CHANGING MINDS, CHANGING LIVES

Innovative, evidence-based approaches to prevent, diagnose and treat depression in young people, and to build depression-resilient communities

YPMH | The Foundation for Young People's Mental Health

UNIVERSITY OF CAMBRIDGE

IfM | Engage

It is a staggering achievement to have set out to 'solve' the root causes of depression in young people and to have seen it through to this point. ***Changing Minds, Changing Lives*** is the culmination of extensive research and many workshops over four years, generating expert consensus across the range of biopsychosocial factors that cause or could be used to address depression. What makes this research so different is that the workshops used novel evidence-based innovation management methods to identify, evaluate, validate and prioritise projects.

The stakeholders taking part came from across the ecosystem that impacts young people's lives, including schools and colleges, the food industry, employers, public health organisations, clinicians, academia and families. The workshops have generated clear priorities to further develop solutions. Encompassing social interventions, biological mechanisms and policy change, the 'next steps' suggested in *Changing Minds, Changing Lives* span the traditional silos of research, breaking down barriers.

By addressing the whole mental health ecosystem and continuing to link seemingly diverse areas together, *Changing Minds, Changing Lives* offers a tremendous step change in how we seek to impact the evolution and trajectory of the mental health crisis among our young people. It offers hope and an invaluable resource to direct future research that could break the current status quo in the limitations of our understanding.

It has been a great honour to have participated in some of these workshops, and consistently illuminating. The objective approach taken by using engineering and management methods continues to shine a light on clear and positive ways forward. I urge everyone involved in young people's mental health at whatever level to consider the powerful messages of this report – and to take action.

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Our vision and mission

YPMH is working towards a better future for young people, where mental health problems are significantly reduced in prevalence and severity.

Our mission is to:

- Reduce the number of young people who experience mental health problems, particularly depression and anxiety;
- Help young people enter adulthood with greater resilience to mental health conditions; and thereby
- Reduce the number of young people who take their own lives.

We strive to help build a future where:

- The pathways and mechanisms of key mental health disorders, especially depression and anxiety, are understood and widely applied to innovations in practice and policy.
- Knowledge and skills for protecting and nurturing mental health are available to young people and their families and carers, and to practitioners.
- Healthcare policy and practice address the "whole self" at the earliest appropriate points in the development of mental health conditions.

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1. Introduction

Depression accounts for the largest share of the world's burden of disease measured by years lost to disability,[1] and it has significant economic and social consequences. One in seven young people aged 10–19 experiences a mental disorder, accounting for 13% of the global burden of disease in this age group.[2]

More young people than ever are suffering from depression. The condition has a huge and potentially devastating impact on them, their family and friends, impairing both their physical and mental health and extending into adulthood.

Despite the availability of effective treatments for depression, up to 80% of affected adolescents do not receive appropriate care[3] and 50–75% experience a relapse, even after successful treatment.[4]

There is a clear and compelling need for a new way forward.

Changing Minds, Changing Lives sets out innovative, evidence-based approaches to help:

- Prevent the development of first-episode depression in children and young people; enable their recovery from depression; and enable them to remain in remission; and
- Build depression-resilient communities.

Our report is the result of two two-year projects undertaken between The William Templeton Foundation for Young People's Mental Health (YPMH), researchers from the University of Cambridge Institute for Manufacturing (IfM) and innovation management specialists from IfM Engage, IfM's knowledge transfer company.

Foundations for the work described in this report

From 2019 to 2020, YPMH 'joined up' social, biological and psychological research into depression to understand the vulnerability factors and the biological mechanisms for depression in young people, and the relationships between them. The understanding of the vulnerability factors, mechanisms and interrelationships was co-developed and validated with experts from around the world.

Building on this joined-up understanding, in 2020 and 2021 we engaged researchers, clinicians, schools, families and other stakeholders to generate over 200 evidence-based ideas for the prevention, early detection, diagnosis, management and treatment of depression in children and young people based on the vulnerability factors and mechanisms identified.

This work was published as *Changing Hearts, Changing Minds*[5] in September 2021.

Opportunities to make a difference

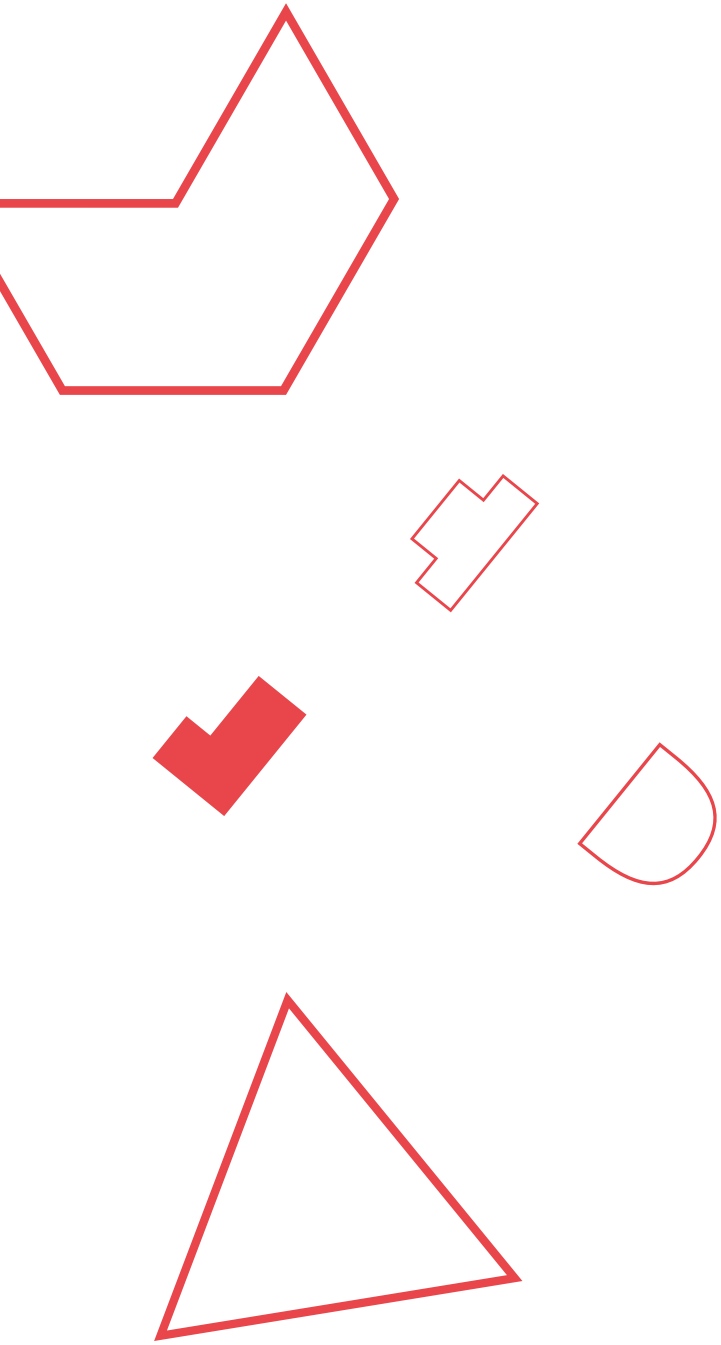
During 2021 and 2022, YPMH and IfM Engage consulted and conducted workshops with a range of stakeholders from across the mental health ecosystem. These included parents, carers and young people; people from across the health and social care system; organisations engaging with young people, such as schools, universities and employers; solution providers, including charities and businesses; and researchers. The outcomes of these consultations, workshops and validation discussions, supported by analysis, are presented in this report.

This work has resulted in:

1. A framework summarising the socio-ecological and individual vulnerability factors, physiological mechanisms and psychological factors for depression in young people;
2. Identification and validation of unmet needs and associated projects for the prevention, early detection,

diagnosis, management and treatment of depression in children and young people;

3. For each stakeholder group (e.g. the health and social care system) and key actors within it (e.g. public health; primary, secondary and tertiary care; social care), a vision for the future role that they can play within the mental health ecosystem to prevent, detect, diagnose, manage and treat depression in children and young people;
4. A structured approach (including examples) for how key actors in the mental health ecosystem can work together to design, build and sustain depression-resilient communities;
5. Emerging collaborations between actors interested in working together to develop and pilot the projects presented in this report.



What next?

The next steps in our mission to improve the prevention, early detection, diagnosis, management and treatment of depression in children and young people are to:

1. Engage collaborators to develop and pilot the high-priority innovations. At the outset of a project, we plan to conduct roadmapping workshops with collaborators to develop a vision for each project and identify the stepping-stones required to realise it. These roadmaps will form the basis for the development, piloting and validation of the innovations, as well as funding applications.
2. Facilitate the engagement of stakeholders from across the mental health ecosystem to collaboratively design and build better ecosystems that support mental health and wellbeing.
3. Engage with organisations funding research and innovation to help inform priorities for:
   - Research into depression in children and young people;
   - Supporting the translation of research into effective, widely applied innovations and policies.

By working together to develop, pilot, validate and implement these ideas, we can improve young people's mental wellbeing, reduce the individual lifelong consequences of depression, and minimise its economic and societal costs around the world. Please join us in this endeavour.

To explore opportunities for collaborating on the projects described, please contact Peter Templeton, peter.templeton@ypmh.org

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2. Summary

2.1 The case for action

There is a clear and compelling case for a new approach to understanding, preventing and treating depression in young people:

- In 2022 18% of children aged 7–16 years and 22% of young people aged 17–24 years had a probable mental disorder.[6]
- 75% of people with a mental health problem develop it before the age of 24, and 50% develop it before the age of 14.[7]
- Depression occurs in about 2.1% of 5–19 year olds[8] and has risen sharply in the last decade.
- The global prevalence of major depressive disorder increased by 27.6% as a result of the COVID-19 pandemic, with younger age groups more significantly affected[9].
- Suicide is the fourth leading cause of death among 15–29-year-olds.[2]
- Depression in adolescence is associated with a nearly three-times higher risk of depression in adulthood.[10]
- The consequences of failing to address mental health conditions in adolescence impact the ability of individuals to lead fulfilling lives as adults.[2]

2.2 Proposals to overcome challenges and enable better outcomes

Our prior publication, *Changing Hearts, Changing Minds,*[5] joined up different areas of scientific understanding about how depression develops in young people. This resulted in an improved understanding of the vulnerability factors and mechanisms of depression, including the links between social, biological and psychological research. The report also identified 200 ideas for early intervention, building on this understanding.

However, there are still many challenges associated with the implementation of projects that would apply this new understanding at scale. *Changing Minds, Changing Lives* presents proposals to address each of these challenges, with the aim of improving young people's mental wellbeing by enabling:

- Prevention of first-episode depression;
- Recovery from depression;
- People to stay in remission.

Four key challenges have been identified and addressed.

1. **Understanding the vulnerability factors, mechanisms and pathways of depression in young people**

   Despite substantial progress in social, biological and psychological research over the last 20 years, there is still limited collaboration between disciplines. While *Changing Hearts, Changing Minds*[5] made an important first step in joining up this research, this understanding is not universal. There is a need to build a common understanding of how depression develops in young people, across disciplines and stakeholder groups.

Changing Minds, Changing Lives presents an accessible model of the vulnerability factors, mechanisms and pathways of depression in young people. This is described in Section 3.

We propose that this model could be used to:

- Build a broader understanding of how depression develops in young people, and to identify potential opportunities for intervention at key points in the pathways;
- Help to identify gaps in knowledge and the work needed to fill these gaps; and
- Provide a structure to aid discussion between stakeholders with a range of expertise and perspectives, helping to focus discussion on key issues.

2. Evaluating and prioritising innovations

Changing Hearts, Changing Minds[5] identified many opportunities for innovations to prevent and address depression in young people. Additionally, many start-ups are being created with the aim of addressing a variety of mental health challenges. However, the translation of research into innovations in the medical field takes a long time and requires significant resources. It is essential that innovations are evidence-based and address a real stakeholder need.

Changing Minds, Changing Lives presents a structured approach to evaluate and prioritise innovations to be taken forward for development and piloting. This process is described in Section 7. Section 4 presents over 40 example projects addressing validated unmet needs.

These projects were prioritised based on patient impact and feasibility of delivery. They address unmet needs at all stages of care (from prevention through to treatment) and are organised under four key themes:

- The need for **information, education and training** to equip and motivate people and organisations to effect positive change.
- The need for **vulnerability assessment, early detection and diagnosis of conditions and causes** to identify an individual's vulnerability factors and underlying causes of depression, and to enable the development of personalised plans for management and treatment.
- The need for **prevention, management and treatment** interventions to address specific mechanisms of depression. These interventions fall into five broad categories:
  - Prevention, management and treatment pathways;
  - Food and nutrition;
  - Exercise;
  - Sleep;
  - Psychological.
- The need for **societal change, policies and regulations** to address cultural, societal, economic, environmental, food and community factors associated with depression.

3. Navigating the complexity of the mental health ecosystem

The mental healthcare system is a complicated system to change. The ecosystem is complex and fragmented, consisting of a large number of actors (people and organisations) involved across the care stages (from prevention through to treatment). Enabling effective communication between actors in the mental health ecosystem, and establishing a common goal, is critical in order to support the successful implementation of innovations designed to address depression in young people.

Changing Minds, Changing Lives defines clear roles for each actor within the mental health ecosystem and provides a structured approach to help actors work together to improve the outcomes for young people and build communities that are resilient to depression. This is presented in Section 5.

In this report we identify five key stakeholder groups with which an individual young person engages directly and which can have an impact on the individual's mental health and wellbeing. These include:

- Families, carers and friends;
- The health and social care system;
- Organisations engaging with young people;
- Solution developers and deliverers;
- Media and social media.

Other stakeholder groups do not engage directly with young people, but they can influence young people's mental wellbeing through their decisions, policies and actions. These include:

- National and local governments;
- Regulators;
- Researchers and research funders.

Each stakeholder group comprises a number of actors, for example:

- The health and social care system comprises public health; primary, secondary and tertiary care; social care; and
- Organisations engaging with young people include nurseries, schools, colleges and universities, employers and custodial institutions.

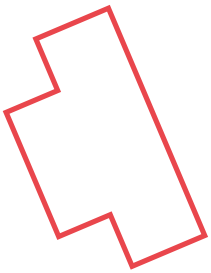
The clarity of each actor's role in the ecosystem, and the interrelationships between multiple actors, are critical in delivering the desired outcomes for young people.

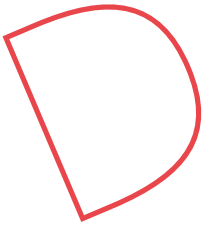
4. Enabling the development and implementation of promising longer-term innovations requires additional research

Research conducted over the last 20 years has established a good basis for understanding the vulnerability factors and mechanisms by which depression develops in young people. This existing evidence base underpins the projects presented in Section 4, which are suitable for development and piloting in the near term.

However, many of these fields are still evolving, as new evidence is generated, and they offer real potential for additional impactful longer-term innovations. In order to support the translation of this new knowledge into practice, further research is required to develop a clear scientific understanding of the mechanisms involved, the relationships between them, and the clinical effectiveness of possible interventions.

Section 6 of *Changing Minds, Changing Lives* summarises the current understanding of the physiological mechanisms and individual vulnerability factors for depression in young people. It makes suggestions for research themes and opportunities to support the development and implementation of future innovations that will address the specific vulnerability factors and mechanisms identified.





3. Models to help understand and address depression in young people

Our aim is to facilitate the development of new approaches to the prevention, detection, diagnosis, management and treatment of depression in young people, using an evidence-based understanding of how depression develops.

This section comprises:

1. A model of the vulnerability factors and mechanisms for how depression develops in young people;
2. Examples, using the vulnerability factors and mechanisms model, of how key vulnerability factors can influence the pathways by which depression can develop including:
   - Chronic stress; and
   - Food and nutrition;
3. A model of the care stages, from prevention through to treatment.

3.1 Vulnerability factors and mechanisms for how depression develops in young people

In *Changing Hearts, Changing Minds*[5] we showed how we used engineering approaches to 'join up' different areas of scientific understanding about how depression develops in young people. The project resulted in a better understanding of the connections between different areas of scientific research and highlighted important links within and between the social, biological and psychological factors associated with depression. This work has been further refined and validated with researchers and other stakeholders to create the model shown in Figure 3.1.

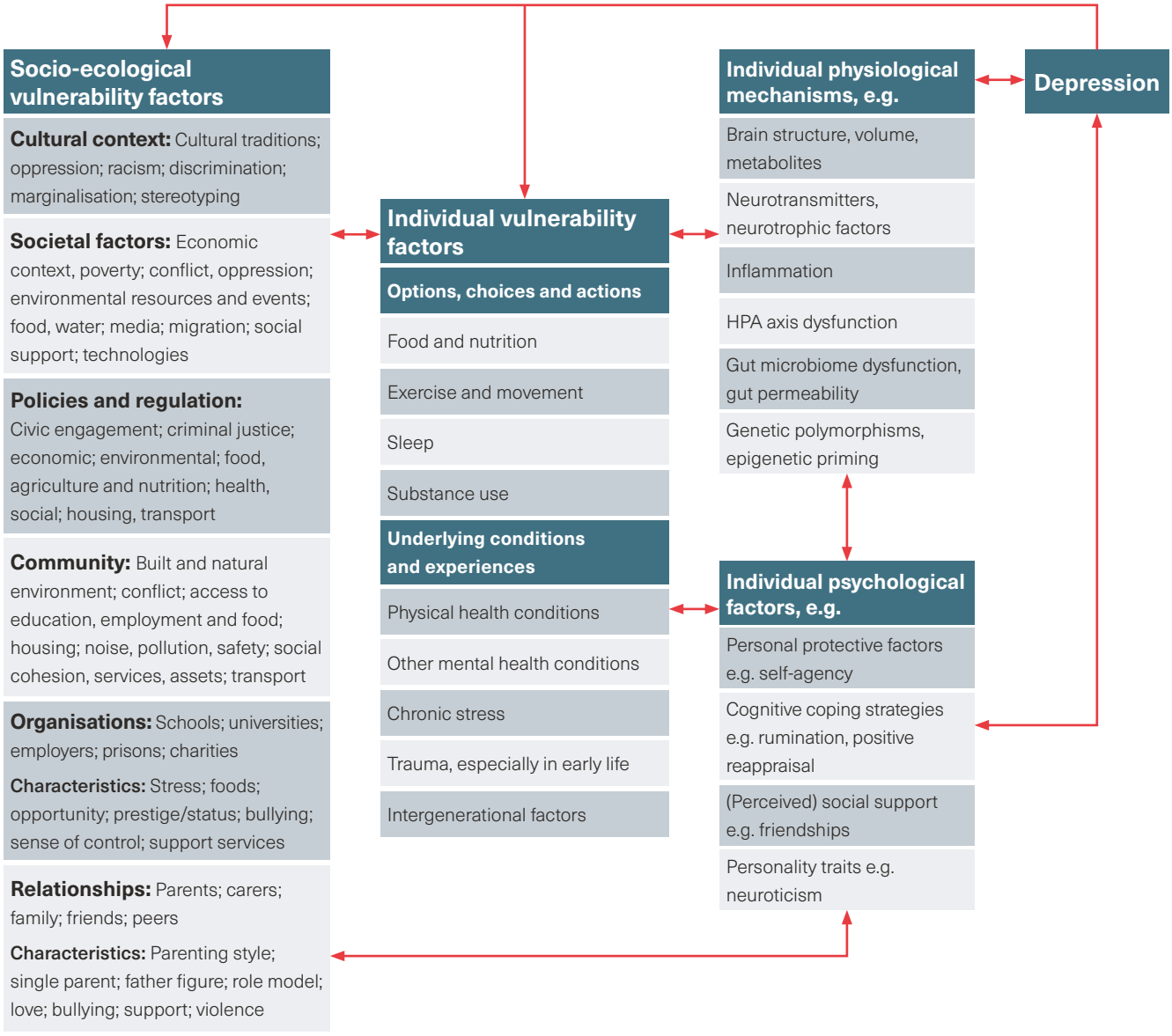


Figure 3.1 Vulnerability factors and mechanisms for the development of depression in young people over the life course

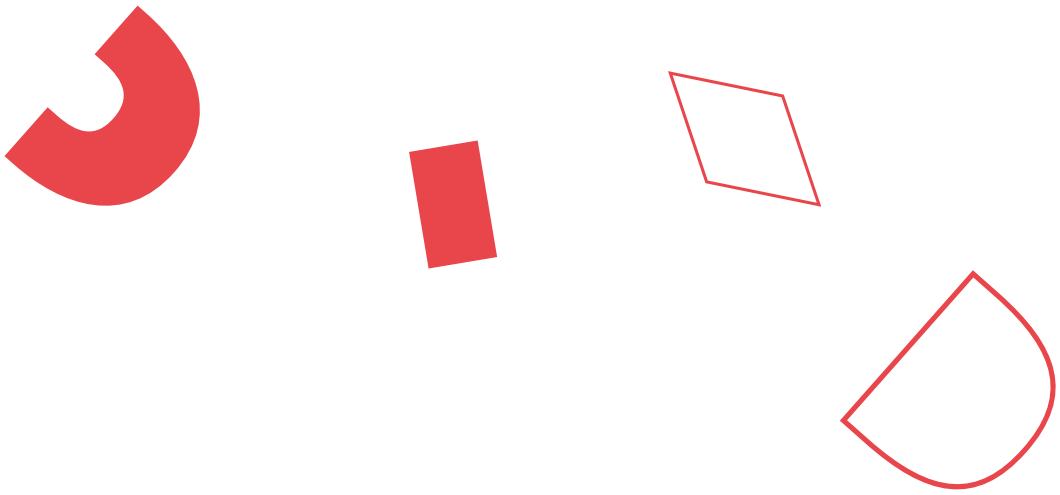
In this model:

- **Socio-ecological vulnerability factors** include the cultural, societal, community, organisational and relationship factors that affect an individual, and the relationships between these factors.[11]
- **Individual vulnerability factors** include the following, and the relationships between them:
  - ***An individual's options, choices and actions*** regarding food and nutrition, exercise, sleep and substance use;
  - ***Underlying conditions and experiences*** including physical health conditions, such as inflammatory disorders, epilepsy; comorbid mental health conditions, such as anxiety, autism, bipolar disorder; chronic stress; early-life trauma; and intergenerational factors.

- **Individual psychological factors** include an individual's psychological attributes that affect their resilience or vulnerability to depression such as:
  - Self-agency: the feeling of control individuals have over actions and their consequences;[12]
  - Coping strategies: the thoughts and behaviours that people use to manage stressful situations;[13]
  - Rumination: repetitive, prolonged and recurrent negative thinking about one's self, feelings, personal concerns and upsetting experiences.[14]
- **Individual physiological mechanisms** include the biological factors and systems that contribute to the development of depression over an individual's life course such as:
  - Genes and epigenetics;
  - The gut microbiome;
  - The hypothalamic–pituitary–adrenal (HPA) axis;
  - The immune system;
  - The blood–brain barrier;
  - Neurotransmitters;
  - Neurotrophic factors;
  - Brain metabolites;
  - Neurogenesis, neuroplasticity, neurotoxicity, atrophy and cell death, and their effects on the volume and structure of parts of the brain associated with depression, such as the hippocampus.
- Causal relationships between different types of vulnerability factors and mechanisms are represented by arrows. Interrelationships between factors within a type of vulnerability factor or between different physiological mechanisms are also present.

The model can be used to:

- Understand how depression develops across the vulnerability factors and mechanisms and to identify potential interventions;
- Help to identify gaps in knowledge;
- Provide a structure to aid discussion between stakeholders with a range of expertise and perspectives, helping to focus discussion on key issues such as:
  - Where it is possible to intervene to prevent, detect, diagnose, manage and treat the condition, and which stakeholder group is best placed to deliver the intervention;
  - Research needs, funding priorities and projects.



3.2 Understanding how depression develops in response to key vulnerability factors: examples

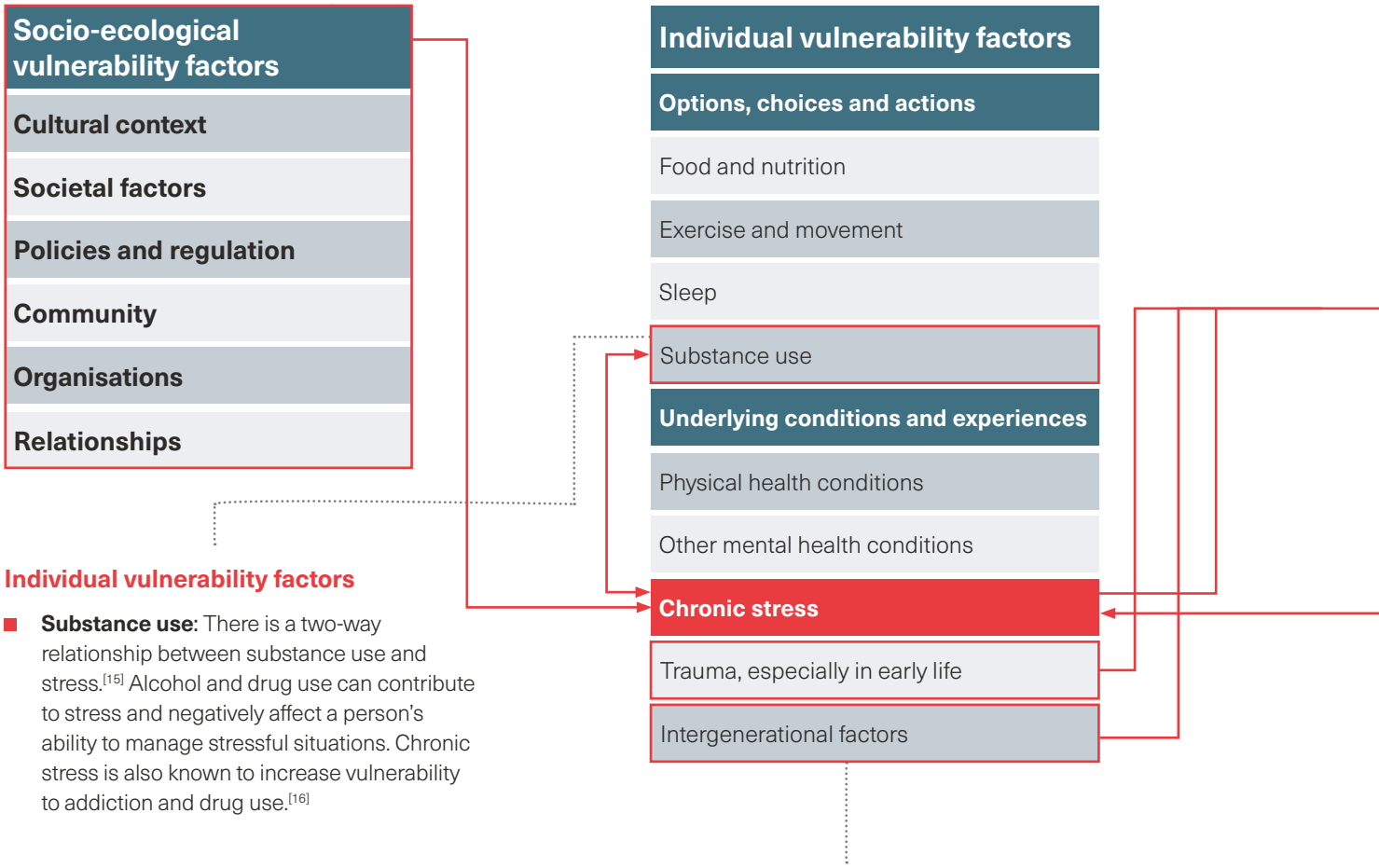
Depression develops as a consequence of an individual's experience of vulnerability factors and their effects on the individual's physiological mechanisms and psychological attributes.

3.2.1 Key vulnerability factor: chronic stress

A wide range of factors can contribute to chronic stress, which can cause dysregulation of the HPA axis (stress response system) and lead to physiological changes that are likely to cause depression. Vulnerability factors for chronic stress include: socio-ecological factors, individual factors and psychological factors.

Socio-ecological vulnerability factors

- **Cultural context,** such as oppression; racism; discrimination; marginalisation; stereotyping;
- **Societal factors,** such as poverty; conflict; adverse environmental events; migration; technologies that enable bullying and abusive behaviours;
- **Community attributes,** such as conflict; social cohesion; access to education, employment, housing; noise; safety, violence; poor transport;
- **Organisational characteristics,** such as bullying; excessive performance management; loss of sense of control, opportunity or prestige/status;
- **Relationship characteristics,** such as abuse, bullying and violence.



Individual vulnerability factors

- **Substance use**: There is a two-way relationship between substance use and stress.[15] Alcohol and drug use can contribute to stress and negatively affect a person's ability to manage stressful situations. Chronic stress is also known to increase vulnerability to addiction and drug use.[16]

The following individual vulnerability factors may also affect the likely impact of chronic stress on HPA axis dysfunction:

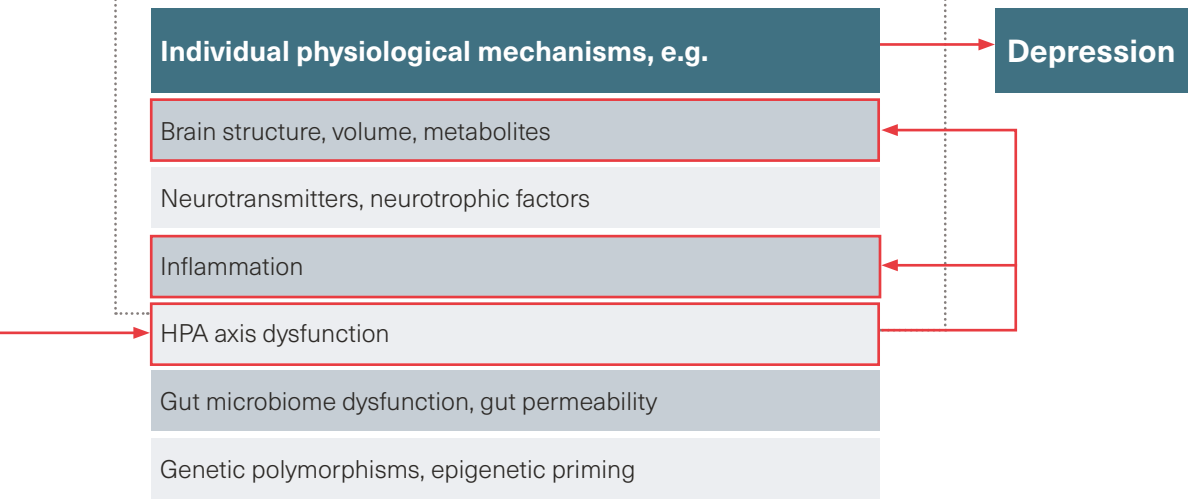
- **Early-life adversity and trauma:** Stress experienced in early life such as physical, sexual or emotional abuse can impact the physiological stress response and activity of the hypothalamic pituitary adrenal (HPA) axis.[21], [22]
- **Intergenerational factors:** Epigenetic marks can pass between generations; maternal prenatal stress can affect the stress system of the fetus. Severe and uncontrollable stress during pregnancy (such as war or abuse) can 'reset' the programming of the fetal HPA axis and cause epigenetic changes to genes that are central to the stress axis,[23] predisposing the individual to an increased cortisol response to stress in adolescence and young adulthood.

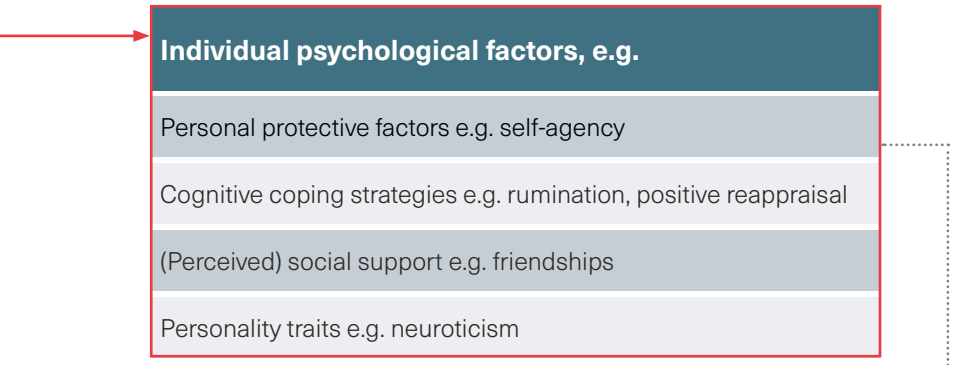
Individual physiological mechanisms

Chronic stress can result in **HPA axis dysfunction**. Dysregulation in the HPA axis is present in upwards of 40–60% of depressed patients, depending on the examined population and severity.[20]

The physiological consequences of chronic stress and HPA axis dysfunction include:

- Reduced hippocampal neurogenesis, decreased synaptic number and function, and atrophy of neurons in the prefrontal cortex and hippocampus.[24] These morphological changes are closely associated with depression.
- Glucocorticoid (GC) resistance, which decreases the sensitivity of immune cells to GC that normally terminate an inflammatory response, leading to chronic inflammation,[25] which in turn can contribute to the development of depression.





Individual psychological vulnerability factors

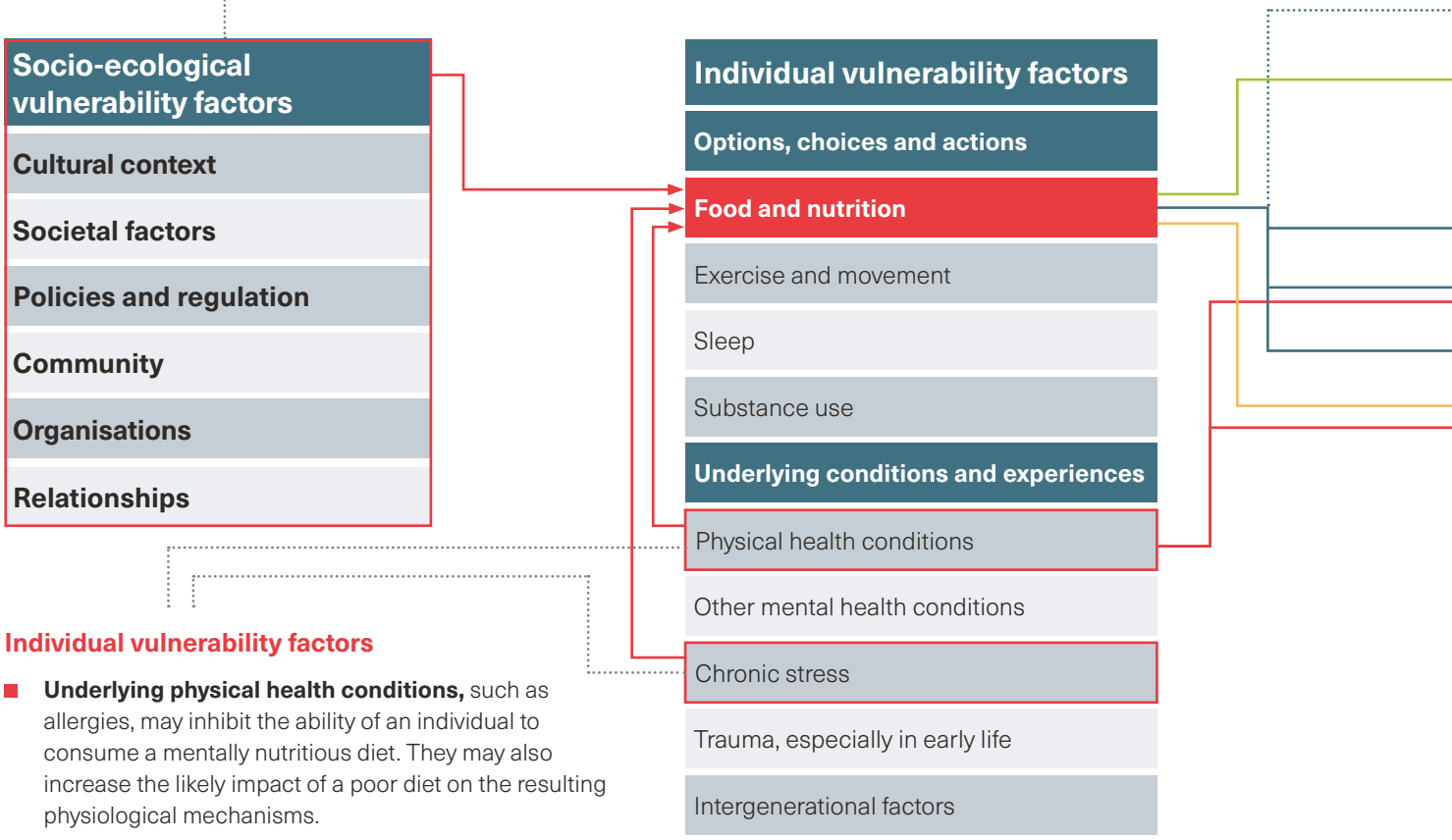
- **Personal protective factors,** such as self-agency, cognitive coping strategies[17] and stress management can impact an individual's ability to regulate emotions and manage stress.
- **Perceived social support** can mitigate against chronic stress.[18], [19]

3.2.2 Key vulnerability factor: food and nutrition

Food and nutrition is emerging as a potentially important vulnerability factor in the development of, and recovery from, depression. A wide range of factors can contribute to the consumption of a diet that can lead to physiological changes that are likely to cause depression. These include socio-ecological vulnerability factors and individual vulnerability factors.

Socio-ecological vulnerability factors

- **Societal factors:** the availability of affordable, nutritious foods at a national or regional level. The opportunity for an individual to plan, buy, prepare and store nutritious food may also be limited.
- **Community factors:** the availability of affordable, nutritious foods at a local level. In poorer communities, 'food deserts' may limit their availability.
- **Policy and regulation:** Herbicides and pesticides that pass through the supply chain into food that is consumed have been shown to have a significant impact on the gut microbiome.[26], [27] They may also lead to increased gut permeability, triggering a chronic immune response that causes chronic inflammation.[28], [29]
- **Organisations,** such as schools, universities, employers and custodial institutions serve food to young people. Most are unaware of the characteristics of foods described above needed to sustain mental wellbeing.



Individual vulnerability factors

- **Underlying physical health conditions,** such as allergies, may inhibit the ability of an individual to consume a mentally nutritious diet. They may also increase the likely impact of a poor diet on the resulting physiological mechanisms.
- **Chronic stress** generally promotes wanting, seeking and intake of palatable high-fat and energy-dense foods.[30]
- The capability of an individual to plan, buy, prepare and store nutritious food may be limited.

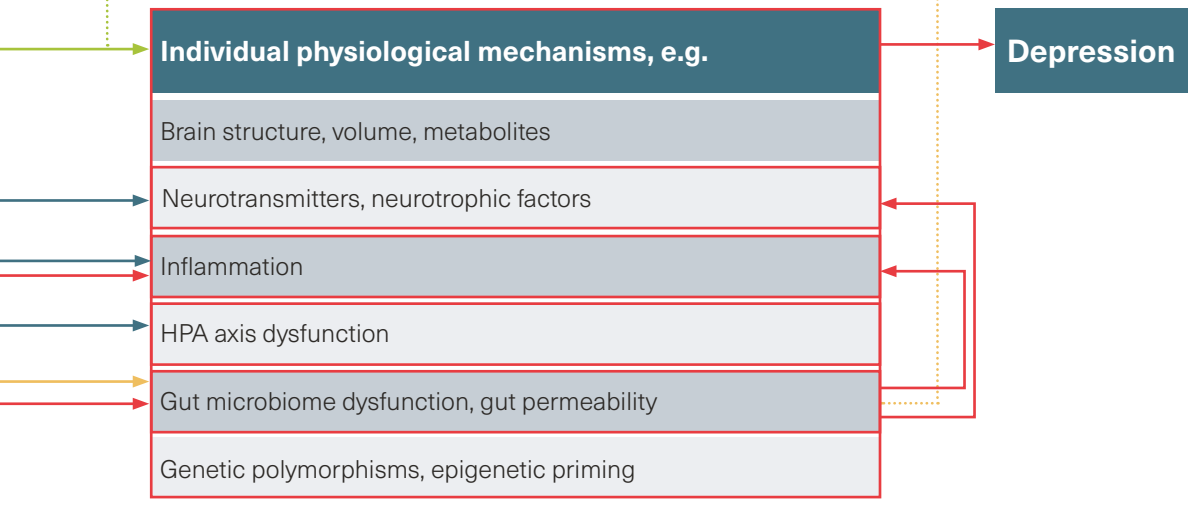
Individual physiological mechanisms

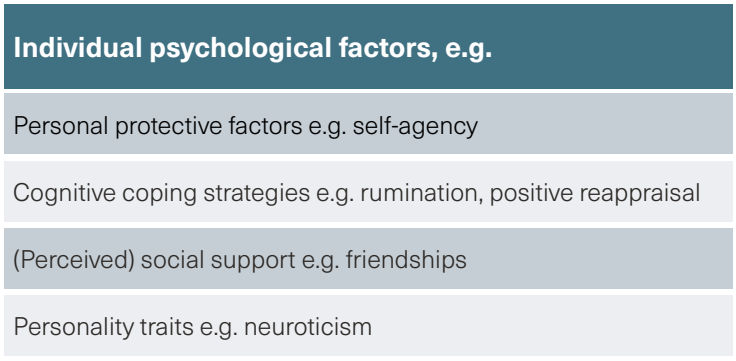
Food and nutrition can result in physiological changes that contribute to the development of depression. Aspects of diet that have a direct effect on physiological mechanisms include:

- Micronutrients, including vitamins, minerals and phytonutrients. A broad range of micronutrients is understood to be necessary to support the following mechanisms that can otherwise contribute to depression:
  - Gene expression;[31]
  - Gut wall integrity;[32]
  - Key processes such as the metabolism of tryptophan;[33], [34]
  - Production of neurotrophic factors[35] and neurotransmitters;[36]
  - Neurogenesis and cognitive function.[36], [37]
- Balance of omega-6/omega-3 fatty acids. An appropriate ratio of omega-6/omega-3 fatty acids and sufficient levels of omega-3 fatty acids are understood to be necessary to support physiological mechanisms that can otherwise contribute to depression:
  - An increased ratio of omega-6/omega-3 fatty acids is understood to contribute to inflammation and to dysregulation of the HPA axis, both of which are associated with the development of depression.[38]
  - Low levels of omega-3 fatty acids in the diet may impair neuronal functioning, especially serotoninergic and dopaminergic neurotransmitters. In contrast, raising levels of omega-3 appears to have an anti-inflammatory effect.[39]

Diversity of dietary fibre. Consumption of a diverse range of plant fibre is understood to be necessary to support the following physiological mechanisms that can otherwise contribute to depression:

- Full functioning of the gut microbiome, enabling the production of short chain fatty acids, neurotransmitters and other chemicals that support mental wellbeing;[40]–[42]
- Sustained integrity of the gut mucosal wall,[32] so preventing bacteria and food proteins from getting into the bloodstream. Physiological consequences of increased gut permeability include triggering a sustained immune response and chronic inflammation.





3.3 Care stages

Figure 3.2 represents the key care stages in the prevention, diagnosis, management and treatment of depression. A shift towards the prevention of depression is desirable, by addressing the vulnerability factors and early physiological mechanisms of the condition. Additionally, it is valuable to diagnose the causes of an individual's condition in order to develop and implement an effective personalised management plan.

A model of care is required that recognises that for some individuals episodic support and treatment is not enough, but lifelong management may be necessary. In the current system additional support needs re-referral, requiring time and momentum. This model considers care throughout the lifespan of an individual, including intergenerational factors and fetal development.

The model can be used in conjunction with the vulnerability factors and mechanisms model to identify opportunities for innovation across the care stages. Different stakeholder groups will have specific roles at different stages of care.

Figure 3.2 Care stages

The stages are defined as:

Care stage	Purpose	Example
Primordial prevention	To prevent/minimise socio-ecological vulnerability factors and so create mentally healthy environments.	National or local policies that address socio-ecological vulnerability factors such as pollution, and access to education, employment and green space.
Primary prevention	To intervene at a community or organisational level (before mental illness occurs), to create an environment in which individuals' vulnerability factors are minimised.	Altering community attributes, and hence individual behaviours, that contribute to the development of depression, by initiatives that address individual vulnerability factors such as food and nutrition, exercise and substance use.
Prediction – community level	To identify and prioritise groups for support.	Public health surveillance, risk group identification, vulnerability factor exploration, and programme implementation/evaluation.
Prediction – individual level	To identify and prioritise individuals and families for support.	Identification of individuals at substantial increased risk of depression through identification of: ■ Significant socio-ecological vulnerability factors; ■ Significant individual vulnerability factors (including underlying physical and mental health conditions that are comorbid with, or precursors to, depression).
Personal prevention	To enable individuals, families and carers to minimise the individual's risk of developing depression (before mental illness occurs).	Information, education and support to enable an individual to identify and manage their addressable vulnerability factors, including: ■ Socio-ecological factors; ■ Individual vulnerability factors (including diet, exercise, sleep, substance use; and underlying physical and mental health conditions that are comorbid with, or precursors to, depression); ■ Psychological factors.
Early detection	To identify an individual who is experiencing the early signs of depression to enable them to address the causes of their condition before it develops.	Identification of individuals experiencing the early signs of depression and/or key vulnerability factors, for example: ■ Chronic stress; ■ Gut microbiome dysfunction; ■ Psychological/behavioural attributes.

Diagnosis of the condition in the individual	To identify that an individual has depression and diagnose its type (e.g. unipolar, bipolar) and its severity so that appropriate action can be taken. In future, this could potentially identify specific phenotypes associated with particular physiological mechanisms.	Structured diagnostic questionnaires (in-person, computer-based) to diagnose the type and severity of an individual's condition.
Diagnosis of the causes of the condition in the individual	To identify the vulnerability factors causing an individual's depression so that a personalised plan for management and treatment can be developed.	A combination of questionnaires and biological diagnostics to identify likely vulnerability factors and mechanisms of an individual's depression, such as: ■ Underlying health conditions, e.g. obesity, metabolic syndrome; ■ Diet, exercise, sleep, substance use; ■ Socio-ecological factors, e.g. relationships, housing; ■ Psychological factors; ■ Physiological mechanisms, e.g. altered gut microbiome.
A **personalised plan** for the individual	To enable the individual with depression to recover and stay in remission by co-developing a plan to manage their main vulnerability factors, while treating symptoms if necessary.	A plan, agreed with the individual, to address their most important needs including management of: ■ Underlying health conditions; ■ Lifestyle vulnerability factors such as diet, exercise, sleep, substance use; ■ Socio-ecological factors. And treatment of: ■ Psychological vulnerability factors; ■ Underlying health conditions; ■ Biological dysfunctions.
Management of the vulnerability factors of an individual's depression	To enable the individual with depression to recover and stay in remission by implementing their personalised (management) plan to address their main vulnerability factors.	Implementation of the personalised management plan by the individual, preferably supported by their family and friends, as well as the health and social care system, including management of: ■ Underlying health conditions; ■ Lifestyle vulnerability factors such as diet, exercise, sleep, substance use; ■ Socio-ecological factors; ■ Psychological vulnerability factors.

Treatment of the causes of an individual's depression	To enable the individual with depression to recover and stay in remission by implementing their personalised (treatment) plan to address their main vulnerability factors.	Implementation of the personalised treatment plan by the individual, preferably supported by their family and friends as well as the health and social care system, including treatment of:
		■ Underlying health conditions, e.g. inflammatory conditions;
		■ Biological dysfunctions, such as:
		  ■ Genetic polymorphisms;
		  ■ Epigenetic DNA methylation;
		  ■ Permeable gut wall;
		  ■ Chronic inflammation.

4. Needs and projects: opportunities to make a difference

The projects described in this section represent opportunities for people and organisations to collaborate to address important issues in the development of depression in children and young people. The projects address unmet needs identified and validated with a range of stakeholders.

Unmet needs

Developing a deep understanding of stakeholder needs is the starting point of a needs-driven innovation process. This process has been successfully developed and demonstrated for healthcare innovation by the Stanford Byers Centre for Biodesign.[43]

An unmet need can be defined as:

- What is the **PROBLEM** that needs to be addressed?
- Who are the **POPULATION** affected?
- What is the desired **OUTCOME**?

Project themes

The unmet needs identified through this work can be organised under four key themes:

1. The need for **information, education and training** to equip and motivate people and organisations to effect positive change.
2. The need for **vulnerability assessment, early detection and diagnosis of conditions and causes** to identify an individual's vulnerability factors and underlying causes of depression and to enable the development of personalised plans for management and treatment.
3. The need for **prevention, management and treatment** interventions to address specific mechanisms of depression. These interventions fall into five broad categories:
   - Prevention, management and treatment pathways;
   - Food and nutrition;
   - Exercise and movement;
   - Sleep;
   - Psychological.
4. The need for **societal change, policies and regulations** to address cultural, societal, economic, environmental and community factors associated with depression.

The need for societal change, policies and regulations spans the other three themes and may be incorporated into longer-term plans to address unmet needs across all areas. Specific examples of issues where changes to policies and regulation can positively support mental wellbeing are presented separately in Section 4.4.

The projects presented in this report have been developed to address unmet needs under each of the first three key themes. Additionally, projects have been developed to address specific challenges in each of the categories of prevention, management and treatment (food and nutrition, exercise, sleep and psychological). The projects demonstrate examples of opportunities that can be implemented within the current system in order to deliver near-term benefit to children and young people with depression.

Stakeholder groups

The unmet needs and projects presented in this report are the result of a series of consultations, workshops and individual discussions conducted with a wide range of stakeholders during 2022. They build on the ideas and opportunities described in *Changing Hearts, Changing Minds*,[5] which identified, refined and validated unmet needs and projects with key stakeholders.

Under each theme, needs and projects are considered from the perspectives of the following key stakeholder groups:

- Individuals, families and carers;
- The health and social care system;
- Organisations engaging with young people, such as schools, universities and employers.

As a result of the interconnected nature of the mental health ecosystem, many needs, and therefore projects, span two or more stakeholder groups. Solution providers, researchers, local authorities and funding organisations were also involved in the validation process.

Future work building on the output of this report will prioritise the projects based on their potential impact and feasibility.

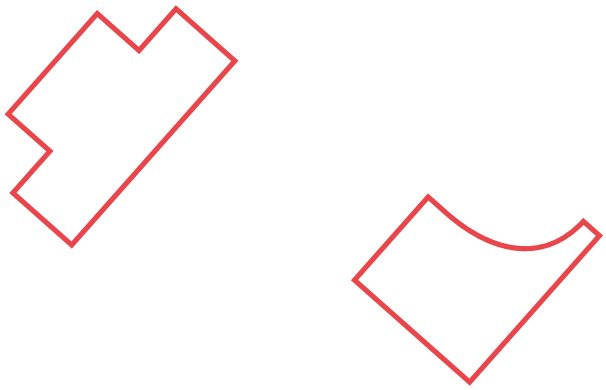
Care stages

The needs and projects identified in *Changing Minds, Changing Lives* span the full spectrum of care stages described in Section 3.3. These stages range from national or community-level prevention, through personal prevention, early detection, diagnosis and development of a personalised plan to address vulnerability factors and mechanisms, to management and treatment.

Prior work providing a foundation for the unmet needs and projects

The needs and projects build upon work conducted previously by YPMH in conjunction with the University of Cambridge, and described in *Changing Hearts, Changing Minds*.[5] This comprises:

- A multidisciplinary understanding (co-developed with researchers and including social, biological and psychological aspects) of how depression develops in young people – notably the key vulnerability factors and mechanisms and how these offer opportunities for early intervention.
- Some 200 ideas and opportunities for prevention and early intervention, including prediction, detection, diagnosis of the condition and its causes, management and treatment.
- Suggestions for how the opportunities can be applied to self-care by individuals and their families, the formal healthcare system and the wider mental health support ecosystem, including schools, mental health support charities, etc.



4.1 Information, education and training

Significant knowledge about the vulnerability factors and mechanisms for the development of depression in young people has been generated by research over the last 20 years. This research was collated in *Changing Hearts, Changing Minds*[5] and is summarised in Section 3. However, not all actors in the mental health ecosystem have an awareness or understanding of this information. This is a substantial barrier to the development and adoption of new approaches that could enable stakeholders to prevent and intervene early in the condition or prevent remission by addressing the underlying causes of depression.

By making this information accessible to stakeholders, we propose to give them the understanding and motivation to act to intervene earlier in the development of depression and offer improved support. It is vital that in making the information accessible to a large range of stakeholders, it is pitched at an appropriate level and offers learning outcomes that are appropriate to their differing needs. For example, clinicians require a much greater depth of understanding than the individual.

The Capability, Opportunity, Motivation, Behaviour (COM-B) model (Figure 4.1) is a widely accepted framework for influencing behaviour change. In this model, **capability**, **opportunity** and **motivation** all interact to generate behaviour change. While a given intervention might change one or more components in the behaviour system, all three elements must be considered in order to maximise impact and stimulate change. Although equipping stakeholders with the necessary knowledge and understanding is a critical first step in initiating change, these projects must also be combined with the development of appropriate interventions to provide stakeholders with the necessary opportunities to make lasting changes.

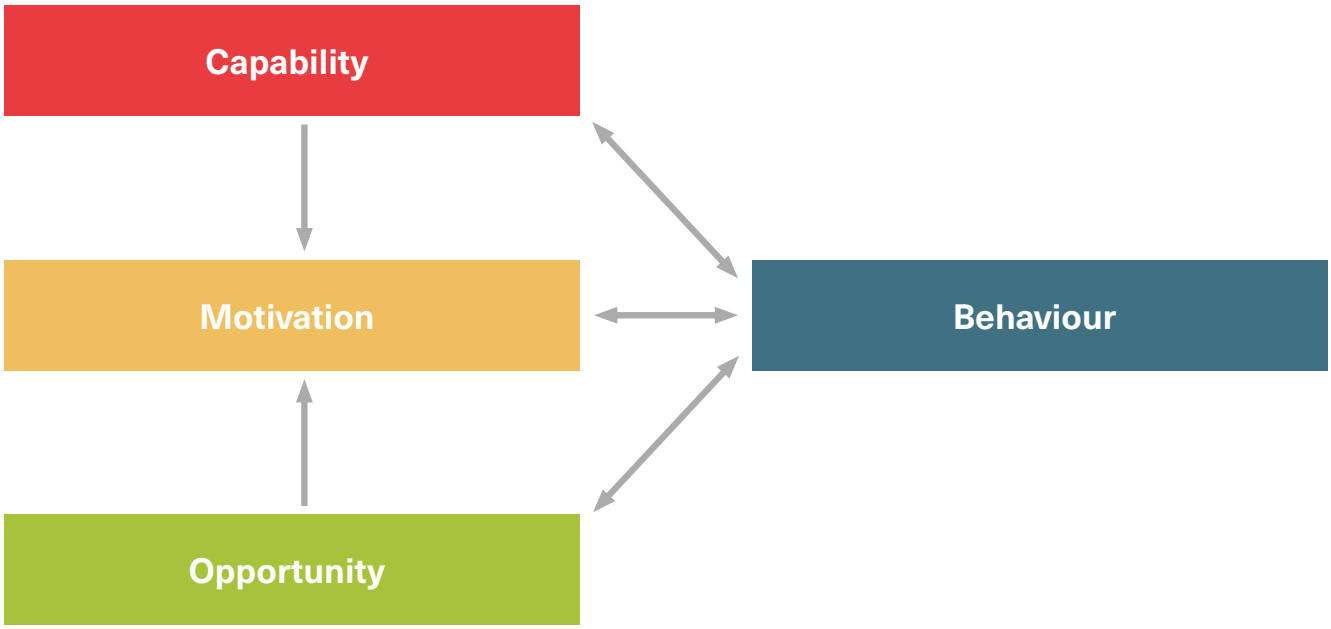


Figure 4.1 The COM-B system[44]

Key opportunities for stakeholder groups

The provision of information, education and training was identified as a priority need for all stakeholder groups. In particular, all stakeholders identified the need to increase awareness of addressable vulnerability factors for depression among the general public. Additionally, a lack of information sharing between stakeholder groups was identified as a major challenge to supporting young people with depression.

There are clear opportunities to improve mental wellbeing by providing stakeholders across all groups with an appropriate level of understanding of what depression is, how it develops and how to minimise the risks. These include:

- **For individuals, parents and carers**, the opportunity to empower individuals to prevent and manage depression by providing them with the necessary understanding to manage their addressable vulnerability factors.
- **For the health and social care system**, the opportunity to equip clinicians of all specialities with an understanding of how they might support their patients to sustain and restore the good physiological and psychological functioning needed to prevent or recover from depression, and to remain in remission. There is also an opportunity to inform the development of a new portfolio of interventions spanning the care stages, from prevention, through early detection and diagnosis, to management and treatment.
- **For organisations engaging with young people** (e.g. schools, universities, employers), the opportunity to inform the development of policies and services that support young people in their care and surrounding communities to maintain good mental health.

Needs and projects for information, education and training

Primordial prevention	Primary prevention	Prediction	**Personal prevention**	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

1. Theme: Information, education and training

Unmet need	Example project(s)
PROBLEM: Individuals are not aware what depression is, what causes it, how to minimise their own vulnerability and how to support others to do so. **POPULATION**: Young people, parents and carers. **OUTCOME**: Individuals are able to make informed choices to reduce their risk of developing depression, and to support others to do so.	Create content based on the principles in *Changing Hearts, Changing Minds*[5] that is accessible to key stakeholder groups (including children and young people) and inspires behavioural change. Make information available through existing communication channels.

Relevance to actors

→ Individuals (all)

→ Organisations (all)

→ Health and social care (all)

Primordial prevention	**Primary prevention**	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

2. Theme: Information, education and training

Unmet need	Example project(s)
PROBLEM: Organisations are not aware of the vulnerability factors for depression and the steps they can take to reduce these, e.g. policies, food, culture, hiring considerations for high stress roles. **POPULATION**: Leaders and responsible managers of organisations including schools, universities, employers. **OUTCOME**: The prevalence of depression in young people within the organisation is reduced.	Develop training, tools and resources to educate organisations on the vulnerability factors for mental health. Develop materials, such as templates, configured for specific organisations (e.g. schools, universities, employers and custodial institutions) to support the development and implementation of policies to promote and sustain good mental health within organisations.

Relevance to actors

→ Organisations (all)

Primordial prevention	**Primary prevention**	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

3. Theme: Information, education and training

Unmet need	Example project(s)
PROBLEM: Education in mental health is not sufficient in all schools. **POPULATION**: School pupils (primary and secondary). **OUTCOME**: Pupils are able to make informed choices and take age-appropriate actions to reduce their risk of developing depression.	Develop age-appropriate lesson plans and materials for schools in life skills: relaxation, stress reduction, mindfulness, diet and exercise, homework planning, avoidance of street drugs, problem-solving and building friendships. Pilot and inform the development of the curriculum.

Relevance to actors

→ Organisations (schools)

Primordial prevention	Primary prevention	Prediction	Personal prevention	**Early detection**	**Diagnosis – condition**	**Diagnosis – causes**	**Personalised plan**	**Management**	**Treatment**

4. Theme: Information, education and training

Unmet need	Example project(s)
PROBLEM: Knowledge among clinicians of the causes of depression in young people, and how these can be addressed, is varied. **POPULATION**: Clinicians of all specialities (to include GPs, paediatricians, clinical psychologists and psychiatrists). **OUTCOME**: Clinicians are able to identify young people with depression and take appropriate actions to address both the causes and the condition itself, thereby enabling patients to recover and remain in remission.	**1.** Develop a portfolio of CPD courses for clinicians of different specialities, accredited by the relevant Royal College, to include: ■ A sound explanation of how depression develops; ■ The vulnerability factors; ■ Recommended practical steps for people to take to help themselves. **2.** Develop training for medical students, to include: ■ A sound explanation of how depression develops; ■ The vulnerability factors; ■ Recommended practical steps for people to take to help themselves.

Relevance to actors

→ Health and social care (clinicians and medical students)

4.2 Vulnerability assessment, early detection and diagnosis of conditions and causes

The mental health condition of depression is preceded by the socio-ecological and individual vulnerability factors, physiological mechanisms and psychological factors described in Section 3.1. Figure 4.2 summarises these factors and indicates how they map to opportunities for vulnerability assessment, early detection, diagnosis of condition and diagnosis of causes.

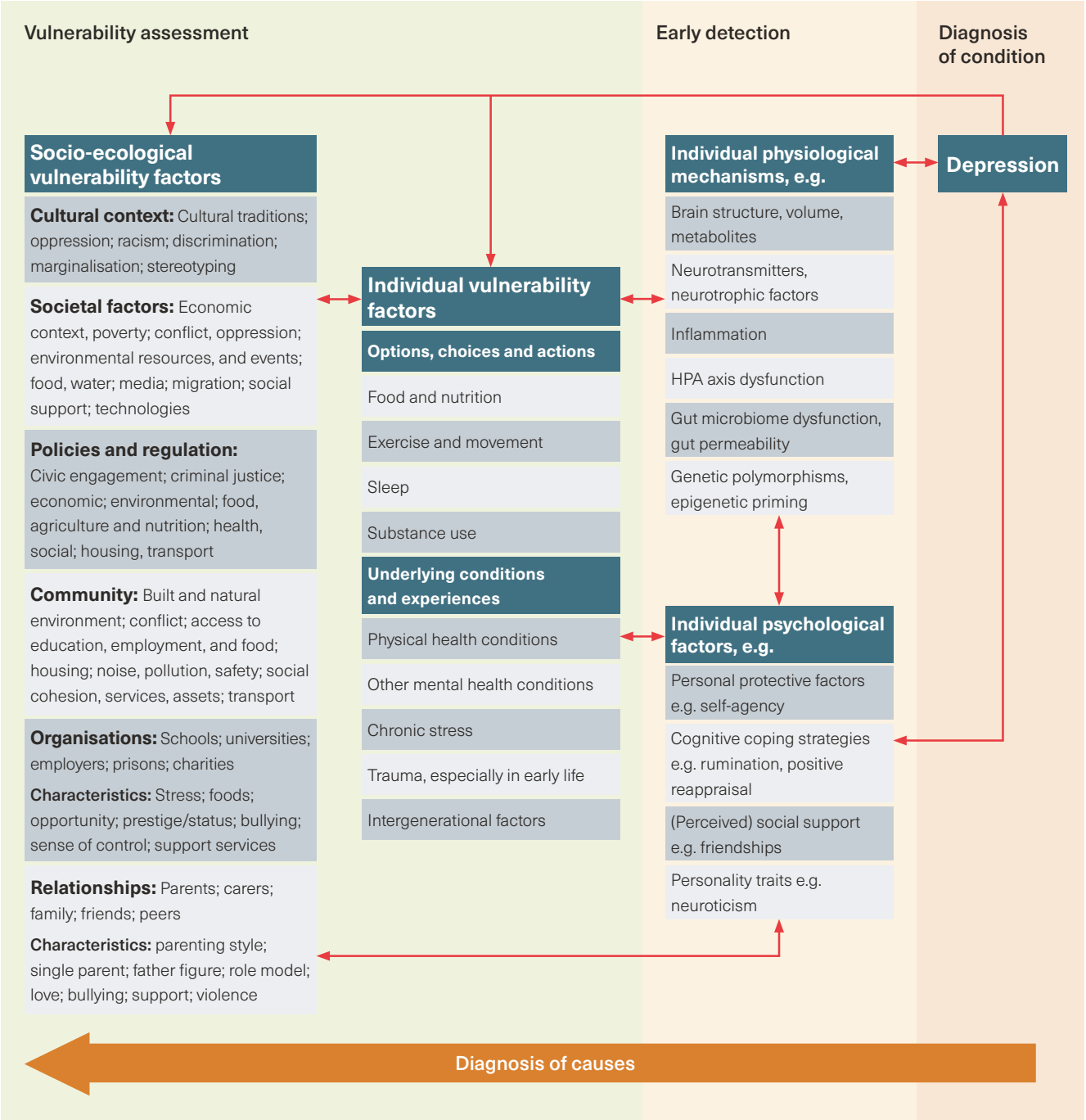


Figure 4.2 Mapping of vulnerability assessment, early detection and diagnosis across the vulnerability factors and mechanisms for depression

The current care pathway for managing depression in children and young people is focused on assessing and treating the symptoms of depression, rather than the underlying causes. There is very little focus on prevention, resulting in overall increased costs to the healthcare system and a strain on treatment services, leading to large waiting lists and inadequate support. Given the existing research on the development of depression, there is an opportunity to trial new approaches and innovations to shift to a more proactive system where:

- There is a greater focus on prevention by identifying and targeting addressable vulnerability factors (including socio-ecological and individual factors).
- The specific mechanisms and causes of depression are diagnosed and the contributing factors are addressed.

This suggested approach is aligned with the care stages diagram (Section 3.3).

This approach to vulnerability assessment, early detection and diagnosis would be achieved through a combination of online assessment tools, questionnaires and biological diagnostics. This may include:

- A review of the individual's medical history to identify health conditions and intergenerational factors that may contribute to inflammation and other physiological mechanisms associated with depression.
- Structured questionnaires to identify likely vulnerability factors such as food and nutrition, exercise and movement, sleep, substance use, chronic stress and trauma. These could inform the selection of biological tests that are helpful for the diagnosis of underlying causes.
- Biological tests, such as for cortisol levels, inflammation, gut permeability, gut microbiota diversity, genetic polymorphisms, etc.

Changing Hearts, Changing Minds[5] sets out much of the research that has been conducted to date on possible biological diagnostics. The further research that is necessary to achieve this vision is set out in Section 6.

The projects discussed in this section focus primarily on the development of interventions that are ready to be implemented in clinical practice. As such, biological diagnostics are not covered specifically, although once a care pathway focused on the identification and treatment of causes is established, these could be implemented through the same approach when backed up by sufficient research.

The needs and opportunities presented in this section focus on:

- **Vulnerability assessment**: Identification of individuals with socio-ecological and individual vulnerability factors, and psychological factors for those who are at risk of developing depression; and
- **Early detection**: Identification of individuals experiencing the physiological mechanisms and psychological factors that can lead to depression.
- **Diagnosis of conditions and causes**:
  - Identification of an individual's condition and its severity. This includes unipolar and bipolar depression and, potentially, specific phenotypes; and
  - Identification of the contributions to an individual's depression, such as physiological mechanisms (e.g. genetic and epigenetic, gut microbiome, immune system) and individual vulnerability factors, including socio-ecological and psychological factors.

As in Section 4.1, it is essential that these projects are also combined with the development of appropriate interventions to provide individuals with sufficient support, following assessment or diagnosis. Assessment and diagnosis of vulnerability factors mean that it is possible to implement a personalised management plan and tailor these interventions to address an individual's vulnerability factors and mechanisms. Implementation of such a plan would enable the individual to prevent an initial episode of depression, recover from the condition and/or remain in remission. These interventions are discussed in detail in Section 4.3.

Key opportunities for stakeholder groups

Supporting individuals to identify and subsequently address their vulnerability factors for depression was identified as a priority need for all stakeholder groups. This was discussed alongside and closely linked to the provision of information, education and training. All stakeholders also identified the need to equip a larger group of professionals with the necessary training and tools to diagnose depression in young people, in order to facilitate earlier detection. The ability to identify and treat the causes of depression was very appealing from both a patient and clinician perspective.

There are clear opportunities to improve the mental wellbeing of the population by the implementation of new approaches for vulnerability assessment and early detection, as well as the diagnosis and management of the causes of an individual's depression. These include:

- **For individuals, parents and carers,** the opportunity to identify addressable vulnerability factors and inform effective actions;
- **For the health and social care system,** the opportunity to identify the causes of depression and support patients to sustain and restore the good physiological and psychological functioning needed to prevent or recover from depression, and to remain in remission; and
- **For organisations engaging with young people** (e.g. schools, universities, employers), the opportunity to detect early signs of depression in young people in their care, and to support them to get timely access to appropriate help.

Needs and projects for vulnerability assessment, early detection, and diagnosis of conditions and causes

Primordial prevention	Primary prevention	Prediction	Personal prevention	**Early detection**	Diagnosis – condition	Diagnosis – causes	Personalised plan	**Management**	Treatment

1. Theme: Vulnerability assessment, early detection and diagnosis of conditions and causes

Unmet need	Example project(s)
PROBLEM: Knowledge and capability among people in positions of authority to identify and address depression in young people are varied. **POPULATION**: People in positions of authority (teachers, student wellbeing support, line managers, police, etc.). **OUTCOME**: Young people with depression are appropriately supported by the organisations with which they engage.	Develop support tools for individuals engaging with children and young people to help identify a range of vulnerability factors and early signs of mental illness. Pair with guidance on how to manage vulnerability factors and appropriate next steps. Training packages should be developed for specific stakeholder groups (e.g. teachers, student wellbeing support, line managers, police).

Relevance to actors

→ Organisations (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	**Early detection**	Diagnosis – condition	Diagnosis – causes	Personalised plan	**Management**	Treatment

2. Theme: Vulnerability assessment, early detection and diagnosis of conditions and causes

Unmet need	Example project(s)
PROBLEM: Schools (and other organisations) can be reluctant to identify children with depression as the result of a lack of both appropriate support options and clear pathways of escalation. **POPULATION**: Leaders and responsible managers. **OUTCOME**: Young people with depression are identified and appropriately supported.	Raise awareness of available mental health services and support young people to access appropriate services as early as practical. Include both local and national services.

Relevance to actors

→ Organisations (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	**Early detection**	Diagnosis – condition	Diagnosis – causes	**Personalised plan**	Management	Treatment

3. Theme: Vulnerability assessment, early detection and diagnosis of conditions and causes

Unmet need	Example project(s)
PROBLEM: University students are at very high risk of depression. Despite a high prevalence of mental illness, very few students seek treatment. **POPULATION**: University students with undiagnosed/ untreated depression. **OUTCOME**: Students engage promptly with an appropriate mental health service and get the right support to recover from depression.	Develop and promote a simple tool for use by individuals, their friends and family, or the wider community to identify young people in need of mental health support. Pair with personalised advice and guidance based on individual vulnerability factors. Work with universities to implement the tool as part of their mental health support infrastructure.

Relevance to actors

→ Organisations (universities)

Primordial prevention	**Primary prevention**	**Prediction**	**Personal prevention**	**Early detection**	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

4. Theme: Vulnerability assessment, early detection and diagnosis of conditions and causes

Unmet need	Example project(s)
PROBLEM: When seeing a patient for other conditions, there is not time to identify and address an individual's vulnerability factors for depression or possible early signs. **POPULATION**: Young people presenting to the healthcare system for another reason. **OUTCOME**: Vulnerability factors for depression are identified early and addressed in order to prevent a first episode of depression/depression is identified earlier.	1. Develop a process within a patient record system to flag patients to screen for mental health conditions (e.g. with commonly comorbid physical conditions or high frequency patients). 2. Provide an on-the-spot assessment by a trained mental health nurse for children and young people attending A&E/ urgent treatment centres who are identified as 'at risk'. This must also be combined with appropriate support.

Relevance to actors

→ Individuals (with depression)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	**Personal prevention**	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

5. Theme: Vulnerability assessment, early detection and diagnosis of conditions and causes

Unmet need	Example project(s)
PROBLEM: In patients with chronic diseases/ conditions, there is a high prevalence of major depressive disorders (MDD). Currently, these patients are not appropriately risk-assessed and managed, which would enable them to sustain good mental health. **POPULATION**: Young people with chronic diseases/ conditions. **OUTCOME**: Young people with chronic diseases/ conditions are supported to make informed choices to reduce their risk of developing depression.	Develop mental health training for clinicians caring for patients with other chronic conditions. Pair with the development of disease-specific management plans and tools and resources for patients to identify and address individual vulnerability factors.

Relevance to actors

→ Individuals (with chronic conditions)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	**Personal prevention**	**Early detection**	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

6. Theme: Vulnerability assessment, early detection and diagnosis of conditions and causes

Unmet need	Example project(s)
PROBLEM: Young people do not seek or access professional help for depression until it is advanced. **POPULATION**: Young people with early signs of depression. **OUTCOME**: Young people with early signs of depression are identified early and supported to manage addressable contributing factors to prevent progression.	Develop an accessible service to support mental wellbeing where young people are motivated to engage (possibly through rewards for participation). Include support for individual lifestyle factors and advise on onwards referral where appropriate.

Relevance to actors

→ Individuals (all)

→ Health and social care (all)

→ Organisations (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	**Early detection**	**Diagnosis – condition**	Diagnosis – causes	Personalised plan	Management	Treatment

7. Theme: Vulnerability assessment, early detection and diagnosis of conditions and causes

Unmet need

PROBLEM: It is challenging and time consuming to accurately diagnose an individual's condition (e.g. bipolar depression) and its severity. This can result in incorrect treatment (and in the case of bipolar, increased suicide risk).

POPULATION: Young people presenting with depression.

OUTCOME: The type and severity of an individual's depression are identified efficiently and effectively, enabling appropriate actions.

Example project(s)

Develop and pilot a portfolio of online diagnostic tools that can identify an individual's specific mental health conditions more effectively than an in-person consultation.

Include appropriate tools for different settings to enable earlier detection.

Relevance to actors

→ Individuals (with depression)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	**Diagnosis – causes**	**Personalised plan**	**Management**	**Treatment**

8. Theme: Vulnerability assessment, early detection and diagnosis of conditions and causes

Unmet need

PROBLEM: It is challenging and time consuming to identify and manage the causes of an individual's depression (approved diagnostic tools do not exist in routine care).

POPULATION: Young people presenting with depression.

OUTCOME: Specific causes of an individual's depression can be identified, enabling the development of a personalised management and treatment plan.

Example project(s)

1. Pilot: For individuals presenting with depression, clinicians should screen for comorbid conditions (e.g. ADHD/allergies/inflammatory conditions) that can lead to depression and treat any underlying condition.
2. Develop and pilot a tool to provide a comprehensive assessment of addressable vulnerability factors (to include diet, exercise, sleep and substance use). Pair with support to manage key risks.

Relevance to actors

→ Individuals (with depression)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	**Early detection**	**Diagnosis – condition**	**Diagnosis – causes**	**Personalised plan**	**Management**	**Treatment**

9. Theme: Vulnerability assessment, early detection and diagnosis of conditions and causes

Unmet need	Example project(s)
PROBLEM: Healthcare guidelines for the care of children and young people with depression do not address the full range of vulnerability factors or opportunities to identify the likely causes of an individual's depression. **POPULATION**: Healthcare professionals. **OUTCOME**: The care pathway supports clinicians to diagnose an individual's full range of vulnerability factors and likely causes of depression and to develop a personalised management and treatment plan.	Facilitate research and evidence generation on the efficacy of potential interventions to address specific causes of an individual's depression Register as a stakeholder to have an input into the NICE guidelines for the management of depression in children and young people.

Relevance to actors

→ Health and social care (healthcare)

4.3 Prevention, management and treatment

The overall aims of prevention, management and treatment are to enable:

1. Prevention of first-episode depression;
2. Recovery from depression;
3. People to remain in remission.

The aim of **prevention** is to minimise or mitigate the development of the physiological and psychological conditions that can lead to depression. This can be achieved by acting at a number of care stages (described in Section 3.3): national and community-level primordial prevention, primary prevention, prediction and personal prevention. Prevention involves:

- Interventions to address socio-ecological vulnerability factors, individual vulnerability factors, and psychological factors.

The aim of **management** is to help people who have, or are beginning to develop, depression by addressing the specific causes that are contributing to their condition, including both their physiological and psychological conditions. This can be achieved by the development and execution of a personalised management plan (through diagnosis of the causes of the individual's condition). Management involves:

- Interventions to address socio-ecological vulnerability factors, individual vulnerability factors, and psychological factors.

The aim of **treatment** is to help people who have, or are beginning to develop, depression by addressing directly the physiological and psychological conditions that are contributing to their depression. This can be achieved by developing a personalised treatment plan (through diagnosis of the causes of the individual's condition). Treatment involves:

- Interventions to directly address the physiological conditions and psychological factors that are contributing to the individual's depression, rather than by addressing vulnerability factors.
- Where necessary, interventions such as medication to help a person with the symptoms of their depression.

Needs and opportunities spanning the prevention, management and treatment care pathways are presented in Section 4.3.1, with specific examples of projects to address individual vulnerability factors given in the following sections:

4.3.2. Food and nutrition
4.3.3. Exercise and movement
4.3.4. Sleep
4.3.5. Psychological

Prevention strategies at the primordial level, to include policies, are not addressed here. Section 4.4 includes some examples of policies and regulation that are needed to address socio-ecological vulnerability factors.

4.3.1 Prevention, management and treatment pathways

Research has shown that a focus on the prevention of mental health conditions can reduce long-term costs to the healthcare system.[45] In an ideal system, prevention, management and treatment strategies should complement one another and be applied in parallel, rather than in isolation. These projects build on the understanding developed by projects presented in Section 4.1 and the ability to identify the vulnerability factors and causes of depression in an individual, enabled by projects in Section 4.2.

Key opportunities for stakeholder groups

Prevention of depression was identified as a key priority by all stakeholders with a focus on embedding preventative initiatives from the early years (both through education and familial support). Information, education and training for individuals, with a focus on addressable vulnerability factors, was identified as a key approach for prevention. All stakeholders identified a lack of availability of suitable management and treatment options for children and young people with depression. It was acknowledged that this lack of support is particularly problematic for children and young people on waiting lists.

There are clear opportunities to improve the mental wellbeing of the population by implementing new approaches for the prevention, management and treatment of depression in children and young people. These include:

- **For individuals, parents and carers**, the opportunity to maintain and restore good mental health through the identification and management of addressable vulnerability factors.
- **For the health and social care system**, the opportunity to identify and manage the causes of depression in order to support patients to sustain and restore the good physiological and psychological functioning needed to prevent or recover from depression, and to remain in remission. There is also an opportunity to directly treat underlying physiological conditions that lead to depression.
- **For organisations engaging with young people** (e.g. schools, universities, employers), the opportunity to develop and implement policies and services that support young people in their care, and surrounding communities, to maintain good mental health.

Needs and projects for prevention, management and treatment pathways

Primordial prevention	**Primary prevention**	**Prediction**	**Personal prevention**	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	**Management**	Treatment

1. Theme: Prevention, management and treatment pathways

Unmet need	Example project(s)
PROBLEM: Individuals with substantial socio-ecological vulnerability factors are at a higher risk of depression as a result of poorer outcomes from individual vulnerability factors (such as food and nutrition, exercise, sleep, substance use, trauma, underlying health conditions and chronic stress). **POPULATION**: Young people and families with substantial socio-ecological vulnerability factors. **OUTCOME**: Individuals with substantial socio-ecological vulnerability factors are supported to manage addressable individual vulnerability factors, thereby reducing the prevalence of depression and enabling patients to recover and remain in remission.	Train social support providers and mentors to work with individuals to reduce individual vulnerability factors for depression. Ensure at-risk young people have access to support providers/mentors.

Relevance to actors

- → Individuals (with substantial socio-ecological vulnerability factors)
- → Organisations (all)
- → Health and social care (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	**Diagnosis – causes**	**Personalised plan**	**Management**	Treatment

2. Theme: Prevention, management and treatment pathways

Unmet need	Example project(s)
PROBLEM: Young people with diagnosed depression lack the knowledge, support, confidence and motivation to appropriately manage the individual vulnerability factors associated with their condition. **POPULATION**: Young people diagnosed with depression. **OUTCOME**: Young people have the opportunity, capability and motivation to address the factors contributing to their condition to enable them to recover from depression and remain in remission.	Support young people to engage in activities to address the individual's vulnerability factors and encourage their good mental health (e.g. through social prescribing).

Relevance to actors

- → Individuals (with depression)
- → Organisations (all)
- → Health and social care (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	**Diagnosis – causes**	**Personalised plan**	**Management**	Treatment

3. Theme: Prevention, management and treatment pathways

Unmet need	Example project(s)
PROBLEM: Young people with moderate–severe depression do not access support to appropriately manage their condition while on the waiting list for Children and Adolescent Mental Health Services (CAMHS). **POPULATION**: Young people with depression on the waiting list for CAMHS. **OUTCOME**: Young people have the opportunity, capability and motivation to address the factors contributing to their condition to enable them to manage and improve their symptoms while on the waiting list.	Conduct a research project to understand why young people are not taking up opportunities for support while on the waiting list. Use this information to develop a service to support young people to manage their condition.

Relevance to actors

→ Individuals (with depression)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	**Early detection**	**Diagnosis – condition**	**Diagnosis – causes**	**Personalised plan**	**Management**	**Treatment**

4. Theme: Prevention, management and treatment pathways

Unmet need	Example project(s)
PROBLEM: The capability in primary care to care for children and young people with depression is limited because of a lack of time and appropriate resources. **POPULATION**: Primary care. **OUTCOME**: GPs have the necessary resources and support to identify young people with depression and take appropriate actions to address both the causes and the condition itself, thereby enabling patients to recover and remain in remission.	Model the configuration of primary care with respect to mental health and in the context of the larger ecosystem in order to identify and evaluate opportunities to optimise the use of resources and improve patient outcomes.

Relevance to actors

→ Health and social care (primary care)

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	**Personalised plan**	**Management**	Treatment

5. Theme: Prevention, management and treatment pathways

Unmet need	Example project(s)
PROBLEM: A lack of information sharing between services engaging with a young person with depression leads to less effective management of the condition. **POPULATION**: Services engaging with children and young people with depression. **OUTCOME**: A joined-up approach to supporting a young person with depression leads to earlier recovery and more efficient service delivery.	Work with schools and health and social care professionals to develop a management plan template for pupils with mental illness. Include examples of good practice and practical recommendations. Deploy an electronic system through which all services can view and edit a single care plan.

Relevance to actors

→ Individuals (all)

→ Organisations (all)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	**Personalised plan**	**Management**	Treatment

6. Theme: Prevention, management and treatment pathways

Unmet need	Example project(s)
PROBLEM: It is difficult for patients to determine the impact of actions on their condition and therefore self-manage individual vulnerability factors in order to sustain progress towards recovery or remain in remission. **POPULATION**: Young people diagnosed with depression. **OUTCOME**: Young people with depression have the capability and motivation to manage their condition, enabling patients to recover faster and remain in remission.	Develop an app that uses smartphone data to monitor sleep, exercise, digital biomarkers and mood, and makes recommendations to modify choices and actions that lead to low mood and depression. (This can be deployed in parallel with standard psychological interventions.)

Relevance to actors

→ Individuals (with depression)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	**Management**	Treatment

7. Theme: Prevention, management and treatment pathways

Unmet need	Example project(s)
PROBLEM: It is difficult for healthcare professionals to monitor adherence to interventions and progress towards recovery. **POPULATION**: Healthcare professionals supporting young people with depression. **OUTCOME**: Healthcare professionals are able to better manage their patient's condition, enabling a faster recovery.	Develop a tool to monitor patient wellbeing over time using an approved mental wellbeing scale and feed back to a clinician as required.

Relevance to actors

→ Individuals (with depression)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	**Management**	Treatment

8. Theme: Prevention, management and treatment pathways

Unmet need	Example project(s)
PROBLEM: It is challenging for schools to provide sufficient support for pupils with severe mental illness. **POPULATION**: School pupils with severe mental illness. **OUTCOME**: School pupils with severe mental illness are supported with a consistent and appropriate management plan from all the services that they engage with.	Work with schools and health and social care professionals to develop a management plan template for pupils with mental illness. Include examples of good practice and practical recommendations. Deploy an electronic system through which all services can view and edit a single care plan.

Relevance to actors

→ Individuals (with depression)

→ Organisations (schools)

→ Health and social care (all)

4.3.2 Food and nutrition

Research has shown that there are multiple links between diet and the biological mechanisms that contribute to the development of depression. We know, for example, that diet affects:

- The composition and diversity of bacteria in the gut[46] and the gut–microbiome–brain axis;[47]
- Inflammation, both directly and via the effects of obesity;[48]
- The production of neurotransmitters, such as serotonin;[49]
- The production of neurotrophic factors, such as brain derived neurotrophic factor (BDNF);[50]
- The availability of co-factors (non-protein chemical compounds or metallic ions that are required for an enzyme's role as a catalyst) that affect biological processes, such as the processing of tryptophan, that contribute to mental wellbeing;[51]
- The functioning and maintenance of brain cells and structures;[52]
- Attenuation of the effects of the MTHFR genetic polymorphism, which is associated with depression.[53]

Vulnerability factors, effects and potential opportunities

The following dietary components have been shown to correlate with specific physiological mechanisms that can affect depression. They offer an opportunity for interventions that aim to prevent or manage the causes of depression through food and nutrition.

Plant fibre diversity

- Research has shown that consumption of 30 or more different plant types each week helps to sustain diversity of the gut microbiota and good functioning of the gut microbiome.[54], [55]
- Low diversity of plant types in the diet leads to:
  - Changes to the diversity and composition of gut microbiota;[56]
  - Changes to important microbial products, such as short chain fatty acids (SCFAs)[57] and neurotransmitters.[58]
- The effects of these changes include inflammation,[42] metabolic changes, changes to brain metabolites and structure, and depression.[59]
- Examples of potential opportunities that could be addressed by initiatives include increasing the diversity of plant types in the diet and supporting key bacteria through fermented foods, prebiotics and/or probiotics.

Balance of omega-3 and omega-6 fatty acids

- Research has shown that a perfectly balanced ratio of omega-6/omega-3 fatty acids should be approximately 1:1. However, in Western diets, the estimated ratio is now raised to around 20:1.[60]
- The early effects of a diet containing a high omega-6/omega-3 ratio includes changes to cell permeability and increased inflammation.[61] Other effects include increased obesity,[62] reduced functioning of neurotransmitters,[63] reduced cognitive function[64] and depression.[65]
- Examples of potential opportunities that could be addressed by nutritional initiatives include reducing intake of omega-6 fatty acids, increasing dietary intake of omega-3 fatty acids and taking supplements containing EHP (eicosapentaenoic acid) and DHA (docosahexaenoic acid) omega-3 fatty acids.

Vitamins, minerals and micronutrients

- Research has shown that vitamins, minerals and micronutrients play vital roles in sustaining mental wellbeing. Examples include vitamins such as folate B9, B12[66] and D; minerals, such as calcium, iron, magnesium and zinc;[67] phytonutrients; amino acids; and antioxidants. In early life, breastfeeding provides essential nutrients, antibodies and other important factors for physical and mental wellbeing and development.
- A lack of vitamins, minerals and micronutrients in the diet leads to reduced levels of co-factors that affect biological processes that can play a role in mental wellbeing. This can lead to reduced production of neurotransmitters, neurotrophic factors and myelin; reduced birth of new brain cells; reduced neuroplasticity; and depression.
- Examples of potential opportunities that could be addressed by nutritional initiatives include increasing the consumption of foods containing vitamins, minerals and micronutrients – particularly through the consumption of fresh and minimally processed foods; supplements; and fortification of foods.

Ultra-processed foods (UPFs)

- Research has shown that increased UPF consumption is associated with an increase in depressive symptoms.[68] In the UK, schoolchildren typically get 65% of their calories from UPFs.[69]
- UPF is a broad term that includes many types of foods. UPFs typically have many of the following characteristics: calorie-dense, nutrient-poor; a lack of fibre diversity, vitamins, minerals and micronutrients; high in omega-6 fatty acids; pro-inflammatory; high levels of sugar, artificial sweeteners, salt and saturated fats; trans-fatty acids; emulsifiers; and are habit-forming and can cause craving. Figure 4.3 illustrates the difference in levels of nutrients between UPFs and wholefoods.
- Proposed mechanisms linking the effects of consuming UPFs as a significant part of a diet, to adverse mental health outcomes include: weakening the integrity of the gut mucosa and increasing gut permeability;[70]

endocrine system dysfunction and hormone disruption; increased risk of obesity; inflammation and oxidative stress; neuronal damage, especially in regions of the brain linked to depression, such as the hippocampus.

- Examples of potential opportunities that could be addressed by nutritional initiatives include reducing the consumption of UPFs and enabling people to plan, buy, prepare and consume whole and minimally processed foods.

Key opportunities for stakeholder groups

The lack of understanding about the correlation between food and nutrition and mental health was identified as a priority need for all key stakeholder groups. The inability to change behaviour as the result of a lack of support was also identified as a barrier to eating and providing foods to sustain good mental health.

There are clear opportunities to improve mental wellbeing through better food and nutrition by motivating and enabling people to buy, prepare and consume whole and minimally processed foods that provide sufficient diversity of plant fibre, a good balance of omega-6/omega-3 fatty acids and sufficient breadth and amounts of vitamins, minerals and micronutrients. These include:

- **For individuals, parents and carers**, the opportunity to equip individuals and families with the knowledge, motivation, opportunity and capability to plan, buy, prepare and consume nutritious foods.
- **For the health and social care system**, the opportunity to provide clinicians with an understanding of how food and nutrition impacts mental health and equip them with the appropriate interventions to support their patients to consume nutritious foods.
- **For organisations engaging with young people** (e.g. schools, universities, employers), the opportunity to support the development and implementation of approaches to source, prepare and serve nutritious foods that young people will eat. In organisations where young people cater for themselves, there is an opportunity to inform initiatives that support young people in their care to develop the motivation, opportunity and capability to buy, prepare and consume nutritious foods.

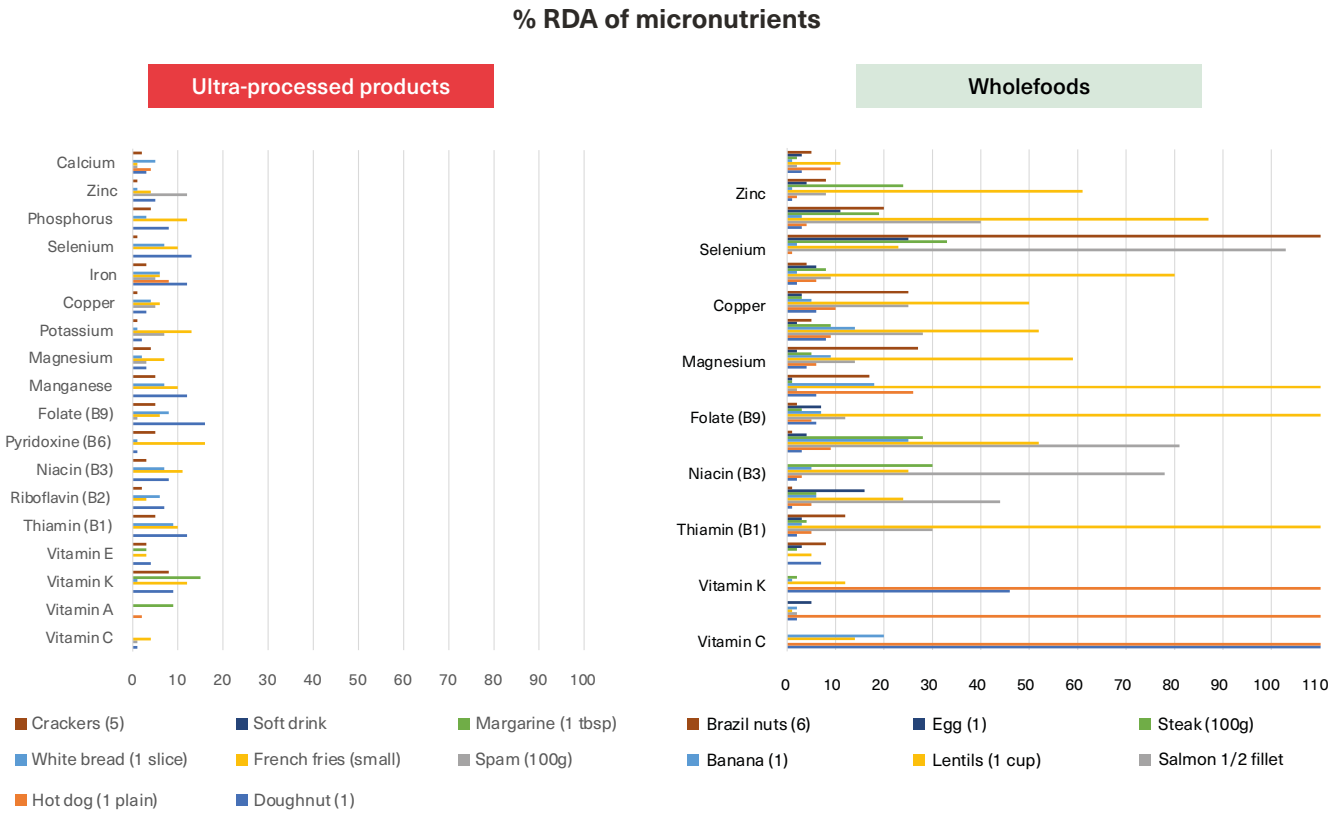


Figure 4.3 Comparison of amounts of micronutrients in UPFs and wholefoods
(By kind permission of Professor Julia Rucklidge, Mental Health and Nutrition Research Group, University of Canterbury, New Zealand)

Needs and projects for food and nutrition

Primordial prevention	**Primary prevention**	Prediction	**Personal prevention**	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	**Management**	Treatment

1. Theme: Food and nutrition

Unmet need	Example project(s)
PROBLEM: Individuals are not aware of the relationship between food and nutrition and mental health. **POPULATION**: Young people, parents and carers. **OUTCOME**: Individuals have the knowledge and motivation to make informed choices to reduce their risk of developing depression.	**1.** Develop an information and education programme for individuals, families, schools, prisons and employers about the link between food and nutrition and depression, and what people can do to prevent and treat it. Reach out to existing campaigns (e.g. charities, public health, etc.) focused on obesity, to include good mental health as part of their messaging. **2.** Provide information and support on nutrition and mental health to families expecting children (everyone expecting a baby is seen by a midwife so this is a good time to reach families directly). Include quick and easy healthy meal recipes. Give coupons to buy ingredients or provide access to cooking classes.

Relevance to actors

→ Individuals (all)

→ Organisations (all)

→ Health and social care (all)

Primordial prevention	**Primary prevention**	Prediction	**Personal prevention**	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

2. Theme: Food and nutrition

Unmet need	Example project(s)
PROBLEM: Time and money are perceived as barriers to eating to support good mental health. **POPULATION**: Young people, parents, carers and organisations. **OUTCOME**: Families have the capability, motivation and opportunity to eat to sustain good mental health and reduce their risk of developing depression.	**1.** Work with industry/retailers (e.g. supermarkets) to develop and promote lower-cost foods for good mental health (including foods that are good for gut microbiota and minimally processed convenience foods). **2.** Develop online resources to support families to make dietary changes to reduce symptoms of anxiety and depression (including questionnaires to identify individual risks, access to affordable/quick recipes, and information on relevant supplements). Initially target high-risk groups.

Relevance to actors

→ Individuals (with depression)

→ Organisations (all)

→ Health and social care (all)

Primordial prevention	**Primary prevention**	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

3. Theme: Food and nutrition

Unmet need	Example project(s)
PROBLEM: There is high availability and convenience of foods that contribute towards depression (e.g. UPFs). **POPULATION**: Young people, parents and carers. **OUTCOME**: Families have the capability, motivation and opportunity to avoid UPFs and eat to sustain good mental health, thereby reducing their risk of developing depression.	Through contribution to evidence, support changes to policy that reduces the consumption of UPFs, trans-fatty acids (TFAs), and food components and contaminants shown to be linked to depression.

Relevance to actors

→ Individuals (all)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	**Personal prevention**	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

4. Theme: Food and nutrition

Unmet need	Example project(s)
PROBLEM: Young people with allergies and chronic conditions (such as IBS) can struggle to eat to sustain mental wellbeing. **POPULATION**: Young people with allergies and chronic conditions (such as IBS). **OUTCOME**: Young people with allergies and chronic conditions (such as IBS) have the capability, motivation and opportunity to eat to sustain good mental health and reduce their risk of developing depression.	Develop resources specifically to support young people with non-immunoglobulin E (non-IgE) mediated food allergies and chronic conditions to eat to maintain mental wellbeing. Include questionnaires to identify individual risks, access to affordable/quick recipes, and information on relevant supplements. Patients should also be supported to monitor their mental wellbeing and adopt other lifestyle interventions.

Relevance to actors

→ Individuals (all)

→ Health and social care (all)

Primordial prevention	**Primary prevention**	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

5. Theme: Food and nutrition

Unmet need	Example project(s)
PROBLEM: Organisations are not aware of the relationship between food and nutrition and mental illness, and the steps they can take to reduce this risk (e.g. how to assess the foods they provide for their suitability to sustain mental wellbeing). **POPULATION**: Leaders and responsible managers of organisations, including schools, employers, universities. **OUTCOME**: Organisations have the capability, motivation and opportunity to provide food to enable young people to eat to sustain good mental health.	Develop and deliver training and tools to enable organisations to understand the relationship between food and mental health; assess the foods they provide to children and young people for their suitability to sustain mental wellbeing; and develop and implement plans to provide foods that sustain children and young people's mental wellbeing.

Relevance to actors

→ Organisations (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	**Management**	**Treatment**

6. Theme: Food and nutrition

Unmet need	Example project(s)
PROBLEM: Dietary management interventions are not available for individuals with depression and anxiety. **POPULATION**: Young people with depression and their parents and carers. **OUTCOME**: Individuals with depression are supported to modify their diet in order to manage their condition.	**1.** Pilot: Provide families of children and young people diagnosed with depression with a programme of sessions with a dietician to enable them to eat to restore good mental wellbeing. This showed success in the SMILES trial in adults in Australia. SMILES was a 12-week, parallel-group, single-blind, randomised controlled trial of an adjunctive dietary intervention in the treatment of moderate to severe depression. The intervention consisted of seven individual nutritional consulting sessions delivered by a clinical dietician. The control condition comprised a social support protocol to the same visit schedule and length.[71] Adapt the SMILE trial for children and young people in the UK. This could potentially include a supplement arm; alternatively, the supplement trial could be conducted as a separate project. Develop an economic model to show the cost/benefit. **2.** Work with existing providers of support for children and young people with depression to include tools and resources to manage diet.

Relevance to actors

→ Individuals (all)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	**Personal prevention**	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

7. Theme: Food and nutrition

Unmet need	Example project(s)
PROBLEM: Families, and young people living away from home, do not all have the skills, motivation or necessary equipment to plan, buy, cook and consume nutritious food at home. **POPULATION**: Families and young people living away from home. **OUTCOME**: Individuals have the capability, motivation and opportunity to eat to sustain good mental health.	1. Promote teaching of cooking skills to children in schools and after school. Extend offer to parents/families through community projects. 2. Provide information for university students on food and nutrition for mental health in combination with courses on 'cooking for mental wellbeing'. Educate universities on the relationship between food and nutrition and mental health, and pilot initiatives to reduce this risk.

Relevance to actors

→ Individuals (all)

→ Organisations (all)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	**Personal prevention**	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

8. Theme: Food and nutrition

Unmet need	Example project(s)
PROBLEM: An increased use of disinfectant cleaning products since COVID-19 has had a negative impact on the gut (and other) microbiomes and associated health conditions (including mental health). **POPULATION**: Families and individuals. **OUTCOME**: Individuals are exposed to microbes that have a positive effect on the gut (and other) microbiomes, resulting in a reduced risk of developing mental health conditions.	Develop a campaign to change the public's perception around 'germs' and encourage exposure to animals, nature, dirt and microbes during early postnatal development, infancy and childhood, including gardening at school, real grass on football fields, etc.

Relevance to actors

→ Individuals (all)

→ Organisations (all)

→ Health and social care (all)

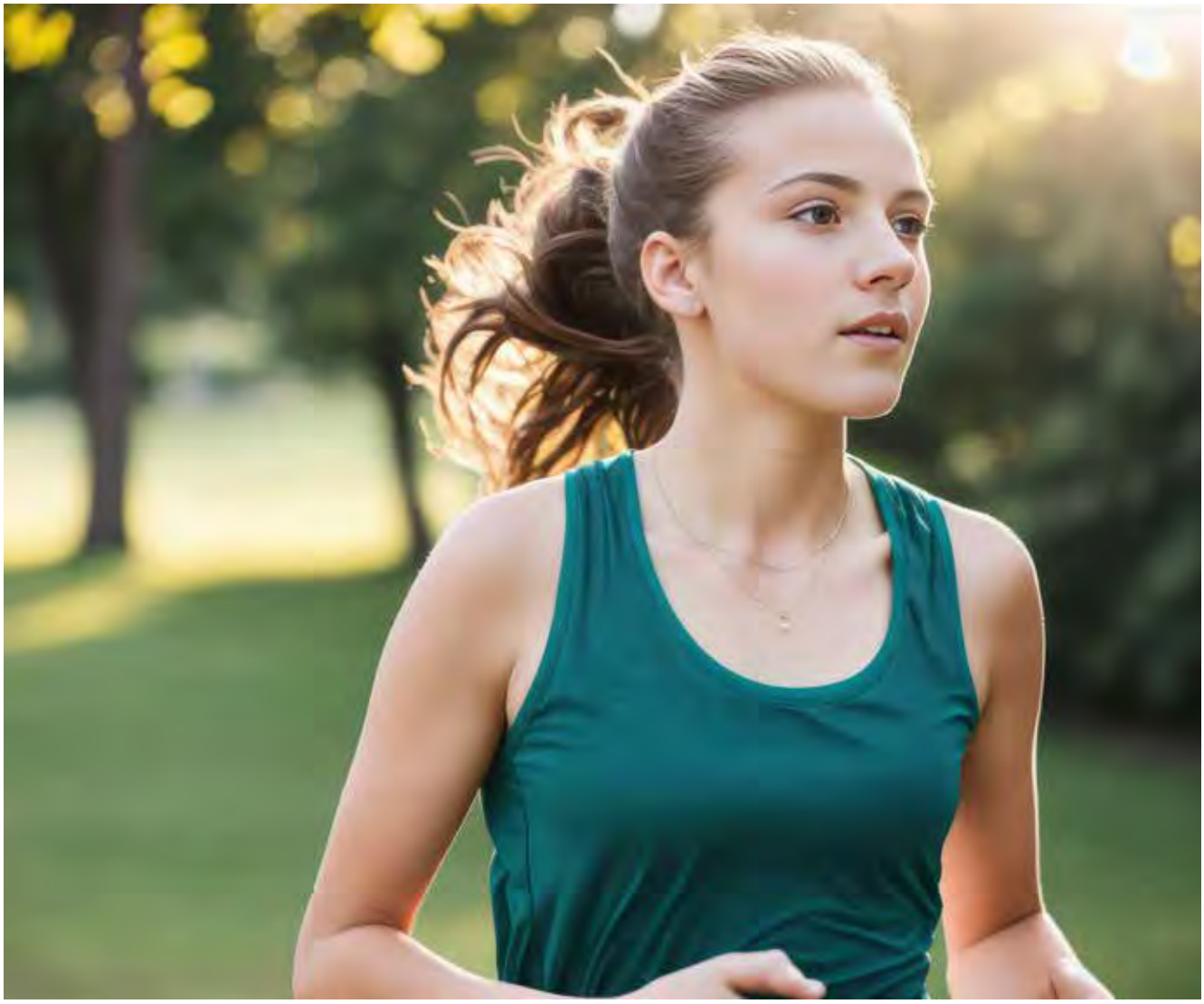
Primordial prevention	**Primary prevention**	**Prediction**	**Personal prevention**	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

9. Theme: Food and nutrition

Unmet need	Example project(s)
PROBLEM: Individuals with substantial socio-ecological vulnerability factors are at a higher risk of depression because of poorer food and nutrition. **POPULATION**: Young people and families with substantial socio-ecological vulnerability factors. **OUTCOME**: Individuals with substantial socio-ecological vulnerability factors are supported to eat to support good mental health, thereby reducing the prevalence of depression and enabling patients to recover and remain in remission.	Work with foodbanks and subsidised food programmes to improve access to nutritious food in order to enable people to eat to sustain good mental health. Provide advice to foodbank clients on eating to sustain good mental health.

Relevance to actors

- → Individuals (with substantial socio-ecological vulnerability factors)
- → Organisations (all)
- → Health and social care (all)



4.3.3 Exercise and movement

Sedentary behaviours in childhood, adolescence and adulthood contribute to the development of depression. Research shows that four in five 11–17-year-olds are not doing enough physical exercise.[72] The links between exercise and depression are complex and broadly fall into three areas:

- **Biological**: The effects of exercise on the gut microbiome,[73] epigenetics[74] and gene expression,[75] the HPA axis,[76] inflammation,[77] neurotransmitter regulation,[78] the production of brain trophic factors[79] and neurogenesis[80] and neuroplasticity;[81]
- **Psychosocial**: The effects of exercise on social connectedness/social support, self-acceptance, self-concept and self-esteem;[82]
- **Behavioural**: The effects of exercise on diet[83], sleep[84] and emotional regulation.[85]

Key opportunities for stakeholder groups

Barriers to exercise and physical activity include individual, patient-level and systemic socio-ecological factors. Motivation was also identified as a key barrier. There is an awareness among the large majority of stakeholders that exercise is beneficial for physical health, although these benefits are often long term. Increasing awareness of the benefits of exercise on mental health, including short-term benefits such as improved sleep and concentration, was identified as a need for all stakeholder groups.

There are clear opportunities to improve mental wellbeing through exercise by motivating and enabling young people to become more physically active. These include:

- **For individuals, parents and carers**, the opportunity to maintain and restore good mental health by becoming more physically active.
- **For the health and social care system**, the opportunity to identify physically inactive patients and use appropriate interventions to support their patients to become more physically active.
- **For organisations engaging with young people** (e.g. schools, universities, employers), the opportunity to inform the development and implementation of approaches to support young people in their care to participate in more physical activity.

Needs and projects for exercise and movement

Primordial prevention	**Primary prevention**	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	**Management**	Treatment

1. Theme: Exercise and movement

Unmet need	Example project(s)
PROBLEM: Individuals are not sufficiently aware of the relationship between exercise and mental health. **POPULATION**: Young people, parents and carers. **OUTCOME**: Individuals understand the relationship between exercise and depression and are able to make informed lifestyle choices to reduce their risk of developing depression.	Develop an information and education programme for individuals, families, schools, prisons and employers to educate about the link between exercise and depression, and what people can do to prevent and treat it. Reach out to existing campaigns (e.g. charities, public health, etc.) focused on physical health, to include good mental health as part of their messaging.

Relevance to actors

→ Individuals (all)

→ Organisations (all)

→ Health and social care (all)

Primordial prevention	**Primary prevention**	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	**Management**	Treatment

2. Theme: Exercise and movement

Unmet need	Example project(s)
PROBLEM: A lack of affordable local opportunities is a barrier to participation in exercise for young people. **POPULATION**: Young people, parents and carers. **OUTCOME**: Individuals have the opportunity to exercise to maintain good mental health and reduce their risk of developing depression.	1. Pilot: Work with schools to increase the time allocated to exercise. Collect data on the effects of increased exercise in schools on mental health to support curriculum changes to provide more opportunity to exercise in schools. 2. Provide/promote access to school facilities to children from the local community and charities to provide opportunities to exercise outside the school day. 3. Develop resources, including a simple 'how to' guide, to provide support to start a variety of exercise clubs/ opportunities in different settings (e.g. schools, universities, offices). Provide examples that have worked successfully in different space- or resource-retrained settings.

Relevance to actors

→ Individuals (all)

→ Organisation (all)

→ Health and social care (all)

Primordial prevention	**Primary prevention**	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

3. Theme: Exercise and movement

Unmet need	Example project(s)
PROBLEM: Individuals are not motivated to exercise to maintain good physical and mental health. **POPULATION**: Young people, parents and carers. **OUTCOME**: Individuals are motivated to exercise to reduce their risk of developing depression.	1. Conduct a research project to improve understanding of why young people (of different ages and backgrounds) are not motivated to exercise. Use this information to inform the development of services to support young people to engage in exercise and movement to support good mental health. 2. Work with academics and digital developers to find opportunities to 'gamify' physical activity and/or incorporate it into the daily routine. Consider a rewards-based model.

Relevance to actors

→ Individuals (all)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	**Diagnosis – causes**	**Personalised plan**	**Management**	Treatment

4. Theme: Exercise and movement

Unmet need

PROBLEM: A lack of exercise is not routinely identified as a contributing factor to depression, and young people do not receive sufficient support to manage this vulnerability factor.

POPULATION: Young people presenting with depression.

OUTCOME: A lack of exercise is identified as a contributing factor to depression, and young people are supported to exercise, so enabling them to recover faster from depression and to remain in remission.

Example project(s)

1. Work with charities providing exercise opportunities for children and young people with depression to collect evidence of the mental health benefits of exercise for specific populations and to determine cost efficacy.
2. Pilot: Provide exercise prescriptions to sedentary young people presenting to the GP (or other clinical professional) with depression. Give young people a choice over activity selection. This could be modelled on the 'Active Kids' eight-week programme in Australia, where the government provided vouchers to support the costs of structured physical activities for children and young people, and which was found to significantly increase children's activity levels over a six-month period. Collect outcome data.

Relevance to actors

→ Individuals (with depression)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	**Personalised plan**	**Management**	Treatment

5. Theme: Exercise and movement

Unmet need

PROBLEM: Motivation to exercise is very low as a result of low energy, low self-agency and low self-esteem.

POPULATION: Young people with depression.

OUTCOME: Individuals have the motivation, capability and opportunity to exercise so enabling them to recover faster from depression and to remain in remission.

Example project(s)

1. Create a database of local opportunities and games that promote physical exercise and other psychosocial benefits. Enable GPs to signpost to or prescribe from this list. Include ideas for low-level exercise that can be done at home, or as part of a daily routine with friends or family.
2. Pilot: Provide access to a health trainer for young people with depression in order to support them to take the first steps to becoming physically active and maintain motivation.

Relevance to actors

→ Individuals (with depression)

→ Health and social care (all)

4.3.4 Sleep

Sleep plays an important role in our physical, emotional and mental regulation, all of which are known to affect depression. The links between sleep and depression are complex and bi-directional.[86] They broadly fall into two areas:

- **Biological**: A number of biological processes have been shown to play a role in the relationship between sleep and depression.[87] These include neurotransmitter systems (serotonin and dopamine),[86] brain circuits (particularly the pre-frontal cortex), hyperarousal (cortisol secretion), immunological processes, changes in sleep architecture and biased memory consolidation.
- **Psychological**: A number of psychological factors have also been proposed linking sleep to depression. These include lying awake at night ruminating/worrying,[88] misperception of sleep deficit (a tendency to underestimate sleep time)[89] and cognitive inflexibility (the inability to switch between modes of thinking).[90]

Key opportunities for stakeholder groups

There is a need to increase public awareness of the importance of sleep and good sleep hygiene. However, it was identified that individuals (particularly adolescents) are often reluctant to implement the necessary changes. Limited availability of tools to support young people to identify and address the causes of poor sleep was also identified as a key barrier to improving the quality and quantity of sleep.

There are clear opportunities to improve mental wellbeing through the implementation of approaches to improve the quality and quantity of sleep. These include:

- **For individuals, parents and carers**, the opportunity to maintain good sleep hygiene, combined with diet and exercise to improve the quality and quantity of sleep.
- **For the health and social care system**, the opportunity to identify characteristics of sleep associated with depression and to use appropriate interventions to support their patients to identify and address the causes of poor sleep.
- **For organisations engaging with young people** (e.g. schools, universities, employers), the opportunity to inform the development and implementation of approaches to support young people in their care to improve the quality and quantity of their sleep.

Needs and projects for sleep

Primordial prevention	**Primary prevention**	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	**Management**	Treatment

1. Theme: Sleep

Unmet need	Example project(s)
PROBLEM: Individuals are not sufficiently aware of the relationship between sleep and mental health or how to practise good sleep hygiene. **POPULATION**: Young people, parents and carers. **OUTCOME**: Individuals are informed and motivated to practise good sleep hygiene to reduce their risk of developing depression.	Develop an information and education programme for individuals, families, schools, prisons and employers to educate about the link between sleep and depression and how people can practise good sleep hygiene. Support with appropriate tools and resources to enable implementation.

Relevance to actors

→ Individuals (all)

→ Organisations (all)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

2. Theme: Sleep

Unmet need	Example project(s)
PROBLEM: The school day does not align with the circadian rhythm of adolescents. **POPULATION**: Adolescents. **OUTCOME**: Adolescents are able to get sufficient sleep in order to get the most out of the school day and reduce their risk of developing depression.	Campaign to delay school start times to accommodate changes to adolescents' body clocks.

Relevance to actors

→ Individuals (all)

→ Organisation (schools)

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	**Diagnosis – causes**	**Personalised plan**	**Management**	Treatment

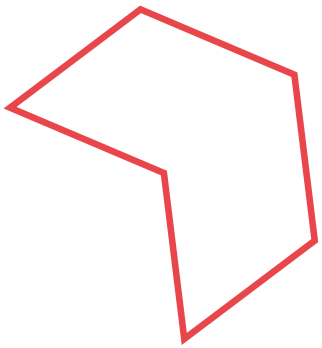
3. Theme: Sleep

Unmet need	Example project(s)
PROBLEM: Poor sleep (and its associated causes) is not routinely identified as a contributing factor to depression in young people, and they do not receive sufficient support to manage this risk factor. **POPULATION**: Young people with depression. **OUTCOME**: A lack of sleep is identified as a factor contributing to depression, and young people are supported to practise good sleep hygiene, thus enabling faster recovery from depression.	Develop a sleep programme for young people under the age of 18 with depression, to include identification of an individual's vulnerability factors and good sleep-hygiene practices. Pilot in primary care and collect outcome measures.

Relevance to actors

→ Individuals (presenting with depression)

→ Health and social care (all)



Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	**Management**	Treatment

4. Theme: Sleep

Unmet need	Example project(s)
PROBLEM: Accessible solutions (such as digital CBT) to improve sleep are not widely available for patients under the age of 18. **POPULATION**: Young people (under 18) with poor sleep. **OUTCOME**: Young people have access to suitable treatments (such as digital CBT) to improve sleep, in order to prevent depression or allow for faster recovery.	Improve the availability of existing evidence-based psychological sleep interventions for children and young people by supporting the collection of data in the under-18 population.

Relevance to actors

- → Individuals (all)
- → Organisation (all)
- → Health and social care (all)

4.3.5 Psychological

Psychological traits and factors (within the mind but influenced by an individual's experiences) have a bearing on depression. The relationships between depression, biological systems, cognitive functions, mood, resilience and our external environment are complex.

- **Depression and cognitive function**
  Changes to cognitive brain function, such as autobiographical, episodic and working memory, attention and concentration, problem-solving, visuospatial function and emotional reactivity are associated with depression.[91], [92]
- **Depression, behaviour and mood**
  When the body experiences inflammation it triggers 'sickness behaviour', which helps it to recover from acute conditions by conserving the energy it needs to combat infection. This can also lead to the development of depressive symptoms in vulnerable individuals.[93] Increased activity of the behavioural inhibition system (BIS), including catastrophising, rumination, and lower positive reappraisal, has also been shown to be linked to depression.[94]
- **Depression, psychology and resilience**
  Several protective factors have been linked to mental health, specifically resilience. People who score highly on goal orientation, self-confidence, social competence, social support and family cohesion are more likely to display resilient characteristics and reduced depressive symptoms.[95]

  Rumination is one of the clearest vulnerability factors for the development of internalising psychopathology.[96] Both adolescents and young people experience an increase in rumination in response to stressful life events.[97] Rumination is an important psychological mechanism linking perceived stress exposure to symptoms of depression and anxiety.

Key opportunities for stakeholder groups

There is a clear need to address external factors that create particularly stressful environments for young people. However, in parallel, there is a need to support young people to develop protective factors to equip them to manage stressful situations and reduce their susceptibility to developing depression. This approach was identified as a priority for all stakeholder groups.

There are clear opportunities to improve mental wellbeing through the implementation of interventions to reduce psychological vulnerability factors for young people. These include:

- **For individuals, parents and carers**, the opportunity to develop protective factors to equip them to manage stressful situations and reduce their susceptibility to developing depression.
- **For the health and social care system**, the opportunity to identify psychological traits associated with depression and use appropriate interventions to support their patients to understand and manage these factors.
- **For organisations engaging with young people** (e.g. schools, universities, employers), the opportunity to create an environment that reduces stress and supports young people in their care to develop and maintain protective psychological traits.

Needs and projects for psychological

Primordial prevention	**Primary prevention**	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

1. Theme: Psychological

Unmet need	Example project(s)
PROBLEM: There is a lot of pressure on children and adolescents to achieve academically, which is inhibiting the uptake of other opportunities. **POPULATION**: Children and adolescents. **OUTCOME**: Children and adolescents are supported within the school system to engage in a range of activities in order to develop protective factors to improve their resilience and mental health.	Develop and promote a whole-school-based approach that focuses on developing the self-esteem and resilience of pupils, thereby enabling their academic success. Children are supported to engage in a balanced range of academic and other activities that build their psychosocial skills.

Relevance to actors

→ Individuals (all)

→ Organisations (schools, universities)

Primordial prevention	**Primary prevention**	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

2. Theme: Psychological

Unmet need	Example project(s)
PROBLEM: Some young people lack close friendships. **POPULATION**: Children and young people (particularly around the age of 14). **OUTCOME**: Young people have the knowledge and opportunity to develop and sustain close friendships and connections.	Develop and implement an activity-based programme that can be implemented within both primary and secondary schools to help individuals develop the skills and behaviours necessary to build and sustain friendships.

Relevance to actors

→ Individuals (all)

→ Organisations (schools)

Primordial prevention	Primary prevention	Prediction	**Personal prevention**	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	**Management**	Treatment

3. Theme: Psychological

Unmet need	Example project(s)
PROBLEM: Children and young people are not equipped to manage stressful situations that arise in schools and universities (e.g. exams) and the workplace (e.g. performance). **POPULATION**: Children and young people. **OUTCOME**: Young people are able to manage stressful situations and prevent the development of chronic stress, thereby reducing their risk of developing depression.	Develop online, accessible questionnaires to help individuals recognise and manage the development of chronic stress, e.g. APES (for adolescents). Pair with support and advice on stress management.

Relevance to actors

→ Individuals (all)

→ Organisations (schools, universities, employers)

Primordial prevention	Primary prevention	Prediction	**Personal prevention**	Early detection	Diagnosis – condition	Diagnosis – causes	Personalised plan	Management	Treatment

4. Theme: Psychological

Unmet need	Example project(s)
PROBLEM: Some young people lack protective factors (such as self-agency and self-esteem) and are therefore more susceptible to developing depression. **POPULATION**: Children and young people. **OUTCOME**: Young people have the opportunity to develop protective factors and coping strategies to improve their resilience.	Support young people to try new things and find hobbies that they find engaging (e.g. through taster sessions or holiday camps) in order to develop as individuals, find value in themselves and improve psychosocial functioning.

Relevance to actors

→ Individuals (all)

→ Organisations (all)

→ Health and social care (all)

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis – causes	**Personalised plan**	**Management**	**Treatment**

5. Theme: Psychological

Unmet need	Example project(s)
PROBLEM: It can be challenging to engage family members in a management plan for a child or young person with depression. **POPULATION**: Children and young people with depression and their families. **OUTCOME**: Young people are supported by a family network to recover from depression and remain in remission.	1. Equip social workers and support workers with the necessary knowledge and tools to be able to help families support a young person to recover from depression and remain in remission. 2. Develop resources for families containing actionable advice. This could include access to a wide range of family activities that support mental wellbeing and ultimately may bring more connections/friendships/ sense of belonging. Work with schools to provide parental classes on wellbeing and mental health based on the resources developed.

Relevance to actors

→ Individuals (presenting with depression and their friends and families)

→ Health and social care (all)

→ Organisations (schools)

6. Theme: Psychological

Unmet need	Example project(s)
PROBLEM: Adolescents who feel depressed are likely to experience social isolation from their friends. **POPULATION**: Young people with depression and their friends. **OUTCOME**: Young people with depression are supported to maintain close friendships in order to prevent social isolation and thereby facilitate faster recovery.	Develop and promote simple resources for use by friends and family to identify individuals in need of support and to provide a basic understanding of depression. Include age-appropriate, actionable advice and the promotion of tolerance and empathy.

Relevance to actors

- → Individuals (presenting with depression and their friends and families)
- → Organisations (all)
- → Health and social care (all)

4.4 Society, policy and regulation

The socio-ecological and individual vulnerability factors described in Section 3 have a significant bearing on the psychological factors and physiological mechanisms that can lead to depression. Society leaders, policy-makers and regulators are vital contributors to the development of depression-resilient communities.

Our project did not focus specifically on the wide range of socio-ecological needs and corresponding policy changes required to address the underlying vulnerability factors (such as cultural context, societal and community factors). However, the following were highlighted in the discussions and are supported by research:

- **Income inequality**: Societies with priorities and policies that reduce income inequality have populations with better mental and physical health.[98] Lower income groups in highly unequal societies are more vulnerable to individual vulnerability factors. For example, they have difficulty accessing the nutritious foods necessary for mental wellbeing.
- **Social stigmas and barriers to accessing mental healthcare**: Legislation and policies that actively perpetuate social stigmas and create barriers to accessing mental healthcare should be amended to remove these effects.
- **Air pollution**: Particulates and other airborne components have been shown to contribute to the development of anxiety[99] and depression[100] through mechanisms such as increased inflammation. Policies and regulations are needed to lower, or ideally eliminate, particulates and other airborne components from the air.
- **Healthcare system design**: An increasing body of research confirms that depression is not 'all in the mind'. Rather, it arises from a complex set of interactions across the life course of an individual. Healthcare systems need to integrate mental and physical healthcare provision.
- **Organisation-related factors**: Characteristics such as bullying, stress and sense of control were considered when examining the roles of actors including schools, universities, employers and secure children's homes, young-offender institutions and secure training centres (see Section 5).

In examining individual vulnerability factors, we identified multiple opportunities for changes in policy and regulation to support mental wellbeing. Table 4.1 below gives examples of problems that need to be addressed in the area of food and nutrition. Policy changes that could be implemented to meet these needs are suggested.

Needs	Policy changes
Often, individuals are not aware which foods and food products contribute to mental wellbeing, so they can struggle to make healthful choices.	Policies and regulations for a clear system for labelling foods, such as those regarding: plant fibre amount and diversity; omega-3/omega-6 balance; vitamins, minerals and other micronutrients.
Chemicals are present in foods that have a significant adverse effect on human physiology, such as: ■ Herbicides such as glyphosate, that affect the gut microbiome;[101], [102], [102] ■ Trans-fatty acids (TFAs) that contribute to inflammation and hence heart disease[103] and depression.[65]	Policies and regulations to lower, or ideally eliminate, chemicals in foods, including: ■ Man-made trans-fatty acids; ■ Herbicides, such as glyphosate; ■ Emulsifiers that are detrimental to the gut microbiome.
Antibiotics and other animal medicines can be found in foods, leading to adverse effects on human physiology, such as the gut microbiome.[104]	Policies and regulations to reduce the use of antibiotics and other animal medicines in food production and limit their carryover into human foods.
UPFs have the adverse effects on physical and mental health described in Section 4.3.2. UK children obtain ~65% of their calorie intake from UPFs,[69] contributing to adverse physical and mental health outcomes, including depression.[68]	Policies and regulations to encourage the food industry to produce and market foods that do not have the adverse effects of UPFs, such as minimally processed foods.
Individuals are not aware of the therapeutic benefits of dietary supplements/nutraceuticals, and companies are not motivated to invest in rigorous studies because of restrictions on advertising claims that they can make. (Nutraceuticals are products derived from food sources that provide health benefits in addition to the basic nutritional value found in foods.)	Develop regulations to allow companies to advertise the evidence-based therapeutic effects of dietary supplements/nutraceuticals subject to sufficient research and evidence.

Table 4.1 Opportunities for policy changes to support mental wellbeing by addressing unmet needs in food and nutrition

5. Building communities that are resilient to depression

The socio-ecological and individual vulnerability factors that can lead to an individual developing depression affect many aspects of daily life. To enable individuals and communities to develop resilience to depression requires a balanced approach that addresses prevention; early detection; diagnosis, not only of conditions but also of the factors that cause them; and personalised approaches to manage and treat an individual's vulnerability factors and mechanisms. However, the ecosystem of people and organisations involved in helping to address the situation is complex and fragmented. A 'joined-up' approach that engages people and organisations across the care stages of prevention through to treatment is vital.

This section presents:

- Clear future-state visions and roles for each actor within the mental health ecosystem that can be understood and supported across the community, and configured for specific local contexts; and
- A structured approach to support stakeholder groups and actors to work together to increase the value that they offer to one another, as well as to the individual. (Value is the exchange between actors, which can include direct monetary value and indirect value such as products, services or information.) This approach is illustrated with examples.

Our vision is that:

- All actors in the ecosystem are aware of the causes of depression and the role that they can play to prevent, detect, diagnose, manage and treat depression in themselves and those around them.
- Actors work together to design, build and operate joined-up mental health ecosystems. These will be key to enabling both the prevention of depression and early intervention to address depression in children and young people.

Figure 5.1 shows a model of a joined-up mental health ecosystem. We have identified five key 'stakeholder groups' (the darker circles) with which an individual young person engages that have an impact on their mental health and wellbeing. Each stakeholder group comprises actors that are specific people or organisations. Some actors interact directly with the young person, such as parents, schools and primary care. Others interact indirectly, their decisions and actions affecting the young person's context and the stakeholder groups with which they engage. These include national and local government, research funders and researchers.

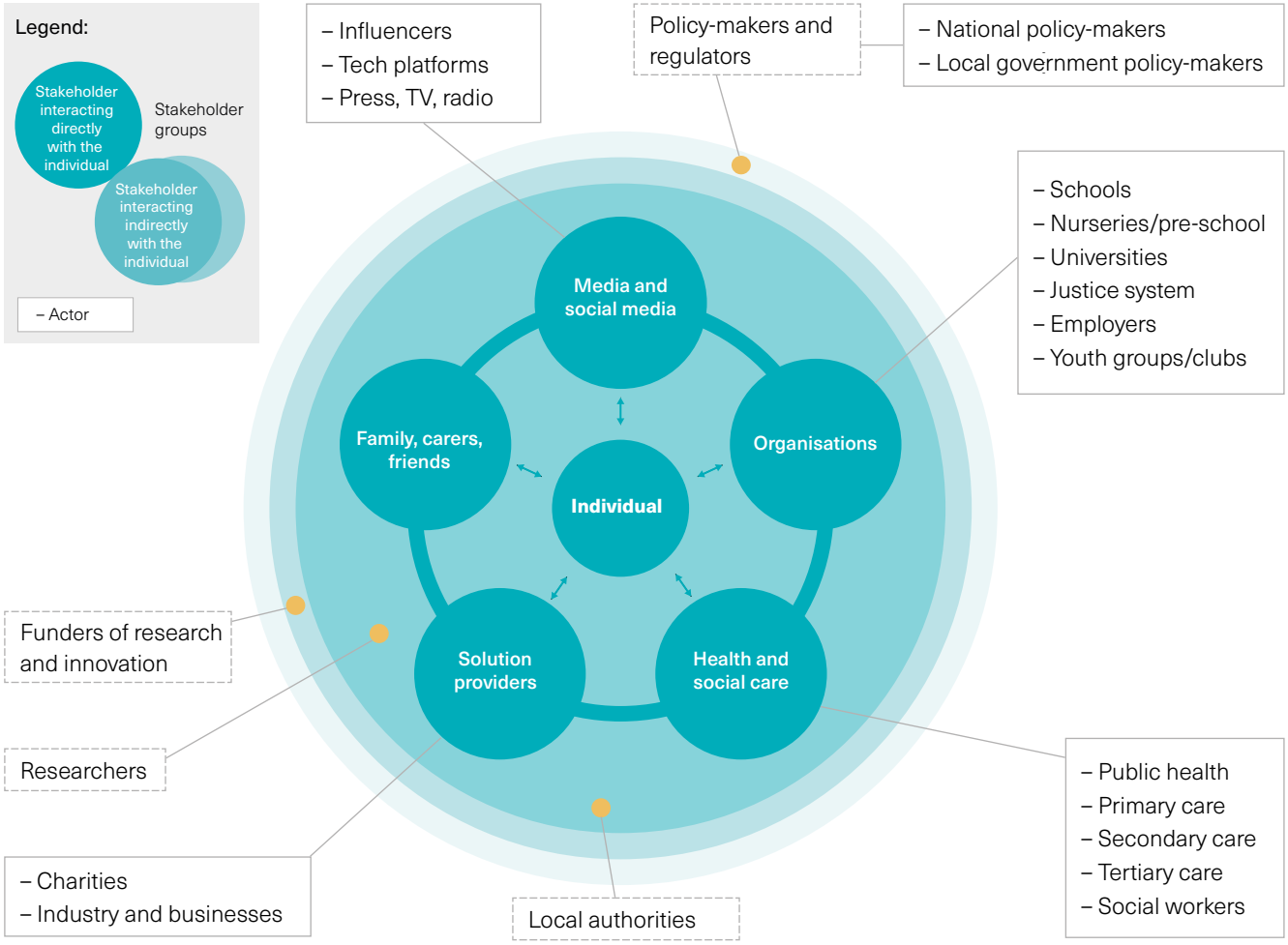


Figure 5.1 Ecosystem design for community resilience: stakeholders and actors engaging with young people

For each of the key actors, we have developed:

- A summary of the core competencies of the actor, i.e. the key focus of their activities;
- A vision of the desired competencies for the actor regarding depression in young people; and
- The vision for the actor mapped across the care stages described in Section 3.3.

These have been validated with people from the relevant stakeholder group.

In this context, core competencies represent the combination of resources (including knowledge, skills and behaviours) and processes that enable the actor to fulfil their role effectively.

The desired vision for each actor represents a 10–15-year ambition to create communities that are resilient to depression. Interactions between the stakeholder groups are also critical to achieving this goal.

However, within the existing ecosystem there are multiple barriers to the implementation of this vision. Many of these are presented as 'unmet needs' in Section 4. The example projects in Section 4 aim to address these unmet needs and go some way to achieving the overall vision for the ecosystem presented here.

5.1 Individuals, families, carers and friends

This stakeholder group primarily includes the individual child or young person and their direct family or carers. Carers may include members of the young person's extended family such as grandparents or siblings, guardians or foster carers. Friends are also included in this section, although their responsibilities towards the individual differ.

Relevant vulnerability factors and mechanisms

Individuals, families and carers live within the context of the socio-ecological vulnerability factors described in Section 3.1. Many of these factors may be outside an individual's direct control, but they can still contribute to the development of individual vulnerability factors. Specific individual vulnerability factors that are more within the control of an individual or family unit include food and nutrition, exercise and movement, sleep and substance use. Relationships between these actors are also critical to maintaining good mental health and developing personal protective strategies. The quality of these relationships can also influence both chronic stress and trauma in early life, either positively or negatively.

Opportunities across the care stages

Individuals, families and carers have the opportunity to reduce the likelihood of a young person developing depression by addressing individual vulnerability factors and maintaining healthy relationships. Such people are best placed to identify early signs of depression, which would enable them to seek support in a timely manner, providing this is available.

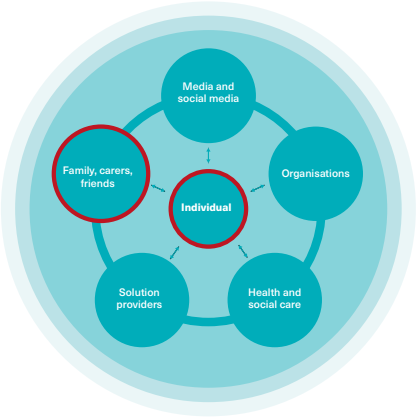
Following diagnosis, the actions of these actors are also critical to managing an individual's condition on a daily basis. This could include adherence to treatment and management of individual vulnerability factors.

Individuals, families, carers and friends

Core competencies: Self-care and care of those around them.

Vision: Individuals, families and carers have the opportunity, motivation and capability to identify and manage addressable vulnerability factors for depression, and to maintain/restore good mental health.

Friends have the opportunity, motivation and capability to help the individual. This needs to reflect the friend's lower level of responsibility with respect to the individual and be appropriate for their age.



Vision mapped across the care stages:

Individuals are living in an environment in which the socio-ecological vulnerability factors for depression are minimised by appropriate policy and regulation

Individuals, families and carers have a highly simplified, but sound, understanding of how depression develops. For their addressable vulnerability factors, they have the opportunity, capability and motivation to take practical steps to help themselves and those around them

Individuals, families and carers have the opportunity, capability and motivation to recover from depression and remain in remission by (wherever possible) addressing their specific underlying causes

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

Individuals, families and carers are equipped to identify early symptoms of depression and to take the appropriate next steps

5.2 The health and social care system

This stakeholder group includes actors across the health and social care system, ranging from community care through to specialised tertiary services. Organisations providing such care may comprise organisations from the public or private sector.

Relevant vulnerability factors and mechanisms

As described in Section 3.1, depression develops through a complex and interconnected range of socio-ecological vulnerability factors, individual vulnerability factors, physiological mechanisms and psychological factors. In order to prevent, manage and treat depression in their patients, healthcare actors need an understanding of these complex relationships.

While many socio-ecological factors may be outside the control of the healthcare system, actors can support their patients to manage addressable vulnerability factors, where appropriate. Social care actors also have the ability to support individuals and families within their communities to manage individual vulnerability factors.

As diagnostics and treatment options improve, healthcare actors also have an important role to play in the identification and management of the early-stage physiological mechanisms that contribute to an individual's depression (including inflammation, HPA axis dysfunction, gut microbiome dysfunction and epigenetic priming).

Opportunities across the care stages

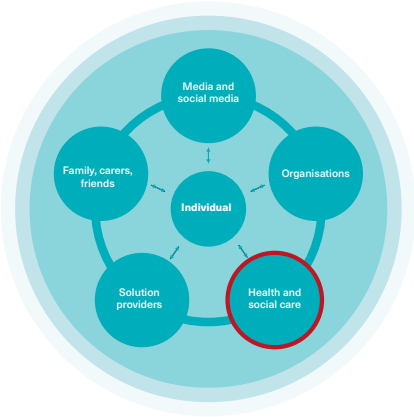
Healthcare actors have the opportunity to identify individual vulnerability factors in their patients and to support individuals to address these preventatively. Public health and social care actors can also act preventatively through the dissemination of appropriate information to individuals.

In patients presenting with depression, healthcare actors have the opportunity to effectively manage the condition through the care stages, from early detection, to diagnosis of the condition and its causes, to development and implementation of a personalised management and treatment plan. This process must be supported by the development of appropriate diagnostics and interventions, as well as assistance from external organisations.

5.2.1 Public health

Core competencies: Population health assessment, monitoring, health promotion, disease and injury prevention, health protection and emergency preparedness.

Vision: Public health actors have a clear understanding of the socio-ecological and individual vulnerability factors and mechanisms that can cause depression in young people and are able to address population-level vulnerability factors. They are able to communicate this information to the public and support the delivery of accessible and joined-up mental health services.



Vision mapped across the care stages:

Public health actors protect public mental health by supporting changes in national and local policy and practice that address the vulnerability factors, such as:

- Socio-ecological vulnerability factors, including:
  - Cultural context, e.g. racism, discrimination
  - Societal factors, e.g. poverty, access to resources
  - Community factors, e.g. the built and natural environment
  - Food and agriculture, e.g. access to nutritious foods, elimination of herbicides in foods
- Individual vulnerability factors, including:
  - Options, choices and actions, e.g. food and nutrition, exercise, sleep, substance use
  - Underlying health conditions and experiences

Public health actors support the generation of evidence, knowledge and research in:

- Diagnosis of mental health conditions in children (including specific phenotypes)
- Diagnosis of the causes of depression and related conditions in children and young people
- Evidence-based management of children and young people with depression
- Development of new treatment options for children and young people with depression

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

Public health programmes communicate with the public:

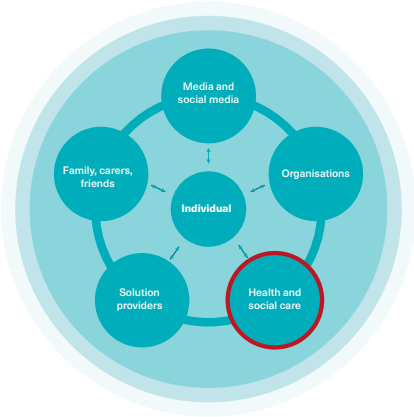
1. A highly simplified, but sound, explanation of how depression develops
2. The addressable vulnerability factors
3. Practical steps that people can take to help themselves and those around them

Public health actors support the joining up of physical and mental health services to ensure that they are effective, efficient and equally accessible

5.2.2 Primary care

Core competencies: Patient care in the community, including management of illnesses and conditions. Triaging and referral of patients as required.

Vision: Primary care actors (including GPs and health visitors) are equipped to risk-assess, detect early, manage and treat mental health conditions in their patients. This includes supporting preventative actions in vulnerable patient groups and appropriate management of patients with depression while they are in their care. Treatment should be personalised through identification, management and treatment of a patient's underlying causes of depression.



Vision mapped across the care stages:

Primary care actors have access to resources and services to refer vulnerable individuals to, in order to prevent the first episode of depression

Primary care actors have the necessary competencies, tools and resources to risk-assess, detect early, diagnose, manage and treat mental health conditions in children and young people

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

GPs have the necessary competencies, tools and support to identify a patient's underlying causes of depression

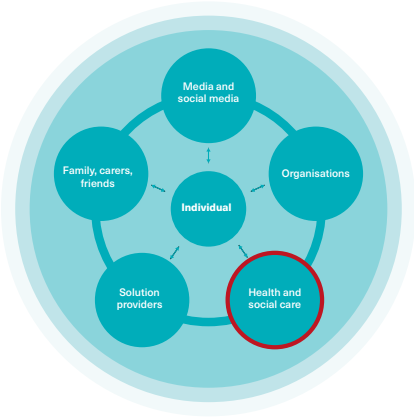
GPs have the necessary competencies, tools and support to develop a personalised management and treatment plan for patients with mild–moderate depression

GPs have access to an appropriate referral pathway for more serious or complex conditions

5.2.3 Secondary care

Core competencies: Specialist patient care in a hospital or outpatient setting.

Vision: Mental health and physical health are treated together. Secondary care actors (of all specialties) are equipped to risk-assess and detect early mental health conditions in their patients, and to take appropriate next steps. This includes supporting preventative actions in vulnerable patient groups. Clinicians dealing specifically with mental health conditions (including clinical psychologists, psychiatrists, mental health nurses and wellbeing practitioners) should have a clear understanding of the causes of depression in children and young people, and they should be supported to optimise management by identification and management of a patient's individual underlying causes.



Vision mapped across the care stages:

Physicians of all specialties have the necessary competencies and tools required to identify and support patients at risk of developing mental health conditions and take appropriate next steps

Physicians of all specialties have the necessary competencies and tools required to identify a patient suffering from comorbid physical and mental health conditions and take appropriate next steps

Clinicians working specifically with children and young people with depression (including clinical psychologists and psychiatrists) have the necessary competencies, tools and resources to risk-assess, detect early, diagnose, manage and treat mental health conditions, such as depression and anxiety. This process includes the identification of the underlying causes of depression and development of a personalised treatment plan to manage the individual's vulnerability factors

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

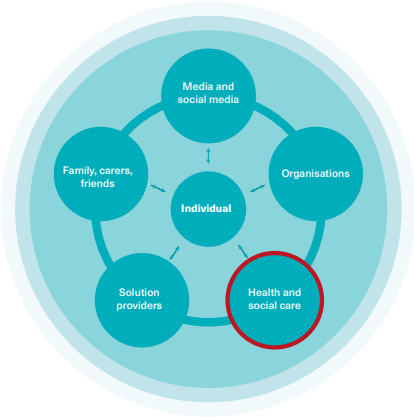
All patients identified as at risk of, or suffering from, mental health conditions have access to the appropriate support, either from their primary physician, from an appropriate third party or through access to a trained psychologist/psychiatrist

There are appropriate structures in place to support patients following treatment to facilitate full recovery and to enable them to remain in remission

5.2.4 Tertiary care

Core competencies: Highly specialised treatment for patients with mental health conditions (including specialist community and hospital care).

Vision: Tertiary care actors are equipped to identify an individual's mental health condition and develop a personalised care plan to manage the underlying causes of depression.



Vision mapped across the care stages:

Clinicians working with children and young people with depression (including clinical psychologists and psychiatrists) have the competencies, tools and resources to identify an individual's specific condition (e.g. MDD, bipolar depression), its severity and its underlying causes

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

Clinicians working with children and young people with depression (including clinical psychologists and psychiatrists) are able to personalise care based on an individual's specific condition and their underlying causes. They have access to the necessary services to offer holistic care and ongoing support to address an individual's causes of depression and vulnerability factors, including:

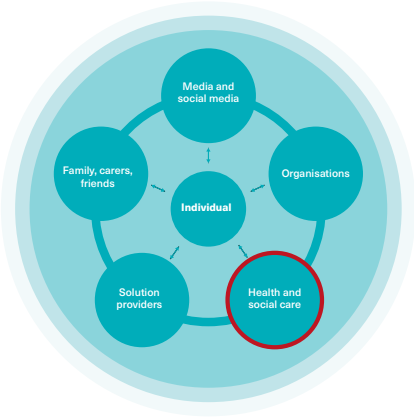
- Physiological mechanisms, e.g. genetics and epigenetics; gut microbiome; endocrine system; immune system
- Psychological mechanisms
- Socio-ecological and individual factors

There are appropriate structures in place to support patients following treatment to facilitate full recovery and to enable them to remain in remission

5.2.5 Social care

Core competencies: Supporting people in the community with their non-clinical needs, including physical, emotional and social support to help people live their lives.

Vision: Social care actors are equipped to identify an individual's vulnerability factors for depression and have the competencies to support preventative actions. Social care workers should have the competencies and tools required to assess mental wellbeing, detect signs of depression early, and to take appropriate next steps.



Vision mapped across the care stages:

Social care workers have the necessary competencies, and tools to identify the vulnerability factors of depression and take appropriate actions to mitigate risks, including:

- Socio-ecological vulnerability factors
- Individual vulnerability factors, including:
  - Options, choices and actions, e.g. food and nutrition, exercise, sleep, substance use
  - Underlying conditions and experiences

Social care workers have the competencies and tools required to assess mental wellbeing, detect signs of depression early, and take appropriate next steps

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

Young people identified as being at risk of developing depression are enabled to obtain access to appropriate support

5.3 Organisations engaging with children and young people

This stakeholder group includes actors engaging with children and young people on a regular basis. Organisations include nurseries and pre-schools, schools, further education colleges and universities, employers, and elements of the justice system such as secure children's homes and young-offender institutions.

Relevant vulnerability factors and mechanisms

Specific vulnerability factors for depression within the control of this group include chronic stress, bullying, sense of control, food and nutrition, and the scope, quality and capacity of support services. In some cases, these organisations may also be able to support individual vulnerability factors such as exercise and movement, sleep and substance use.

These organisations are working within the context of other socio-ecological vulnerability factors, such as cultural factors, community factors, and economic and social environments, including the effects of poverty. They are also working with individuals whose vulnerability factors include their individual vulnerability factors outside the control of the organisation, such as relationships, food and nutrition, exercise, sleep, substance use, underlying health conditions and trauma.

Opportunities across the care stages

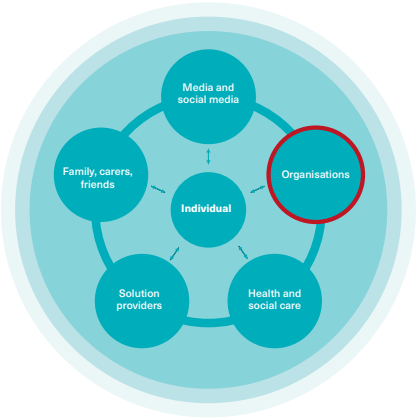
Organisations typically interact with children and young people on a more regular basis than the health and social care system. As such, they are ideally placed to support individuals to manage their vulnerability factors for depression. It is within the organisation's interest to create a mentally healthy environment to support the prevention of depression.

As a result of their regular interactions, organisations also have an opportunity to identify early signs of depression and to help a young person seek appropriate support. They are also likely to shoulder the burden of managing a young person with depression on a daily basis, and it is therefore important for the necessary support structures to be in place.

5.3.1 Nurseries and pre-schools

Core competencies: Pastoral care and education of children from 6 weeks of age until they start primary school.

Vision: Nurseries and pre-schools provide a mentally healthy environment and equip children with the necessary competencies to promote good mental health. Members of staff are informed and empowered to identify children at risk of, or suffering from, mental health conditions and take appropriate next steps.



Vision mapped across the care stages:

A whole-organisation approach to mental health is adopted, including:

- Training of staff in sustaining their own mental wellbeing and helping to promote good mental health in the children in their care
- Education design and implementation that promotes good mental health
- Physical health and safety
- Support for all members of the nursery to manage individual vulnerability factors (including stress, food and nutrition, exercise and sleep)

Staff have the competencies and tools to identify children at risk of depression, or struggling with mental health conditions, and to take appropriate next steps

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

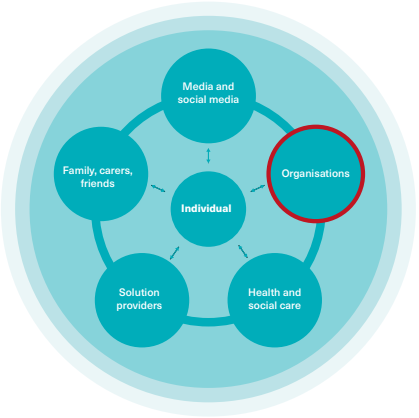
Children have the opportunity, capability and motivation to manage addressable vulnerability factors for mental health, including:

- Access to mentally healthful meals
- Access to a suitable environment for sleep
- Opportunities to engage in preventative activities, such as exercise and time outdoors
- Opportunities to try new activities to improve psychosocial functioning
- Support to build good relationships, including friendships
- Education in understanding moods and emotions

5.3.2 Schools

Core competencies: Education of children (5–18 years); pastoral care.

Vision: Schools provide a mentally healthy environment and equip children with the necessary competencies to maintain good mental health. Members of staff are informed and empowered to identify children at risk of, or suffering from, mental health conditions and take appropriate next steps.



Vision mapped across the care stages:

A whole-school approach to mental health is adopted, including:

- Training of staff in sustaining their own mental wellbeing
- Education of pupils in sustaining their own mental wellbeing and that of their peers
- A positive culture that helps to prevent bullying
- Education design and implementation that helps to prevent chronic stress
- Physical health and safety
- Support for all members of the school to manage individual vulnerability factors (including stress, food and nutrition, exercise, sleep and substance use)

Staff have the competencies and tools to identify children at risk of depression, or struggling with mental health conditions, and to take appropriate next steps

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

Children have the opportunity, capability and motivation to manage addressable vulnerability factors for mental health, including:

- Access to mentally healthful meals
- Access to appropriate tools/resources, e.g. for stress management
- Opportunities to engage in preventative activities, such as exercise
- Support to minimise substance use

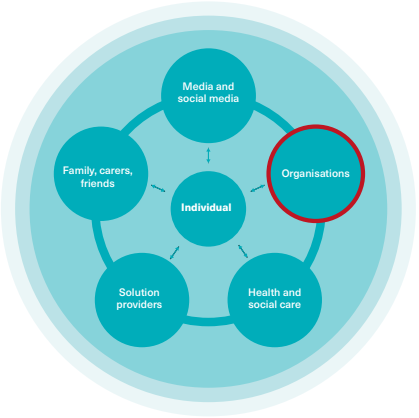
- Opportunities to try new hobbies and activities to improve psychosocial functioning
- Support to maintain good relationships, including friendships
- Access to training/resources to understand:
  1. A highly simplified, but sound, explanation of how depression develops
  2. The addressable vulnerability factors
  3. Practical steps that they can take to help themselves and those around them

Children have access to appropriate tiers of support to sustain good mental health and manage mental ill-health. This could include peer support, mentors or access to trained practitioners

5.3.3 Colleges and universities

Core competencies: Higher and further education of students (18+ years).

Vision: Universities and colleges provide a mentally healthy environment. Students are equipped and empowered to protect their mental wellbeing and have access to adequately resourced, effective and accessible mental health services that address underlying causes, as well as mental health outcomes. Members of staff engaging with students have the competencies to identify students at risk of, or suffering from, mental health conditions and take appropriate next steps.



Vision mapped across the care stages:

A whole-college/university approach to mental health is adopted, including:

- Training of staff and education of students in sustaining their own mental wellbeing and that of their peers
- A positive culture that helps to prevent bullying
- Education design and implementation that helps to prevent chronic stress
- Physical health and safety
- Support for all members of the college/university to manage individual vulnerability factors (including stress, food and nutrition, exercise, sleep and substance use)

Students are equipped with the opportunity, capability and motivation to identify and manage symptoms of depression by addressing the underlying causes. All students have access to adequately resourced and effective mental health services that identify and address underlying causes, as well as mental health outcomes

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

Students have the opportunity, capability and motivation to manage addressable vulnerability factors for mental health, including:

- Access to mentally healthful meals
- Access to appropriate tools/resources, e.g. for stress management
- Opportunities to engage in preventative activities, such as exercise
- Support to minimise substance use

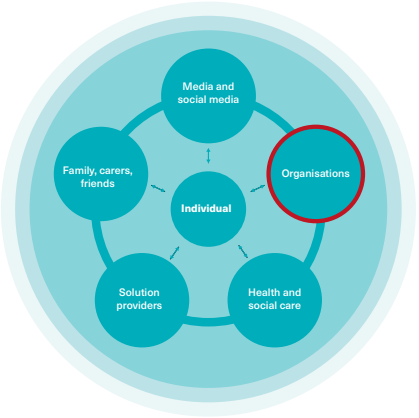
- Opportunities to develop and practise good sleep hygiene
- Opportunities to try new hobbies and activities to improve psychosocial functioning
- Access to training/resources to understand:
  1. A highly simplified, but sound, explanation of how depression develops
  2. The addressable vulnerability factors
  3. Practical steps that they can take to help themselves and those around them

Students have access to appropriate tiers of support to sustain good mental health and manage mental ill-health. This could include peer support, mentors or access to trained practitioners

5.3.4 Employers

Core competencies: Organisation operations; human resource management; workplace training and development.

Vision: Organisations provide a mentally healthy environment. Employees should have access to resources to support good mental health. Members of staff are informed and empowered to identify employees at risk of, or suffering from, mental health conditions and take appropriate next steps.



Vision mapped across the care stages:

A whole-organisation approach to mental health is adopted, including:

- Training of staff in sustaining their own mental wellbeing and that of their colleagues
- A positive culture that helps to prevent bullying
- Job design, leadership and management that helps to prevent chronic stress and burnout
- Physical health and safety
- Support for all members of the organisation to manage individual vulnerability factors (including stress, food and nutrition, exercise, sleep and substance use)

People in positions of authority have the necessary competencies, tools and resources to identify and support a young person with depression (or at risk of developing depression) and take appropriate next steps

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

Employees have the opportunity, capability and motivation to manage addressable vulnerability factors for mental health, including:

- Access to mentally healthful meals
- Access to appropriate tool/resources, e.g. for stress management
- Opportunities to engage in preventative activities, such as exercise

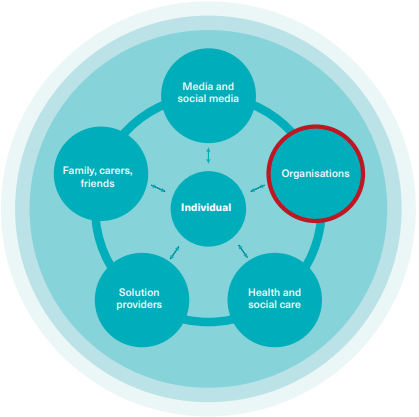
- Support to minimise substance use
- Access to training/resources to understand:
  1. A highly simplified, but sound, explanation of how depression develops
  2. The addressable vulnerability factors
  3. Practical steps that they can take to help themselves and their families

Employees have access to appropriate tiers of support to sustain good mental health and manage mental ill-health. This could include peer support, mentors or trained practitioners

5.3.5 Secure children's homes, secure training centres and young-offender institutions

Core competencies: Custody, education and rehabilitation of young offenders (10–24 years).

Vision: Custodial settings for young people are mentally healthy environments and equip young people with the competencies to maintain good mental health. Members of staff are equipped and empowered to identify young people at risk of, or suffering from, mental health conditions and take appropriate next steps.



Vision mapped across the care stages:

A whole-organisation approach to mental health is adopted, including:

- Training of staff and education of young people in sustaining their own mental wellbeing and that of their peers
- A positive culture that helps to prevent bullying and chronic stress
- Physical health and safety
- Support for all members of the organisation to manage individual vulnerability factors (including stress, food and nutrition, exercise, sleep and substance use)

People in positions of authority have access to the necessary competencies, tools and resources to identify and support a young person with depression (or at risk of developing depression) and take appropriate next steps

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

Young people have the opportunity, capability and motivation to manage addressable vulnerability factors for mental health, including:

- Access to appropriate tools/resources, e.g. for stress management
- Access to mentally healthful meals
- Opportunities to engage in preventative activities, such as exercise
- Opportunities to develop and practise good sleep hygiene

- Support to minimise substance use
- Opportunities to try new hobbies and activities to improve psychosocial functioning
- Access to training/resources to understand:
  1. A highly simplified, but sound, explanation of how depression develops
  2. The addressable vulnerability factors
  3. Practical steps that they can take to help themselves and those around them

Young people have access to appropriate tiers of support to sustain good mental health and manage mental ill-health. This could include peer support, mentors or trained practitioners

5.4 Solution providers

Solution providers comprise organisations that develop and provide products and/or services to prevent, predict, diagnose, manage or treat depression in children and young people. They may be public, private or charity-sector organisations. They may provide products and/or services directly to the individual and their family and carers, to the health and social care system, or to organisations engaging with children and young people.

Relevant vulnerability factors and mechanisms

Solution providers have the ability to develop products and services to address the majority of vulnerability factors and mechanisms associated with depression. As research generates additional evidence, this creates the opportunity for solution providers to develop and deliver an increased range of solutions, including improved diagnostic and treatment options.

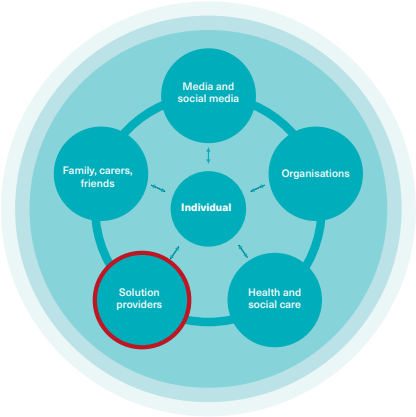
Opportunities across the care stages

Based on a sound understanding of the vulnerability factors and mechanisms of depression, solution providers have the opportunity to develop and deliver products and services to address needs across the care stages, from prevention through to treatment.

5.4.1 Solution providers

Core competencies: Development, implementation and delivery of products and/or services for young people with, or at risk of, depression.

Vision: Solution providers have a clear understanding of the vulnerability factors and mechanisms that can cause depression in young people and have the motivation and capability to incorporate relevant aspects of these into their products and services. Solution providers include children and young people in the scope and development of their services and products when possible.



Vision mapped across the care stages:

Solution providers are aware of the complete picture of the vulnerability factors and mechanisms that can cause depression, including:

- Socio-ecological vulnerability factors
- Individual vulnerability factors, including:
  - Options, choices and actions, e.g. food and nutrition, exercise, sleep, substance use
  - Underlying conditions and experiences, e.g. physical health conditions, other mental health conditions, chronic stress, trauma, intergenerational factors
- Individual psychological factors
- Physiological mechanisms

They have an understanding of the opportunity for innovations in their product and/or service offerings that identify or address an individual's vulnerability factors or causes of depression.

Where a solution provider does not address the full range of an individual's needs, they are able to connect the individual to appropriate support within an established network of providers. Information sharing is enabled between solution providers

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

Diagnostic solution providers are aware of the different types (e.g. MDD, bipolar) and phenotypes of depression and the opportunities for innovation for specific patient groups

Solution providers use new research and evidence to enable:

- Development of products and/or services to manage depression in children and young people
- Development of new treatment options for children and young people

5.5 Media and social media

Media includes national, local and sector-focused press, television and radio. This section also considers the role of social media platforms and content providers, including influencers.

Relevant vulnerability factors and mechanisms

Research has shown that social media platforms provide benefit to individuals, families, friendship groups and communities through improved connectedness and communication. However, they also pose challenges to mental wellbeing that need to be addressed. Both socio-ecological vulnerability factors and individual vulnerability factors can be negatively influenced by media and social media through online bullying, inaccurate content and misinformation, and dangerous information, such as that encouraging self-harm and suicide.

Opportunities across the care stages

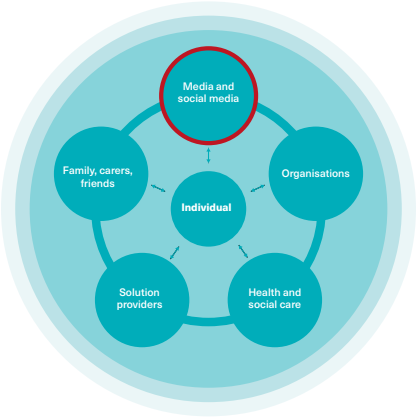
Media and social media actors have a vital role to play in improving the public understanding of depression, particularly addressable individual vulnerability factors. Through the dissemination of appropriate content they have the opportunity not only to inspire behavioural changes that prevent depression but also to support those living with depression to manage their condition better.

Additionally, media and social media actors have the opportunity to support campaigns for changes to policy that address socio-ecological vulnerability factors, such as cultural, societal and community factors. This would support the prevention of depression at the primordial level.

5.5.1 Media and social media

Core competencies: Content creation and dissemination, communication, marketing.

Vision: Technology platforms are regulated to support good mental health. Content reflects an accurate understanding of what depression is, how it develops and practical steps that individuals can take to help themselves and those around them.



Vision mapped across the care stages:

Technology platforms are regulated and designed to support good mental health for users of all ages, including:

- Positive content development and programming
- Protection measures for young people

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

Journalists and content creators/influencers have a sufficient understanding of the underlying principles of depression, ensuring that content reflects an accurate understanding of what depression is, how it develops and practical steps that individuals can take to help themselves and those around them

Particularly for social media platforms, age-appropriate content reaches individuals at risk of, or suffering from, depression and equips individuals with the capability and motivation to tackle addressable risk factors

5.6 Enabling organisations

Enabling organisations do not necessarily interact directly with children and young people, although their actions affect actors within the mental health ecosystem. These stakeholders include policy-makers and regulators, local authorities, funders of research and innovation, and researchers.

Relevant vulnerability factors and mechanisms

Enabling organisations have an influence over the socio-ecological vulnerability factors that an individual is exposed to. They also have the ability to support additional research across all vulnerability factors and mechanisms. This is particularly important in order to advance the understanding of individual physiological mechanisms.

Opportunities across the care stages

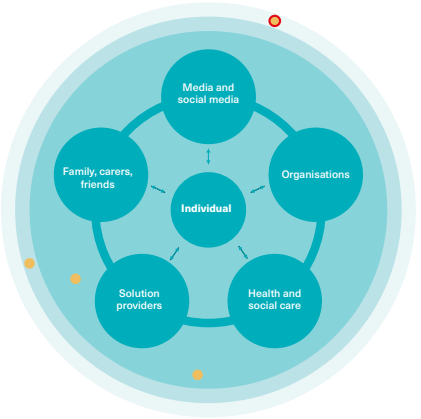
Enabling organisations have the opportunity to make changes to policy and regulation, or to deliver programmes that address socio-ecological vulnerability factors, such as cultural, societal and community factors. This would support the prevention of depression at the primordial level.

As a result of their impact on all actors in the ecosystem, they also have the opportunity to support initiatives that enable more effective detection, diagnosis, management and treatment of depression. This could take the form of programme delivery building on current understanding, or the generation of additional evidence to support an improved vision for the future, where an individual's causes of depression can be identified and managed or treated more effectively.

5.6.1 Policy-makers and regulators

Core competencies: Development and implementation of policy and regulations.

Vision: Policy-makers and regulators have a clear understanding of the vulnerability factors and mechanisms that can cause depression in young people, and through the life course; and they have the motivation and capability to develop policy and regulations to protect public mental health. Regulators support solution providers to collect evidence in children and young people.



Vision mapped across the care stages:

Policy-makers and regulators are aware of the vulnerability factors and mechanisms that can cause depression in young people and through the life course. Policy and regulations protect public mental health by addressing the vulnerability factors for depression, including:

- Socio-ecological vulnerability factors, including:
  - Cultural context, e.g. racism, discrimination
  - Societal factors, e.g. poverty, access to resources
  - Community factors, e.g. the built and natural environment, housing, pollution and access to green spaces
  - Food and agriculture, e.g. access to nutritious foods, elimination of herbicides in foods
- Individual vulnerability factors, including:
  - Options, choices and actions, e.g. food and nutrition, exercise, sleep, substance use
  - Underlying conditions and experiences, e.g. physical health conditions, other mental health conditions, chronic stress, trauma, intergenerational factors

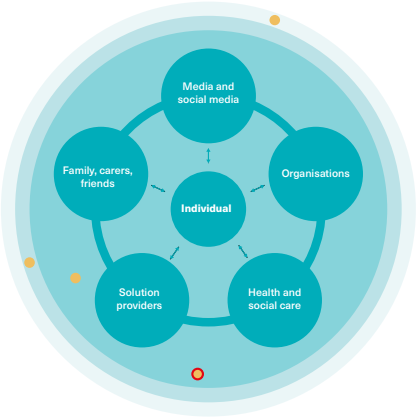
Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

Regulators support solution providers to collect evidence in children and young people, to ensure that children and young people have access to new innovations and treatment options for depression

5.6.2 Local authorities

Core competencies: Representation of local communities; decisions about, and delivery of, services for people and businesses in a defined area; and the provision of community leadership.

Vision: Local authorities (to include county councils, district councils, unitary authorities, metropolitan districts and London boroughs) should have a clear understanding of the vulnerability factors and mechanisms that can cause depression in young people, and through the life course; and they should provide programmes that address socio-ecological and individual vulnerability factors.



Vision mapped across the care stages:

Local authorities are aware of the vulnerability factors and mechanisms that can cause depression in young people, and they implement community-wide and targeted programmes to protect public mental health by addressing the socio-ecological vulnerability factors for depression, including:

- Cultural context, e.g. racism, discrimination
- Societal factors, e.g. poverty, access to resources
- Community factors, e.g. the built and natural environment, housing, transport infrastructure, access to education and employment, access to nutritious foods, pollution and access to green spaces

Local authorities facilitate the joining up of data and services across local organisations to enable more effective identification, support and management of vulnerable children and young people

They facilitate the improvement of services by the sharing of information between local networks and learning across areas

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

Culturally relevant information is communicated to local communities, including signposting to local services.

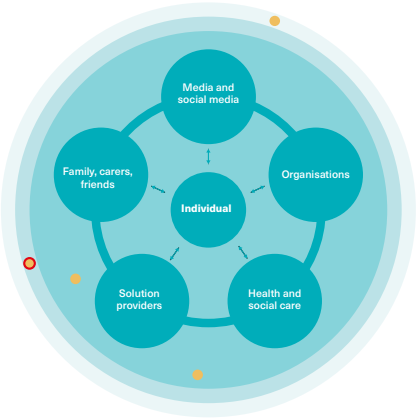
Local authorities implement community-wide and targeted programmes to protect public mental health by addressing the individual vulnerability factors for depression, including:

- Options, choices and actions, e.g. food and nutrition, exercise, sleep, substance use
- Underlying conditions and experiences

5.6.3 Funders of research and innovation

Core competencies: Funding of scientific research, translation and innovation.

Vision: Funders have a clear understanding of the vulnerability factors and mechanisms that can cause depression in young people, and through the life course. They are able to use this knowledge to build a portfolio of projects that help to improve mental health through prevention, prediction, early detection, diagnosis of conditions and their causes, and personalised management and treatment of depression and related conditions.



Vision mapped across the care stages:

Funders have a clear understanding of the full range of vulnerability factors and mechanisms that can cause depression and related conditions in young people, including socio-ecological and individual vulnerability factors, physiological mechanisms and psychological factors. They maintain an understanding of new evidence to enable funding of the most promising innovations and services to prevent, predict, diagnose, manage and treat depression in children and young people (including innovations to identify or address the causes of depression).

Funders review the applicability of proposals to children and young people and, where appropriate, support applicants to collect evidence in children and young people, to ensure that children and young people have access to new innovations and treatment options for depression.

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

Funders develop and manage a portfolio of investments that:

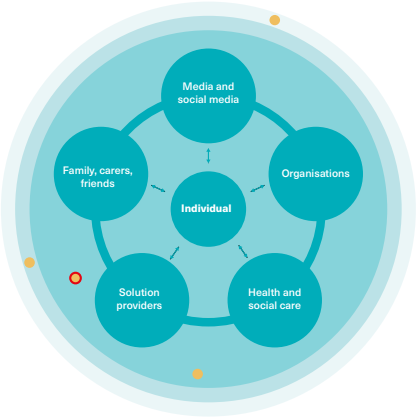
- Builds on underpinning knowledge and joins up understanding to determine how conditions develop
- Supports innovations and research across the care stages, including: prevention, prediction, early detection, diagnosis of conditions and their causes, and personalised management and treatment
- Supports research and innovation across the translational spectrum, enabling rapid translation and adoption, leading to realised impact for patients

Funders support long-term projects in order to allow the benefits to be realised and measured. Consistency of support is achieved through long-term funding of community initiatives.

5.6.4 Researchers

Core competencies: Basic scientific research, pre-clinical research, clinical research.

Vision: Researchers in the field of mental health have a clear understanding of the vulnerability factors and mechanisms that can cause depression in young people, and through the life course; and of how their research informs understanding of this system. Researchers across a range of specialties are supported to apply their research to the field of mental health where this has a possible impact on the socio-ecological vulnerability factors, individual vulnerability factors, physiological mechanisms or psychological factors of depression. Research and innovation should be conducted across the translational spectrum, with the aim of rapid translation and adoption, leading to realised impact for patients.



Vision mapped across the care stages:

Researchers in the field of mental health have a clear understanding of the full range of vulnerability factors and mechanisms that can cause depression and related conditions in young people, including socio-ecological and individual vulnerability factors, physiological mechanisms and psychological factors. Research builds on underpinning knowledge and is considered in the context of a joined-up understanding to determine how conditions develop

Researchers across a range of specialties are supported to apply their research to the field of mental health where this has a possible impact on the socio-ecological vulnerability factors, individual vulnerability factors, physiological mechanisms or psychological factors of depression. Collaboration is supported across disciplines to facilitate the translation of research to address this multifactorial condition. This includes research in effecting societal, organisational, system and individual behavioural change

Primordial prevention	Primary prevention	Prediction	Personal prevention	Early detection	Diagnosis – condition	Diagnosis causes	Personalised plan	Management	Treatment

Researchers consider the applicability of their research to children and young people and, where appropriate, increase the scope of clinical research to collect evidence in children and young people, to ensure that children and young people have access to new innovations and treatment options for depression

Researchers have access to the appropriate tools to investigate depression in children and young people. The use of standardised, population-appropriate, outcome measures enables the joining up of research

5.7 Enabling effective collaborations between actors in mental health ecosystems

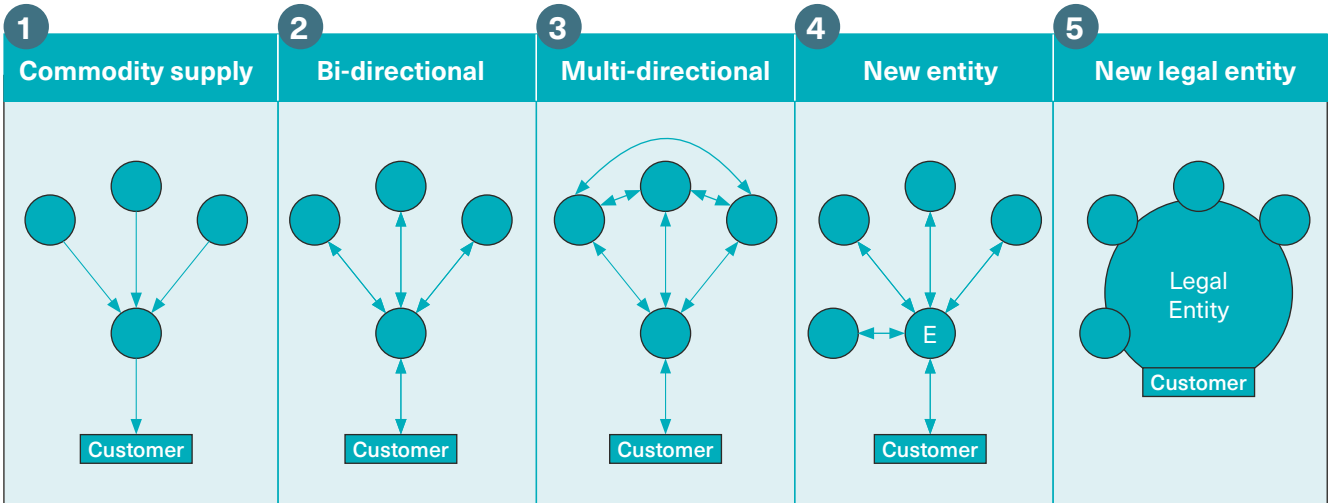
5.7.1 Using ecosystem management methods to improve the prevention, detection and management of depression

The future-state visions presented in *Changing Minds, Changing Lives* give clarity to the purpose and roles of individual actors across the care stages, from prevention through to early detection, diagnosis and management. However, collaboration between stakeholder groups and actors across the mental health ecosystem is critical in order to provide accessible, effective and continuous care for individuals at risk of, or suffering from, depression. In addition, the types of connections between the actors in the ecosystem are important. The classification model in Figure 5.2 demonstrates how ecosystems differ in their type of partner connections.

It is desirable to capture the value that each actor can offer to other stakeholders in the ecosystem through closer collaboration and exchange of information. Value can be defined as either direct (e.g. monetary value exchanged for a product or service) or indirect (e.g. additional value that can be categorised as value for the organisation, the managers, the organisation's strategy or risk). In this section, we apply research-based methods in ecosystem management in order to demonstrate how we can improve the outcomes for individuals by understanding and capturing value between different stakeholder groups within the mental health ecosystem. This work will form the basis of future workshops to identify specific opportunities for collaboration and innovation.

In the complex mental health ecosystem, it is often desirable to work towards multi-directional value exchange between stakeholders (shown in models 3 and 4 of Figure 5.2), which offers the opportunity to improve communication between stakeholders. An example of how this has been achieved in practice is through the mental health support teams (MHSTs). These have been established in education settings and act as a link with local children and young people's mental health (CYPMH) services, supervised by NHS staff. A preliminary report published on the early evaluation of this scheme found that MHSTs were much more effective where they were flexible and adaptive to the specific needs of an individual school. This offered increased value to the school and achieved better results compared to offering services through a traditional commodity supply model.[106]

Figure 5.3 illustrates a desirable model for value exchange between specific actors in the mental health ecosystem. In this model the 'customer' is the individual, although there are multiple customer segments, including children and young people of different ages and living within different socio-ecological contexts; individuals at risk of developing depression; and individuals suffering from depression and/or other mental health conditions.



Commodity supply	Bi-directional	Multi-directional	New entity	New legal entity
Value flow is one-directional and of a commodity nature. No need for innovation, just need for supply of service.	Value delivered changes on the requirements of the focus company. Innovation need is higher than in (1).	The value delivered needs closer communication between all ecosystem participants to fulfil requirements for the outcome.	A new entity (E) is formed by the partners. The delivery of the value is done by the entity. The staff members from the partners are staying in their original legal companies.	A new legal entity (LE) is formed by the partners as a delivery mechanism of the ecosystem. The staff members from the partners are seconded into the new legal entity. The partners are owners of the legal entity.

Figure 5.2 Different types of connection in ecosystems[105]

We propose that this model could be used to explore the value offered to the 'customer' (the individual) by a specified 'primary actor' (such as schools) and co-develop with other actors how this value can be best delivered. This would involve closer collaboration with and between secondary actors, using the most appropriate connections of those shown in Figure 5.2.

Each actor also requires key capabilities in order to increase the value delivered to other actors, including the individual. Capabilities include:

- Key resources (including people, technology, products, facilities and equipment);
- Operational and management processes (including coordination mechanisms with other actors in the ecosystem).

The example shown in Figure 5.4 uses this model to demonstrate the value exchange between primary care and the individual, as well as the connections between primary care and other actors. The level of complexity in this ecosystem is immediately clear.

In complex ecosystems, it is important to understand and appreciate the complexity and number of relationships between different actors and to define key actors with whom a connection can add the most value to the relationship with the individual. Sometimes, simpler unidirectional relationships are preferable where one stakeholder is offering limited value to the system. In these cases, the commodity supply model (shown in Figure 5.2) is desirable.

Overcomplicating the system unnecessarily can reduce the value received by the individual. This is caused by the increased complexity, which requires more time and effort from actors in the system, leaving less time for delivery of the service to the individual. This is important, for example, in primary care, where a GP typically has only 10–15 minutes per patient. Connections with different actors may be of greater or lesser importance for different patients, and the implementation needs to provide flexibility to allow for this.

In this example, it could be argued that an intervention to improve the communication channels and information exchange between primary care and social care would help with the identification and management of patients suffering from both socio-ecological vulnerability factors and mental illness. However, it may not be possible to achieve the full benefit of this intervention unless social care actors are also equipped with the necessary tools and resources to identify and address vulnerability factors for depression, thus reducing the burden on primary care resources.

Patient confidentiality is acknowledged as a large barrier to communication between primary care and organisations (including schools, employers and universities). More effective communication between healthcare services is enabled where data sharing is permissible. However, because of other barriers in the system, this information does not necessarily reach actors engaging with the individual on a regular basis. Innovation is required to address this barrier, improving the system and the service to the individual, without compromising other value exchanges because of unrealistic expectations on a clinician's time.

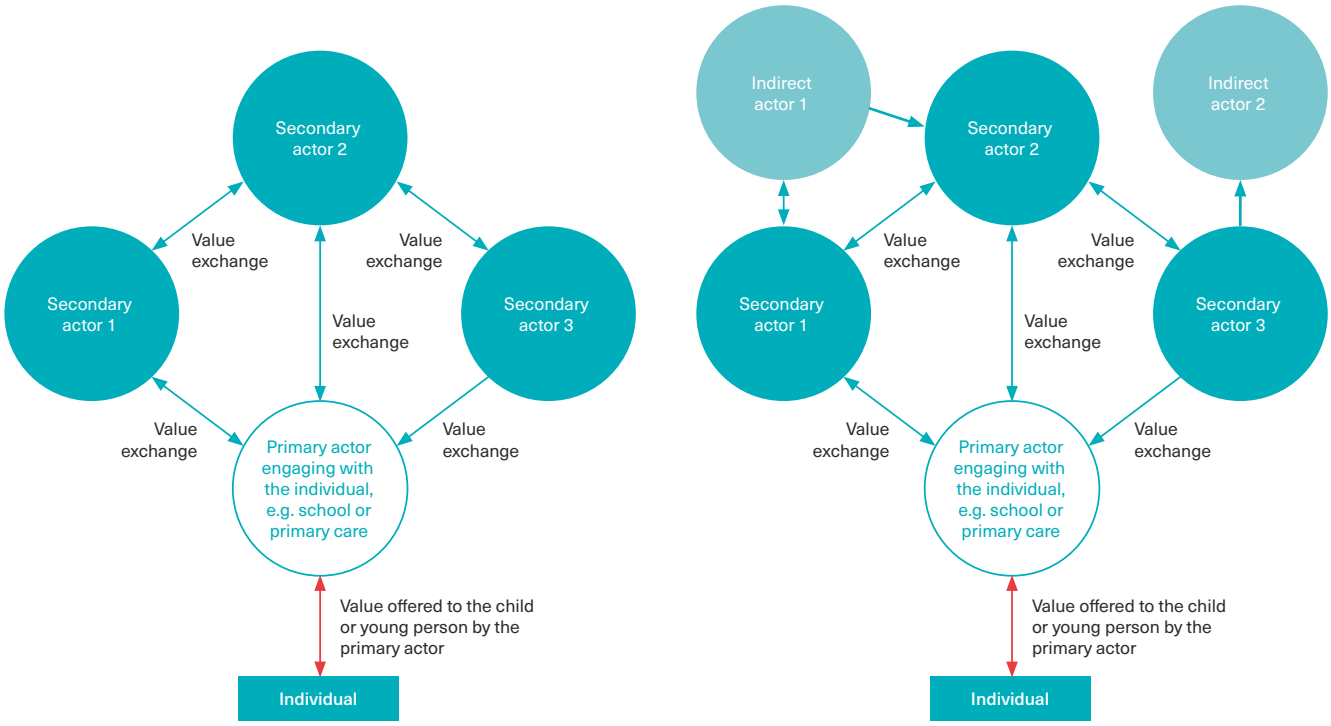


Figure 5.3 Model for the design of mental health ecosystems. Value exchanges, where present, may be unidirectional or bidirectional in order to optimise value to the individual: a) shows primary and secondary actors only; b) also includes indirect actors who have value exchanges with the direct actors in the system

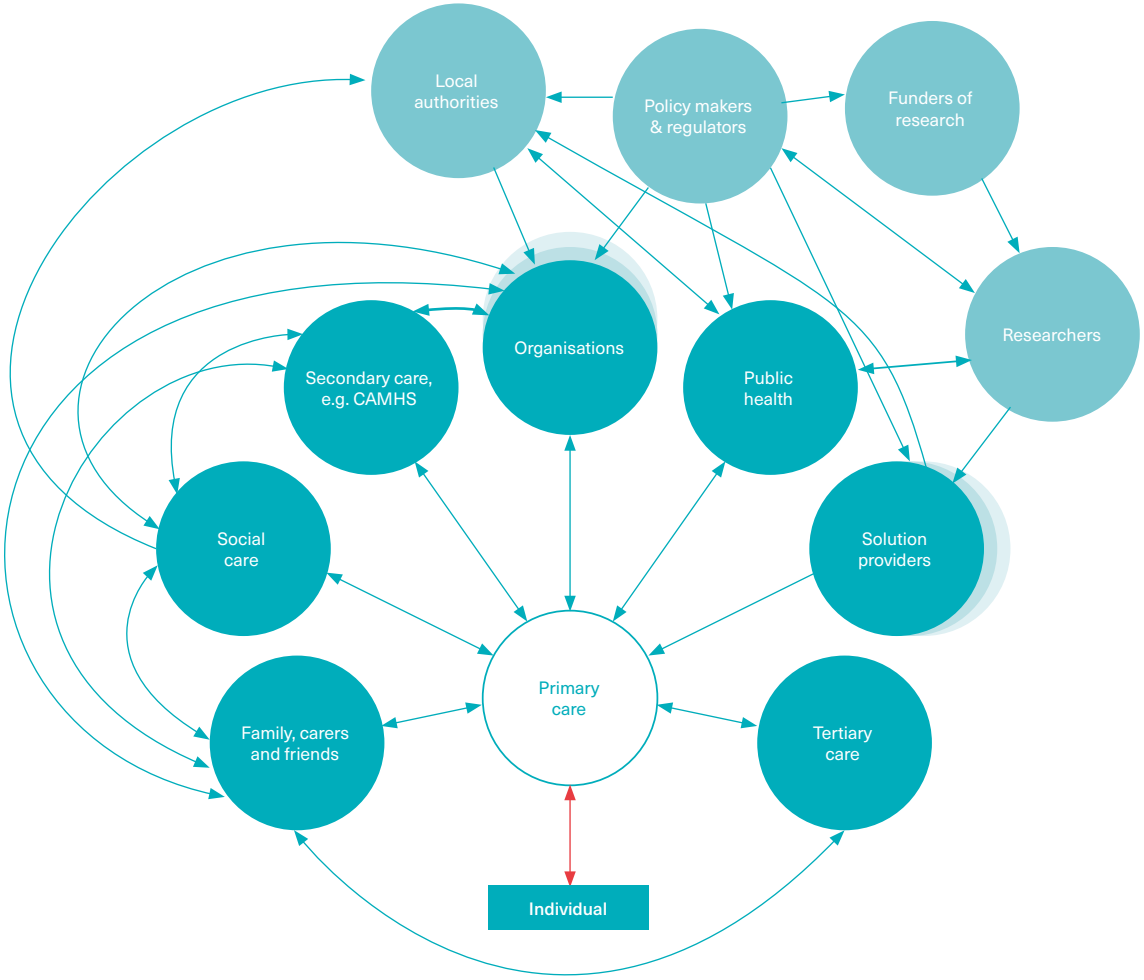


Figure 5.4 Ecosystem model for the connections between actors required to enhance the value exchange between primary care and an individual young person, and so to achieve improved health outcomes

Solution providers also report challenges engaging with primary care because of time constraints. A system providing a complete and up-to-date understanding of the capabilities and availability of local solution providers would support other actors in the ecosystem (including primary care) to signpost young people to appropriate services more effectively. This could be developed in collaboration with public health actors. It is suggested that value exchange between these actors could also be improved by the implementation of infrastructure that supports the adoption of new digital technologies into the current care pathway.

Overcoming ecosystem complexity

Figure 5.4 illustrates the complexity of the ecosystem required to deliver primary care services to an individual. Such complexity is common in the delivery of healthcare services. This complexity itself can be a barrier to change, potentially delaying or preventing the realisation of a future-state vision. Ecosystem management and design methods, researched and developed at the Institute for Manufacturing, offer the potential to make such change less challenging, enabling the transformation to be designed and implemented in manageable steps. This is achieved with the participation and support of service providers, users and other stakeholders, enabling co-development of solutions and building support for change. The approach is described below.

5.7.2 Future work

We will build on the ecosystem management approaches described above to support stakeholders in working together to build and operate ecosystems that achieve clear, mutually beneficial outcomes for actors across the ecosystem – and for children and young people.

We plan to collaborate with stakeholders across the mental health ecosystem (including integrated care systems) to define the key connections required between specific actors. For each connection, the value that is currently captured and the value that is currently missed will be defined, enabling the key opportunities for innovation within the system to be identified. This information will form the basis for a mental health ecosystem model where the key requirements and activities to achieve the desired vision are defined.

The following process could be applied for each actor within the mental health ecosystem engaging directly with the individual child or young person:

1. Define the desired relationship and value exchange between the specified ‘primary actor’ and the individual. This is described in the vision for each actor and mapped across the care stages. See Sections 5.1–5.6.
2. Identify the secondary and indirect actors involved in achieving this vision.

3. Model the desired connections between the actors in the ecosystem (using the classification model in Figure 5.2) that best support the desired vision. These include unidirectional, bidirectional and multi-directional value flows between actors.
4. Identify the key value exchanges required between actors, including value currently captured and value that is currently missed. Missed value represents an opportunity for innovation within the ecosystem.
5. Define the capabilities required by each actor to deliver the desired value.
6. Identify opportunities to capture additional value within the ecosystem, thereby strengthening the value offered by the primary actor to the individual.

5.7.3 Using ecosystem management methods to configure the mental health ecosystem in order to achieve a desired vision: example

Enabling schools to identify children at risk of depression and to take appropriate next steps

This example (shown in Figure 5.5) illustrates the connections and value exchanges between actors required to deliver an aspect of the vision for the primary actor 'schools': 'Staff have the competences and tools to identify children at risk of depression, or struggling with mental health conditions, and to take appropriate next steps.

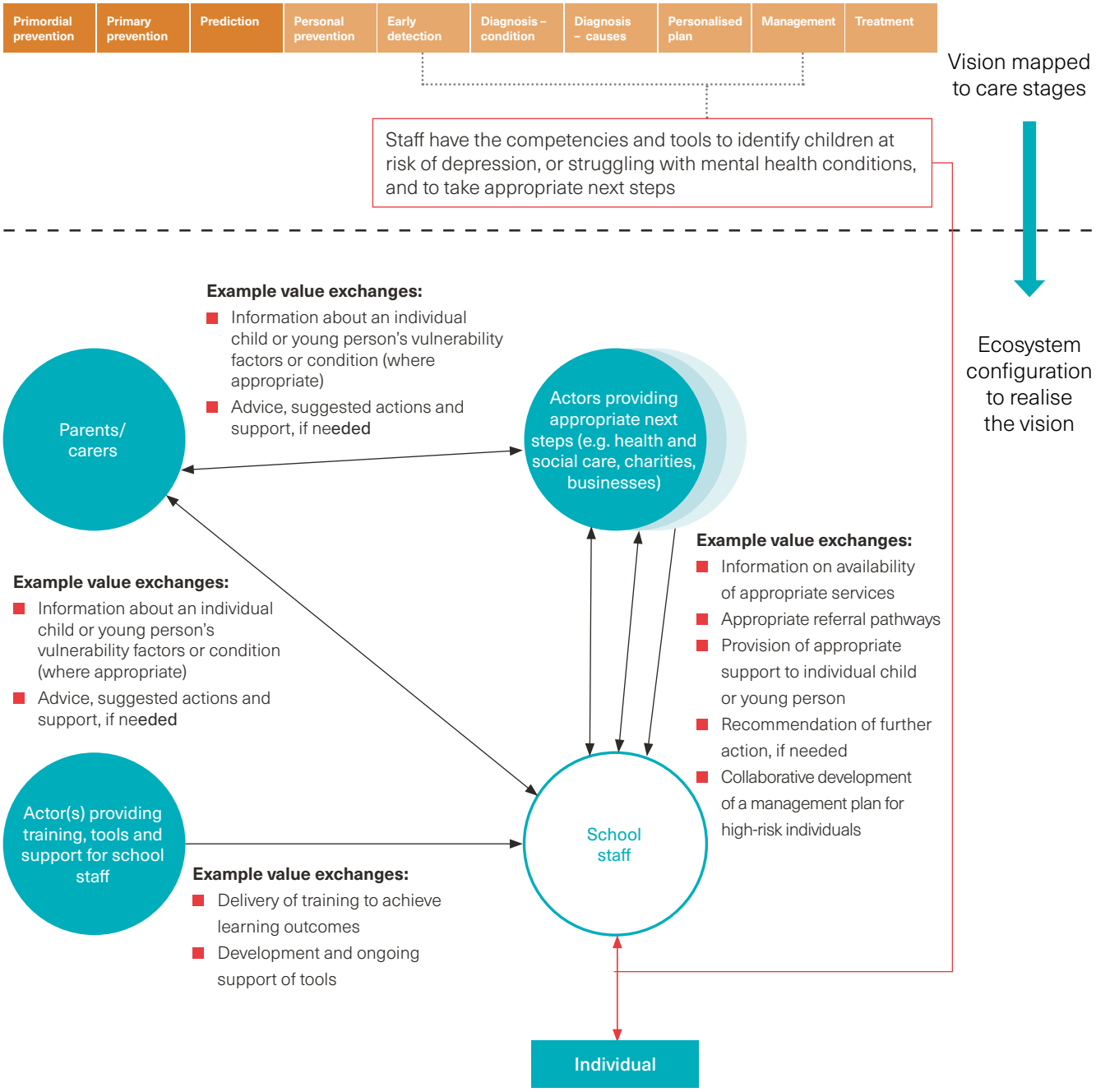


Figure 5.5 Ecosystem design enabling school staff to identify children at risk of depression or struggling with mental health conditions, and to take appropriate next steps

The capabilities (key resources and processes) required by each actor to deliver this vision are presented in Table 5.1.

Actor	Capabilities
Schools	Key resources ■ Competencies (knowledge, skills and behaviours) and tools to identify children who are at risk of depression or struggling with mental health conditions ■ An understanding of the relevant actors to provide appropriate next steps Key processes ■ Management of children and young people at risk of, or suffering from, mental health conditions, including referral to external actors ■ Management and coordination of engagement with: actors who provide appropriate next steps; parents and carers, etc.
Providers of tools and training	Key resources ■ Effective tools, training and support Key processes ■ Delivery of training to schools ■ Assessment of school staff's ability to use tools effectively
Actors providing next steps	Key resources ■ Services and tools to support children and young people at risk of, or suffering from, depression Key processes ■ Acceptance, management and discharge of patients
Parents and carers	Key resources ■ Competencies (knowledge, skills and behaviours) to support children and young people to manage addressable vulnerability factors for depression Key processes ■ None identified

Table 5.1 The capabilities required by each actor to enable school staff to identify children at risk of depression or struggling with mental health conditions, and to take appropriate next steps

6. Research themes and opportunities

This report defines a vision for the future of the mental health ecosystem, as well as specific, near-term, opportunities for intervention. The projects presented in Section 4 demonstrate opportunities where sufficient evidence already exists to enable the development and refinement of an innovation within the next one to three years. Following development and piloting, a sufficient amount of clinical evidence will be required before progressing to clinical implementation.

In order to realise the long-term visions presented in Section 5, this work also identifies the need for additional basic science, preclinical research and clinical research required to build on the current understanding of the mechanisms of depression in children and young people.

The translational science spectrum, as defined by the National Center for Advancing Translational Sciences (NCATS), consists of five key stages, from the understanding of the biological basis of health and disease, through to the actual implementation of interventions that improve the health of individuals and the public. The non-linear nature of this process is shown in Figure 6.1, and definitions for each stage are provided in Table 6.1.

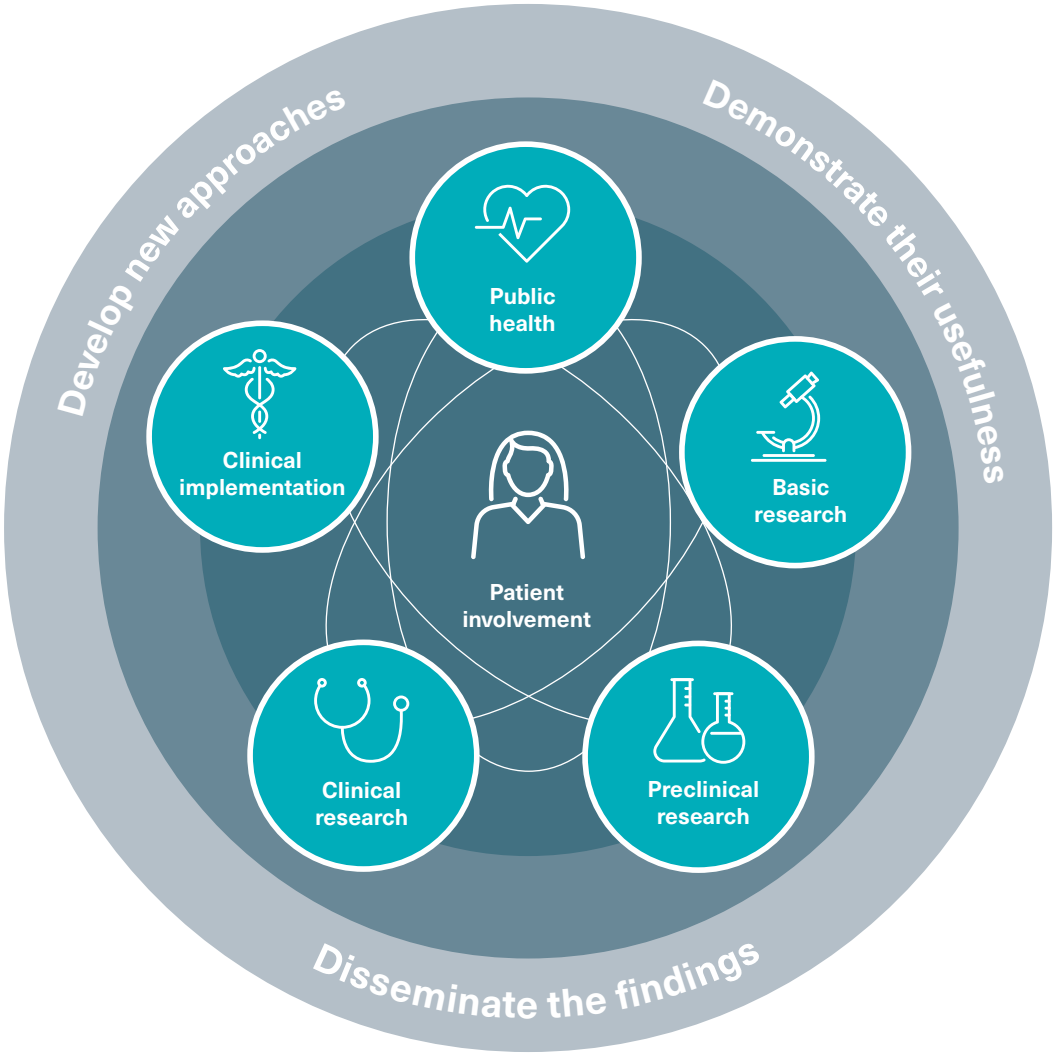


Figure 6.1 Translational science spectrum[107]

1. *Basic research*	Basic research involves scientific exploration that can reveal fundamental mechanisms of biology, disease or behaviour. Every stage of the translational research spectrum builds upon and informs basic research. NCATS scientists typically do not conduct basic research; however, insights gained from the Center's studies along the translational spectrum can inform basic research.
2. *Preclinical research*	Preclinical research connects the basic science of disease with human medicine. During this stage, scientists develop model interventions to further understand the basis of a disease or disorder and find ways to treat it. Testing is carried out using cell or animal models of disease; samples of human or animal tissues; or computer-assisted simulations of drug, device or diagnostic interactions within living systems.
3. *Clinical research*	Clinical research includes studies to better understand a disease in humans and relate this knowledge to findings in cell or animal models; testing and refinement of new technologies in people; testing of interventions for safety and effectiveness in those with or without disease; behavioural and observational studies; and outcomes and health services research. The goal of many clinical trials is to obtain data to support regulatory approval for an intervention.
4. *Clinical implementation*	The clinical implementation stage of translation involves the adoption of interventions that have been demonstrated to be useful in a research environment into routine clinical care for the general population. This stage also includes implementation research to evaluate the results of clinical trials and to identify new clinical questions and gaps in care.
5. *Public health*	In this stage of translation, researchers study health outcomes at the population level to determine the effects of diseases and efforts to prevent, diagnose and treat them. Findings help to guide scientists working to assess the effects of current interventions and to develop new ones.

Table 6.1 Definitions of the five key stages in the translational science spectrum (reproduced from[107])

The research opportunities presented below sit within the first three stages of the translational science spectrum. They are distinct from the projects presented previously in this report, which sit further towards the translational end of the spectrum. However, they are necessary in order to support the development and implementation of future innovations that will target the specific mechanisms of depression in children and young people, previously identified in *Changing Hearts, Changing Minds*.[5] They therefore underpin the YPMH vision for the future, in which the causes and vulnerability factors of an individual's depression can be identified and effectively managed or treated to prevent a first episode of depression or enable the individual to recover faster and remain in remission.

Research themes and opportunities were split into two categories:

1. Physiological mechanisms;
2. Individual vulnerability factors and psychological factors.

Information on each of the key topics was collated from the most recent review papers (from 2019 onwards).

6.1. Physiological mechanisms

Topic	Current understanding
Genes and epigenetics	
Polymorphisms	■ Common genetic variation plays a role in childhood psychiatric traits. ■ Polygenic risk scores (PRS) for major depressive disorder (MDD) and bipolar disorder explain a small proportion of the variance for all phenotypes (< 2%). ■ MDD is heavily influenced by multiple genetic and environmental factors that are further modified by sex and life course. This has led to the concept of gene–environment (GxE) studies: that individuals with specific polymorphisms are more or less sensitive to the effects of their environments. However, over 20 years of investigations in humans on candidate polymorphisms have found little reproducible evidence that they have major effects. ■ Evidence of associations between the MDD–PRS and childhood trauma or stressful life events is inconsistent. ■ Associations between a PRS and antidepressant treatment response have been reported for a number of traits in patients with unipolar MDD.
Epigenetics	■ There is evidence from case/control studies that implicate epigenetic processes in MDD and responses to early-life adversity. These are likely to be driven by both genetic and environmental factors. ■ Recently developed 'epigenetic clocks' provide an estimate of biological age. Several studies have demonstrated a link between exposure to childhood adversities and accelerated epigenetic ageing, as well as MDD. ■ Lifestyle choices involving diet, physical activity, sleep, social relationships, stress and mindfulness-based interventions (MBIs) influence epigenetic processes and can therefore play a role in determining whether an individual suffers from depression.

Future research opportunities	References
■ Genome-wide association studies (GWAS) in children and young people with increased sample sizes and collaborative longitudinal studies will lead to increased power to identify genetic variants and to understand the genetic architecture and genetic predictors of depression in young people. This will ultimately be beneficial for targeted prevention strategies. ■ Combining polygenic risk scores with other biological, psychological and environmental vulnerability factors has the potential to improve outcome prediction of mental health disorders and aid clinical decision-making. ■ Genome-wide hypothesis-free approaches (controlling for genetic backgrounds, environment, gender and age) could identify polymorphisms that regulate GxE interactions. Identifying these could enable better prediction of an individual's sensitivity to particular environments or treatments. ■ There is a need for larger study cohorts and the use of standardised outcome measures to determine the potential for using PRS to predict treatment response to antidepressants. Future studies should also consider combining prediction strategies involving both genetic and non-genetic contributions.	[108] W. A. Akingbuwa, A. R. Hammerschlag, M. Bartels, and C. M. Middeldorp, "Systematic Review: Molecular Studies of Common Genetic Variation in Child and Adolescent Psychiatric Disorders," J Am Acad Child Adolesc Psychiatry, vol. 61, no. 2, pp. 227–242, Feb. 2022, doi: 10.1016/J.JAAC.2021.03.020. [109] G. K. Murray, T. Lin, J. Austin, J. J. McGrath, I. B. Hickie, and N. R. Wray, "Could Polygenic Risk Scores Be Useful in Psychiatry?: A Review," JAMA Psychiatry, vol. 78, no. 2, pp. 210–219, Feb. 2021, doi: 10.1001/JAMAPSYCHIATRY.2020.3042. [110] S. Mistry, J. R. Harrison, D. J. Smith, V. Escott-Price, and S. Zammit, "The use of polygenic risk scores to identify phenotypes associated with genetic risk of bipolar disorder and depression: A systematic review," J Affect Disord, vol. 234, pp. 148–155, Jul. 2018, doi: 10.1016/J.JAD.2018.02.005. [111] V. Warrier et al., "Gene-environment correlations and causal effects of childhood maltreatment on physical and mental health: a genetically informed approach," Lancet Psychiatry, vol. 8, no. 5, pp. 373–386, May 2021, doi: 10.1016/S2215-0366(20)30569-1. [112] J. J. Meerman, S. E. ter Hark, J. G. E. Janzing, and M. J. H. Coenen, "The Potential of Polygenic Risk Scores to Predict Antidepressant Treatment Response in Major Depression: A Systematic Review," J Affect Disord, vol. 304, pp. 1–11, May 2022, doi: 10.1016/J.JAD.2022.02.015.
■ There is a need to identify robust aberrant epigenetic mechanisms occurring in MDD, and in responses to early stress, to increase our understanding of the molecular mechanisms governing this disease. These could serve as biomarkers and guide future treatment. ■ Further research is needed to better understand the potential role of epigenetic clocks to understand the role of biological age acceleration in depression. Further development of sex-specific clocks for early childhood and adolescence, through longitudinal studies, could allow for better identification of the causes and mechanisms of child and adolescent psychopathology.	[113] S. Penner-Goeke and E. B. Binder, "Epigenetics and depression," Dialogues Clin Neurosci, vol. 21, no. 4, pp. 397–405, Dec. 2019, doi: 10.31887/DCNS.2019.21.4/EBINDER. [114] C. A. M. Cecil, A. Neumann, and E. Walton, "Epigenetics applied to child and adolescent mental health: Progress, challenges and opportunities," JCPP Advances, p. e12133, Dec. 2022, doi: 10.1002/JCV2.12133. [115] J. S. Lee, A. Jaini, and F. Papa, "An Epigenetic Perspective on Lifestyle Medicine for Depression: Implications for Primary Care Practice," American Journal of Lifestyle Medicine research, vol. 16, no. 1, pp. 76–88, 2022, doi: 10.1177/1559827620954779.

Topic	Current understanding
The gut microbiome and the gut–brain axis	
Gut microbiome	■ Recent findings provide strong evidence for the presence of bidirectional communication networks between the gut microbiota and the central nervous system, and such crosstalk has been correlated with alterations in MDD and other psychiatric disorders. ■ The biochemical composition and functionality of the gut can have profound impacts on whole-body inflammation, immune functioning, and ultimately neurotransmission.
Increased gut permeability	■ The mechanisms that connect psychological stress, 'leaky gut', neuroinflammation and depression are beginning to be uncovered. ■ The role of gut barrier function is considered to be important, but there are many unresolved questions, as there are no validated clinical diagnostic tests.
The HPA axis and glucocorticoid resistance	
Cortisol	■ Elevated morning, but not evening, cortisol levels were prospectively associated with later MDD development in adolescence and young adulthood. However, morning cortisol levels did not significantly differ between healthy controls and individuals with MDD in cross-sectional studies.

Future research opportunities	References
■ Future studies should examine the feasibility of incorporating probiotics and diet therapy into the treatment regimens of patients with MDD. ■ Future research should focus on the identification and characterisation of specific bacterial strains involved in MDD, with the hope of applying these findings in the prevention and treatment of MDD. ■ Future studies are needed to look at specific subtypes of depression and how they map onto the gut microbiota. ■ Longitudinal studies that look at gut microbiota function and evaluate gut microbiota changes over time are required to understand their relationship to disease development and may help to determine causality. ■ There is a clear need for the harmonisation of reporting and methodologies in gut microbiome research. Clinical parameters to measure gut microbiome alteration need to be established.	[116] C. Schrodt et al., "The gut microbiome and depression: a review," Nutr Neurosci, 2022, doi: 10.1080/1028415X.2022.2111745. [117] Z. Yang et al., "Updated review of research on the gut microbiota and their relation to depression in animals and human beings," Molecular Psychiatry 2020 25:11, vol. 25, no. 11, pp. 2759–2772, Apr. 2020, doi: 10.1038/s41380-020-0729-1. [118] T. Limbana, F. Khan, and N. Eskander, "Gut Microbiome and Depression: How Microbes Affect the Way We Think," Cureus, vol. 12, no. 8, Aug. 2020, doi: 10.7759/CUREUS.9966. [119] V. L. Nikolova, M. R. B. Hall, L. J. Hall, A. J. Cleare, J. M. Stone, and A. H. Young, "Perturbations in Gut Microbiota Composition in Psychiatric Disorders: A Review and Meta-analysis," JAMA Psychiatry, vol. 78, no. 12, pp. 1343–1354, Dec. 2021, doi: 10.1001/JAMAPSYCHIATRY.2021.2573. [120] A. J. McGuinness et al., "A systematic review of gut microbiota composition in observational studies of major depressive disorder, bipolar disorder and schizophrenia," Mol Psychiatry, vol. 27, no. 4, pp. 1920–1935, Apr. 2022, doi: 10.1038/S41380-022-01456-3.
■ Further research is required to understand the causal relationship between the gut microbiome, increased gut permeability and systemic inflammation, and their influences on mood. ■ Research is needed to determine the effect of restoring gut barrier function on clinical symptoms. ■ Validated clinical diagnostic tests for gut permeability need to be established.	[121] M. Camilleri, "Leaky gut: mechanisms, measurement and clinical implications in humans," Gut, vol. 68, no. 8, pp. 1516–1526, Aug. 2019, doi: 10.1136/GUTJNL-2019-318427. [122] J. M. Peirce and K. Alviña, "The role of inflammation and the gut microbiome in depression and anxiety," J Neurosci Res, vol. 97, no. 10, pp. 1223–1241, Oct. 2019, doi: 10.1002/JNR.24476.
■ Research is needed to investigate the cortisol response in different phenotypes of depression and to understand appropriate management. This could be achieved through the use of continuous cortisol monitoring over 24 hours.	[123] Z. Zajkowska et al., "Cortisol and development of depression in adolescence and young adulthood - a systematic review and meta-analysis," Psychoneuroendocrinology, vol. 136, Feb. 2022, doi: 10.1016/J.PSYNEUEN.2021.105625.

Topic	Current understanding
The immune system: inflammation, cytokines, IDO and the kynurenine pathway	
Inflammation	■ Based on the reviewed studies there is some evidence for inflammatory dysregulation in young people with MDD in clinical samples, whereas generally no associations between inflammatory cytokines and dimensional measures of depression were found in healthy controls from community samples. ■ Differences in inflammatory cytokines were inconsistent across studies. For example, IL-2 and IFN-γ showed significant differences in most clinical studies, but both increases and decreases in cytokine levels were observed. ■ Most cross-sectional clinical studies found no differences in cytokines IL-6, CRP and TNF-α in young people with MDD, which have been most consistently implicated in adult MDD. ■ Longitudinal studies suggest evidence for a causal role of IL-6 and CRP in depression in young people. This is backed up by genetic epidemiological studies. ■ Longitudinal studies confirmed a bidirectional relationship between inflammation and depression: increases in inflammatory cytokines were predictive of subsequent depression, and depression was also shown to precede increased levels of inflammatory cytokines. ■ Inflammatory dysregulation seems to be particularly related to neurovegetative symptoms of depression, including appetite disturbances, sleep disturbances, fatigue and psychomotor retardation, as well as social disconnection and anhedonia (the reduced ability to experience pleasure).
Kynurenine pathway	■ Research into the peripheral blood of individuals with depression has shown a consistent decrease in levels of tryptophan, kynurenine and kynurenic acid in major depression. However, there is limited evidence for causality. ■ Studies using brain tissue have shown conflicting results to peripheral blood studies. Brain tissue studies have shown an overall decrease in activity of the neurotoxic arm of the kynurenine pathway and an increase in the neuroprotective arm in some studies.
Brain derived neurotrophic factor (BDNF)	■ Studies on early-onset depression consistently point to the importance of 5-HTTLPR and BDNF Val66Met polymorphisms in the susceptibility to early-onset depression. ■ According to the neuroinflammatory theory of depression, IL-6 and BDNF remain closely related, as chronic neuroinflammation is considered to cause a decrease of BDNF level in the brain. Indeed, some studies confirm that BDNF is significantly lower in children with depression. ■ A growing body of evidence suggests a relationship between environmental stress and BDNF expression in children. ■ The relationship between antidepressant treatment and BDNF serum level in children remains unclear. Despite the promising role of BDNF as a marker of successful treatment in adults, the only study that addressed this question in the child population has yielded unexpected results, with a decrease of BDNF level after treatment.

Future research opportunities	References
■ Future clinical trials are needed to test the usefulness of anti-inflammatory interventions (that have previously shown promising results in adults with depression) in young people with depression. Such trials would also help to elucidate potential mechanisms of action in young people with depression. ■ A critical next step is to further characterise inflammatory pathways that are causally related to depression in young people (as a whole), and their relationship to specific symptom profiles. This would help to refine the choice of treatment target and agent in future trials. ■ Stratified patient selection in future studies would be key in order to understand the characteristics of inflammation-related depression. Future treatment studies should consider multiple different 'immunophenotypes' (each characterised by a unique clustering of immune and other biological dysregulations +/-specific symptom profile).	[124] Y. J. Toenders et al., "Inflammation and depression in young people: a systematic review and proposed inflammatory pathways," Molecular Psychiatry 2021 27:1, vol. 27, no. 1, pp. 315–327, Oct. 2021, doi: 10.1038/s41380-021-01306-8. [125] N. mac Giollabhui, T. H. Ng, L. M. Ellman, and L. B. Alloy, "The longitudinal associations of inflammatory biomarkers and depression revisited: systematic review, meta-analysis, and meta-regression," Mol Psychiatry, vol. 26, no. 7, pp. 3302–3314, Jul. 2021, doi: 10.1038/S41380-020-00867-4.
■ Further studies are needed to understand the causal relationships between the peripheral kynurenine pathway, inflammation and depression. ■ Further studies are required to characterise the relationship between the peripheral and central kynurenine pathway in depression. ■ More research is required to investigate the therapeutic benefits of targeting the kynurenine pathway using an evidence-based approach centred on human brain findings and the heterogenous subtypes of depression. Subtyping of depression is critical in order to identify people with depression who are likely to benefit from immunological interventions.	[126] S. J. Brown, X. F. Huang, and K. A. Newell, "The kynurenine pathway in major depression: What we know and where to next," Neurosci Biobehav Rev, vol. 127, pp. 917–927, Aug. 2021, doi: 10.1016/J.NEUBIOREV.2021.05.018. [127] W. Marx et al., "The kynurenine pathway in major depressive disorder, bipolar disorder, and schizophrenia: a meta-analysis of 101 studies," Molecular Psychiatry 2020 26:8, vol. 26, no. 8, pp. 4158–4178, Nov. 2020, doi: 10.1038/s41380-020-00951-9.
■ Further research is required to determine the exact mechanisms of action of BDNF. ■ More studies on large samples are needed to verify the usefulness of serum BDNF and IL-6 as biomarkers of depression and antidepressant treatment response in children.	[128] W. Zwolińska, M. Dmitrzak-Węglarz, and A. Słopień, "Biomarkers in Child and Adolescent Depression," Child Psychiatry & Human Development 2021 54:1, vol. 54, no. 1, pp. 266–281, Sep. 2021, doi: 10.1007/S10578-021-01246-Y. [129] J. Lee, S. Chi, and M. S. Lee, "Molecular Biomarkers for Pediatric Depressive Disorders: A Narrative Review," International Journal of Molecular Sciences 2021, Vol. 22, Page 10051, vol. 22, no. 18, p. 10051, Sep. 2021, doi: 10.3390/IJMS221810051.

6.2. Individual vulnerability factors and psychological factors

Topic	Current understanding
Food and nutrition	
Omega-3 fatty acids	■ Current studies have only demonstrated small-to-medium effects of the use of omega-3 fatty acids in the treatment of depressive disorders. ■ Considering the limited evidence of omega-3 fatty acids in the acute treatment of major depressive disorders, it did not seem to offer a clear advantage for children and adolescents.
Vitamin D	■ The vast majority of assessed studies supported the potential positive influence of vitamin D on mental health in children. ■ Vitamin D intake within a properly balanced diet or as a supplement should be indicated as an element to support good mental health in children. It should be recommended to meet the required 25(OH)cholecalciferol blood level in order to prevent or alleviate mental health problems.
Prebiotics, probiotics and synbiotics	■ Significant differences have not been observed in alpha diversity, but a significant difference in beta diversity has been shown between patients with MDD and healthy controls. There are fluctuations in the abundance of specific bacterial taxa in patients with MDD relative to healthy controls. ■ Probiotic and synbiotic, but not prebiotic, treatment showed a modest benefit in reducing depressive symptoms in patients with MDD over four to nine weeks.

Future research opportunities	References
■ Given the anti-inflammatory properties of omega-3 fatty acids, future studies should be conducted in MDD patients with signs of low-grade inflammation. ■ Studies should specifically focus on the omega-6/omega-3 ratio.	[130] L. Zhang, H. Liu, L. Kuang, H. Meng, and X. Zhou, "Omega-3 fatty acids for the treatment of depressive disorders in children and adolescents: A meta-analysis of randomized placebo-controlled trials," Child Adolesc Psychiatry Ment Health, vol. 13, no. 1, pp. 1–9, Sep. 2019, doi: 10.1186/S13034-019-0296-X/TABLES/2. [131] K. Suneson, J. Lindahl, S. C. Hårsmar, G. Söderberg, and D. Lindqvist, "Inflammatory Depression—Mechanisms and Non-Pharmacological Interventions," International Journal of Molecular Sciences 2021, Vol. 22, Page 1640, vol. 22, no. 4, p. 1640, Feb. 2021, doi: 10.3390/IJMS22041640.
■ Studies conducted so far presented various study populations, outcomes and psychological measures. More studies are necessary to strengthen the causal inference, facilitate comparisons and deepen the observations.	[132] D. Głąbska, A. Kołota, K. Lachowicz, D. Skolmowska, M. Stachoń, and D. Guzek, "The Influence of Vitamin D Intake and Status on Mental Health in Children: A Systematic Review," Nutrients, vol. 13, no. 3, pp. 1–22, Mar. 2021, doi: 10.3390/NU13030952.
■ More research is required into the underlying mechanisms here (i.e. what effect do pre/probiotic supplements have on the production of neuroactive metabolites). ■ The gut microbiome profiles of patients with MDD differ significantly from healthy controls, but further studies are needed to elucidate the benefits of prebiotic, probiotic and synbiotic treatments relative to antidepressants and over longer follow-up times before these therapies are implemented into clinical practice. ■ It is recommended that three specific factors be considered in future psychobiotic trials: (1) specificity of population studied (e.g. patients, developmental age); (2) specificity of intervention; and (3) homogeneity in outcome measures. ■ Research is also required to determine whether those with a poorer (more Western) diet or a better (healthier, more diverse) diet respond better to probiotic interventions.	[133] S. R. Alli, I. Gorbovskaya, J. C. W. Liu, N. J. Kolla, L. Brown, and D. J. Müller, "The Gut Microbiome in Depression and Potential Benefit of Prebiotics, Probiotics and Synbiotics: A Systematic Review of Clinical Trials and Observational Studies," Int J Mol Sci, vol. 23, no. 9, May 2022, doi: 10.3390/IJMS23094494. [134] M. Basso, N. Johnstone, P. Knytl, A. Nauta, A. Groeneveld, and K. Cohen Kadosh, "A Systematic Review of Psychobiotic Interventions in Children and Adolescents to Enhance Cognitive Functioning and Emotional Behavior," Nutrients, vol. 14, no. 3, p. 614, Feb. 2022, doi: 10.3390/NU14030614/S1.

Topic	Current understanding
Dietary counselling to increase consumption of micronutrients and fibre diversity	■ Several small randomised controlled trials (RCTs) have been conducted in people with MDD and have reported moderate-to-large improvements in depressive symptoms when randomised to receive Mediterranean-style dietary intervention compared to controls. ■ Healthful dietary patterns such as the Mediterranean diet, high in vegetables, fruit, wholegrains, legumes, nuts, fish and low-fat dairy, alongside moderate to low consumption of meat and healthy fats, have an inverse association with pro-inflammatory biomarkers, particularly CRP, IL-6 and TNF-α, in children and adolescents. ■ Consistently significant and positive effects of dietary interventions on depressive symptoms have been observed across dietary interventions primarily aimed at (1) reducing bodyweight, (2) improving nutrition or (3) decreasing dietary fat intake.
Exercise	
Exercise	■ Evidence suggests that exercise interventions may be associated with a moderate decrease in adolescent depression severity.

Future research opportunities	References
■ Future research studies should use biological, rather than self-reported, dietary measures as a more accurate and reliable way of investigating dietary intake. ■ More research is required to determine the effectiveness of dietary interventions in the prevention and treatment of depression in children and young people. ■ More research is required to understand the biological mechanisms of action of dietary components on depression (including the link between dietary fibre intake, inflammation and depression). ■ Further research is needed to identify individual demographic (e.g. age, sex, BMI, comorbid medical conditions), behavioural (e.g. motivation to change) and biological (e.g. oxidative stress, inflammation) factors that might influence the appropriateness of dietary interventions, as well as dietary treatment response. ■ Further research is required to investigate the comparative efficacy of the wide array of potentially therapeutic dietary interventions (e.g. Mediterranean diet versus ketogenic diet versus caloric restriction), which differ greatly in macro- and micro-nutrient composition. ■ Given the potentially cumulative effects of diet and exercise together, future research should explore the modification of diet in combination with other lifestyle modifications to provide a more integrated approach.	[135] W. Marx et al., "Clinical guidelines for the use of lifestyle-based mental health care in major depressive disorder: World Federation of Societies for Biological Psychiatry (WFSBP) and Australasian Society of Lifestyle Medicine (ASLM) taskforce," World J Biol Psychiatry, 2022, doi: 10.1080/15622975.2022.2112074. [136] M. Bujtor, A. I. Turner, S. J. Torres, L. Esteban-Gonzalo, C. M. Pariante, and A. Borsini, "Associations of Dietary Intake on Biological Markers of Inflammation in Children and Adolescents: A Systematic Review," Nutrients 2021, Vol. 13, Page 356, vol. 13, no. 2, p. 356, Jan. 2021, doi: 10.3390/NU13020356. [137] W. Marx et al., "Diet and depression: exploring the biological mechanisms of action," Molecular Psychiatry 2020 26:1, vol. 26, no. 1, pp. 134–150, Nov. 2020, doi: 10.1038/s41380-020-00925-x. [42] O. G. Swann, M. Kilpatrick, M. Breslin, and W. H. Oddy, "Dietary fiber and its associations with depression and inflammation," Nutr Rev, vol. 78, no. 5, pp. 394–411, May 2020, doi: 10.1093/NUTRIT/NUZ072. [138] J. Firth et al., "The Effects of Dietary Improvement on Symptoms of Depression and Anxiety: A Meta-Analysis of Randomized Controlled Trials," Psychosom Med, vol. 81, no. 3, pp. 265–280, Apr. 2019, doi: 10.1097/PSY.0000000000000673.
■ There is a need for high-quality trials evaluating the effect of exercise in children and adolescents with depression. ■ Future trials should assess exercise as a first-line intervention and consider longer follow-up periods to investigate whether exercise has long-lasting effects. ■ A wider range of outcomes should be measured in future trials, including quality of life, social functioning and psychological wellbeing. ■ There is a need to understand what type, mode, intensity and frequency of exercise should be recommended, and how it should be implemented in different populations.	[139] B. Axelsdóttir, S. Biedilæ, Å. Sagatun, L. v. Nordheim, and L. Larun, "Review: Exercise for depression in children and adolescents –a systematic review and meta-analysis," Child Adolesc Ment Health, vol. 26, no. 4, pp. 347–356, Nov. 2021, doi: 10.1111/CAMH.12438. [140] A. Heissel et al., "Exercise as medicine for depressive symptoms? A systematic review and meta-analysis with meta-regression," Br J Sports Med, vol. 0, pp. 1–10, Feb. 2023, doi: 10.1136/BJSPORTS-2022-106282.

Topic	Current understanding
Sleep	
Sleep	■ Evidence shows a small but statistically significant effect size, indicating that disturbed sleep was prospectively associated with depression in children and young people. ■ Disturbed sleep is a component of the multifaceted risk profile of depression and should be included in prevention programmes as early as childhood.
Behaviour, psychology, cognition and resilience	
Resilience	■ Higher levels of resilience are consistently related to fewer mental health problems. ■ There is a significant beneficial effect of school-related physical activity interventions on resilience, positive mental health, wellbeing and anxiety. ■ Resilience-oriented cognitive behavioural interventions are effective for addressing depressive symptoms among students up to six months follow-up.
Cognitive behavioural therapy (CBT)	■ Numerous RCTs and meta-analyses of CBT report its efficacy and effectiveness for both depressive and anxiety disorders. ■ Psychotherapies (predominantly CBT) for depression in young people have been shown to be effective compared to control conditions. However, the response rates are moderate, with about 60% of those receiving therapy not responding within two months. ■ The treatment satisfaction of CBT among children and adolescents is moderate to high in depression and anxiety CBT treatments. ■ There is robust evidence for the effectiveness of computer-based CBT in the treatment of anxiety and depressive disorders in adolescents and young adults compared with passive controls, with small to medium post-treatment effect sizes. ■ The effects of computer-based CBT compared to active treatment controls are unclear for patients with depressive symptoms.

Future research opportunities	References
■ Randomised clinical trials targeting disturbed sleep as early as childhood are needed to inform the planning and evaluation of depression prevention programmes.	[141] C. Marino et al., "Association Between Disturbed Sleep and Depression in Children and Youths: A Systematic Review and Meta-analysis of Cohort Studies," JAMA Netw Open, vol. 4, no. 3, Mar. 2021, doi: 10.1001/JAMANETWORKOPEN.2021.2373.
■ As resilience is a dynamic process that can change over time, there is a need for longitudinal studies that assess resilience and psychopathology in children and adolescents prospectively. ■ Future research should explore factors that predict the magnitude of the effect of resilience-oriented cognitive behavioural interventions (CBIs). ■ Future research should investigate the impact of interventions that target both internal and external protective factors for childhood depression.	[142] E. Mesman, A. Vreeker, and M. Hillegers, "Resilience and mental health in children and adolescents: an update of the recent literature and future directions," Curr Opin Psychiatry, vol. 34, no. 6, pp. 586–592, Nov. 2021, doi: 10.1097/YCO.0000000000000741. [143] S. Andermo et al., "School-related physical activity interventions and mental health among children: a systematic review and meta-analysis," Sports Med Open, vol. 6, no. 1, pp. 1–27, Dec. 2020, doi: 10.1186/S40798-020-00254-X/TABLES/4. [144] L. Ma, Y. Zhang, C. Huang, and Z. Cui, "Resilience-oriented cognitive behavioral interventions for depressive symptoms in children and adolescents: A meta-analytic review," J Affect Disord, vol. 270, pp. 150–164, Jun. 2020, doi: 10.1016/J.JAD.2020.03.051.
■ There is a need for standardised measures for treatment satisfaction in future research. ■ Future research should examine potential reasons why children and adolescents do not respond and whether treatment response rates could be increased by enhancing treatment fidelity, optimising delivery methods, combining treatments, applying personalised approaches or sequential treatments. ■ There is a need to investigate the effectiveness of computer-based CBT in comparison to active treatment control groups. Future research should also include larger sample sizes and longer follow-up periods, and they should investigate the effect of computer-based CBT in lower-educated samples, as well as young people from low-income countries, for whom face-to-face mental health treatment is often unavailable.	[145] N. Choque Olsson, P. Juth, E. Högberg Ragnarsson, T. Lundgren, M. Jansson-Fröjmark, and T. Parling, "Treatment satisfaction with cognitive-behavioral therapy among children and adolescents with anxiety and depression: A systematic review and meta-synthesis," J Behav Cogn Ther, vol. 31, no. 2, pp. 147–191, Jun. 2021, doi: 10.1016/J.JBCT.2020.10.006. [146] C. Christ et al., "Internet and Computer-Based Cognitive Behavioral Therapy for Anxiety and Depression in Adolescents and Young Adults: Systematic Review and Meta-Analysis," J Med Internet Res, vol. 22, no. 9, Sep. 2020, doi: 10.2196/17831. [147] P. Cuijpers et al., "The effects of psychological treatments of depression in children and adolescents on response, reliable change, and deterioration: a systematic review and meta-analysis," Eur Child Adolesc Psychiatry, vol. 32, no. 1, Jan. 2023, doi: 10.1007/S00787-021-01884-6.

Topic	Current understanding
Mindfulness-based Interventions (MBIs)	■ Significant effects of MBIs were observed for children and adolescents with depression. Effect sizes for these significant effects ranged from small to small-to-moderate. ■ Benefits for depression are limited to selective MBIs.
Adverse childhood experiences (ACEs)	■ ACEs are associated with increased economic burden and increased risk of poor physical and mental health outcomes across the lifespan. ■ Using multicomponent interventions, it is feasible to reduce child behavioural/mental health problems and improve the parent–child relationship for children aged 1–5 years. ■ Multicomponent medium- to high-intensity interventions that utilise professional home visitors to provide parenting education or mental health counselling demonstrate the largest effects.

Future research opportunities	References
■ Future RCT evaluations should incorporate scaled-up definitive trial designs to further evaluate the robustness of MBIs in young people. ■ Future research should carefully consider the context of schools, and implementation factors, as well as the unique needs and developmental stage of young people.	[148] D. L. Dunning et al., "Research Review: The effects of mindfulness-based interventions on cognition and mental health in children and adolescents – a meta-analysis of randomized controlled trials," Journal of Child Psychology and Psychiatry, vol. 60, no. 3, pp. 244–258, Mar. 2019, doi: 10.1111/JCPP.12980. [149] D. Dunning et al., "Do mindfulness-based programmes improve the cognitive skills, behaviour and mental health of children and adolescents? An updated meta-analysis of randomised controlled trials," Evid Based Ment Health, vol. 25, no. 3, pp. 135–142, Aug. 2022, doi: 10.1136/EBMENTAL-2022-300464.
■ Future research is required to evaluate the impact of paediatric primary care screening and referral for ACEs. ■ Future research should evaluate the effect of integrating additional intervention components into practice, including: expanded parenting education, expanded social support for families, integration of behavioural health services for both parents and children, and linkages to home-visiting programmes.	[150] A. Marie-Mitchell and R. Kostolansky, "A Systematic Review of Trials to Improve Child Outcomes Associated With Adverse Childhood Experiences," Am J Prev Med, vol. 56, no. 5, pp. 756–764, May 2019, doi: 10.1016/J.AMEPRE.2018.11.030. [151] K. Petruccelli, J. Davis, and T. Berman, "Adverse childhood experiences and associated health outcomes: A systematic review and meta-analysis," Child Abuse Negl, vol. 97, Nov. 2019, doi: 10.1016/J.CHIABU.2019.104127.

7. Processes and methods

The work described in *Changing Minds, Changing Lives* follows on from work conducted by YPMH in collaboration with the Centre for Technology Management (CTM) at the Institute for Manufacturing (IfM) and IfM's knowledge transfer company, IfM Engage Ltd. The previous work (published as *Changing Hearts, Changing Minds*,[5] 2021) applied the technology and innovation management methods researched by CTM to identify ideas for evidence-based approaches to prevent, diagnose and treat depression in children and young people.

This report:

1. **Builds on the ideas** from *Changing Hearts, Changing Minds*[5] to develop and initiate high-impact projects for the prevention, diagnosis and management of depression in children and young people (Section 4);
2. **Maps out a vision** for the mental health ecosystem, defining roles for specific actors and opportunities for collaboration (Section 5);
3. **Provides direction for future research projects** necessary to support the vision described in this report (Section 6).

Structured methods researched and applied by IfM and IfM Engage, respectively were used to help deliver the work. These include innovation management approaches, and ecosystem mapping and design. A key aspect of these methods is that they help to engage key stakeholders and draw out their expertise and insights in a spirit of openness that enables highly productive collaborative working and co-development.

7.1 Project generation, evaluation and selection

Figure 7.1 shows the approach to develop and initiate high-impact projects for the prevention, diagnosis and management of depression in children and young people. Innovation management methods are highlighted in **blue**. The innovation workshops and consultations were delivered online by specialist facilitators to enable effective collaboration between participants located around the world.

The primary input was the ~200 ideas generated from *Changing Hearts, Changing Minds.*[5] The structured innovation management approach was instrumental in the development, evaluation and selection of high-impact, quality projects to take forwards to development and piloting.

Stakeholder engagement was central to the collaborative approach taken throughout this work. Approximately 150 stakeholders were involved, comprising:

- Parents, young people and carers;
- Healthcare actors, including people from public health, GPs, clinical psychologists and psychiatrists;
- Organisations engaging with young people, including schools, universities and employers;
- Organisations providing services and products to young people and their families, and to the health and social care system, including charities and businesses;
- Researchers and innovators.

7.1.1 Project generation

Consultations

A series of 12 online consultations were conducted with key stakeholders to explore the ideas suggested in the *Changing Hearts, Changing Minds*[5] report. Six workstreams were identified, which were used as themes for the consultations.

Each consultation set out:

- The problems to be addressed;
- The opportunity for intervention;
- The YPMH proposed strategy to address the problem;
- 3–4 initiatives to deliver the strategy (each initiative could be delivered through a number of projects).

The consultations had four main aims:

1. To validate the initiatives with stakeholders;
2. To identify any barriers that might prevent or inhibit the implementation of each initiative;
3. To determine any factors that might enable the implementation of each initiative;
4. To identify additional ideas for potential projects to address each initiative.

Four themes emerged consistently from the consultations:

1. The need for **information, education and training** to equip and motivate people and organisations to effect positive change.
2. The need for **vulnerability assessment, early detection and diagnosis of conditions and causes** to identify an individual's vulnerability factors and underlying causes of depression and to enable the development of a personalised management plan.
3. The need for **prevention, management and treatment** interventions to address specific mechanisms of depression. These interventions fall into five broad categories:
   - Prevention, management and treatment pathways
   - Food and nutrition
   - Exercise and movement
   - Sleep
   - Psychological
4. The need for **societal change, policies and regulation** to address cultural, societal, economic, environmental and community factors associated with depression.

(The need for changes to society, policy and regulation spans the other three themes. Projects generated at this stage did not specifically focus on policy or regulation, but supporting societal and policy change may form steps in implementation roadmaps for other projects.)

Following the consultations, projects were generated from the ~200 ideas from *Changing Hearts, Changing Minds,*[5] taking into account stakeholder feedback on each initiative. Projects were classified under the above themes, and three innovation workshops were designed to address themes 1 to 3. For the third workshop, it was decided to focus on interventions in the category of 'food and nutrition'. Projects for the other areas of intervention were later validated and refined through interviews with stakeholders.

7.1.2 Project validation, evaluation and prioritisation

Unmet needs

The definition of an unmet need is given in Section 4. Prior to the innovation workshops, unmet needs were defined for key stakeholder groups, spanning all stages of care, from prevention to treatment. Unmet needs were identified by working with key stakeholders to understand the current mental health ecosystem and challenges along the patient pathways for children and young people with depression.

Unmet needs were mapped across the care stages (as shown in Figure 7.2), to ensure that needs were identified at all phases of care. Subsequently, opportunities for innovations were explored at all stages.

Projects were mapped against the unmet needs to ensure alignment between projects and the desired visions for key stakeholder groups.

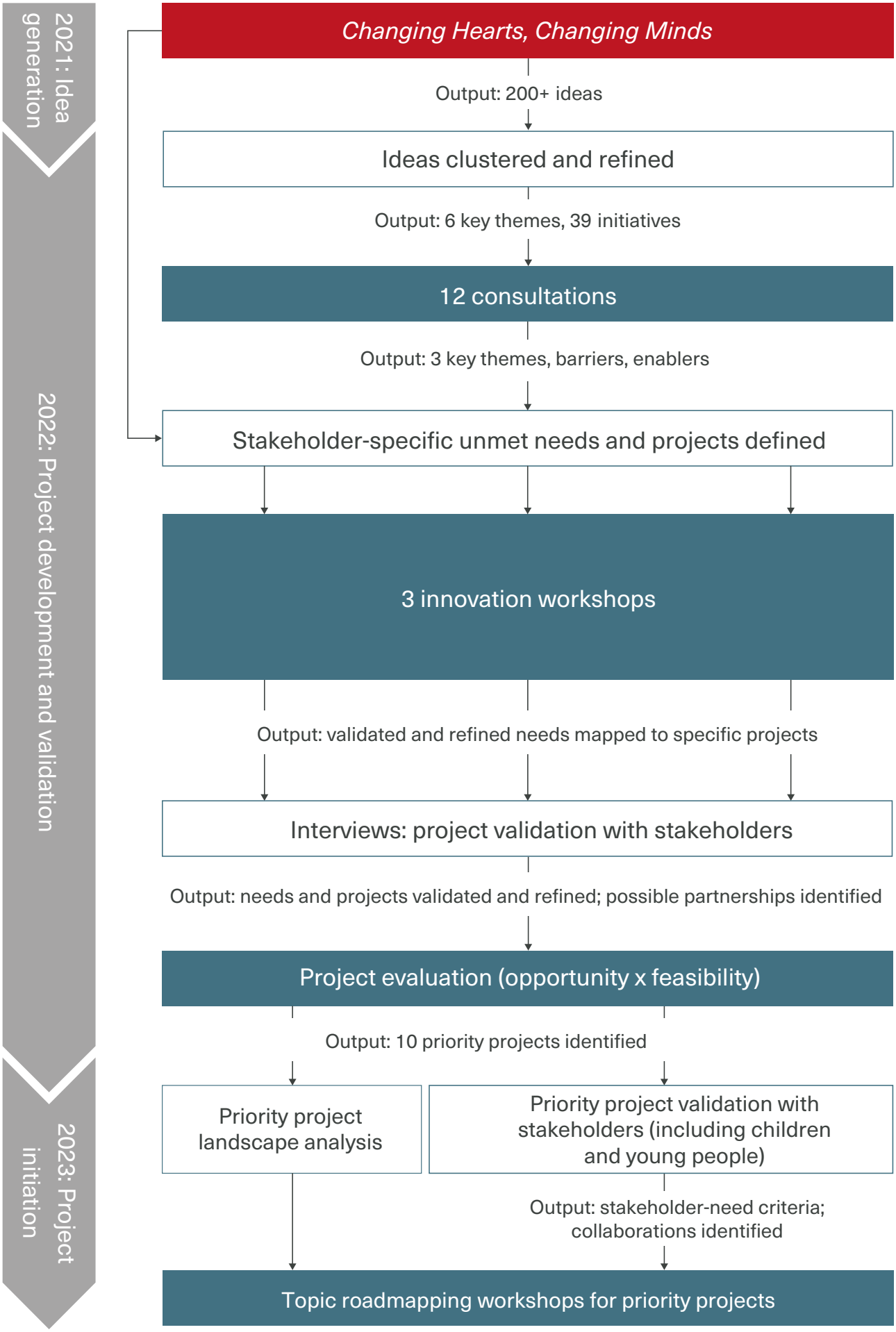


Figure 7.1 The innovation process

Innovation workshops

The aim of the innovation workshops was to help select priority innovation projects to be taken forwards for development and piloting, starting in 2023. The following approach was taken to the prioritisation of projects for each theme:

1. Refine and prioritise unmet needs for each stakeholder group;
2. Identify, prioritise and refine projects to meet prioritised unmet needs for each stakeholder group.

During the workshops, participants validated and refined the list of unmet needs for specific stakeholder groups. The unmet needs were then prioritised by participants based on the following criteria:

- How well is the need currently addressed? (Priority was given to unmet needs.)
- Likely patient impact? (Priority was given to needs that, if solved, would be likely to prevent depression or enable recovery from it.)

The most promising project ideas to address the prioritised stakeholder needs were selected by the stakeholder groups. These were further refined during the workshops using the template shown in Table 7.1.

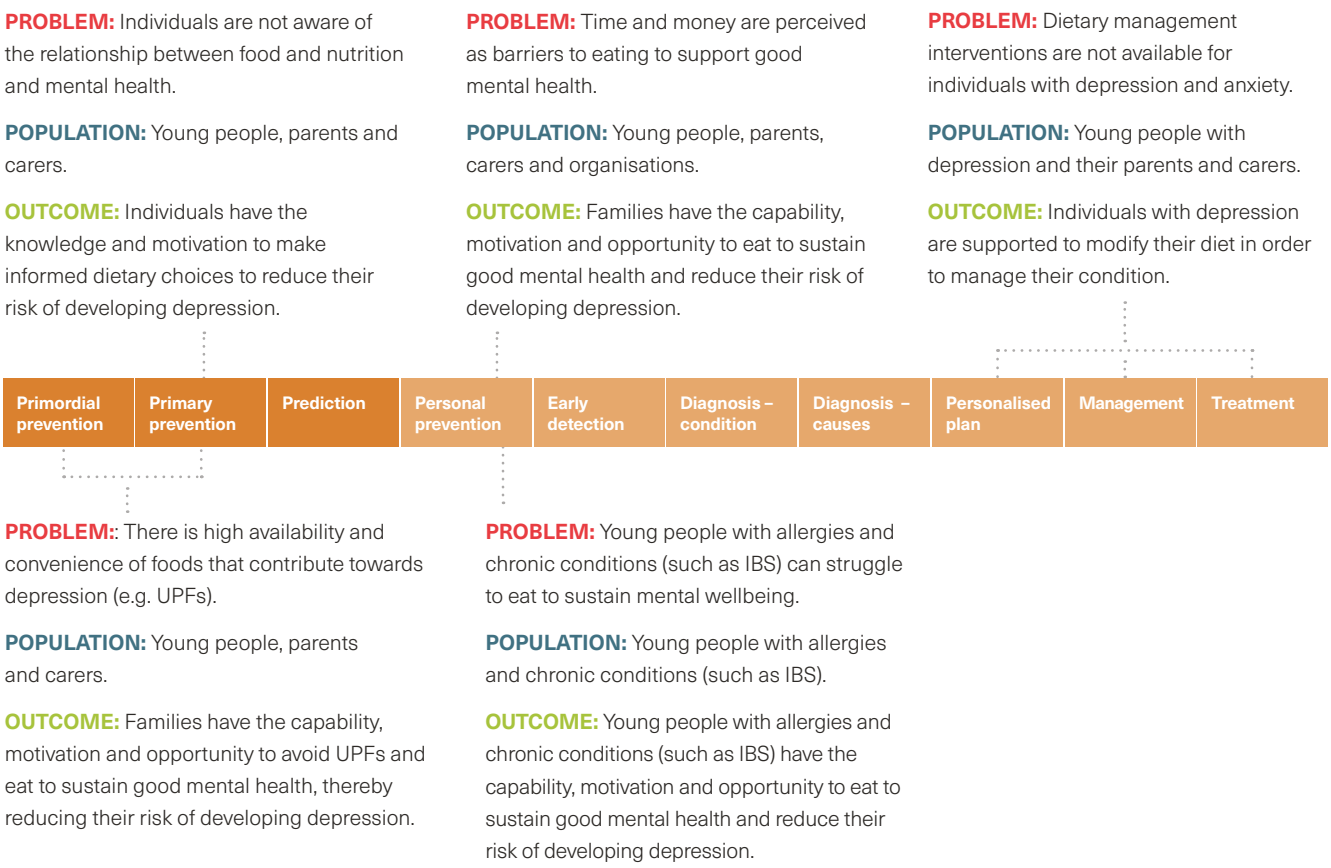


Figure 7.2 Examples of unmet needs mapped across the care stages

Unmet need	Problem, population, outcome
Project summary	Summary of proposed project to be delivered to meet the need
Project outcome	What outcome measures does the project need to achieve in order to be successful?
How could this project best be developed and implemented?	What form should the project take? How could it best be delivered?
Stakeholder-need criteria	What criteria must the project meet to be used by stakeholders? e.g. cost, usability, clinical efficacy, safety
Possible collaborators	Who needs to be involved for the project to be successful? Are any known groups already working on something similar?

Table 7.1 Project summary used in innovation workshops

Validation interviews

The workshop output was validated with the attendees to ensure the necessary information had been captured correctly.

Further validation of specific needs and projects was conducted with over 40 additional stakeholders and subject-matter experts through a series of 1:1 interviews, and the projects were refined accordingly.

Future validation will be conducted for prioritised projects with children and young people by running a series of interactive sessions in schools, colleges and universities. Specifically, this will be used to develop criteria to ensure that the projects meet the needs of children and young people.

Project evaluation and prioritisation

Validated projects were evaluated using two broad, independent dimensions of 'opportunity' and 'feasibility'. **Opportunity** was broadly defined as the magnitude of the potential for a project to make a significant impact on the population by addressing their unmet needs, while aligning with the goals of YPMH. **Feasibility** was defined as the ease with which an opportunity could be exploited by YPMH through delivery of the proposed project.

Specific factors were developed to better define the dimensions of opportunity and feasibility. In total four opportunity factors and two feasibility factors were selected for use by the project team for an initial evaluation of projects. The factors and corresponding scores are shown in Table 7.2.

Each project was scored independently by the project team across all six factors, using feedback from stakeholder validation. The results were transferred onto the matrix shown in Figure 7.3, with opportunity shown on the vertical axis and feasibility shown on the horizontal axis. Projects identified as strategic building blocks for future YPMH projects were also highlighted.

This mapping was used to facilitate selection of the most appropriate projects to take forwards to roadmapping workshops in 2023.

Opportunity factors	**Scores**
Likely patient impact – How well does the project address the needs of the target population?	0 = Does not address the needs of the target population 1 = Low 2 = Limited without additional intervention 3 = High
How well are the needs currently met?	0 = Initiatives exist that are well accepted and effective 1 = Initiatives exist but have minor deficiencies that need to be overcome 2 = Some initiatives exist but have limited impact 3 = No existing initiatives
Is the project a strategic building block for YPMH?	0 = Requires prerequisite project 1 = Stand-alone project 2 = Could form a basis for other projects 3 = Clear basis for future YPMH projects
Does the project represent a sustainable opportunity for YPMH?	0 = Multiple factors, e.g. scarcity of skilled people and financial cost, make the project unsustainable 1 = Financial cost to YPMH (following implementation) 2 = Project would be cost-neutral (following implementation) 3 = Project would generate income for YPMH
Feasibility factors	**Scores**
Is there existing evidence that this project will successfully achieve the desired clinical outcome?	0 - No evidence exists 1 - Little/limited evidence exists 2 - Evidence exists but is of variable quality / size of impact is uncertain 3 - Good-quality evidence exists
Are possible collaborators identified?	0 = No collaborators identified 1 = Possible collaborators identified to reach out to 2 = Existing interested collaborators 3 = Existing interested collaborators with ability to scale up

Table 7.2 Factors used for evaluation of the opportunity and feasibility of projects

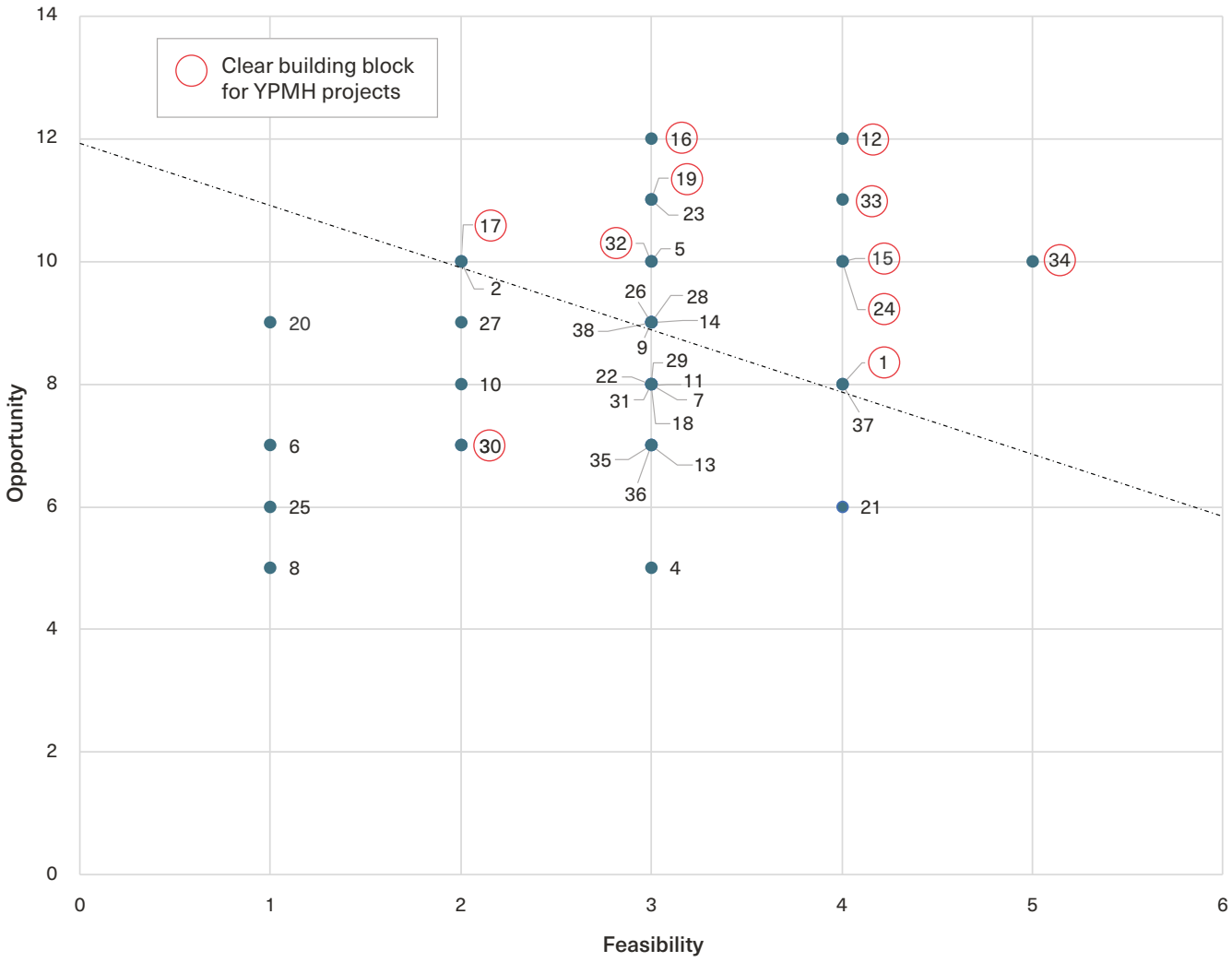


Figure 7.3 Example opportunity and feasibility matrix for visualising the prioritised projects

7.2 The mental health ecosystem: defining roles for key actors and opportunities for collaboration

Ecosystem mapping and design methods were used to configure the mental health ecosystem and actor visions presented in Section 5. The approaches used to develop both the ecosystem and the opportunities for collaboration are also described in Section 5.

7.3 Literature review of current research

A literature review was conducted on each of the research themes identified in Section 6 using Google Scholar. Search terms used included 'Topic e.g. gut microbiome', 'depression', 'mental health', 'children', 'adolescent', 'young people', 'paediatric' and 'pediatric'. Papers were filtered by 'date' and 'type'. Review articles (including systematic reviews and meta-analyses) published from 2019 onwards were extracted for analysis.

8. References

[1] K. Smith, "Mental health: a world of depression," Nature, vol. 515, no. 7526, p. 181, Nov. 2014, doi: 10.1038/515180A.

[2] "Mental health of adolescents." https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health (accessed Feb. 28, 2023).

[3] R. E. Lewandowski et al., "Evidence for the Management of Adolescent Depression," Pediatrics, vol. 132, no. 4, p. e996, Oct. 2013, doi: 10.1542/PEDS.2013-0600.

[4] I. M. Goodyer and P. O. Wilkinson, "Practitioner Review: Therapeutics of unipolar major depressions in adolescents," J Child Psychol Psychiatry, vol. 60, no. 3, pp. 232–243, Mar. 2019, doi: 10.1111/JCPP.12940.

[5] "Changing Hearts, Changing Minds: Evidence-based approaches to the prevention, diagnosis and treatment of depression in young people." The William Templeton Foundation for Young People's Mental Health (YPMH), 2021

[6] Newlove-Delgado T, Marcheselli F, Williams T, Mandalia D, Davis J, McManus S, Savic M, Treloar W, Ford T. (2022) Mental Health of Children and Young People in England, 2022. NHS Digital, Leeds.

[7] R. C. Kessler, P. Berglund, O. Demler, R. Jin, K. R. Merikangas, and E. E. Walters, "Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication," Arch Gen Psychiatry, vol. 62, no. 6, pp. 593–602, Jun. 2005, doi: 10.1001/ARCHPSYC.62.6.593.

[8] "Depression in young people|Royal College of Psychiatrists." https://www.rcpsych.ac.uk/mental-health/parents-and-young-people/young-people/depression-in-young-people (accessed Feb. 28, 2023).

[9] D. F. Santomauro et al., "Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic," The Lancet, vol. 398, no. 10312, pp. 1700–1712, Nov. 2021, doi: 10.1016/S0140-6736(21)02143-7.

[10] D. Johnson, G. Dupuis, J. Piche, Z. Clayborne, and I. Colman, "Adult mental health outcomes of adolescent depression: A systematic review," Depress Anxiety, vol. 35, no. 8, pp. 700–716, Aug. 2018, doi: 10.1002/DA.22777.

[11] Michaels, C., Blake, L., Lynn, A., Greylord, T., & Benning, S. (2022, April 18). "Mental health and well-being ecological model." Center for Leadership Education in Maternal & Child Public Health, University of Minnesota–Twin Cities. Retrieved Mar. 08, 2023, from https://mch.umn.edu/resources/mhecomodel/.

[12] J. W. Moore, "What Is the Sense of Agency and Why Does it Matter?," Front Psychol, vol. 7, Aug. 2016, doi: 10.3389/FPSYG.2016.01272.

[13] S. Folkman, "Stress: Appraisal and Coping," Encyclopedia of Behavioral Medicine, pp. 1913–1915, 2013, doi: 10.1007/978-1-4419-1005-9_215.

[14] E. R. Watkins, "Constructive and Unconstructive Repetitive Thought," Psychol Bull, vol. 134, no. 2, p. 163, Mar. 2008, doi: 10.1037/0033-2909.134.2.163.

[15] K. T. Brady and R. Sinha, "Co-occurring mental and substance use disorders: The neurobiological effects of chronic stress," American Journal of Psychiatry, vol. 162, no. 8, pp. 1483–1493, Aug. 2005, doi: 10.1176/APPI.AJP.162.8.1483/ASSET/IMAGES/LARGE/P410F2.JPEG.

[16] R. Sinha, "Chronic Stress, Drug Use, and Vulnerability to Addiction," Ann N Y Acad Sci, vol. 1141, p. 105, 2008, doi: 10.1196/ANNALS.1441.030.

[17] N. ; Garnefski, N. Garnefski, J. Legerstee, V. Kraaij, T. Van, and J. Teerds, "Cognitive coping strategies and symptoms of depression and anxiety: A comparison between adolescents and adults. Cognitive coping strategies and symptoms of depression and anxiety: a comparison between adolescents and adults," J Adolesc, pp. 603–611, 2002, doi: 10.1006/jado.2002.0507.

[18] F. H. Norris and K. Kaniasty, "Received and Perceived Social Support in Times of Stress: A Test of the Social Support Deterioration Deterrence Model," J Pers Soc Psychol, vol. 71, no. 3, pp. 498–511, 1996, doi: 10.1037/0022-3514.71.3.498.

[19] S. J. Lepore, G. W. Evans, and M. L. Schneider, "Dynamic Role of Social Support in the Link Between Chronic Stress and Psychological Distress," J Pers Soc Psychol, vol. 61, no. 6, pp. 899–909, 1991, doi: 10.1037/0022-3514.61.6.899.

[20] J. Keller et al., "HPA Axis in Major Depression: Cortisol, Clinical Symptomatology, and Genetic Variation Predict Cognition," Mol Psychiatry, vol. 22, no. 4, pp. 527–536, 2017, doi: 10.1038/mp.2016.120.

[21] A. R. Tyrka, K. K. Ridout, and S. H. Parade, "Childhood Adversity and Epigenetic Regulation of Glucocorticoid Signaling Genes: Associations in Children and Adults," Dev Psychopathol, vol. 28, no. 4 Pt 2, p. 1319, Nov. 2016, doi: 10.1017/S0954579416000870.

[22] K. R. Kuhlman, J. J. Chiang, S. Horn, and J. E. Bower, "Developmental psychoneuroendocrine and psychoneuroimmune pathways from childhood adversity to disease," Neurosci Biobehav Rev, vol. 80, p. 166, Sep. 2017, doi: 10.1016/J.NEUBIOREV.2017.05.020.

[23] H. Palma-Gudiel, A. Córdova-Palomera, E. Eixarch, M. Deuschle, and L. Fañanás, "Maternal psychosocial stress during pregnancy alters the epigenetic signature of the glucocorticoid receptor gene promoter in their offspring: a meta-analysis," Epigenetics, vol. 10, no. 10, p. 893, 2015, doi: 10.1080/15592294.2015.1088630.

[24] R. J. Schloesser, H. K. Manji, and K. Martinowich, "Suppression of Adult Neurogenesis Leads to an Increased HPA Axis Response," Neuroreport, vol. 20, no. 6, p. 553, Apr. 2009, doi: 10.1097/WNR.0B013E3283293E59.

[25] S. Cohen et al., "Chronic stress, glucocorticoid receptor resistance, inflammation, and disease risk," Proc Natl Acad Sci U S A, vol. 109, no. 16, p. 5995, Apr. 2012, doi: 10.1073/PNAS.1118355109.

[26] Y. Aitbali, S. Ba-M'hamed, N. Elhidar, A. Nafis, N. Soraa, and M. Bennis, "Glyphosate based- herbicide exposure affects gut microbiota, anxiety and depression-like behaviors in mice," Neurotoxicol Teratol, vol. 67, pp. 44–49, May 2018, doi: 10.1016/J.NTT.2018.04.002.

[27] L. Leino et al., "Classification of the glyphosate target enzyme (5-enolpyruvylshikimate-3-phosphate synthase) for assessing sensitivity of organisms to the herbicide," J Hazard Mater, vol. 408, p. 124556, Apr. 2021, doi: 10.1016/J.JHAZMAT.2020.124556.

[28] C. Lima, M. A. P. Falcão, J. G. S. Rosa, G. R. Disner, and M. Lopes-Ferreira, "Pesticides and Their Impairing Effects on Epithelial Barrier Integrity, Dysbiosis, Disruption of the AhR

Signaling Pathway and Development of Immune-Mediated Inflammatory Diseases," International Journal of Molecular Sciences 2022, Vol. 23, Page 12402, vol. 23, no. 20, p. 12402, Oct. 2022, doi: 10.3390/IJMS232012402.

[29] I. Del Castilo et al., "Lifelong Exposure to a Low-Dose of the Glyphosate-Based Herbicide RoundUp® Causes Intestinal Damage, Gut Dysbiosis, and Behavioral Changes in Mice," Int J Mol Sci, vol. 23, no. 10, p. 5583, May 2022, doi: 10.3390/IJMS23105583.

[30] A. M. Chao, A. M. Jastreboff, M. A. White, C. M. Grilo, and R. Sinha, "Stress, cortisol, and other appetite-related hormones: Prospective prediction of 6-month changes in food cravings and weight," Obesity (Silver Spring), vol. 25, no. 4, p. 713, Apr. 2017, doi: 10.1002/OBY.21790.

[31] R. J. Cousins, "Nutritional regulation of gene expression," American Journal of Medicine, vol. 106, no. 1 A, pp. 20–23, Jan. 1999, doi: 10.1016/s0002-9343(98)00342-8.

[32] R. Farré, M. Fiorani, S. A. Rahiman, and G. Matteoli, "Intestinal Permeability, Inflammation and the Role of Nutrients," Nutrients, vol. 12, no. 4, Apr. 2020, doi: 10.3390/NU12041185.

[33] T. Fukuwatari and K. Shibata, "Nutritional Aspect of Tryptophan Metabolism," Int J Tryptophan Res, vol. 6, no. Suppl 1, p. 3, 2013, doi: 10.4137/IJTR.S11588.

[34] J. M. Gostner, S. Geisler, M. Stonig, L. Mair, B. Sperner-Unterweger, and D. Fuchs, "Tryptophan Metabolism and Related Pathways in Psychoneuroimmunology: The Impact of Nutrition and Lifestyle," Neuropsychobiology, vol. 79, no. 1–2, pp. 89–99, Jan. 2020, doi: 10.1159/000496293.

[35] N. Ravikumar, M. Chegukrishnamurthi, S. Gadde Venkata, N. Ravikumar, · M Chegukrishnamurthi, and S. Gadde Venkata, "Role of Micronutrients in Neurological Development," pp. 177–199, 2022, doi: 10.1007/978-981-16-8158-5_9.

[36] E. Huskisson, S. Maggini, and M. Ruf, "The Influence of Micronutrients on Cognitive Function and Performance," J Int Med Res, vol. 35, pp. 1–19, 2007.

[37] S. M. Poulose, M. G. Miller, T. Scott, and B. Shukitt-Hale, "Nutritional Factors Affecting Adult Neurogenesis and Cognitive Function," Advances in Nutrition, vol. 8, no. 6, p. 804, Nov. 2017, doi: 10.3945/AN.117.016261.

[38] A. P. Simopoulos, "The importance of the ratio of omega-6/omega-3 essential fatty acids," Biomedicine & Pharmacotherapy, vol. 56, no. 8, pp. 365–379, Oct. 2002, doi: 10.1016/S0753-3322(02)00253-6.

[39] G. Grosso et al., "Omega-3 Fatty Acids and Depression: Scientific Evidence and Biological Mechanisms," Oxid Med Cell Longev, vol. 2014, 2014, doi: 10.1155/2014/313570.

[40] R. D. Hills, B. A. Pontefract, H. R. Mishcon, C. A. Black, S. C. Sutton, and C. R. Theberge, "Gut Microbiome: Profound Implications for Diet and Disease," Nutrients, vol. 11, no. 7, Jul. 2019, doi: 10.3390/NU11071613.

[41] P. Portincasa et al., "Gut Microbiota and Short Chain Fatty Acids: Implications in Glucose Homeostasis," Int J Mol Sci, vol. 23, no. 3, Feb. 2022, doi: 10.3390/IJMS23031105.

[42] O. G. Swann, M. Kilpatrick, M. Breslin, and W. H. Oddy, "Dietary fiber and its associations with depression and inflammation," Nutr Rev, vol. 78, no. 5, pp. 394–411, May 2020, doi: 10.1093/NUTRIT/NUZ072.

[43] P. Yock, "Needs-based innovation: the biodesign process," BMJ Innov, vol. 1, no. 1, p. 3, Jan. 2015, doi: 10.1136/BMJINNOV-2014-000024.

[44] S. Michie, M. M. van Stralen, and R. West, "The behaviour change wheel: A new method for characterising and designing behaviour change interventions," Implementation Science, vol. 6, no. 1, pp. 1–12, Apr. 2011, doi: 10.1186/1748-5908-6-42/TABLES/3.

[45] D. Mcdaid et al., "The economic case for investing in the prevention of mental health conditions in the UK," London School of Economics and Political Science / Mental Health Foundation, 2022.

[46] Z. Xu and R. Knight, "Dietary effects on human gut microbiome diversity," British Journal of Nutrition, 2015, doi: 10.1017/S0007114514004127.

[47] J. Horn, D. E. Mayer, S. Chen, and E. A. Mayer, "Role of diet and its effects on the gut microbiome in the pathophysiology of mental disorders," Translational Psychiatry 2022 12:1, vol. 12, no. 1, pp. 1–13, Apr. 2022, doi: 10.1038/s41398-022-01922-0.

[48] G. Ambrósio et al., "Depression and peripheral inflammatory profile of patients with obesity," Psychoneuroendocrinology, vol. 91, pp. 132–141, May 2018, doi: 10.1016/J.PSYNEUEN.2018.03.005.

[49] M. Briguglio et al., "Dietary Neurotransmitters: A Narrative Review on Current Knowledge," Nutrients, vol. 10, no. 5, May 2018, doi: 10.3390/NU10050591.

[50] A. Sánchez-Villegas et al., "The effect of the Mediterranean diet on plasma brain-derived neurotrophic factor (BDNF) levels: the PREDIMED-NAVARRA randomized trial.," Nutr Neurosci, vol. 14, no. 5, pp. 195–201, 2011, doi: 10.1179/1476830511Y.0000000011.

[51] J. J. Rucklidge, B. J. Kaplan, and R. T. Mulder, "What if nutrients could treat mental illness?," http://dx.doi.org/10.1177/0004867414565482, vol. 49, no. 5, pp. 407–408, Jan. 2015, doi: 10.1177/0004867414565482.

[52] F. Gómez-Pinilla, "Brain foods: the effects of nutrients on brain function," Nat Rev Neurosci, vol. 9, no. 7, p. 568, Jul. 2008, doi: 10.1038/NRN2421.

[53] K. M. Al-Batayneh et al., "Association between MTHFR 677C>T Polymorphism and Vitamin B12 Deficiency: A Case-control Study," J Med Biochem, vol. 37, no. 2, p. 141, Apr. 2018, doi: 10.1515/JOMB-2017-0051.

[54] D. McDonald et al., "American Gut: an Open Platform for Citizen Science Microbiome Research," mSystems, vol. 3, no. 3, Jun. 2018, doi: 10.1128/MSYSTEMS.00031-18/SUPPL_FILE/SYS003182229ST5.XLSX.

[55] T. D. (Timothy D. Spector, "Food for life : the new science of eating well," p. 509, Accessed: Mar. 07, 2023. [Online]. Available: https://www.penguin.co.uk/books/435986/food-for-life-by-spector-tim/9781787330498

[56] P. Cronin, S. A. Joyce, P. W. O'toole, and E. M. O'connor, "Dietary Fibre Modulates the Gut Microbiota," Nutrients, vol. 13, no. 5, May 2021, doi: 10.3390/NU13051655.

[57] B. Dalile, L. Van Oudenhove, B. Vervliet, and K. Verbeke, "The role of short-chain fatty acids in microbiota–gut–brain communication," Nature Reviews Gastroenterology & Hepatology 2019 16:8, vol. 16, no. 8, pp. 461–478, May 2019, doi: 10.1038/s41575-019-0157-3.

[58] K. Berding, C. Carbia, and J. F. Cryan, "Going with the grain: Fiber, cognition, and the microbiota-gut-brain-axis," Exp Biol Med, vol. 246, no. 7, p. 796, Apr. 2021, doi: 10.1177/1535370221995785.

[59] H. Shi et al., "A fiber-deprived diet causes cognitive impairment and hippocampal microglia-mediated synaptic loss through the gut microbiota and metabolites," Microbiome, vol. 9, no. 1, pp. 1–20, Dec. 2021, doi: 10.1186/S40168-021-01172-0/FIGURES/7.

[60] A. H. Mariamenatu and E. M. Abdu, "Overconsumption of Omega-6 Polyunsaturated Fatty Acids (PUFAs) versus Deficiency of Omega-3 PUFAs in Modern-Day Diets: The Disturbing Factor for Their 'Balanced Antagonistic Metabolic Functions' in the Human Body," J Lipids, vol. 2021, pp. 1–15, Mar. 2021, doi: 10.1155/2021/8848161.

[61] K. S. Husted and E. V. Bouzinova, "The importance of n-6/n-3 fatty acids ratio in the major depressive disorder," Medicina (Kaunas), vol. 52, no. 3, pp. 139–147, 2016, doi: 10.1016/J.MEDICI.2016.05.003.

[62] A. P. Simopoulos, "An Increase in the Omega-6/Omega-3 Fatty Acid Ratio Increases the Risk for Obesity," Nutrients, vol. 8, no. 3, Mar. 2016, doi: 10.3390/NU8030128.

[63] J. J. Dinicolantonio and J. H. O'keefe, "The Importance of Marine Omega-3s for Brain Development and the Prevention and Treatment of Behavior, Mood, and Other Brain Disorders," Nutrients, vol. 12, no. 8, pp. 1–15, Aug. 2020, doi: 10.3390/NU12082333.

[64] K. W. Sheppard and C. L. Cheatham, "Omega-6 to omega-3 fatty acid ratio and higher-order cognitive functions in 7- to 9-y-olds: a cross-sectional study," Am J Clin Nutr, vol. 98, no. 3, pp. 659–667, Sep. 2013, doi: 10.3945/AJCN.113.058719.

[65] L. Wang et al., "Abnormal erythrocyte fatty acid composition in first-diagnosed, drug-naïve patients with depression," J Affect Disord, vol. 318, pp. 414–422, Dec. 2022, doi: 10.1016/J.JAD.2022.09.023.

[66] A. Coppen and C. Bolander-Gouaille, "Treatment of depression: time to consider folic acid and vitamin B12," J Psychopharmacol, vol. 19, no. 1, pp. 59–65, Jan. 2005, doi: 10.1177/0269881105048899.

[67] J. Wang, P. Um, B. A. Dickerman, and J. Liu, "Zinc, Magnesium, Selenium and Depression: A Review of the Evidence, Potential Mechanisms and Implications," Nutrients 2018, Vol. 10, Page 584, vol. 10, no. 5, p. 584, May 2018, doi: 10.3390/NU10050584.

[68] L. Zheng, J. Sun, X. Yu, and D. Zhang, "Ultra-Processed Food Is Positively Associated With Depressive Symptoms Among United States Adults," Front Nutr, vol. 7, p. 600449, Dec. 2020, doi: 10.3389/FNUT.2020.600449/FULL.

[69] B. M. Onita, C. M. Azeredo, P. C. Jaime, R. B. Levy, and F. Rauber, "Eating context and its association with ultra-processed food consumption by British children," Appetite, vol. 157, Feb. 2021, doi: 10.1016/J.APPET.2020.105007.

[70] L. Elizabeth, P. Machado, M. Zinöcker, P. Baker, and M. Lawrence, "Ultra-Processed Foods and Health Outcomes: A Narrative Review," Nutrients, vol. 12, no. 7, pp. 1–36, Jul. 2020, doi: 10.3390/NU12071955.

[71] F. N. Jacka et al., "A randomised controlled trial of dietary improvement for adults with major depression (the 'SMILES' trial)," BMC Med, vol. 15, no. 1, pp. 1–13, Jan. 2017, doi: 10.1186/S12916-017-0791-Y/TABLES/2.

[72] R. Guthold, G. A. Stevens, L. M. Riley, and F. C. Bull, "Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1·6 million participants," Lancet Child Adolesc Health, vol. 4, no. 1, pp. 23–35, Jan. 2020, doi: 10.1016/S2352-4642(19)30323-2.

[73] A. Dalton, C. Mermier, and M. Zuhl, "Exercise influence on the microbiome–gut–brain axis," Gut Microbes, vol. 10, no. 5, p. 555, Sep. 2019, doi: 10.1080/19490976.2018.1562268.

[74] J. S. Lee, P. A. Jaini, and F. Papa, "An Epigenetic Perspective on Lifestyle Medicine for Depression: Implications for Primary Care Practice," Am J Lifestyle Med, vol. 16, no. 1, p. 76, Jan. 2022, doi: 10.1177/1559827620954779.

[75] S. C. Gammie, "Creation of a gene expression portrait of depression and its application for identifying potential treatments," Scientific Reports 2021 11:1, vol. 11, no. 1, pp. 1–19, Feb. 2021, doi: 10.1038/s41598-021-83348-0.

[76] C. Chen, S. Nakagawa, Y. An, K. Ito, Y. Kitaichi, and I. Kusumi, "The exercise-glucocorticoid paradox: How exercise is beneficial to cognition, mood, and the brain while increasing glucocorticoid levels," Front Neuroendocrinol, vol. 44, pp. 83–102, Jan. 2017, doi: 10.1016/J.YFRNE.2016.12.001.

[77] E. M. Paolucci, D. Loukov, D. M. E. Bowdish, and J. J. Heisz, "Exercise reduces depression and inflammation but intensity matters," Biol Psychol, vol. 133, pp. 79–84, Mar. 2018, doi: 10.1016/J.BIOPSYCHO.2018.01.015.

[78] T. W. Lin and Y. M. Kuo, "Exercise Benefits Brain Function: The Monoamine Connection," Brain Sciences 2013, Vol. 3, Pages 39-53, vol. 3, no. 1, pp. 39–53, Jan. 2013, doi: 10.3390/BRAINSCI3010039.

[79] P. Rasmussen et al., "Evidence for a release of brain-derived neurotrophic factor from the brain during exercise," Experimental Physiology-Research Paper, vol. 94, pp. 1062–1069, doi: 10.1113/expphysiol.2009.048512.

[80] P. Z. Liu and R. Nusslock, "Exercise-Mediated Neurogenesis in the Hippocampus via BDNF," Front Neurosci, vol. 12, no. FEB, p. 52, Feb. 2018, doi: 10.3389/FNINS.2018.00052.

[81] K. Hötting and B. Röder, "Beneficial effects of physical exercise on neuroplasticity and cognition," Neurosci Biobehav Rev, vol. 37, pp. 2243–2257, 2013, doi: 10.1016/j.neubiorev.2013.04.005.

[82] H. Collins, J. N. Booth, A. Duncan, S. Fawkner, and A. Niven, "The Effect of Resistance Training Interventions on 'The Self' in Youth: a Systematic Review and Meta-analysis," Sports Med Open, vol. 5, no. 1, Dec. 2019, doi: 10.1186/S40798-019-0205-0.

[83] K. Beaulieu et al., "Exercise Training Reduces Reward for High-Fat Food in Adults with Overweight/Obesity," Med Sci Sports Exerc, vol. 52, no. 4, pp. 900–908, Apr. 2020, doi: 10.1249/MSS.0000000000002205.

[84] B. A. Dolezal, E. V. Neufeld, D. M. Boland, J. L. Martin, and C. B. Cooper, "Interrelationship between Sleep and Exercise: A Systematic Review," Adv Prev Med, vol. 2017, pp. 1–14, 2017, doi: 10.1155/2017/1364387.

[85] Y. Zhang, R. Fu, L. Sun, Y. Gong, and D. Tang, "How Does Exercise Improve Implicit Emotion Regulation Ability: Preliminary Evidence of Mind-Body Exercise Intervention Combined With Aerobic Jogging and Mindfulness-Based Yoga," Front Psychol, vol. 10, no. AUG, p. 1888, 2019, doi: 10.3389/FPSYG.2019.01888.

[86] H. Fang, S. Tu, J. Sheng, and A. Shao, "Depression in sleep disturbance: A review on a bidirectional relationship, mechanisms and treatment," J Cell Mol Med, vol. 23, no. 4, p. 2324, Apr. 2019, doi: 10.1111/JCMM.14170.

[87] M. Gradisar et al., "Sleep's role in the development and resolution of adolescent depression," Nature Reviews Psychology 2022 1:9, vol. 1, no. 9, pp. 512–523, Jun. 2022, doi: 10.1038/s44159-022-00074-8.

[88] D. K. Thomsen, M. Y. Mehlsen, S. Christensen, and R. Zachariae, "Rumination—relationship with negative mood and sleep quality," Pers Individ Dif, vol. 34, no. 7, pp. 1293–1301, May 2003, doi: 10.1016/S0191-8869(02)00120-4.

[89] A. G. Harvey and N. K. Y. Tang, "(Mis)Perception of Sleep in Insomnia: A puzzle and a resolution," Psychol Bull, vol. 138, no. 1, p. 77, Jan. 2012, doi: 10.1037/A0025730.

[90] T. Kato, "Impact of psychological inflexibility on depressive symptoms and sleep difficulty in a Japanese sample," Springerplus, vol. 5, no. 1, p. 712, Dec. 2016, doi: 10.1186/S40064-016-2393-0.

[91] A. D. Askelund, S. Schweizer, I. M. Goodyer, and A. L. van Harmelen, "Positive memory specificity is associated with reduced vulnerability to depression," Nat Hum Behav, vol. 3, no. 3, pp. 265–273, Mar. 2019, doi: 10.1038/S41562-018-0504-3.

[92] K. D. Young, P. S. F. Bellgowa, J. Bodurka, and W. C. Drevets, "Behavioral and neurophysiological correlates of autobiographical memory deficits in patients with depression and individuals at high risk for depression," JAMA Psychiatry, vol. 70, no. 7, pp. 698–708, 2013, doi: 10.1001/JAMAPSYCHIATRY.2013.1189.

[93] R. Dantzer, J. C. O'Connor, G. G. Freund, R. W. Johnson, and K. W. Kelley, "From inflammation to sickness and depression: when the immune system subjugates the brain," Nat Rev Neurosci, vol. 9, no. 1, p. 46, Jan. 2008, doi: 10.1038/NRN2297.

[94] Y. Li, Y. Xu, and Z. Chen, "Effects of the behavioral inhibition system (BIS), behavioral activation system (BAS), and emotion regulation on depression: A one-year follow-up study in Chinese adolescents," Psychiatry Res, vol. 230, no. 2, pp. 287–293, Dec. 2015, doi: 10.1016/J.PSYCHRES.2015.09.007.

[95] J. Fritz, A. M. de Graaff, H. Caisley, A. L. van Harmelen, and P. O. Wilkinson, "A Systematic Review of Amenable Resilience Factors That Moderate and/or Mediate the Relationship Between Childhood Adversity and Mental Health in Young People," Front Psychiatry, vol. 9, p. 230, Jun. 2018, doi: 10.3389/FPSYT.2018.00230/BIBTEX.

[96] A. Aldao, S. Nolen-Hoeksema, and S. Schweizer, "Emotion-regulation strategies across psychopathology: A meta-analytic review," Clin Psychol Rev, vol. 30, no. 2, pp. 217–237, Mar. 2010, doi: 10.1016/J.CPR.2009.11.004.

[97] L. C. Michl, K. A. McLaughlin, K. Shepherd, and S. Nolen-Hoeksema, "Rumination as a Mechanism Linking Stressful Life Events to Symptoms of Depression and Anxiety: Longitudinal Evidence in Early Adolescents and Adults," J Abnorm Psychol, vol. 122, no. 2, p. 339, 2013, doi: 10.1037/A0031994.

[98] V. Patel, J. K. Burns, M. Dhingra, L. Tarver, B. A. Kohrt, and C. Lund, "Income inequality and depression: a systematic review and meta-analysis of the association and a scoping review of mechanisms," World Psychiatry, vol. 17, no. 1, p. 76, Feb. 2018, doi: 10.1002/WPS.20492.

[99] M. C. Power, M. A. Kioumourtzoglou, J. E. Hart, O. I. Okereke, F. Laden, and M. G. Weisskopf, "The relation between past exposure to fine particulate air pollution and prevalent anxiety: observational cohort study," BMJ, vol. 350, Mar. 2015, doi: 10.1136/BMJ.H1111.

[100] Z. Jia et al., "Exposure to Ambient Air Particles Increases the Risk of Mental Disorder: Findings from a Natural Experiment in Beijing," Int J Environ Res Public Health, vol. 15, no. 1, Jan. 2018, doi: 10.3390/IJERPH15010160.

[101] P. Puigbò, L. I. Leino, M. J. Rainio, K. Saikkonen, I. Saloniemi, and M. Helander, "Does Glyphosate Affect the Human Microbiota?," Life, vol. 12, no. 5, May 2022, doi: 10.3390/LIFE12050707/S1.

[102] L. Rueda-Ruzafa, F. Cruz, P. Roman, and D. Cardona, "Gut microbiota and neurological effects of glyphosate," 2019, doi: 10.1016/j.neuro.2019.08.006.

[103] T. Monguchi et al., "Excessive intake of trans fatty acid accelerates atherosclerosis through promoting inflammation and oxidative stress in a mouse model of hyperlipidemia," J Cardiol, vol. 70, no. 2, pp. 121–127, Aug. 2017, doi: 10.1016/J.JJCC.2016.12.012.

[104] R.-A. Chen et al., "Dietary Exposure to Antibiotic Residues Facilitates Metabolic Disorder by Altering the Gut Microbiota and Bile Acid Composition," mSystems, vol. 7, no. 3, Jun. 2022, doi: 10.1128/MSYSTEMS.00172-22.

[105] F. Urmetzer, A. Neely, and V. Martinez, "LINKING FIRMS IN VALUE BUSINESS ECOSYSTEMS: TOWARDS A CLASSIFICATION MODEL ☆," The Journal of Japanese Operations Management and Strategy, vol. 8, no. 1, pp. 18–34, 2018.

[106] J. Ellins et al., "Early evaluation of the Children and Young People's Mental Health Trailblazer programme Interim report".

[107] "Translational Science Spectrum | National Center for Advancing Translational Sciences." https://ncats.nih.gov/translation/spectrum (accessed Feb. 20, 2023).

[108] W. A. Akingbuwa, A. R. Hammerschlag, M. Bartels, and C. M. Middeldorp, "Systematic Review: Molecular Studies of Common Genetic Variation in Child and Adolescent Psychiatric Disorders," J Am Acad Child Adolesc Psychiatry, vol. 61, no. 2, pp. 227–242, Feb. 2022, doi: 10.1016/J.JAAC.2021.03.020.

[109] G. K. Murray, T. Lin, J. Austin, J. J. McGrath, I. B. Hickie, and N. R. Wray, "Could Polygenic Risk Scores Be Useful in Psychiatry?: A Review," JAMA Psychiatry, vol. 78, no. 2, pp. 210–219, Feb. 2021, doi: 10.1001/JAMAPSYCHIATRY.2020.3042.

[110] S. Mistry, J. R. Harrison, D. J. Smith, V. Escott-Price, and S. Zammit, "The use of polygenic risk scores to identify phenotypes associated with genetic risk of bipolar disorder and depression: A systematic review," J Affect Disord, vol. 234, pp. 148–155, Jul. 2018, doi: 10.1016/J.JAD.2018.02.005.

[111] V. Warrier et al., "Gene-environment correlations and causal effects of childhood maltreatment on physical and mental health: a genetically informed approach," Lancet Psychiatry, vol. 8, no. 5, pp. 373–386, May 2021, doi: 10.1016/S2215-0366(20)30569-1.

[112] J. J. Meerman, S. E. ter Hark, J. G. E. Janzing, and M. J. H. Coenen, "The Potential of Polygenic Risk Scores to Predict Antidepressant Treatment Response in Major Depression: A Systematic Review," J Affect Disord, vol. 304, pp. 1–11, May 2022, doi: 10.1016/J.JAD.2022.02.015.

[113] S. Penner-Goeke and E. B. Binder, "Epigenetics and depression," Dialogues Clin Neurosci, vol. 21, no. 4, pp. 397–405, Dec. 2019, doi: 10.31887/DCNS.2019.21.4/EBINDER.

[114] C. A. M. Cecil, A. Neumann, and E. Walton, "Epigenetics applied to child and adolescent mental health: Progress, challenges and opportunities," JCPP Advances, p. e12133, Dec. 2022, doi: 10.1002/JCV2.12133.

[115] J. S. Lee, A. Jaini, and F. Papa, "An Epigenetic Perspective on Lifestyle Medicine for Depression: Implications for Primary Care Practice," American Journal of Lifestyle Medicine research, vol. 16, no. 1, pp. 76–88, 2022, doi: 10.1177/1559827620954779.

[116] C. Schrodt et al., "The gut microbiome and depression: a review," Nutr Neurosci, 2022, doi: 10.1080/1028415X.2022.2111745.

[117] Z. Yang et al., "Updated review of research on the gut microbiota and their relation to depression in animals and human beings," Molecular Psychiatry 2020 25:11, vol. 25, no. 11, pp. 2759–2772, Apr. 2020, doi: 10.1038/s41380-020-0729-1.

[118] T. Limbana, F. Khan, and N. Eskander, "Gut Microbiome and Depression: How Microbes Affect the Way We Think," Cureus, vol. 12, no. 8, Aug. 2020, doi: 10.7759/CUREUS.9966.

[119] V. L. Nikolova, M. R. B. Hall, L. J. Hall, A. J. Cleare, J. M. Stone, and A. H. Young, "Perturbations in Gut Microbiota Composition in Psychiatric Disorders: A Review and Meta-analysis," JAMA Psychiatry, vol. 78, no. 12, pp. 1343–1354, Dec. 2021, doi: 10.1001/JAMAPSYCHIATRY.2021.2573.

[120] A. J. McGuinness et al., "A systematic review of gut microbiota composition in observational studies of major depressive disorder, bipolar disorder and schizophrenia," Mol Psychiatry, vol. 27, no. 4, pp. 1920–1935, Apr. 2022, doi: 10.1038/S41380-022-01456-3.

[121] M. Camilleri, "Leaky gut: mechanisms, measurement and clinical implications in humans," Gut, vol. 68, no. 8, pp. 1516–1526, Aug. 2019, doi: 10.1136/GUTJNL-2019-318427.

[122] J. M. Peirce and K. Alviña, "The role of inflammation and the gut microbiome in depression and anxiety," J Neurosci Res, vol. 97, no. 10, pp. 1223–1241, Oct. 2019, doi: 10.1002/JNR.24476.

[123] Z. Zajkowska et al., "Cortisol and development of depression in adolescence and young adulthood - a systematic review and meta-analysis," Psychoneuroendocrinology, vol. 136, Feb. 2022, doi: 10.1016/J.PSYNEUEN.2021.105625.

[124] Y. J. Toenders et al., "Inflammation and depression in young people: a systematic review and proposed inflammatory pathways," Molecular Psychiatry 2021 27:1, vol. 27, no. 1, pp. 315–327, Oct. 2021, doi: 10.1038/s41380-021-01306-8.

[125] N. Mac Giollabhui, T. H. Ng, L. M. Ellman, and L. B. Alloy, "The longitudinal associations of inflammatory biomarkers and depression revisited: systematic review, meta-analysis, and meta-regression," Mol Psychiatry, vol. 26, no. 7, pp. 3302–3314, Jul. 2021, doi: 10.1038/S41380-020-00867-4.

[126] S. J. Brown, X. F. Huang, and K. A. Newell, "The kynurenine pathway in major depression: What we know and where to next," Neurosci Biobehav Rev, vol. 127, pp. 917–927, Aug. 2021, doi: 10.1016/J.NEUBIOREV.2021.05.018.

[127] W. Marx et al., “The kynurenine pathway in major depressive disorder, bipolar disorder, and schizophrenia: a meta-analysis of 101 studies,” Molecular Psychiatry 2020 26:8, vol. 26, no. 8, pp. 4158–4178, Nov. 2020, doi: 10.1038/s41380-020-00951-9.

[128] W. Zwolińska, M. Dmitrzak-Węglarz, and A. Słopień, “Biomarkers in Child and Adolescent Depression,” Child Psychiatry & Human Development 2021 54:1, vol. 54, no. 1, pp. 266–281, Sep. 2021, doi: 10.1007/S10578-021-01246-Y.

[129] J. Lee, S. Chi, and M. S. Lee, “Molecular Biomarkers for Pediatric Depressive Disorders: A Narrative Review,” International Journal of Molecular Sciences 2021, Vol. 22, Page 10051, vol. 22, no. 18, p. 10051, Sep. 2021, doi: 10.3390/IJMS221810051.

[130] L. Zhang, H. Liu, L. Kuang, H. Meng, and X. Zhou, “Omega-3 fatty acids for the treatment of depressive disorders in children and adolescents: A meta-analysis of randomized placebo-controlled trials,” Child Adolesc Psychiatry Ment Health, vol. 13, no. 1, pp. 1–9, Sep. 2019, doi: 10.1186/S13034-019-0296-X/TABLES/2.

[131] K. Suneson, J. Lindahl, S. C. Hårsmar, G. Söderberg, and D. Lindqvist, “Inflammatory Depression—Mechanisms and Non-Pharmacological Interventions,” International Journal of Molecular Sciences 2021, Vol. 22, Page 1640, vol. 22, no. 4, p. 1640, Feb. 2021, doi: 10.3390/IJMS22041640.

[132] D. Głąbska, A. Kołota, K. Lachowicz, D. Skolmowska, M. Stachoń, and D. Guzek, “The Influence of Vitamin D Intake and Status on Mental Health in Children: A Systematic Review,” Nutrients, vol. 13, no. 3, pp. 1–22, Mar. 2021, doi: 10.3390/NU13030952.

[133] S. R. Alli, I. Gorbovskaya, J. C. W. Liu, N. J. Kolla, L. Brown, and D. J. Müller, “The Gut Microbiome in Depression and Potential Benefit of Prebiotics, Probiotics and Synbiotics: A Systematic Review of Clinical Trials and Observational Studies,” Int J Mol Sci, vol. 23, no. 9, May 2022, doi: 10.3390/IJMS23094494.

[134] M. Basso, N. Johnstone, P. Knytl, A. Nauta, A. Groeneveld, and K. Cohen Kadosh, “A Systematic Review of Psychobiotic Interventions in Children and Adolescents to Enhance Cognitive Functioning and Emotional Behavior,” Nutrients, vol. 14, no. 3, p. 614, Feb. 2022, doi: 10.3390/NU14030614/S1.

[135] W. Marx et al., “Clinical guidelines for the use of lifestyle-based mental health care in major depressive disorder: World Federation of Societies for Biological Psychiatry (WFSBP) and Australasian Society of Lifestyle Medicine (ASLM) taskforce,” World J Biol Psychiatry, 2022, doi: 10.1080/15622975.2022.2112074.

[136] M. Bujtor, A. I. Turner, S. J. Torres, L. Esteban-Gonzalo, C. M. Pariante, and A. Borsini, “Associations of Dietary Intake on Biological Markers of Inflammation in Children and Adolescents: A Systematic Review,” Nutrients 2021, Vol. 13, Page 356, vol. 13, no. 2, p. 356, Jan. 2021, doi: 10.3390/NU13020356.

[137] W. Marx et al., “Diet and depression: exploring the biological mechanisms of action,” Molecular Psychiatry 2020 26:1, vol. 26, no. 1, pp. 134–150, Nov. 2020, doi: 10.1038/s41380-020-00925-x.

[138] J. Firth et al., “The Effects of Dietary Improvement on Symptoms of Depression and Anxiety: A Meta-Analysis of Randomized Controlled Trials,” Psychosom Med, vol. 81, no. 3, pp. 265–280, Apr. 2019, doi: 10.1097/PSY.0000000000000673.

[139] B. Axelsdóttir, S. Biedilæ, Å. Sagatun, L. V. Nordheim, and L. Larun, “Review: Exercise for depression in children and adolescents – a systematic review and meta-analysis,” Child Adolesc Ment Health, vol. 26, no. 4, pp. 347–356, Nov. 2021, doi: 10.1111/CAMH.12438.

[140] A. Heissel et al., “Exercise as medicine for depressive symptoms? A systematic review and meta-analysis with meta-regression,” Br J Sports Med, vol. 0, pp. 1–10, Feb. 2023, doi: 10.1136/BJSPORTS-2022-106282.

[141] C. Marino et al., “Association Between Disturbed Sleep and Depression in Children and Youths: A Systematic Review and Meta-analysis of Cohort Studies,” JAMA Netw Open, vol. 4, no. 3, Mar. 2021, doi: 10.1001/JAMANETWORKOPEN.2021.2373.

[142] E. Mesman, A. Vreeker, and M. Hillegers, “Resilience and mental health in children and adolescents: an update of the recent literature and future directions,” Curr Opin Psychiatry, vol. 34, no. 6, pp. 586–592, Nov. 2021, doi: 10.1097/YCO.0000000000000741.

[143] S. Andermo et al., “School-related physical activity interventions and mental health among children: a systematic review and meta-analysis,” Sports Med Open, vol. 6, no. 1, pp. 1–27, Dec. 2020, doi: 10.1186/S40798-020-00254-X/TABLES/4.

[144] L. Ma, Y. Zhang, C. Huang, and Z. Cui, “Resilience-oriented cognitive behavioral interventions for depressive symptoms in children and adolescents: A meta-analytic review,” J Affect Disord, vol. 270, pp. 150–164, Jun. 2020, doi: 10.1016/J.JAD.2020.03.051.

[145] N. Choque Olsson, P. Juth, E. Högberg Ragnarsson, T. Lundgren, M. Jansson-Fröjmark, and T. Parling, “Treatment satisfaction with cognitive-behavioral therapy among children and adolescents with anxiety and depression: A systematic review and meta-synthesis,” J Behav Cogn Ther, vol. 31, no. 2, pp. 147–191, Jun. 2021, doi: 10.1016/J.JBCT.2020.10.006.

[146] C. Christ et al., “Internet and Computer-Based Cognitive Behavioral Therapy for Anxiety and Depression in Adolescents and Young Adults: Systematic Review and Meta-Analysis,” J Med Internet Res, vol. 22, no. 9, Sep. 2020, doi: 10.2196/17831.

[147] P. Cuijpers et al., “The effects of psychological treatments of depression in children and adolescents on response, reliable change, and deterioration: a systematic review and meta-analysis,” Eur Child Adolesc Psychiatry, vol. 32, no. 1, Jan. 2023, doi: 10.1007/S00787-021-01884-6.

[148] D. L. Dunning et al., “Research Review: The effects of mindfulness-based interventions on cognition and mental health in children and adolescents – a meta-analysis of randomized controlled trials,” Journal of Child Psychology and Psychiatry, vol. 60, no. 3, pp. 244–258, Mar. 2019, doi: 10.1111/JCPP.12980.

[149] D. Dunning et al., “Do mindfulness-based programmes improve the cognitive skills, behaviour and mental health of children and adolescents? An updated meta-analysis of randomised controlled trials,” Evid Based Ment Health, vol. 25, no. 3, pp. 135–142, Aug. 2022, doi: 10.1136/EBMENTAL-2022-300464.

[150] A. Marie-Mitchell and R. Kostolansky, “A Systematic Review of Trials to Improve Child Outcomes Associated With Adverse Childhood Experiences,” Am J Prev Med, vol. 56, no. 5, pp. 756–764, May 2019, doi: 10.1016/J.AMEPRE.2018.11.030.

[151] K. Petruccelli, J. Davis, and T. Berman, “Adverse childhood experiences and associated health outcomes: A systematic review and meta-analysis,” Child Abuse Negl, vol. 97, Nov. 2019, doi: 10.1016/J.CHIABU.2019.104127.

This publication is the result of a remarkable two-year collaboration involving over 150 people who so kindly engaged in consultations, workshops and individual discussions with the aim of improving young people's mental health and wellbeing. Participants included parents and young people; professionals from across the health and social care system; organisations engaging with young people, including schools, universities and employers; and charities and businesses developing and delivering services and products to support young people's mental health. Thank you all for your thoughtful engagement, support and encouragement.

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Finally, thank you to the sponsors who have made this project possible. These include the Aviva Foundation, The Waterloo Foundation, and dozens of individuals and families who generously donated to YPMH.

I profoundly hope that the results of this collaboration will begin to bring about innovations to tangibly improve how young people's mental wellbeing is addressed, and so enable:

- **Prevention of first-episode depression;**
- **Recovery from depression;**
- **People to stay in remission.**

Peter Templeton
Founder
YPMH

The Aviva Foundation aims to help people and communities feel in control and positive about their financial futures. The foundation funds organisations working on new ways to help people prevent and prepare for financial challenges, or to deal with and recover from financial setbacks.

The foundation's ambition is to tackle difficult problems in new ways – giving organisations the support and stability they need so they can use their expertise to innovate and transform the lives of those who need it the most.

The foundation is independent of Aviva and is administered by Charities Trust under charity registration number 327489.

The Waterloo Foundation is an independent grant-making foundation. We give grants to organisations both in the UK and worldwide. We are most interested in projects that help globally, with a particular focus on the disparity of opportunities, wealth, and the unsustainable use of the world's natural resources. We want to help both the global community and our local community in Wales.

The foundation has four main areas of thematic interest: child development, the environment, world development, and Wales. In addition to the impact we hope to achieve in these thematic areas, as funders, we also aim to provide significant intangible benefits and value to our applicants. We work with them on maximising their impact. We network organisations to increase project scope. We aim to maximise the ripple effect and keep open, flexible lines of communication with applicants.

The Foundation for Young People's Mental Health

The William Templeton Foundation for Young People's Mental Health (YPMH) is a charitable foundation working to improve the lives of young people by facilitating innovative approaches to resolve mental health conditions.

YPMH was established in memory of Will Templeton, by his parents Anne and Peter and his brother John. The family's aspiration is to enable the 'joining-up' of excellent research and practice across the many fields associated with young people's mental health to improve the prevention, identification, diagnosis and treatment of conditions such as depression and anxiety.

About *Changing Minds, Changing Lives*

This publication sets out innovative, evidence-based approaches to help:

- Prevent the development of first-episode depression in children and young people, enable their recovery from depression, and enable them to remain in remission; and
- Build depression-resilient communities.

It describes:

1. A model summarising the vulnerability factors and mechanisms for depression in young people;
2. Projects to help enable the prevention, early detection, diagnosis, management and treatment of depression in children and young people;
3. 10–15-year visions for how individuals, families and carers, the health and social care system, and organisations engaging with young people, such as schools, can apply these innovative approaches to improve the mental wellbeing of young people;
4. Opportunities for additional research to enable the development and implementation of promising longer-term innovations.

This report aims to bring stakeholders across the mental health ecosystem together to:

- Build partnerships to develop, pilot, validate and implement innovations that meet real needs;
- Collaboratively design and build better ways of working that support young people's mental health and wellbeing;
- Inform priorities for research and for the translation of research into effective, widely applied innovations and policies.

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