A mechanistic approach to developing effective, acceptable, and accessible psychological therapies for young people and emerging adults

Abstract

Three-quarters of all mental health problems start before the age of 24 and yet outcomes from standard psychological therapies such as CBT are poorer for this age group compared to working age and older adults. More effective, acceptable, and accessible psychological interventions are needed during this period of peak onset. They offer the potential to change the longer-term trajectory for young people. A key challenge is how best to develop these treatments. In this paper we set out ten steps to facilitate translational treatment development that focuses on understanding and targeting psychological mechanisms. Each step is informed by theoretical underpinning, as well as consideration of the developmental context, and perspectives of young people, families, and key stakeholders. We introduce a public digital resource (https://aim.mhid.org.uk) which includes a searchable library of measures of psychological mechanisms, intended to encourage sharing of best practice and continued innovation.

Key Words

Young people; adolescent; mental health; psychological intervention; psychological mechanism; treatment development

Introduction

Adolescence[1] (Sawyer et al., 2018)—a period of significant physical, psychological, and social transition—is a particularly vulnerable time for the onset of mental health problems (MHPs). Approximately three-quarters of all MHPs begin before the age of 24 (Kessler et al., 2005). Anxiety and related disorders typically emerge between ages 7 and 15, while depression (peak age of onset: 19.5 years) and schizophrenia spectrum disorders (peak onset: 20.5 years) tend to appear later in adolescence and early adulthood (Solmi et al., 2022). Importantly, most severe mental health problems do not begin *de novo*, but are preceded by earlier difficulties—such as subclinical symptoms and anxiety or depressive disorders (Cross et al., 2017; Iorfino et al., 2019). Amid this picture of increasing risk, adolescence and early adulthood is also potentially a window of opportunity, when delivery of targeted interventions may be particularly impactful (McGorry et al., 2022) and powerful due to the inherent plasticity of this period (Sisk & Gee, 2022).

Early and effective intervention[2] is key to improving long-term prognosis and mitigating the enduring effects of these conditions throughout life. Psychological therapy, particularly cognitive behavioural therapy (CBT), is the recommended first line intervention for a broad range of MHPs in young people (YP) (Weisz et al., 2017). However, meta-analyses and large cohort designs indicate that CBT outcomes are poorer for YP compared to working age and older adults in the treatment of anxiety and depressive disorders (Barry et al., 2018; Cuijpers et al., 2016; Saunders et al., 2025). These age-related differences are likely to reflect a combination of factors, including methodological differences between studies with younger and older participants, and service-level factors such as greater barriers to engagement for YP, who tend to have higher rates of cancelled sessions and drop-outs. Beyond these factors, it is also possible that existing treatments are inherently less effective for YP. This possibility raises the question of whether treatment efficacy could be improved by modifying intervention content. One approach is to develop interventions that are developmentally informed, rather than extending treatments developed for pre-adolescents or adults without meaningful adaptation.

There have been significant strides in treatment outcomes for adult MHPs in the last few decades. Notable examples of this include cognitive therapy for social anxiety disorder, PTSD, panic disorder, and paranoia and positive affect treatment for anxiety and depression. These advances have been driven, in part, by the mechanistic lens – taken to treatment development, as exemplified by David M Clark, Anke Ehlers, Daniel Freeman, Michelle Craske and colleagues (Clark, 2004; Craske et al., 2024; Ehlers et al., 2005; Freeman, 2024). We use a narrow definition of the term ‘mechanism’ here, to refer specifically to psychological

[1] 10-24 years: the focus of this paper and referred to as ‘adolescents’ and ‘young people’ interchangeably.

[2] Intervention: we use this term to refer to *psychological* therapies specifically which may be prevention, secondary prevention, treatment, continuation therapy, or relapse prevention.

mechanisms; cognitive and behavioural processes that are amenable to modification. This mechanistic approach is now being applied in treatment development for young people. However, as study findings tend to be reported separately, the underlying strategy can be opaque. In response, we describe a translational pathway for psychological treatment innovation for young people that is theoretically embedded, developmentally sensitive, and systematic. We provide a public digital resource to support researchers in applying this translational approach to improve outcomes for young people (https://aim.mhid.org.uk). It is intended as a complement to broader frameworks such as the Medical Research Council Complex Intervention Framework (Skivington et al., 2021).

In this paper, we detail Ten Steps in the process of translational development – from identifying the treatment gap to implementing new psychological interventions (see Table 1 for an outline of the pathway). Within this process we are focused on developing psychological interventions to target cognitive and behavioural mechanisms, such as attentional bias, safety-seeking behaviours, mental imagery. The mechanistic focus detailed here enables precision in development. When selecting which mechanisms to target, we often consider those that are common, potentially tractable, and important to the young person. There will be other influences that are also important, such as biological factors, but these are beyond the scope of this paper because they are not the target of psychological intervention. Throughout this translational development process there are foundational principles (which we term keystones) that inform each step: the developmental context; the voices of young people, families, and stakeholders; and the conceptual and theoretical understanding. Further to this, there are important and explicit values underpinning this work – hope, respect, valuing the person and their perspective. This influences the treatment focus and style, as well as the conduct of the research. The translational development process is typically iterative, rather than linear or prescriptive. The different steps can each be important and impactful at different moments in treatment development – though it may not be necessary to complete them all. A further principle underpinning all research on the pathway is replicability. Psychological science has faced a reproducibility challenge in recent years that has undermined confidence in findings. Transparent research practices and open science offer part of the solution to this problem. This includes registration of study protocols, pre-specification of statistical analysis plans, and ensuring code and anonymized datasets are accessible.

Three Keystones

There are three keystones that underpin all Ten Steps of intervention development (see Figure 1). These are the foundational elements that support and connect the other components.

Keystone 1: Developmental Context

Adolescence is characterised by significant biological, psychological, and social changes (Blakemore, 2008). Biologically, this includes the onset of puberty and ongoing brain maturation. Cognitively, adolescents develop more advanced capacities for abstract thinking, reasoning, and self-reflection. Emotionally and socially, there is increased sensitivity to peer evaluation and a shift towards greater reliance on peer relationships. Adolescence is also a critical period for identity formation and the development of autonomy from caregivers.

Research examining mechanisms underlying mental health difficulties in adolescence need to be situated within this developmental context. This is for two main reasons.

First, developmental changes in biological, cognitive, emotional, and social domains shape the psychological mechanisms of interest (Pfeifer & Allen, 2021). This means that we are often aiming at a moving target. For example, affective control measured using a behavioural task is associated with mental health difficulties, but this association varies as a function of age, with a stronger association in early compared to late adolescence (Schweizer et al., 2020). In depression, the gender difference in prevalence rates that emerges in early adolescence can be explained in part by the greater tendency of girls to ruminate compared to boys and may be linked to hormonal changes occurring at this time (Johnson & Whisman, 2013).

Second, there are certain factors that are specific to adolescence and emerging adulthood that are relevant to the persistence of MHPs to be accounted for in intervention development. Key influences include family dynamics, peer relationships, educational settings (such as schools, colleges, and universities), and major life transitions. Societal and cultural changes also shape the experience of adolescence—for example, the increasing recognition that adolescence may extend into the mid-20s (Sawyer et al., 2018) in part due to prolonged education and delayed independence. These factors interact with individual-level mechanisms to influence risk, resilience, and the effectiveness of interventions; it is therefore important we take account of these when researching mechanisms and developing targeted interventions.

Measuring development in adolescence is not a trivial problem. Age is often used as a proxy for developmental stage offering utility in large survey studies, but this approach has limitations. Development does not progress in a uniform, stage-like manner, and age alone may not capture relevant variation. However, the alternatives are not straightforward either. Some have used measures of pubertal development, such as the Tanner scale, but this brings issues around acceptability given the sensitive nature of the questions, especially in large community-based surveys. Another possibility is to assess the cognitive/emotional facet(s) thought to influence the mechanism of interest, for example, measuring susceptibility to peer influence to understand risk taking behaviour in the context of MHPs. We encourage consideration of these challenges when

undertaking this work and renewed efforts to sensitively measure adolescent development. A further point to note is that the analytic approaches of many studies do not reflect possible trajectories of change. To examine associations between developmental processes and mental health, researchers often compare age groups or test for linear associations with age. However, such associations are frequently non-linear, requiring more nuanced analytic approaches.

Keystone 2: Voices of Young People, Families and Stakeholders
The involvement of young people, families, teachers, health professionals, and service providers helps to ensure that treatments are acceptable, effective, and accessible. There are benefits to including stakeholders in research, such as increased relevance of topics and findings, improved research outcomes and culture, and empowerment and upskilling of youth advisors. Such involvement can take many forms and should allow for flexibility, fluidity of roles, and shared decision-making within the research team (Prebeg et al., 2023). A range of resources and digital tools are available to support meaningful engagement, from advisory participation to co-production and peer-led research. Examples include digital platforms such as VoiceIn (https://voicein.org/welcome) (Branitsky et al., 2024) and networks such as the Parent-Carer Research Network (https://mhid.org.uk/parent-carer-research-network/). The GRIPP2 reporting guidelines provide a framework to transparently document stakeholder participation in research (Staniszewska et al., 2017).

Issues of equality, diversity, and inclusion are central: without adequate representation during treatment development and evaluation, interventions risk being ineffective or inaccessible, particularly for those facing intersectional disadvantages, multiple co-occurring difficulties, or systemic barriers. Certain research practices, such as parental consent procedures in schools-based research, have the potential to embed systemic bias. Further to this, some young people will not currently be attending school or will be in special education needs settings. There are other potential barriers to generalisability such as the predominance of research based on WEIRD samples, which are critical to consider. Efforts should be made to include groups minoritised by ethnicity, socioeconomic status, gender identity, sexuality, and other intersecting characteristics in activities throughout the treatment innovation pathway, and the SOCIAL GRACES framework (Burnham, 2012) may be a useful organising tool for this discussion. Careful and inclusive engagement at every stage—from conceptualisation and design to conduct and interpretation—is therefore required to ensure that treatments adequately meet the needs of young people and families.

Keystone 3: Conceptual and Theoretical Understanding
In order to target mechanisms, we need a plausible explanation of how the mechanism leads to the difficulty. This is the process of forming a psychological understanding of the problem. It requires the application, and likely development, of underpinning psychological theories to make sense of the problem and causal mechanisms, potentially facilitated by a

logic model. This is then used to drive treatment development by testing the hypothesised model. Research studies using the Ten Steps are informed and motivated by these theory-driven hypotheses and the findings feed back into the theory and conceptualization in an iterative manner.

The conceptualisation may be new, may draw on existing models, theories, and frameworks, or may be an adaptation of existing approaches. New developments should be grounded in a thorough synthesis of existing work in the area (e.g., published empirical studies, theoretical models, and prior intervention frameworks), potentially undertaken with systematic reviews, scoping reviews, and meta-analyses. Theories from across the lifespan can be relevant, though attention to developmental context (Keystone 1) is essential. To initiate this process, broad psychological principles can be applied to a specific clinical observation. This initial understanding can then be expanded to patterns across individuals and linked to broader thinking and behaviour. Visualisation can support the articulation of hypothesised causal processes.

It is clear from first-person accounts that young people often face multiple, co-occurring problems (Keystone 2). Often there is diagnostic uncertainty both in the immediate presentation and in the longer-term trajectory (e.g., Polari et al. (2018)). There are likely many interrelated contributory causal factors. Mapping these relationships is useful to understand causal dynamics and highlight potential treatment targets. By testing and refining theoretical models, greater precision in the articulation of the problem and mechanisms can be achieved, leading to more rigorous treatment development and a higher likelihood of positive outcomes.

A Ten Step Process

Published guidelines and resources for each step, where available, are presented in Table 1.

Step 1: Listen carefully
The first step in treatment development is identifying the psychological process of interest. There are various sources of information which may guide this, including animal models of behaviour and translational neuroscience; here, we focus on the clinical process. The need for innovation often becomes clear when there are challenges in treatment. These may be difficulties in treatment acceptability, outcome, or access, for example, treatments that do not address the specific developmental context of YP (Keystone 1), or that too few YP are able to access. These clinical challenges often spark the research process.

To generate a focus for treatment development it is helpful to synthesise clinical observations with the existing literature. Clinical reflections, recordings of therapy sessions, supervision discussions, and

questionnaires can all produce meaningful insights. They can help us to listen carefully to the key stakeholders (Keystone 2) and give clues to the potential mechanisms at play. Existing theories and models can be applied to try to make sense of the difficulty, resulting in a preliminary conceptualisation (Keystone 3) to further develop and test. This process can also help generate hypotheses about how mechanistic processes might overlap, interact with developmental processes (Keystone 1), or contribute to more severe difficulties. Therefore, clinical insights and close attention to the phenomena young people experience can firstly focus investigations of the existing literature and then ensure treatment innovation addresses a meaningful target. In this early phase, it is also important to scope the potential context of any future intervention – in essence considering implementation from the outset.

Step 2: Observe phenomena

Qualitative methods offer a systematic approach to examining phenomena of interest that also affords richness and complexity through the detailed study of a small number of participants. These methods are valuable for examining and understanding psychological mechanisms, including their impact on behaviour, attention, emotional processes, and symptoms, and how they unfold over time. For example, in their qualitative study of anhedonia in 34 young people with elevated symptoms or a diagnosis of depression, Watson et al. (2020) noted one common thread was a lack of positive imagery for future events and prospective memory difficulties within the theme of 'loss of joy of flattening of emotions'. This potential mechanism is now being targeted with promising early results (e.g., Hutchinson et al. (2024)).

Qualitative methods can also reveal developmental sensitivities (Keystone 1). For instance, Hewitt et al. (2021) found that the adolescent social context (and/or individuals' appraisals of it) significantly shaped the experience of panic attacks, with participants describing feeling isolated and disconnected from their peers as a result of panic attacks. Findings such as these can inform our conceptual understanding (Braun and Clarke (2014); Keystone 3) as well as guiding research and intervention, for example the potential to examine young people's appraisals of self and others in relation to panic attacks and how these may maintain symptoms, as well as the potential for involving schools, family, and peer networks in interventions.

A strength of qualitative methods – the in-depth study with a small number of participants – is also potentially a limitation, as findings cannot be generalised to the wider population. However, they allow a nuance and complexity that can be valuable in the exploration phase and can complement quantitative methods. Also, new approaches permit examination of qualitative text data with much larger samples with the use of large language models permits qualitative insights with larger, representative samples (e.g., Chiu et al. (2022)).

Step 3: Measure accurately

Precise measurement is necessary to understand the scale of a problem, detect those in need, inform treatment development, and track intervention outcomes. To identify and modify contributory causal factors accurate measures of putative mechanisms are also required, and we advocate a multi-modal measurement approach including both implicit and explicit measures where possible. However, this is often not feasible, and whilst we acknowledge the limitations of self-report measures, including their reliance on meta-cognition and an awareness the phenomena being reported on, in this paper we focus on explicit (typically self- or carer-report) rather than implicit measures of mechanisms (such as the Implicit Association Test; Greenwald et al. (1998)) because of their greater utility for use at scale in real world settings.

Measures need to: capture the phenomena of interest (either the target problem or mechanism) by working with people with lived experience of the problem (Keystone 2); be developed and validated in representative cohorts, including large general population and clinical groups (to cover the continuum of severity); have excellent reliability and validity; and be easily usable across settings (including clinical services, schools, and online). It is also important that measures enable interpretation by age, gender, neurodiversity, and other key characteristics. We have created a library of psychometrically robust, developmentally sensitive measures of mechanisms that can be found here (aimlibrary.mhid.org.uk). This library of measures of psychological mechanisms is a community resource which researchers and clinicians are invited to use and to contribute to themselves, and it complements existing resources such as the Catalogue of Mental Health Measures (https://www.cataloguementalhealth.ac.uk) and CORC (https://www.corc.uk.net).

When an appropriate tool does not exist then investment in measure development will be valuable. This could include adaptation of an existing measure, validation of an existing measure in the target population (e.g., Illingworth et al. (2024)), or development of a novel measure (e.g., Bird et al. (2020)). Grounding the measure development in qualitative work can help to ensure the items are relevant, meaningful, and suited to the developmental context it is designed for. Specific guidance and resources on measure development and psychometric evaluations exist (e.g., Boateng et al. (2018)).

There are also further methods that can be applied to achieve greater efficiency in measure completion. For example, by evaluating the item properties using item response theory, it is possible to administer a measure adaptively to limit the number of items required to estimate the underlying construct reliably. These computer adaptive tests (CAT) have the potential to minimize participant burden, as highlighted in a recent qualitative study examining the feasibility and acceptability of CAT to assess YP mental health in UK primary care settings (Lan et al., 2025).

In contrast, ecological momentary assessment (EMA) involves repeated data collection conducted in real time with the individual in their everyday

environment (with data often collected via a mobile phone) (Shiffman et al., 2008). This improves the ecological validity of the data, reduces recall bias, and offers a route to see how particular mechanisms interact in particular settings and over different, typically briefer, time periods. For example, in an EMA study with 43 YP aged 17-24 years, more frequent non-suicidal self-injurious imagery predicted an increased likelihood of later non-suicidal self-injurious behaviour, over and above the effects of existing urge (Ji et al., 2024). An EMA study examining emotion regulation in adolescents found rumination was associated with increased momentary negative affect and reduced momentary positive affect (Debra et al., 2025).

Step 4: Assess the scale and scope of the problem
Observational studies, particularly those leveraging large-scale longitudinal datasets, contribute to our understanding of psychological mechanisms underlying MHPs in young people. For example, they can offer insights into how frequently certain cognitive, emotional, or behavioural processes occur in the population, including among those at risk of or currently experiencing MHPs. When conducted with representative samples—such as those accessed through schools or population-based youth cohorts—these studies enable the identification of patterns that may otherwise go unnoticed in smaller or more selective clinical samples.

Importantly, longitudinal datasets allow for the examination of associations between proposed mechanisms and symptoms over time, providing support for causal inference, ideally with at least three measurement points. This allows researchers to assess temporal ordering, distinguish within-person change from stable between-person differences, and test mediation over time. Many large cohort studies focus on broad symptomatology, demographic variables, and general risk factors, and unfortunately often do not include fine-grained, theory-driven measures of specific psychological mechanisms, meaning researchers will often need to collect datasets from scratch.

Longitudinal observational studies offer an opportunity to explore how associations between mechanisms and outcomes vary by developmental stage. For example, some studies have shown age-related differences in the strength or nature of these associations (Evans et al., 2021), suggesting that certain mechanisms may have greater relevance at particular points in development (Keystone 1). This can help us more accurately characterise risk pathways and identify windows of opportunity for intervention.

Step 5: Map interconnected problems /the causal complexity
MHPs are complex phenomena: there are likely many inter-related contributory causal factors and therefore a range of potential treatment targets. This theoretical stance is one of multifactorial causation. We assume there are multiple contributory causal factors that interact in a dynamic interplay and that these may vary, at least to some degree,

between individuals. A dynamic network perspective offers a way of tackling this complexity by modelling symptoms and mechanisms as interacting nodes (Borsboom & Cramer, 2013). This is a route to inform the theoretical conceptualisation (Keystone 3) and identify treatment targets as when considered within these dynamic networks, highly connected problems become potentially valuable treatment targets. Therefore, treatment can target common specific and non-specific factors which have to date have often been overlooked (e.g., Waite et al. (2020)). Clinical staging models indicate that broad spectrum treatments might be particularly valuable in preventative interventions as there are often less differentiated presentations in the early phases of MHPs (McGorry et al., 2022; Shah et al., 2020).

Network analysis and structural equation modeling (SEM) are statistical techniques ideally suited to this work. These approaches are explicitly built on the recognition of multi-factorial causation and can identify key mechanisms to target in treatment. For example, directed acyclic graph models (DAGs) – a type of network analysis - were used to map potential psychological and social factors contributing to paranoia in adolescents (Bird et al., 2019). Likewise, SEM was used to investigate the contribution of different aspects of social media use such as social comparison, passing time, seeking support, and experiencing hostility (to and from others) to depression in adolescents (Twivy et al., 2025). Latent Change Score models, a subtype of SEM, represent change between time points as a latent construct, capturing how earlier levels and predictors influence the magnitude and pattern of subsequent change while accounting for measurement error. Computational approaches offer huge potential to improve our understanding of clinical disorders (e.g., Palminteri et al. (2016)), with theory-driven methods allowing us to map the dynamic interplay of variables within and between various levels of explanation. Huys et al. (2016) emphasise the importance of close collaboration between those with expertise in computational approaches and clinicians and related methodologists in order to realise the full potential of computational approaches for delivering clinical benefit for young people and families.

Whilst the methodological approaches outlined are powerful and have considerable potential, they also, inevitably, have limitations (e.g., issues of drift, limited survey length, habituation, and reactivity to self-monitoring in EMA), and so triangulation of methods is ideal. Mapping multiple hypothesised causal mechanisms in this way can help identify potentially influential targets within the network of interconnected problems. However, to determine causality, manipulation methods are required.

Step 6: Manipulate the mechanisms

Experimental methods offer a powerful approach to investigating the causal role of psychological mechanisms in the onset, maintenance, or amelioration of mental health difficulties. These methods are rooted in a causal-interventionist framework (Kendler & Campbell, 2009), which

involves deliberately perturbing or “disturbing” the system to observe whether changes in the hypothesised mechanism lead to changes in relevant outcomes. Such designs are crucial for isolating mechanisms and establishing causal relationships, providing a robust foundation for the development of targeted interventions. The first decision involves selecting the psychological mechanism of interest (e.g., mental imagery), and which facet to target (e.g., imagery valence, vividness, perspective, or time orientation). Designing an experimental study then requires considering several factors, including how to manipulate the process, which control condition to use, and how to account for context and complexity (see Table 2 for an overview).

We would encourage researchers who are designing manipulation procedures with the aim of treatment innovation to consider, from the outset, how they can do this in an ecologically valid way that is acceptable and meaningful to the young people of interest. Involving young people and stakeholders (Keystone 2) at this stage can improve the likelihood of developing procedures that are more likely to translate into therapeutic procedures. Related to this, inclusion of open questions at the end of the testing session to learn about participants’ experience of the procedure, and systematic logging of potential adverse effects (however apparently minor) will all be valuable as therapy processes are developed.

Also critical is the choice of the comparator condition. Historically studies have tended to use either passive controls (e.g., no instruction) or active controls (e.g., instructing the opposite behaviour or using an attention placebo). An active comparator condition provides a more robust test of causality compared to a passive control as it minimizes dependence on sample characteristics—participants in passive conditions may otherwise engage in widely varying mental processes depending on their symptom profile. However, without a passive control we cannot establish absolute efficacy. As such, inclusion of a passive and active control is optimal but requires a larger sample size which may not be feasible.

How can we establish a manipulation has been successful? The majority of studies rely on self-report (typically Visual Analogue Scales [VAS] after the manipulation), asking participants to rate the extent to which they followed the instructions or engaged in the particular process during the preceding period. VAS are quick and easy to include in paradigms but bring a range of issues, including, potential biases and subjectivity such as demand characteristics and lack of insight into the particular process; measurement error due to common reliance on single item measures; and inability to accurately capture the temporal variability in how individuals engage with a process over time. Implicit measures overcome some of these issues but are associated with concerns including interpretational ambiguity and sensitivity to task conditions. In the absence of a reliable and valid manipulation check, we suggest using a combination of implicit and self-report measures.

Outcome measures should be selected with care when developing experimental paradigms with treatment relevance. Ideally, these should go beyond immediate task performance to include proximal and distal indicators of therapeutic change (e.g., changes in affect, behaviour, or symptom expression). Pilot testing can provide crucial insights into feasibility, acceptability, and sensitivity of both the manipulation and outcome measures, allowing refinement before progressing to larger studies.

Although we are usually striving to isolate a psychological mechanism as tightly as possible in experimental tests of causality, in reality it is highly unlikely that psychological processes operate alone and instead the numerous processes will act in tandem, reciprocally, to drive symptoms (Everaert et al., 2012; Hirsch et al., 2006). There is therefore a tension between the lab and real-world setting, but there are good examples of how we can bring complexity into our experimental paradigms. For instance, multiple mechanisms can be manipulated within one study (AlMoghrabi et al., 2022; Kavallari & Lau, 2022; Platt et al., 2017). Alternatively, in studies which manipulate one mechanism, the other relevant mechanisms can be measured (e.g., measuring attribution bias when manipulating ruminative thinking in response to stress in the context of depression, or intolerance of uncertainty when manipulating abstract thinking style in the context of generalized anxiety). An example of this approach comes from adolescent social anxiety, in which the manipulation of imagery in social situations (negative vs. benign) was associated with a differential effect on spontaneous use of safety behaviours, with participants using more safety behaviours when holding a negative compared to positive image in mind (Leigh et al., 2020).

Step 7: Develop the intervention
The experimental paradigm can be used in treatment development (hence intervention development may overlap with experimental testing). Employing a casual-interventionist paradigm – with a specific single focus of the intervention to bring greater confidence in the conclusions drawn from the work – facilitates the testing of the treatment and the underlying theory simultaneously, potentially speeding clinical translation (Freeman, 2011).

Single-case experimental designs (SCED) can be used to test the effect of an intervention with a small number of patients (typically one to three) and involve repeated measurements, sequential (potentially randomised) introduction of intervention techniques, and method-specific data analysis such as visual analysis and specific statistics. The essential components of the design framework are: 1) studying prospectively and intensively a single person or group of individuals over time; 2) frequent repeated measurement of outcomes and mechanisms; and 3) sequential addition and/or withdrawal of intervention techniques. The repeated measures allow the individual to act as their own control, by comparing the baseline score (before the intervention is introduced) [phase A] with the intervention phase [phase B]. The methods can be used to evaluate the

efficacy of the treatment – the key question of: does it work? It can be used specifically to pilot novel interventions, modify existing treatments, and investigate the active components of an intervention package. SCED can provide an insight into the components of therapy that lead to meaningful change which is necessary to refine the treatment. Regular assessment within treatment also provides the necessary data to track patterns of change and potentially model different trajectories to predict outcome. Measures of treatment fidelity and quality will also be important to interpret the findings of treatment evaluation. Examples of SCED designs include: Krasny-Pacini and Evans (2018); Smith (2012).

Other treatment development methods include cohort studies, in which an A-B design can be applied to a group of participants with analysis of data by the participant group rather than at the individual level. Feasibility trials are used to gain information regarding the potential viability of completing a full efficacy trial. In this early phase 1 treatment development work the focus is on generating proof of concept data. Studies are not sufficiently powered to test treatment effects fully. Therefore, analysis should be mainly descriptive or focus on confidence interval estimation, rather than reporting p-values (Lancaster et al., 2004). Progression to full-scale trials should be determined against pre-specified criteria, defined in advance to ensure transparent decision-making. These criteria should set minimum thresholds for signals of efficacy, feasibility, acceptability, and evidence of a credible causal effect, so that only interventions demonstrating sufficient promise are taken forward to more definitive evaluation.

Step 8: Evaluate the intervention
Randomised controlled trials (RCTs) are the gold standard to evaluate therapeutic efficacy and effectiveness and should be planned and carried out in line with best practice guidelines, and include adverse event recording and reporting, which is often inconsistently done in psychotherapy research (Duggan et al., 2014; Klatte et al., 2025; Lodewyk et al., 2023). To strengthen mechanistic insight, RCTs should incorporate measures that assess proposed mechanisms of change, such as validated questionnaires and, where possible, objective or behavioural measures. Including mechanistic assessments allows for testing whether interventions work through the pathways they target, helping refine theory and improve intervention precision (see Step 9). In addition, mechanistic learning can be enhanced by careful selection of the comparator condition, to maximise the discrepancy in the purported active elements, an approach exemplified by comparisons of therapies targeting positive vs. negative affect (Barnes-Horowitz et al., 2024).

Greater efficiency in translational treatment development may be possible through the use of novel trial designs such as platform trials in which it is possible to test multiple mechanistic treatments simultaneously or in multiphase or sequential designs. Treatment acceptability is often measured by satisfaction and treatment uptake. Yet few measures of acceptability (e.g., Tarnowski and Simonian (1992)) have been developed,

especially for YP. Qualitative methods can be employed to gain insights into the patient experience of the intervention and explore what works, when, and why (e.g., Waite et al. (2025)). This can be used to refine treatment further. Qualitative investigations with treatment deliverers can inform the likely feasibility of future implementation (see Step 10). This can help identify who is best placed to deliver an intervention – clinician, teacher, peer, or standalone digital resource. Throughout treatment development and evaluation attention should also be given to the therapeutic style and ethos of the approach. This can be done through co-production methods to ensure treatments are meaningful and acceptable to YP, including under-represented groups (Keystone 2).

Propensity Score Matching (PSM) is an alternative approach that can be used to reduce selection bias in observational studies when an RCT is not feasible due to ethical, practical, or financial constraints. PSM estimates each participant's probability of receiving the treatment based on observed covariates, then matches individuals with similar scores to create comparable groups. This mimics some of the benefits of randomisation by balancing covariates between groups. PSM is especially useful when researchers cannot randomly assign participants but still want to draw causal inferences. However, it only accounts for measured confounders and may exclude unmatched cases, reducing sample size. For example, Lee and Lang (2024) compared Trauma-focused CBT with routine care in the treatment of PTSD in YP using PSM, and controlled for a range of covariates, including demographics, family risk (e.g., family poverty), trauma history, and clinical characteristics (e.g., severity, comorbidity).

Step 9: Distill the mechanistic learning to refine the treatment
Intervention studies can offer valuable insights into psychological mechanisms when they are designed with this goal in mind. Mediation analyses, for example, can test whether changes in a proposed mechanism account for the therapeutic effect, providing evidence for a causal pathway (e.g., Pineda and Dadds (2013); Idsoe et al. (2019)). Beyond mediation, the process of "back-translation" — where specific intervention procedures and their effects are examined in the context of therapy— further contributes to our understanding of mechanisms (Cohen et al., 2023). For example, within the context of cognitive therapy for adolescent social anxiety, large effects of the self-focus attention and safety behaviour experiment and video feedback were found on anxiety and self-appraisals, indicating their value in therapy and providing support for the role of self-focus, safety behaviours, and negative imagery in the maintenance of social anxiety (Leigh et al., 2025). Dismantling studies, which isolate and remove components of a treatment, and factorial RCTs, which systematically vary the presence or absence of different elements, are further powerful methods for identifying active ingredients and their interactions. Moderation analyses can reveal for whom and under what conditions certain mechanisms operate most strongly. In line with this, examination of non-responders to treatment can help to identify if and how interventions may need to be modified for certain individuals. In-

session data can be analysed to identify trajectories of change. These approaches can highlight individual or contextual differences in how interventions work. Taken together, they can help clarify the psychological processes driving change and guide the refinement of more effective, targeted treatments.

Step 10: Implement accessibly
Successful implementation of evidence-based treatments is critical for improving outcomes for YP. Yet too often there are delays and barriers, meaning exciting innovations do not reach those who need them. Over the last 20 years the field of implementation science has generated greater understanding and methods to improve the sustainability of new treatment approaches in health care (e.g., Greenhalgh et al. (2004)).

A range of models, frameworks, and guidelines have been produced which set out key elements to be applied – with several common principles spanning the field (e.g., McGinty et al. (2024)). Firstly, there is a drive, whenever possible, to integrate implementation throughout the intervention development pathway, for example engaging and listening carefully to key stakeholders (as described in Keystone 2 and Steps 1 and 2). This includes drawing on the range of perspectives and disciplines and embedding this understanding in the conceptualisation (Keystone 3). It is also important to consider the scale of delivery required and the potential structural barriers to this, including inequities in health problems and access. This requires recognition of the complexity within the broad range of settings that interventions may be delivered – for example, clinics, schools, digital (standalone or supported). Breadth and diversity of settings, and their unique challenges, can be valuable sources of innovation with local adaptations spurring further treatment development.

Implementation requires evaluation across a number of outcomes, such as acceptability, adoption, appropriateness, feasibility, fidelity, cost, penetration, and sustainability (Proctor et al., 2011) across different settings, and over time. Implementation is ongoing, it must be reviewed and renewed in line with intervention and context changes to ensure YP continue to benefit from effective, acceptable, and accessible interventions.

Future directions

Here we have set out a Ten Step translational research pathway to aid the development of effective, acceptable, and accessible psychological treatments for young people. There are a number of challenges and opportunities in this approach.

Causal complexity and personalisation
For most young people, the presence of multiple problems will be the rule rather than the exception. Therefore, we need to account for the co-occurrence and often shared causation between problems. This underscores the importance of cross-disciplinary or multi-disciplinary

approaches to issues that are complex and multidetermined within a biopsychosocial framework. For example, the integration of insights from psychology, psychiatry, sociology, education, and clinical practice may be particularly important for the development and implementation of effective interventions. It will also be important to consider the interplay of psychological mechanisms with neurodevelopmental traits. For example, Lei et al. (2024) describe the mechanisms maintaining social anxiety in autistic individuals noting the shared central features (such as fear of negative evaluation from others) as well as the autism specific factors (such as differences in social skills, empathy, and cognitive flexibility). Likewise, exploration of systemic influences at multiple levels (e.g., family, school, community, cultural and policy contexts) may be relevant and Bronfenbrenner's Ecological Systems Theory (Bronfenbrenner, 1999) could provide a helpful lens for conceptualising and articulating these levels.

Inherently there is a tension between the need for precision and isolating treatment targets and the recognition of multifactorial causation. In the process of developing treatments from experimental tests, we also need to consider the order of techniques, length of overall treatment, and therapeutic style. One approach is to design single session interventions – that expect only one contact with the health provider (Schleider et al., 2020; Schleider et al., 2025). These types of brief, intensive, concentrated interventions have the potential to increase access and uptake, as well as to test specific treatment targets. Brief, targeted treatments may also provide a route for personalisation. Not all mechanisms will be relevant to all people. Therefore, a range of treatment targets, length, and style will be needed. It may be that modular treatments can be adapted to fit the key causal processes for that individual – with treatment decisions led by patient choice and empirical data regarding the best order of mechanistic targets, as we have seen in treatments for adults with psychosis (Freeman et al., 2021). This aligns with recent moves away from the historical focus on diagnoses and towards specific target mechanisms (e.g., aberrant reward processing) or symptoms (e.g., intrusive memories), an approach advocated by NIMH in the Research Domain Criteria (RDOC; Insel et al. (2010)).

Digital environments and innovation

Young people and emerging adults are living in a world undergoing rapid technological and social change. Digital spaces have become central to their daily lives, offering affordances and social dynamics that can differ substantially from those in the physical world. We are only beginning to understand how psychological mechanisms relevant to mental health may be amplified, attenuated, or qualitatively different in these environments, and how these effects may differ across clinical profiles. As clinical researchers, we must acknowledge the equal significance that many young people assign to their online and offline experiences (Fassi et al., 2025). This recognition requires us to incorporate digital environments throughout the translational Ten Step pathway — for example, asking

about online behaviours in qualitative work, manipulating mechanisms in digital paradigms (Goldman et al., 2025), to developing and validating robust measures of mechanisms as they manifest in digital contexts (e.g. Skjerdingstad and Leigh (2026)).

Digital innovation also provides an opportunity to harness the unique features of technology to create more effective and accessible treatments, increasing treatment fidelity and reducing 'therapy drift'. For example, apps can provide therapy content directly to the individual at any time and any place. Virtual reality (VR) can be used both with a therapist and standalone to try scenarios that would otherwise feel out of reach. For example, VR can be used for people struggling to get out into the situations they fear (Beele et al., 2024) or to build positive beliefs and greater confidence in everyday situations (Freeman et al., 2024).

Dataset collaborations
Collaborative work on large-scale datasets offers a promising route for the robust measurement of psychological mechanisms over time and across contexts. Up to now, progress has been constrained because datasets do not typically include measures of psychological processes. Such datasets would allow for more precise modelling of how mechanisms unfold and interact with environmental and developmental factors, reducing redundancy and improving generalizability, and allowing psychometric refinement with IRT approaches. Platforms to support this longitudinal mechanistic focus include the Atlas of Longitudinal Datasets (https://atlaslongitudinaldatasets.ac.uk) and the Catalogue of Mental Health Measures (https://www.cataloguementalhealth.ac.uk).

Extending this approach
We have focused on young people and emerging adults aged 11-24 years, but we anticipate that the approach may be usefully applied to treatment development with younger children as well, albeit with additional considerations, such as around managing the additional complexity of measurement in this age group.

A new digital platform to support psychological therapy innovation for young people - NIHR Oxford Health BRC AIM Digital Resource
Innovation in methods, designs, and theoretical understanding offer opportunities to revisit old challenges and tackle new ones, with a spirit of curiosity and persistence, as Clark states: "*if at first you don't succeed, try, try again*" (Clark, 2004, p.1099). We have developed an open resource (https://aim.mhid.org.uk/) that collates tools, methods, and guidance for mechanism-focused research in youth mental health. It includes a searchable library of measures of psychological mechanisms. Many digital platforms exist to support mental health researchers, our intention is to provide a platform that is both distinct from and complementary to these, and to support users to move easily between these platforms.

We are excited by the new and evolving methods and hope this will be a living resource with active contributions from the clinical academic community. We anticipate this will serve as a home for examples of good practice across a diversity of researchers and clinicians, and a hub for driving psychological therapy innovation for MHPs in young people and emerging adults.

Table 1. Summary of Ten Steps

Step	Focus	Approach	Relevant guidelines and tools
1. Listen carefully	Identify the treatment focus and implementation context from real-world challenges (acceptability, outcomes, access).	Synthesise clinical observations with literature; reflect on sessions, supervision notes, questionnaires; early stakeholder listening; apply theory to build a preliminary conceptualisation (Keystone 1–3).	-
2. Observe phenomena	Understand mechanisms and lived experience in depth.	Qualitative studies (interviews/focus groups) including developmental sensitivities (Keystone 1).	Numerous tools exist for evaluating the quality of qualitative research (Majid & Vanstone, 2018; Santiago-Delefosse et al., 2016) The Big Q Qualitative Reporting Guidelines (BQQRG). Developed by Braun and Clarke (2025) to provide a guide for Big Q qualitative researchers based on the values of qualitative research rather than on a consensus-based framework. Reflexive Thematic Analysis Reporting Guidelines: RTARG (Braun & Clarke, 2024) to support conceptual and methodological clarity in reporting. Consolidated criteria for Reporting Qualitative research: COREQ (Tong et al., 2007) is a 32-item checklist designed to improve quality and promote complete and transparent reporting.

3. Measure accurately	Build/select robust, scalable measures of problems and mechanisms.	Co-develop items with lived-experience input (Keystone 2); establish psychometric properties in representative and clinical samples; enable interpretation across key characteristics; consider adaptive testing to minimise burden.	Best practice guidelines for the development of mental health measurement scales developed by Stefana et al. (2025).
4. Assess scale & scope	Quantify prevalence, trajectories, and correlates of mechanisms and symptoms.	Observational studies; large, representative longitudinal datasets (≥3 waves); collect mechanism-focused measures.	Depending on the nature of the study, specific guidance is available via https://www.equator-network.org/reporting-guidelines-study-design/observational-studies/ Information on undertaking research in schools: https://wisdom.mhid.org.uk To identify longitudinal datasets, see: https://atlaslongitudinaldatasets.ac.uk
5. Map interconnected problems	Model multifactorial causation to prioritise targets.	Network analysis, Structural Equation Modelling (SEM) and computational methods; identify highly connected nodes; consider clinical staging and common factors/paths.	Reporting standards for network analysis of cross-sectional data are provided by Burger et al. (2023).
6. Manipulate the mechanisms	Test causal roles of mechanisms experimentally.	Experimental and causal-interventionist designs; choose mechanism facet; involve stakeholders for acceptability (Keystone 2); select active/passive comparators; use mixed manipulation checks (self-report + implicit); pilot outcomes beyond task performance.	-
7. Develop the intervention	Translate experimental procedures into therapy components and packages.	Use causal-interventionist paradigm; Single-Case Experimental Designs, cohort, or feasibility trials; track mechanisms & outcomes frequently;	The SCRIBE and RoBiNT guidelines provide recommendations on defining the target variable, measurement, and good practice (Tate et al., 2016; Tate

		assess fidelity/quality.	et al., 2013).
8. Evaluate the intervention	Establish efficacy/effectiveness and acceptability.	Conduct randomised controlled trials (RCT); embed mechanistic measures; consider platform/multiphase designs; assess acceptability; use qualitative process evaluation; apply Propensity Score Matching when RCTs are not feasible.	The CONSORT statement provides guidance for conducting and reporting RCTs (Hopewell et al., 2025). Guidance on selection of the control condition has been developed by Hohenschurz-Schmidt et al. (2023).
9. Distil mechanistic learning	Confirm how and for whom the intervention works; refine theory and treatment.	Conduct mediation and moderation analyses; run dismantling and factorial trials; apply back-translation of procedures; analyse in-session trajectories.	-
10. Implement accessibly	Achieve sustainable, equitable delivery at scale.	Integrate implementation theory early in treatment development; conduct stakeholder co-production (Keystone 2); plan for setting diversity (clinics, schools, digital); allow local adaptations; evaluate implementation outcomes.	Many frameworks have been developed to support sustainable implementation which may suit particular contexts and interventions. https://thecenterforimplementation.com brings together useful information. Consolidated Framework for Implementation Research (CFIR; https://cfirguide.org; Damschroder et al. (2009)) aims to help guide systematic assessment of potential barriers and facilitators, and the Theoretical Domains Framework (TDF; Atkins et al. (2017)) aims to support behaviour change. Procotor et al (2011) sets out key outcomes to evaluate implementation efforts.

Table 2. Overview of steps in experimental design in Step 6

1	**Specify mechanism and facet** Consider related mechanisms to measure or manipulate in combination to examine augmentation/combined effects.
2	**Develop manipulation procedure** Consider ecological validity Consider acceptability to optimise potential downstream implementation
3	**Identify and develop control procedure** Consider passive vs active vs both
4	**Select outcome measures** Consider explicit vs implicit Timing/follow-up to examine duration of effects
5	**Select manipulation checks** Consider explicit vs implicit checks (which may be preferable to reduce demand effects)
6	**Include open text responses** To elicit feedback to better understand pilot results
7	**Pilot procedures** Refine and pilot in iterative manner

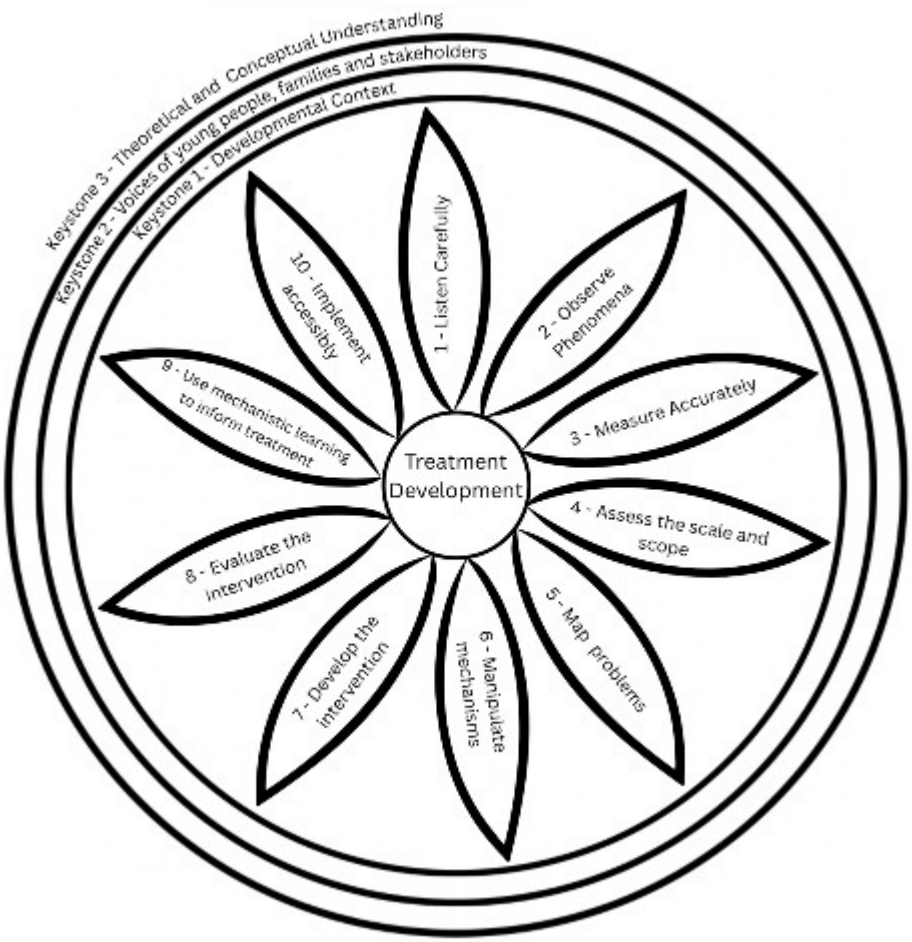

Figure 1. The Ten Step translational pathway for developing psychological therapies for young people.

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