	(8)
Data collection of interventional group			1				
Retrospective	14	(36)	13	13	(50)	1	(8)
Prospective	25	(64)	13	13	(50)	11	(85)
Number of comparison groups by study							
0 (precomparison/postcomparison in a single group)	9	(23)	7	7	(27)	2	(15)
1	25	(64)	16	16	(61)	9	(69)
>1	5	(13)	3	3	(11)	2	(15)
Type of comparison group (n=30)*							
Historical group	11	(37)	10	10	(38)	1	(9)
Randomised group	9	(30)	1	1	(4)	8	(73)
Non-participants group	5	(17)	5	5	(19)	0	(0)
Contemporary data from another service/center/care setting	5	(17)	3	3	(11)	2	(18)
Non-randomised parallel group	1	(3)	0	0	(0)	1	(9)
Mixed data of historical cohort and non-participants group	1	(3)	1	1	(4)	0	(0)
Blinding strategy	2	(5)	0	0	(0)	2	(15)
Control in randomised studies (n=9)							
Usual care	6	(67)	1	1	(4)	5	(62)
Other intervention	3	(33)	0	0	(0)	3	(38)
	Median	(Minimum–maximum)	NR	Median	(Minimum–maximum)	Median	(Minimum–maximum)
Size of intervention group or recruitment target (studies in progress)	41	(11–215)	42	42	(11–215)	33	(14–105)
Number of outcomes	4	(1–12)	3	3	(1–7)	6	(1–12)
Time of last data collection after transfer (months)	12	(3–96)	3	12	(3–96)	12	(3–24)

*The fact that the sum of comparison is higher than total number of studies is explained by the possibility for studies to have more than one comparison group.
NR, not reported.

disability^{30–36} and 2/39 (5%) did not include those with comorbidities.^{33–37} One study did not include patients known to be non-adherent³³ and one excluded those with condition(s) which in the opinion of the investigator might interfere with the ability to participate in the study.²⁴

Persons involved: The involvement of families is reported in 11/26 (42%) of published studies and in

2/13 (15%) of ongoing studies (table 3). The participation in interventions by adult teams is reported in 23/39 (59%).

DISCUSSION

This review shows that there has been relatively little assessment of transition interventions, with only 39

Table 2 Description of outcomes in the 39 included studies

Outcomes*	Global N=39		Studies with published results n=26		Studies in progress n=13	
	Number	(%)	Number	(%)	Number	(%)
Single outcome	5	(13)	4	(15)	1	(8)
Several outcomes	34	(87)	22	(85)	12	(92)
Distinction between primary and secondary	14	(41)	4	(15)	10	(83)
At least one health providers perspectives outcome†	28	(72)	20	(77)	8	(61)
Clinical and biological data	27	(96)	19	(73)	8	(100)
Medical treatment adherence	6	(21)	2	(8)	4	(50)
At least one policymaker's perspectives outcome†	26	(67)	17	(65)	9	(69)
Health service usage	25	(96)	16	(61)	9	(100)
Cost	1	(4)	1	(4)	0	(0)
At least one patients perspectives outcome†	27	(69)	16	(61)	11	(85)
Satisfaction	19	(70)	13	(50)	6	(54)
Psychological state	10	(37)	7	(27)	3	(27)
Condition and care knowledge	8	(30)	3	(11)	5	(45)
Quality of life	11	(41)	4	(15)	7	(64)
Autonomy/self-management	9	(33)	3	(11)	6	(54)
Familial and social issues	5	(18)	0	(0)	5	(45)
Collection method for patients perspectives outcome†						
Qualitative (interview)	3	(8)	3	(11)	0	
Quantitative (questionnaires)	23	(59)	14	(54)	9	(69)
Validated tools	11	(28)	5	(19)	6	(46)
NR	2	(5)			2	(15)
Statistical assessment	12	(46)	12	(46)	–	–

*In this table, there is no distinction between primary and secondary criteria.

†The fact that the sum of different outcome types is higher than total number in each category is explained by the possibility for studies to report more than one outcome by category.

NR, not reported.

Table 3 Description of the type of transfer and reported persons involved in the 39 included studies

	Global N=39		Studies with published results n=26		Studies in progress n=13	
	Number	(%)	Number	(%)	Number	(%)
Type of transfer *						
In the same centre	20	(51)	16	(61)	4	(29)
Between 2 centres	23	(59)	14	(54)	9	(64)
NR	1				1	(7)
Reported persons involved						
At least one medical doctor (from paediatric or adult care)	26	(67)	21	(81)	5	(38)
At least one paramedical/social professional (from paediatric or adult care)	28	(72)	20	(77)	8	(61)
At least one paediatric care professional†	28	(72)	20	(77)	8	(62)
Medical team	22	(56)	17	(65)	5	(38)
Paramedical/social team	22	(56)	15	(58)	7	(54)
At least one adult care professional†	26	(67)	21	(81)	5	(38)
Medical team	23	(59)	19	(73)	4	(31)
Paramedical/ social team	16	(41)	14	(54)	2	(15)
Paediatric and adults teams together	20	(51)	16	(61)	4	(31)
Family of the young people	9	(23)	7	(27)	2	(15)
External persons‡	3	(8)	1	(4)	2	(15)

*In one study in progress and four studies with published results the two types of transfer are planned.

†The fact that the sum of professionals involved is higher than total number of studies is explained by the possibility for studies to involve both medical and paramedical teams in their intervention.

‡See online supplementary appendix 3 for more details.

NR, not reported.

comparative studies in the whole review period. Overall, there is room for improvement in methodological quality and reporting, to enhance the reliability and value of studies and to determine which interventions are really effective. However, evidence-based assessment in the field of transition interventions faces a number of difficulties which go some way towards explaining the methodological weaknesses of these studies. All complex interventions pose substantial challenges to investigators,³⁸ and only a small number of academic research teams work on transition issues. Consequently, methodological progress in evaluation over the review period (including the use of validated measurement tools, the choice of an unbiased comparator or the choice of an adapted evaluation design) has been relatively slow when compared with advances in transition care approaches.³⁹ From the results of this review we have identified six areas for possible future improvement and related proposals (table 4).

The possible actions which we propose are general actions: using randomisation, calculation of a realistic sample size, the use of blind evaluation, validated questionnaires, standardised outcomes, an adapted reporting grid.

Some of the problems about transition evaluation are common to all paediatric research such as the recruitment problems due to the small number of eligible patients. But some are more specific to transition intervention and other complex intervention: the lack of standardisation of usual care; the absence of consensus on the main outcomes that we have to evaluate, the absence of consensus on how we have to evaluate these outcomes (which tool, at what point in time...), the choice of an adapted evaluation design, the difficulty to perform the blind trial.

Methodological implications for future studies

Users' involvement: Actively involving young people and their perspectives in transition's research can help in the ethical design and conduct of research. Thus, the research and intervention are more relevant, useful and beneficial to the patients. It may also help to define what is of high priority and acceptable to participants; improve the process of informed consent; improve the experience of participating in research; and improve the communication of findings to participants.^{45 46}

Recruitment: Conducting studies in the field of paediatric clinical research is challenging due to the small number of patients in the area of transition studies. Participant recruitment is well known to be a limiting factor in the realisation of high-quality randomised controlled trials (RCTs).⁴⁷ The inclusion of a sufficient number of patients is not always possible, particularly in the field of transition. Thus, a better adapted methodological approach is needed for intervention assessment that includes a basis on reasonable and relevant hypothesis that allow a realistic sample size to conclude. The

choice of a quantitative criterion, ideally one proposed by the consensus study,⁴⁸ reduces the number of participants required.

For example, 264 patients are required if the calculation is made on the assumption of a decrease in the proportion lost to follow-up (binary criterion) from 15% to 5% (with $\alpha=5\%$, $1-\beta=80\%$) while 72 patients are required if the calculation is made on the assumption of an increase in the transition satisfaction score (quantitative criterion) from 7/10 to 9/10 (with $SD=3$).

An alternative solution for investigators could be to broaden the recruitment to achieve the required number. A possible solution to insufficient recruitment—due to the low numbers of young people in transition in each medical specialty—could be to provide interventions targeting groups of young people suffering from various chronic diseases. Our review found that intervention programmes are in fact generally non-specific, which leads us to suggest that a pooling of resources and interventions could be beneficial. Similarly, about one in five studies excluded young people with intellectual disabilities: restrictive inclusion criteria tending to retain the 'good performers' should be avoided to ensure the external validity of the study.⁴⁹ Last but not least, the possibility to carry out multicentre RCTs should be considered.

Control groups: Only a quarter of the studies reviewed were RCTs. The use of historical comparison groups was the most common method. It may introduce bias, and the results must be interpreted with caution.⁵⁰ There is no guarantee that the historical group is comparable to present patients: service recruitment and medical conditions may have changed over time. Moreover, care may have evolved, particularly in the transition field where healthcare teams are increasingly aware and informed.³⁹ Among RCTs, two-thirds involved were non-active groups. In regard to recommendations published over the two last decades, the control group should benefit from the following usual care for transition: ongoing information throughout the care pathway, inclusion of the family, consideration of developmental aspects, proposal of specific education and resources, coordination with primary care, time of transfer adapted to the individual level.⁵¹

Blinding: Only two studies reported the use of blinding strategies. One reported the blinding of analysts and outcome assessors,²⁴ and one planned the blinding of participants in the context of a phone and computer-based intervention.²⁵ Other studies were open-label design. The nature of the interventions often makes it impossible to blind participants or personnel; however, assessors of at least some outcomes may be blinded. In the absence of a blinding strategy for patients, patient-reported outcomes will inevitably be collected with knowledge of the intervention received, but outcomes like clinical or physiological aspects may be measured by an independent outcome assessor to fulfil quality requirements²⁷ and avoid detection bias.⁵²

Table 4 Areas of methodology improvement in transition intervention evaluation

Area for improvement	Possible actions	Need for additional research
User's involvement	Actively involving young people and their perspectives in transition's research can help in the ethical design and conduct of research by making it more relevant and beneficial to the patients	
Control groups and design	Using randomisation is the most reliable method to ensure a fair comparison between groups. If a conventional parallel group randomised trial is not appropriate, other randomised designs such as cluster randomised trials, stepped wedge designs or preference trials and randomised consent designs should be considered. Studies should respect the concept of equipoise. Thus, it is advisable to propose to the comparison group a control transition procedure based on global recommendations as standard of care. If randomisation is not possible, quasiexperimental or observational designs may be considered but the conditions under which observational methods can yield reliable estimates of effect are limited. Measures to take bias into consideration must be developed. The use of a mixed-methods design (that includes both quantitative and qualitative approaches) is advocated in the evaluation of complex interventions such as transition programmes. ⁴⁰ Nowadays it concerns only a small number of studies.	Standardise the standard of care to ensure a degree of homogeneity in control groups taking over
Sample size and external validity	Calculate a sample size based on realistic and clinically useful assumptions. The estimation of the intervention effect should be relied on the existing literature. To achieve the target sample size and ensure external validity studied interventions should be applicable to young people with various chronic diseases; restrictive inclusion criteria favouring selection of 'good performers', should be avoided. The possibility to carry out multicentre studies should be considered.	Study the transition-specific adjustment factors that have to be taken into account in the implementation and assessment of multicentre studies
Blinding	Blinding of outcome assessors or choice of independent assessors should be considered systematically for appropriate outcomes. The reason for choosing open-label design and its potential effect of assessment bias on the results should be discussed.	
Measurement validity	Search of existing validated questionnaires for criteria assessment should be performed before starting the study. Conception and use of new ones for a protocol should be subject to a validation study in parallel. To allow interstudies comparison the assessments by generic and commonly used questionnaires is relevant. ^{41 42}	Define consensual criteria and methodologies to identify and assess the success of the transition interventions Validate a generic questionnaire that measures transition satisfaction ⁴³
Standardised assessment	Research on standardisation of outcomes and methods for data collection should be pursued. Outcomes relevant to patients and measures of importance to the health system, including costs must be evaluated, regarding the timing of data collection; evaluation at 36 months after the transfer has to be considered.	Develop a methodology to use administrative databases for transition assessments
Interpretation of the effects	Refer to the key elements of the Medical Research Council on developing and evaluating complex interventions, particularly on process evaluation that allows a better understanding of the observed effects. ^{17 44} The effects should be interpreted taking into account not only the theoretical efficacy of the intervention itself but also contextual factors that may affect implementation, intervention mechanisms and outcomes.	Identify specific elements of the transition programmes' evaluation that can impact an intervention—apart from the effectiveness of the programme itself—and that should be taken into account when developing the efficacy study and interpreting the results of its evaluation
Reporting	Transition interventions should respect the specific set of criteria that has been developed to ensure high-quality reporting of studies. ^{27 28} This allows the good interpretation and replication of complex interventions.	

Measurement validity: Among studies using questionnaires, half of them used validated questionnaires. The remaining studies used non-validated questionnaires, whose content is generally not described. In designing new studies, we would advise research of existing validated tools for assessment, and that the use of existing, pertinent and valid tools should be preferred. Design and use of new measurement tools need to be accompanied by validation studies to ensure valid, precise and reproducible measures.⁵³ Furthermore, to allow interstudies comparison the use of non-disease-specific questionnaires will be relevant. The Transition Readiness Assessment Questionnaire (TRAQ), best-validated transition-readiness tool,^{42 54} which measures the independence in transition-relevant skills and the 36-item Short Form Health Survey (SF-36) which was found to be useful in differentiating the global health benefits produced by a wide range of different treatments⁴¹ can be considered to assess the independence and QOL criteria. Unfortunately, there is currently no generic validated questionnaire that measures transfer to adult healthcare satisfaction.⁴³

Standardised assessment: Transition interventions are complex with various components at different levels. Here a median number of four outcomes are used to assess the effects of interventions. Cost is used as an end point in only one study. However, as it is a complex intervention, investigators should systematically include economic measures, in addition to outcomes relevant to patients and to the health system.⁵⁵ Cost assessment is crucial to gauge effectiveness and feasibility on a large scale.

Among the studies we reviewed, outcomes were multiple and varied thus, comparison between studies was not conducive. The international consensus study identified one indicator that was considered as essential and a very important indicator to assess transition success.⁴⁸ There should be a shared reflection on standardised methodologies of assessment, including the best timing of data collection. In the studies reviewed, the time of data collection after transfer of patients, varies between 3 and 96 months. This illustrates that standardised assessment criteria alone will not solve the problem of comparison if methods of data collection are not the same. Attendance at an adult care clinic should be a starting point given that it has been identified as consensual,⁴⁸ but the timing or frequency of data collection and the exact nature of what is being measured (at least one adult consultation, any missed consultation, number of months elapsed since the last visit in specialised care or any structure of care) remains to be determined. Among the historic recommendations on transition assessment, Blum stated that the research should follow patients for sufficient time (3–5 years) to account for the variation in natural history among their conditions. For reasons of feasibility and costs, assessments at 3 years appear to be relevant. Finally the use of administrative databases for transition assessments must be considered

since it enables the access of data regularly updated, with no additional costs of collection, in addition to the capture of individuals who may not respond to surveys and the potential linkage with other data sets.⁵⁶

Effects interpretation: The transition period between childhood and adulthood involves many rapid changes in physical, emotional, mental, psychological, social and cognitive terms. Emerging adults with chronic disease also have to assume increasingly full responsibility for disease management. The transitioning youth's developmental and functional abilities may influence the transition's success.² These may complicate the evaluation of transition programme. These changes may act as a third factor linked both to intervention and outcome and can skew the cause–effect relation. This is why the use of a randomised controlled group is particularly relevant. Random allocation ensures no systematic differences between intervention groups in factors that may affect outcome. Thus, only the effect of intervention explains the differences observed.⁵⁷ As complex interventions, transition programmes' effects have to be interpreted in regard to some specific factors as it has been mainly described in the guidance of the Medical Research Council (MRC).⁴⁴ The observed effects should be interpreted taking into account the theoretical efficacy of the intervention itself as well as contextual factors that may affect implementation, intervention mechanisms and outcomes. In fact, transition interventions are not only complex interventions they take place in a period of developmental changes as well as structural care-related changes that are important contextual factors. Lack of effect may reflect implementation failure rather than genuine ineffectiveness; a thorough process evaluation is needed to identify implementation problems. The MRC recommends the realisation of a pilot study to examine the key uncertainties that have been identified during development that may impact on the effects obtained in the following efficacy study (including questions of acceptability, compliance, delivery of the intervention, recruitment and retention, expected effect sizes).¹⁷ When interpreting the results of the transition programme it is necessary to take into account possible implementation failure, variability in individual level that may reflect higher level processes, the choice of the primary outcome that may not make best use of the data, the strict standardisation of the intervention that may be not adapted to each local settings.

Reporting: As noted in the Template for Intervention Description and Replication (TIDieR) checklist,⁵⁸ description of an intervention involves more than providing a label or an 'ingredients list'; all the key features can influence efficacy and replicability. For complex interventions, providing details for each component of the intervention is a minimum requirement to enable other researchers to replicate the intervention or to build on research findings. For this purpose, a specific set of criteria has been developed to ensure high-quality reporting of studies for the development and evaluation

of complex interventions.²⁸ In contrast it has also been reported that in non-pharmacological interventions⁵⁹ and complex interventions,³⁸ the completeness of intervention information is often insufficient.

Indeed, if we refer to guidelines^{27 28 58} for complete reporting of diverse study designs, the transition studies included in our research have some gaps. All four elements—population, intervention, comparison and outcomes—show specific areas for possible improvement. For instance, in terms of population, age at transfer of the populations studied is rarely reported, although this characteristic is a key element of population description in the context of transition intervention.^{60 61} Concerning the intervention, it is important to clarify, for example, what is the educational background of the transition coordinator and what materials are used during education sessions of the intervention or if it was provided individually or in a group. ‘The usual care must also be described with a high level of detail. For example, authors should explain the content of the therapeutic education programme delivered in usual care, which varies greatly between different teams, and potentially has an impact on the preparation of youth during the transition’. Regarding the comparator, it is important to describe the context in which the transition took place when the comparison involves a historical group or another centre, and particularly the differences in terms of handover and structure. Furthermore, the modalities of transition for control groups receiving ‘usual care’ must be explicitly described. In complex interventions, the standard practice used as a control can be as complex as the intervention, and may change with time.⁵⁵ Concerning outcomes, it is necessary to specify the timing of data collection, its frequency and the period between data collection and intervention or between data collection and transfer. In addition to the tools or technologies used, the mode of questionnaire administration has to be specified, knowing that variations in the results may result from the collection method.⁶²

Finally, we need to consider that such interventional research should be replicated. Tools have been designed to identify the key domains and factors that facilitate implementation of complex health interventions,^{63 64} and these could be used in approaching the possible dissemination of the evaluated intervention on a large scale, as was done in the transition programme Ready Steady Go.⁶⁵

Strengths and limitations

To the best of our knowledge, this is the first study focusing on the methodological issues used in transition interventions that examines the uptake of key recommendations in the field of transition. One of the strengths of this study is the extensive research of the literature in multiple databases and the inclusion of studies in progress. For some of the published studies, data were not available; this enabled us to observe

reporting quality, but we have not contacted the authors to retrieve missing data.

We did not focus extensively on existing information which exist in guidelines and checklists developed in the field of complex interventions. It is however necessary that investigators wishing to develop or evaluate a transition action go beyond the references we cited in this review and applied appropriate existing recommendations.

We excluded qualitative assessment studies while quantitative studies are only part of the whole works of assessment transition programmes. We did not analyse the methodologies used and specific challenges of qualitative research evaluation. This remains to be done since the qualitative research can add value, for example, by providing more insightful and illuminating ways of understanding phenomena and the ways in which they can best be managed.

We selected solely those studies that had at least one part of their assessment of outcomes after transfer. This allows us to focus on studies that evaluate of the whole transition process. The whole process includes the preparation of transition which happens in paediatrics before transfer—and which is undoubtedly a very important part of the process—as well as transfer and the after transfer periods.⁶ To have access to the methodologies used in the most recent studies, we extended our search to an online trial registry. We used a single register. Regarding the exhaustiveness of protocols found, the International Committee of Medical Journal Editors (ICMJE) requires and recommends that all medical journal editors require registration of clinical trials in a public trials registry at or before the time of first patient enrolment as a condition of consideration for publication. One limitation is that this search is more specific to the trials than to quasiexperimental designs that could be eligible for this review. Protocols found with the register search are perhaps not representative of the whole comparative studies currently underway in the field of transition, with a possible over-representation of experimental trials.

We did not undertake an assessment of the risk of bias in RCTs, since most of these are in progress and methodological characteristics (details on randomisation or blinding procedures, intention to treat, and analysis plan) were not systematically described in the online registry. We conducted a bias evaluation without the use of a specific tool; however, we discussed the various sources of bias that we identified during the review. A specific risk of bias assessment tool is missing to evaluate the level of bias of non-randomised studies in the field of complex intervention.

CONCLUSION

Our study highlights the fact that few evaluative studies exist in the area of transition (26 published, 11 in progress) and few are randomised, even among studies in

progress. This has consequences for the strength of evidence but can be explained in part by the complexity of studies of multifaceted interventions, with multiple stakeholders, multiple outcomes, difficult blinding, and in the context of paediatrics, low numbers. We have identified areas which still need improvement in terms of randomisation, recruitment and external validity, blinding, measurement validity, and standardised assessment and reporting (table 4). Some improvements could be implemented now on the basis of what is already known, and others require additional methodological research. Improvement of the methodology used for unbiased studies and the standardisation of measures are important for enabling interstudy comparisons to determine the most effective interventions.

Contributors ELR conceptualised and designed the study, designed the data collection instruments, collected data, carried out the initial analyses, drafted the initial manuscript, revised the manuscript and approved the final manuscript as submitted. HM collected data, participated in the interpretation of the data, revised the manuscript and approved the final manuscript as submitted. RB and CA provided methodological advices, interpretation of data, critically reviewed the manuscript and approved the final manuscript as submitted. SG-C, PJ and SG provided interpretation of data, critically reviewed the manuscript and approved the final manuscript as submitted. CA and ELR are the guarantors for the study.

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