



# A systematic review and meta-analysis of psychological interventions to improve mental wellbeing

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**Our current understanding of the efficacy of psychological interventions in improving mental states of wellbeing is incomplete. This study aimed to overcome limitations of previous reviews by examining the efficacy of distinct types of psychological interventions, irrespective of their theoretical underpinning, and the impact of various moderators, in a unified systematic review and meta-analysis. Four-hundred-and-nineteen randomized controlled trials from clinical and non-clinical populations ( $n = 53,288$ ) were identified for inclusion. Mindfulness-based and multi-component positive psychological interventions demonstrated the greatest efficacy in both clinical and non-clinical populations. Meta-analyses also found that singular positive psychological interventions, cognitive and behavioural therapy-based, acceptance and commitment therapy-based, and reminiscence interventions were impactful. Effect sizes were moderate at best, but differed according to target population and moderator, most notably intervention intensity. The evidence quality was generally low to moderate. While the evidence requires further advancement, the review provides insight into how psychological interventions can be designed to improve mental wellbeing.**

Literature investigating ‘positive’ states of mental health or states of mental wellbeing has proliferated<sup>1</sup>. Traditionally, these subjective interpretations of wellbeing are placed in the context of ‘hedonic’ and ‘eudaimonic’ wellbeing, or the search for pleasure and happiness compared to striving for optimal psychological functioning and self-realization. These two aspects of wellbeing are operationalised by two streams of research. One stream focuses on subjective wellbeing<sup>2</sup>, studying affect and life satisfaction; the other stream focuses on psychological wellbeing<sup>3</sup>, and includes areas such as meaning or purpose and positive relationships. More than 40 years of observational and interventional research has linked high mental wellbeing to improvements in health, development and longevity as well as other outcomes<sup>4</sup>.

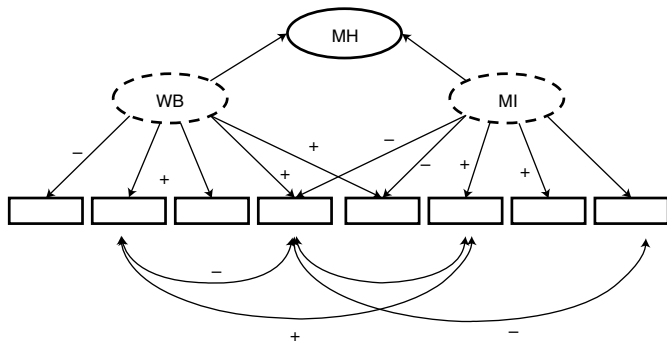
For example, improvement in mental wellbeing over a 10-year period is associated with reducing the risk of developing mental illness by up to 8.2 times in people without mental illness<sup>5,6</sup> and with improving the chance of recovery in people with mental illness<sup>7,8</sup>. Similarly, good mental wellbeing is predictive of recovery from physical illnesses<sup>4</sup>—for instance, in the case of acute coronary syndrome, even when accounting for the impact of depression and anxiety<sup>9</sup>. This is notable in light of the growing body of scientific literature demonstrating that states of mental wellbeing can be seen as independent from states of mental illness, despite their overlap and interrelation. A recent scoping review<sup>10</sup> identified more than 80 peer-reviewed studies that supported the notion that ‘indicators’ or ‘states’ of mental wellbeing can occur regardless of the presence or diagnosis of mental illness, that both constructs have common but

also differential antecedents, that both needed to be assessed using dedicated scales, and that psychological interventions can lead either to improvements in both mental wellbeing and indicators of illness, or to changes in only one of the domains. A visualization of this relationship is displayed in Fig. 1.

This evidence is first increasingly elevating mental wellbeing as a therapeutic route to disease prevention as well as clinical and personal recovery<sup>11,12</sup>. Second, it points to the utility of addressing mental wellbeing in both clinical and non-clinical populations. This research direction paves the way for systematic implementation of interventions and therapeutic approaches that focus on (1) the promotion of mental wellbeing as its own essential outcome regardless of the presence of physical or mental illness; and (2) mental wellbeing as a complementary target when interventions that are based on traditional therapeutic approaches do not have the desired effect—for example, if they do not lead to clinically meaningful changes or do not resonate with the individual patient<sup>13</sup>. Interventions that target symptoms of mental illness and those that target mental wellbeing can focus on shared processes—for example, reducing rumination or building a sense of purpose—but can also focus on differential antecedents or target areas—for example, guilt or hopelessness for mental illness or personal growth for wellbeing. As a consequence, psychological or behavioural interventions, defined as activities or groups of activities aimed to change behaviours, feelings and emotional states<sup>14</sup>, can lead to improvements in either mental wellbeing or mental illness, or both. While existing evidence syntheses point to the potential utility of psychological interventions, our current

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**Fig. 1 | Simplified relationship between outcomes of mental health and indicators of illness and wellbeing.** Schematic of the relationship between scores on outcomes measures of mental wellbeing (MW) and mental illness (MI) (represented by dashed ovals) that are influenced by distinct and shared factors (represented by the rectangles), jointly acting to determine the 'latent' mental health (MH) factor (represented by a solid oval). The + and - symbols represent hypothetical positive and negative relationships, respectively.

understanding of the impact of the complete landscape of psychological interventions has traditionally been obstructed for a number of reasons.

The first reason relates to the traditional separation of research on and practice in wellbeing and mental illness<sup>11,15,16</sup>. The main body of research investigating the impact of psychological interventions on wellbeing stems from the field of positive psychology, and looks at positive psychological interventions (PPIs). These are defined as "treatment methods or intentional activities that aim to cultivate positive feelings, behaviours, or cognitions"<sup>17</sup>. Several systematic reviews have been conducted to determine the effects of PPIs on wellbeing and its sub-components, which show that PPIs typically have a small effect on outcomes of wellbeing<sup>17–21</sup>. PPIs, however, comprise only a very limited subset of psychological approaches and typically do not address focus areas of traditional psychological interventions, such as rumination and worry. Although previous reviews investigating the efficacy of psychological interventions on wellbeing have included the evidence from other non-PPI interventions such as mindfulness and meditation<sup>18,22</sup>, syntheses to date have largely ignored the ability of well-known or more traditional therapeutic approaches to improve wellbeing. A review by Weiss and colleagues<sup>18</sup> is a notable exception, as they investigated the impact of psychological interventions in general on outcome measures of psychological wellbeing, but excluded the large body of studies that use popular subjective measures of wellbeing, such as the Satisfaction With Life Scale (SWLS) or measures of positive affect such as the Positive and Negative Affect Schedule (PANAS)<sup>23,24</sup>.

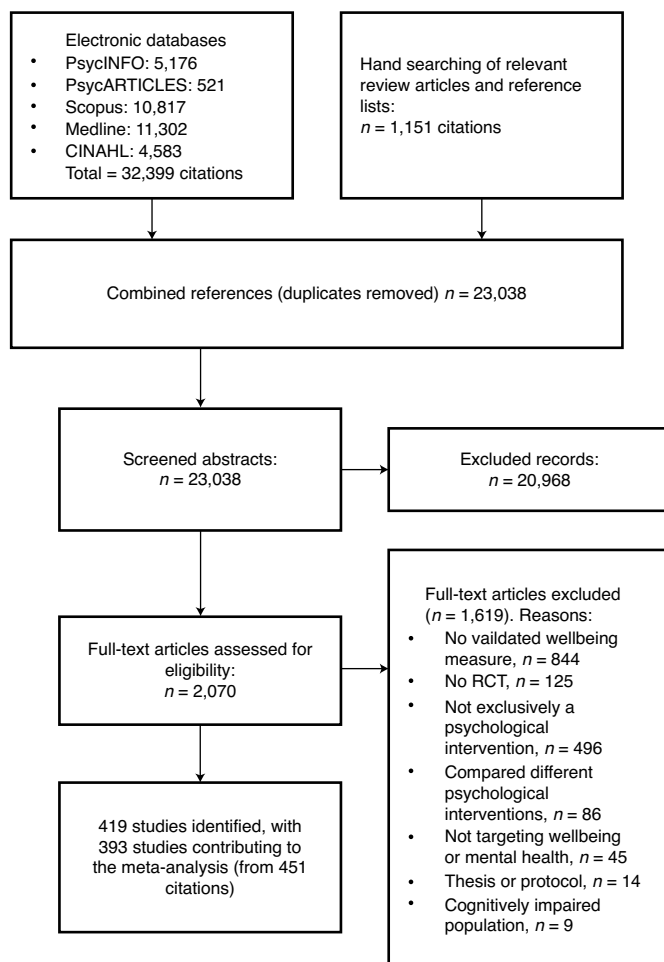
As PPIs, by definition, traditionally neglect to focus on maladaptive behaviours and thoughts, there is a considerable evidence gap regarding the impact of other psychological interventions. For instance, the impact of interventions derived from cognitive therapy, cognitive behavioural therapy (CBT), acceptance and commitment therapy (ACT), those using individual techniques such as behavioural activation or interventions stemming from other psychological streams such as humanistic psychology have not yet been extensively mapped<sup>25</sup>. Interventions stemming from different therapeutic paradigms can target a variety of underlying processes related to mental health and wellbeing. To use an analogy: cancer can be addressed using a variety of techniques—for example, surgery, chemotherapy, radiation therapy and hormone therapy, among others<sup>26</sup>. Canvassing the state of scientific evidence on psychological interventions that target areas other than positive states is useful for

practitioners and developers of interventions who aim to look at diversifying their array of useful interventions or techniques.

Second, there has been considerably less focus on determining the impact of different types of psychological interventions in building mental wellbeing in clinical populations. There is a need to synthesize the research on the efficacy of psychological interventions to build wellbeing of populations that suffer from physical illness, both acute and chronic, as mental health status has an important role in disease management and treatment<sup>13,27</sup>. Simply looking at relieving symptoms of depression or anxiety in those with a physical illness is inadequate as it ignores a substantial proportion of patients who do not have clinical symptoms of common mental disorder, but are having suboptimal mental health. Similarly, there is a need to look at the impact of interventions on patients who demonstrate symptoms of clinical mental illness. Recent research has again looked at the impact of PPIs in improving mental wellbeing in clinical mental health populations<sup>19</sup>, but systematic reviews on the impact on wellbeing by interventions based on more traditional paradigms such as CBT are limited; approaches that are far more readily used and accepted in clinical settings. These approaches have had their large empirical evidence base synthesized for mental illness—for example, the article by Hofmann and colleagues<sup>28</sup>—but not yet for their impact on mental wellbeing. An exception is the work by Brown and colleagues<sup>29</sup>, who explored the impact of ACT-based interventions in web-based formats, thereby leaving the impact of other modalities on mental wellbeing unanswered.

Third, interpreting results of existing independent syntheses poses challenges as a result of their methodological differences. For instance, as mental wellbeing is a broad concept with differing definitions<sup>30</sup>, it is important to synthesize studies that have used similar subjective measurement methods to measure wellbeing<sup>31</sup>. The inclusion of psychological distress or generic quality-of-life scales as a proxy for mental wellbeing outcomes will lead to different conclusions than if only measures of mental wellbeing are included. Similarly, the use of differing search criteria and statistical procedures for meta-analysis leads to reviews on similar topics coming to different conclusions<sup>21</sup>. Finally, the use of differing criteria for study quality between reviews makes it difficult to assess the quality of different reviews and the overall quality of the evidence presented in meta-analyses. For instance, systematic reviews typically include a measure of study quality such as risk of bias<sup>32</sup>, but do not typically include quality estimates on the evidence of the overall meta-analysis<sup>33</sup>. Not all meta-analyses are equal and the absence of quality estimates on meta-analyses can lead to inaccurate conclusions being made regarding the utility of interventions.

Expenditure on healthcare and mental healthcare is growing, posing serious challenges for governments around the world<sup>34</sup>. Psychological interventions to build mental wellbeing can have a vital role in reducing the pressure and burden of illness via stepped or integrated care models, in addition to simply building the wellbeing of individuals (itself an important outcome)<sup>35</sup>. Determining the state of the scientific literature on how varying psychological interventions can contribute to building wellbeing is a necessary step to start empowering stakeholders to implement much-needed reform. It can arm researchers and mental health advocates in their call for a larger focus and innovation in the prevention of mental illness to reduce the burden on mental healthcare systems<sup>36–38</sup>. It can empower practitioners to explore a broader range of evidence-based treatment solutions depending on each client and their mental or physical health status, which can be a vehicle for treatment engagement<sup>39</sup>. It can inform mental health policy makers to further explore mental wellbeing as an outcome and consider different psychological interventions into their policy. Finally, it can stimulate discussion and new research among the scientific and professional community, enabling greater sophistication in research to further understand how to improve mental wellbeing in an evidence-based manner.



**Fig. 2 | Study PRISMA flow diagram.** PRISMA flow diagram describing the different phases of this systematic review.

This systematic review and meta-analysis aimed to create a clear synthesis of the impact of different types of psychological interventions on mental wellbeing, irrespective of their theoretical foundation, and establish the differential impact of these types of interventions in clinical and non-clinical populations. The primary outcome was the impact on mental wellbeing in general, with a secondary aim to explore differences in impact of psychological intervention types on outcomes of hedonic and eudaimonic wellbeing. It further considered the impact of various important methodological moderators. It considered intervention-specific moderators, including type of intervention, intensity of the intervention and mode of delivery. It considered study-specific moderators such as the impact of the control group, assessment follow-up and study quality. It also considered population-specific moderators by splitting the results for the general population, those with a mental illness and those with a physical illness. Finally, it aimed to shed light on the overall quality of the evidence provided in the meta-analyses and to discuss the implications of the evidence for future research and mental healthcare delivery in practice.

## Results

**Study sample and design characteristics.** This review identified 419 studies that met the inclusion criteria, see Fig. 2 for the PRISMA flow diagram summarizing the study selection process. Out of these 419 studies, 393 provided sufficient information to be included in the final quantitative analysis. The total participant pool consisted

of a combined  $n = 53,288$  participants,  $n = 41,491$  from the general population (274 studies),  $n = 5,712$  from populations with a mental illness (61 studies) and  $n = 6,085$  from populations with a physical illness (58 studies). Sample sizes of studies ranged between  $n = 13$  and  $n = 3,070$ . Most studies were conducted in the United States (120), Australia (33), the Netherlands (30), the UK (26), Iran (25) and China (21), with a total of 42 Western and non-Western countries contributing to the evidence base (Supplementary Information).

The majority of studies looked at multi-component PPIs followed by singular PPIs (singular intervention techniques or activities that stemmed from positive psychology), mindfulness-based interventions and interventions based on cognitive therapy or CBT principles. Table 1 provides an overview of the identified interventions; the grouping of studies is explained in the Methods. The interventions were delivered in a number of different formats of modality, the most prominent being technology-driven interventions ( $n = 23,784$ ) followed by group settings ( $n = 18,574$ ) and individual face-to-face delivery methods ( $n = 9,031$ ), with the remainder using a combination of these formats. An overview of the exact outcome measures used in studies can be found in Table 2.

**Risk of bias.** The complete summary of risk of bias for each study is presented in Supplementary Fig. 4. Overall, we noted a high level of ‘unclear’ risk of bias, which was the result of insufficient reporting of randomization procedures and a failure to report whether randomization was conducted under blind and independent circumstances. Due to the nature of the interventions and/or the designs chosen (for example, waitlist-control conditions), blinding of personnel and participants was often not conducted or was not reported. Attrition was typically reported, but a moderate number of articles did not report adequate CONSORT statements or had uneven drop-out between groups. Furthermore, the large majority of studies did not publish a protocol or register the studies on trial registries, making it difficult to assess reporting bias. These relatively high rates of omission in methodology and high risk of bias led to downgrading of the evidence quality for the large majority of the included intervention types.

**Impact of interventions on overall wellbeing.** The impact of intervention type on overall mental wellbeing for each population type is presented in Fig. 3; specific effect sizes and other outcome data for the intervention types presented below are summarized in Table 3. Results are described below for the main intervention types included in the meta-analysis on overall wellbeing. Sub-analyses for subjective and psychological wellbeing are presented in Supplementary Figs. 1 and 2, and Supplementary Tables 3 and 4. Any distinct intervention type that could not be meta-analysed (for example, because there were insufficient studies available) is described in Supplementary Table 6.

**ACT interventions.** A significant positive small to moderate effect on overall wellbeing was found for ACT-based interventions compared with control groups in the general population alone. The evidence quality for ACT-based interventions in the general population population was downgraded to low as a result of the aforementioned problems with risk of bias, in addition to the wide confidence interval spans between a small and a moderate effect ( $g$  of 0.2 and 0.5), implying that the effect size estimate in the population differs from the one found in this review. No significant result was found for ACT-based interventions in physically ill populations. The evidence quality for this meta-analysis, however, was very low. This was the result of problems related to risk of bias, a wide confidence interval (ranging between no effect and a moderate effect) and the fact that the analysis was underpowered. There were insufficient studies available to be included in the meta-analysis for mentally ill populations.

**Table 1 | Intervention types that were included in the systematic review, with studies being grouped with the different intervention types on the basis of the description of the intervention as provided in the original manuscripts**

Intervention	Description of intervention	Studies
ACT interventions	Interventions based on ACT. The large majority of interventions involved multi-session interventions using ACT-based techniques, which typically focus on creating hope and building commitment to change, acceptance instead of control, and cognitive diffusion. Other interventions include ACT-based self-help books.	83-101
Compassion interventions	Interventions focusing on increasing compassion to others, for instance by interacting with another person in a supportive or considerate way. Typically, participants are asked to reflect on the compassionate behaviours at regular intervals. These can be single interventions or can be delivered as multi-component programmes that include loving kindness meditation.	102-113
Cognitive therapy or CBT interventions	Interventions based on CBT, which typically are multi-session and target maladaptive thinking patterns, developing coping skills, emotional regulation and cognitive reappraisal, as well as improvement of positive emotions and goal setting. Other formats include self-help books and websites. When offered in a physically ill population, focus is often placed on symptom or pain management and coping, together with addressing comorbid mental health symptoms.	114-162
Expressive writing	Participants are asked to write about trauma, adversity, stressful or negative events, typically over a period of time. Instructions may focus on how the event related to the life of the participant, what coping methods they used and whether these were successful.	95,108,154,163-175
Mindfulness interventions	Interventions that are solely focused on mindfulness or meditation. Interventions can be one-off or consist of multiple sessions. Techniques used include diaphragmatic breathing, mind-body scan and mindful imagery. Subtypes of interventions are mindfulness-based cognitive therapy, mindfulness-based stress reduction and mindful self-compassion.	91,106,120,123,133, 146,176-263
Multi-theoretical interventions	Interventions combining two or more clear psychological paradigms into one intervention, with no clear 'main' paradigm focus. Typically involves a cognitive therapy- or CBT-based focus with PPIs and/or mindfulness, but can include other paradigms such as ACT-based or interpersonal therapy-focused. Typically involves group interventions of higher intensity.	132,135,154,164,239, 254,264-311
PPIs, multi-component	A combined package of largely or solely positive psychology exercises, typically bundled into a programme delivered over an extended period of time. Includes positive psychotherapy, a clinical therapy that utilizes positive psychology interventions, such as focusing on using strengths, gratitude visits, active constructive response, counting blessings and savouring. Includes wellbeing therapy.	123,132,145,156, 184,198,241, 244,290-292, 312-372
PPI, singular	Individual activities or exercises stemming from positive psychology or interventions that focus only on building on positive construct—that is, not combining different positive psychological exercises. A number of key PPIs are described in more detail below.	
Best possible selves/ optimism	Participants are instructed to imagine a future life, and what it will ideally look like. They typically focus on different domains per period (for example, day or week) and often gain insight into the domains at the start of the intervention. Example domains are: love, hobbies, employment, physical and mental health. Other interventions focusing on optimism are grouped under this classifier.	42,104,373-394
Character strengths	Participants do a strengths assessment (for example, values in action character strengths) and use their top strengths in a new way, as a one-off or over a period of time. Suggestions are typically provided to explain how strengths can be used. Variations of this task are included (for example, set goals in relationship to best or preferred strengths).	42,113,340,360, 391,395-404
Gratitude	Participants are asked to reflect on experiences, events or people they are grateful for. May involve expressing gratitude to other people.	42,57,113,249,327,360,374, 376,382,383,390-393, 396,399,403,405-429
Pleasurable experiences	Participants are asked to reflect on or think about experiences that were fun, amusing or joyful, or that are bringing happiness to their life.	166,188,318,319,413
Three good things	Participants are asked to write or think about three good things that happened over a period (typically reflecting back on the same day) and reflect on why those things occurred. The activity is typically repeated for a number of days.	42,113,360,375, 378,381,391,396, 400,403,415,430-433
Other PPIs	A variety of different takes on the PPIs mentioned above were further tested, including acts of novelty and acts of kindness, gift of time, savouring interventions, meaning making, humour interventions and alternate forms of character strength interventions.	56,132,318,319,360, 374,384,396, 397,422,431-448
Reminiscence interventions	Interventions that focus on reviewing past experiences. Includes life review therapy focusing on integration of difficult life events from the past, development of agentic life stories and retrieval of specific positive memories.	169,172,305,400, 431,449-466
Other	A range of other interventions were tested which could not be added into the meta-analysis, as the review did not find sufficient studies to be included as a distinct type. Interventions include assertiveness training, behaviour activation, behavioural experiments, benefit-finding interventions, communication skills training, couples interventions, emotional awareness and expression therapy, forgiveness skills training, goal setting, interpersonal psychotherapy, narrative exposure therapy, parenting styles, emotion management, psychoeducation, rational emotive therapy, stimulus control training, social skill building, supportive group therapy, core transformation therapy, spiritual counselling, storytelling, positive memories, problem solving and self-affirmations.	118,126,128,137,144,164, 166,232,278,350,397, 398,431,432,434,436, 445,460,467-499

**Table 2 | Outcome measures used to capture mental states of wellbeing by included studies**

Wellbeing type	Measure	Studies
SWB	Satisfaction with Life Scale (SWLS) <sup>23</sup>	57,83,96,97,99,105-107,113,115-117,124,126,127,136,138,147,156,158-160,163, 168,170,172,179,183,187,188,192,195,197,201,208,209,216,218,221-223,230, 233,238,241,254,256-263,267,269,271,273,274,278,282,286,287,289, 291,292,295,298,306,308,310,322,323,325,329-331,336,339-341,344,353, 359,363,367,371,373-376,383,387,390,393,397,398,405-407,411,413-415,418,419, 426-428,431,435,437,438,440,441,446,451,454,461,468,479,480,487,489, 492-496,500
SWB	Satisfaction with Life Scale for Children (SWLS-C) <sup>501</sup>	140
SWB	Temporal Satisfaction with Life Scale (TSWLS) <sup>502</sup>	389
SWB	Subjective Happiness Scale (SHS) <sup>501</sup>	102,106,198,241,249,262,320,322,327,365,383,384,388,414,418, 425,427,431,441,446,447,461,468,471,491,500
SWB	WHO-5 Wellbeing Index (WHO5) <sup>503</sup>	91,94,146,151,161,199,237,239,244,245,248,253,254,265,275,285,296, 309,347,361,366,455,467,484,497
SWB	Authentic Happiness Index or Steen Happiness Index (AHI) <sup>504</sup>	42,56,103,104,114,318,332,360,391,396,397,399,400,403,404,417,432,433,443
SWB	Life Satisfaction Index - A, Z, Third Age (LSIA) <sup>505</sup>	125,134,305,449,450,453,455,458,464,466,470,474
SWB	Students Life Satisfaction Scale (SLSS) <sup>506</sup>	131,231,313,333
SWB	Brief Multidimensional Students Life Satisfaction Scale (BMSLSS) <sup>507</sup>	118,333,335,370,391,392,410,429
SWB	Subjective Wellbeing Scale (SWBS) <sup>508</sup>	93,203
SWB	Personal Wellbeing Index—Adult Scale (PWI-A) <sup>509</sup>	372,398
SWB	Affectometer 1 and 2 (AM1) <sup>510</sup>	144,175
SWB	Index of General Affect and Index of Wellbeing (IGA) <sup>511</sup>	483
SWB	Life Satisfaction Questionnaire (LiSat9) <sup>512</sup>	212
SWB	Life Satisfaction Questionnaire (LiSat11) <sup>513</sup>	206,477
SWB	Memorial University of Newfoundland Scale of Happiness (MUNSH) <sup>514</sup>	456,460
SWB	Subjective Authentic-Durable Happiness Scale (SA-DHS) <sup>515</sup>	214,251
SWB	SPF-Index Level Scale (SPF-IL) <sup>516</sup>	270
SWB	Types of Positive Affect Scale (TPAS) <sup>517</sup>	165
SWB	Chinese Happiness Inventory (CHI)	518
PWB	Psychological Wellbeing Scale (PWBS) <sup>3</sup>	84,93,109,116,136,200,211,218,220,229,238,243,246,271,279, 302,306,311,317,328,330,343,350,356,358,416,475,490,519,445
PWB	Oxford Happiness Inventory (OHI) <sup>520</sup>	128,232,242,247,325,329,338,358,413,457,469,481,486,488
PWB	Flourishing Scale (FS) <sup>521</sup>	183,184,225,266,293,366,386,411,480,495
PWB	Questionario sul Benessere Psicologico (QBP) <sup>522</sup>	314
PWB	The Eudemonic Wellbeing Scale (EWBS) <sup>523</sup>	227
Affect	Positive and Negative Affect Scale (PANAS) <sup>24</sup>	90,101,105,108,111,112,116,120,123,126,129,130,132,133,137,139, 149,154,155,162,164,166-168,171-174,176-178,181-183,190,200, 204,205,222,226,228,233,235,236,240,245,250,252,255,258, 261,268,269,272,274,277,280,282,298,306,307,311,312,321, 325,330-332,334,336,341,346,349,353,359,362,365,367,368, 372,375,377,378,381,382,384,386,387,389,394,398,402,414,415, 418,422,423,427,430,436,437,444,452,461,471,473,482,487,489,490,495,498
Affect	Positive and Negative Affect Scale Extended (PANASX) <sup>524</sup>	194,196,412,442,448
Affect	Positive and Negative Affect Scale-Child (PANAS-C) <sup>525</sup>	333,335,370,392,410,429
Affect	Differential Emotions Scale (DES) <sup>526</sup>	174,219,288,315,316,364,499

Continued

**Table 2 | Outcome measures used to capture mental states of wellbeing by included studies (continued)**

Wellbeing type	Measure	Studies
Affect	Differential Emotions Scale–Modified(mDES) <sup>527</sup>	326,348,433,440
Affect	Scale of Positive and Negative Experience (SPANE) <sup>521</sup>	184,238,289,295,376,391,405,407,426,428,434,480
Affect	Bradburn Affect Balance Scale (BABS) <sup>528</sup>	213,215,216,276,465,478
Affect	Derogatis Affects Balance Scale (DABS) <sup>529</sup>	152,264
Affect	Affectivity Scale (AFFS) <sup>530</sup>	363
Affect	Brief Mood Introspection Scale (BMIS) <sup>531</sup>	145
Affect	Chinese Affect Scale (CAS) <sup>532</sup>	424
Affect	<i>Mehrdimensionaler Befindlichkeitsfragebogen</i> (MB) <sup>533</sup>	207
Affect	Affect-Adjective Scale (AAS) <sup>534</sup>	374,420
Affect	The Global Mood Scale (GMS) <sup>535</sup>	193,210
Combined	Bradley's Wellbeing Questionnaire (BWBQ) <sup>536</sup>	476
Combined	Mental Health Continuum—Short Form (MHC-SF) <sup>537</sup>	85,86,88,89,95,96,98,111,132,143,169,202,212,234,265,300,319,342,349,351,354,355,357,361,391,421,459,462,463,538
Combined	Brief Inventory of Thriving (BIT) <sup>539</sup>	401
Combined	Pemberton Happiness Index (PHI) <sup>540</sup>	185
Combined	Wellbeing Manifestations Measure Scale (WBMMS) <sup>541</sup>	87
Combined	Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS) <sup>542</sup>	92,100,110,129,142,148,153,157,180,186,224,255,281,283,284,294,297,299,304,369,378,381,472,485
Combined	Short Warwick-Edinburgh Mental Wellbeing Scale (SWEMWBS) <sup>543</sup>	141,150,290,301,313,324,352
Combined	The PERMA Profiler (PERMA) <sup>544</sup>	303
SWB	Life Satisfaction Questionnaire (LSQ) <sup>545</sup>	93

SWB, scales that mainly measure subjective wellbeing; PWB, scales that measure mainly psychological wellbeing; combined, scales that combine subjective and psychological wellbeing constructs.

**Compassion interventions.** Compassion interventions just failed to find a significant small effect in the general population, as the *P*-value was 0.014, just above the threshold for significance of 0.01 for this review (Methods). This result is influenced by a diminished power of the meta-analysis, which was just below 0.80. The evidence quality was graded as low due to problematic risk of bias and wide confidence intervals. There were insufficient studies available to be included in the meta-analysis for mentally and physically ill populations.

**Cognitive therapy- or CBT-based interventions.** A significant *P*-value for CBT interventions was found for the general population, but the effect size estimate failed to meet the small-effect threshold. This indicates that on average, cognitive therapy- or CBT-based interventions do not reach a meaningfully beneficial effect on wellbeing in the general population. The evidence quality was rated as moderate, as the large sample increases the confidence of the effect size estimate. No significant impact of CBT was noted for the physically ill population. The evidence quality for this meta-analysis was rated as low. In populations with a mental illness, cognitive therapy- or CBT-based interventions led to clear significant improvements compared with control conditions, reaching a small-to-moderate effect. The evidence quality was moderate for the population with a mental illness.

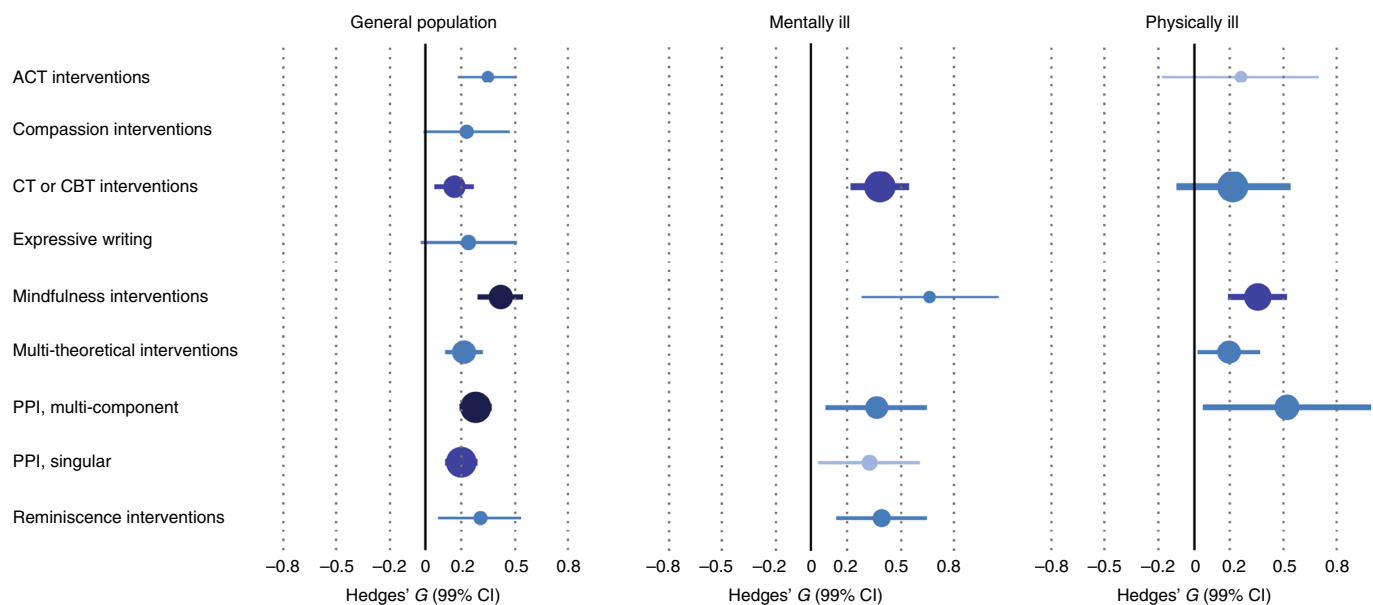
**Expressive writing.** Wellbeing was not significantly improved by using expressive writing interventions in the general population, as the *P*-value was 0.019. The evidence quality was low due to issues with risk of bias and the presence of a wide confidence interval.

There were insufficient studies available to be included in the meta-analysis for mentally and physically ill populations.

**Mindfulness-based interventions.** Mindfulness-based interventions led to significant small-to-moderate improvements in the general and physically ill population and a moderate-to-large effect in cohorts with a mental illness. This demonstrates the significant utility of mindfulness-based interventions in both clinical and non-clinical populations. The evidence quality was high for the general population, as the confidence interval was narrow and the large study count and sample size warranted upgrade of evidence quality. The evidence quality was moderate and low for physically ill and mentally ill cohorts, respectively.

**Multi-theoretical interventions.** Interventions that deliberately combined multi-theoretical approaches significantly improved mental wellbeing in the general population and the physically ill population. The evidence quality for both meta-analyses was low as a result of imprecision due to wide confidence intervals spanning between no effect and a small effect, as well as the aforementioned risk of bias. There were insufficient studies available to be included in the meta-analysis for cohorts with a mental illness.

**PPIs, multi-component.** Multi-component PPIs significantly improved wellbeing in the general population, showing small effect sizes. This evidence was graded as high-quality evidence as a result of the large number of studies contributing to this analysis, which counters the limitations and subsequent downgrading related to risk of bias in the included studies. Multi-component PPIs also



**Fig. 3 | Forest plot visualizing the impact of each intervention type on overall wellbeing compared with control conditions split by population type.** Horizontal bars show 99% confidence intervals, with interventions having a significant effect denoted by horizontal bars that do not touch the solid vertical line (the line of no effect). The dashed lines indicate small ( $g=0.2$ ), moderate ( $g=0.5$ ) or large ( $g=0.8$ ) effects. Circle sizes reflect the weight of the overall study. The colours denote the evidence quality, based on grade recommendations<sup>33</sup> for high (dark purple), moderate (purple), low (blue) and very low (light blue) evidence quality. Only intervention types with more than four studies were included in the meta-analysis and were displayed in the forest plot. Specific effect sizes and other statistics applying to this forest plot are presented in Table 3. CT, cognitive therapy.

significantly improved wellbeing in the physically ill cohorts, showing moderate effect sizes. Effect sizes for the general and mentally ill population were small, but significant. However, the evidence quality was graded as low for both clinical populations.

**PPIs, singular.** The combined effect size of singular PPIs on wellbeing in the general population was small and significant. The total number of studies investigating PPIs in the general population was large and overall the evidence quality was graded as high. There were insufficient studies that investigated the impact of singular PPIs in physically ill populations. The impact of singular PPIs in cohorts with a mental illness was significant, but the evidence quality was very low. This was the result of risk of bias, imprecise effect size estimate and the fact that the analysis was underpowered due to a low combined sample size.

A number of distinct individual PPIs could furthermore be included into their own distinct meta-analyses, which are detailed in the Supplementary Fig. 3 and Supplementary Table 5. In brief, the following PPIs were included in distinct meta-analyses: three good things, best possible selves or other interventions focusing on building optimism, character strength interventions, gratitude interventions and interventions aimed at induces or experiencing pleasure (referred to as pleasurable activities). Only character strength interventions reached a significant positive effect that was meaningful. The evidence quality for all singular PPI meta-analyses was low.

**Reminiscence interventions.** A significant positive effect on mental wellbeing in the general population was found. Similarly, a small positive effect of reminiscence intervention in cohorts with a mental illness was found. The evidence quality for both outcomes was low as a result of risk of bias and wide confidence intervals.

**Impact of moderators on intervention effect on wellbeing.** Table 4 summarizes the effect sizes for each moderator of intervention effect on wellbeing. In the general population, all three types of

intervention intensity showed significant impact reaching a small effect size. A trend, however, could be observed showing that higher-intensity interventions led to higher effect sizes, particularly for mentally ill populations and the general population. No such difference was found for physically ill populations, where moderate and high-intensity interventions had similar effects. Low-intensity interventions were not tested in clinical populations.

Group-based interventions reached the highest effect size compared with individual and technology-based interventions in the general and mentally ill populations. For those with a physical illness, interventions delivered using an individual format reached the highest effect size. Whereas the effect size confidence intervals between group formats and the other two formats in the general population did not overlap by much, this was not the case for both clinical populations. This means that the impact of modality in both clinical populations is less clear compared with the general population.

**Study-specific moderators.** Time to follow-up was associated with an effect on wellbeing scores in the general population, with overall effect sizes decreasing over time for all population types. The significant effect sizes were maintained at the 3-month follow-up period compared to afterwards, before dropping below  $g=0.2$  by the 6-month follow-up. A similar trend could be observed for both clinical populations.

Looking at comparator groups, effect sizes were larger when studies used a waitlist-control or assessment-only design. When studies used a control group that included some form of interaction (for example, a placebo control group), effect sizes were much lower, with effect sizes in the general population dropping below the threshold for a small effect.

**Impact of interventions on sub-domains of mental wellbeing.** Separate meta-analyses were conducted for hedonic and eudaimonic wellbeing, and are presented in detail in the Supplementary

**Table 3 | Outcome of meta-analyses grouped by intervention type across the general and clinical population**

Population	Intervention type	Hedges' G	99% CI	P value	Int n	Con n	Total n**	Q	I <sup>2</sup>	K	Grade	PB	Pow
General population	ACT interventions	0.348	0.18 0.51	0.000	508	365	990	4.84	0.00	7	2	–	0.98
	Compassion interventions	0.230	–0.01 0.47	0.014	538	559	1,097	8.44	5.22	9	2	–	0.76
	Cognitive therapy- or CBT-based	0.162	0.05 0.27	0.000	2,085	2,071	4,156	8.49	0.00	10	3	No	0.97
	Expressive writing	0.240	–0.03 0.51	0.019	703	521	1,274	7.81	0.00	9	2	–	0.87
	Mindfulness interventions	0.420	0.29 0.55	0.000	2,703	2,606	5,613	55.62	0.00	56	4	No	1
	Multi-theoretical interventions	0.215	0.11 0.32	0.000	2,811	2,830	5,714	32.61	0.00	36	2	Yes	1
	PPI, multi-component	0.280	0.19 0.37	0.000	6,354	5,985	12,412	65.16	3.31	64	4	No	1
	PPI, singular	0.200	0.11 0.29	0.000	7,420	4,118	11,935	89.35	18.29	74	3	No	1
	Reminiscence interventions	0.307	0.07 0.54	0.001	575	508	1,083	10.48	0.00	12	2	Yes	0.96
Mentally ill	Cognitive therapy or CBT interventions	0.382	0.22 0.55	0.000	1,121	1,033	2,154	16.81	4.84	17	3	No	1.00
	Mindfulness interventions	0.664	0.28 1.05	0.000	113	136	249	5.09	1.76	6	2	–	0.97
	PPI, multi-component	0.365	0.08 0.65	0.001	426	411	837	13.14	8.66	13	2	Yes	0.98
	PPI, singular	0.325	0.04 0.61	0.004	177	143	320	3.01	0.00	5	1	–	0.47
	Reminiscence interventions	0.392	0.14 0.65	0.000	225	197	422	3.92	0.00	5	2	–	0.82
Physically ill	ACT interventions	0.263	–0.18 0.70	0.121	204	190	394	5.235	23.60	5	1	Yes	0.37
	Cognitive therapy or CBT interventions	0.217	–0.10 0.54	0.078	771	700	1,606	10.55	14.73	9	2	–	0.88
	Mindfulness interventions	0.357	0.19 0.52	0.000	589	590	1,179	13.06	0.47	14	3	No	1.00
	Multi-theoretical interventions	0.196	0.02 0.37	0.000	410	453	863	5.77	0.00	9	2	–	0.46
	PPI, multi-component	0.521	0.05 0.99	0.004	547	441	988	10.85	0.00	15	2	Yes	1

Meta-analysis output corresponding to Fig. 2. Q is Cochran's Q, a measure of heterogeneity; I<sup>2</sup> is a measure of heterogeneity; K is number of studies contributing to the meta-analysis; grade is a measure of evidence quality, with 1 indicating very low quality evidence, 2 indicating low quality evidence, 3 indicating moderate quality evidence and 4 indicating high-quality evidence; PB indicates presence of publication bias (yes or no; calculated only where there are 10 studies or more); Int n is intervention sample size; Con n is control group sample size; Pow is a power calculation for meta-analysis. \*\*Total n can deviate from group n as a result of the specific analyses performed and the availability of per-group data; 99% CI, 99% confidence interval.

Information (Supplementary Figs. 1 and 2, and Supplementary Tables 3 and 4). In brief, the large majority of studies used subjective wellbeing outcome measures, with psychological wellbeing outcome measures being used considerably less often. In general, results for subjective (hedonic) wellbeing mirrored the findings for the general mental wellbeing scores, with mindfulness and multi-component PPIs showing the highest significant effect sizes across populations ( $g$  ranging between 0.35 and 0.65 for mindfulness and 0.36 and 0.62 for multi-component PPIs, all  $P=0.000$ ). Other multi-theoretical interventions ( $g=0.26$ ,  $P=0.000$ ), singular PPIs ( $g=0.20$ ,  $P=0.000$ ) and reminiscence interventions ( $g=0.34$ ,  $P=0.000$ ) also significantly improved subjective wellbeing in the general population. Cognitive therapy- or CBT-based interventions only led to significant improvements in wellbeing for cohorts with mental illness ( $g=0.40$ ,  $P=0.000$ ). Multi-theoretical interventions were efficacious in the physically ill populations ( $g=0.24$ ,  $P=0.002$ ). While evidence for the efficacy of mindfulness and both types of PPI was high in the general population, the majority of studies were judged

to have low or very low evidence quality. Psychological wellbeing could only be included in a meta-analysis examining the impact of multi-component PPIs, showing a small-to-moderate significant effect ( $g=0.44$ ,  $P=0.002$ ). No other interventions were tested in sufficient numbers to allow a robust meta-analysis to be conducted.

## Discussion

This systematic review aimed to synthesize the current scientific evidence on distinct psychological interventions in both clinical and non-clinical populations in improving mental states of wellbeing, and found that mental wellbeing can be significantly improved using a variety of psychological interventions. Two types of interventions were consistently associated with positive findings across populations, specifically multi-component PPIs and mindfulness-based interventions. Meta-analyses also found that ACT-based interventions, cognitive therapy- or CBT-based interventions, singular PPIs, and interventions focusing on reminiscence were effective. The significance and effect sizes for interventions differed among the



**Table 4 | Impact of moderators of intervention impact on overall wellbeing, split into the general population and the two clinical populations (cohorts with a mental illness and those with a physical illness)**

Moderator	General population					Mentally ill					Physically ill					
	Time	<i>g</i>	99% CI		<i>K</i>	<i>N</i>	<i>g</i>	99% CI		<i>K</i>	<i>N</i>	<i>g</i>	99% CI		<i>K</i>	<i>N</i>
Post		0.276	0.23	0.32	274	41,491	0.440	0.30	0.58	58	6,085	0.352	0.21	0.50	61	5,712
3 month		0.234	0.13	0.33	61	14,237	0.385	0.16	0.61	13	2,303	0.218	0.05	0.39	19	1,532
6 month		0.151	0.06	0.24	38	9,070	0.098	-0.15	0.35	5	686	0.155	0.04	0.27	20	1,968
12 month		0.103	-0.07	0.28	12	4,101	-	-	-	-	-	0.023	-0.17	0.21	5	1,133
<b>Intensity</b>																
Low		0.198	0.13	0.27	80	12,877	-	-	-	-	-	-	-	-	-	-
Moderate		0.294	0.19	0.40	63	7,100	0.261	0.00	0.53	12	1,061	0.397	0.183	0.611	6	333
High		0.321	0.26	0.39	128	21,001	0.551	0.36	0.74	42	4,219	0.367	0.243	0.492	51	5,045
<b>Comparator</b>																
Assessment only		0.342	0.28	0.40	161	25,200	0.462	0.38	0.54	43	4,669	0.418	0.18	0.66	30	3,270
Active or passive comparator		0.184	0.12	0.24	114	16,845	0.228	0.03	0.43	15	1,449	0.248	0.14	0.36	29	2,202
<b>Modality</b>																
Individual		0.238	0.14	0.34	63	6,878	0.421	0.18	0.66	24	1,389	0.422	0.18	0.66	16	764
Online		0.222	0.16	0.28	103	20,263	0.333	0.20	0.47	11	1,470	0.343	0.06	0.63	14	2,051
Group		0.362	0.28	0.44	97	13,730	0.539	0.22	0.85	19	2,004	0.319	0.10	0.54	29	2,840
<b>Quality</b>																
High		0.296	0.18	0.41	38	8,228	0.398	0.21	0.59	18	2,142	0.246	0.09	0.41	17	2,266
Low		0.274	0.23	0.32	239	34,027	0.462	0.27	0.66	40	3,943	0.394	0.19	0.59	44	3,446

Mean effect sizes and range of values are shown. Low intensity refers to interventions that lasted less than a week; moderate-intensity interventions lasted between a week and a month, and high-intensity interventions lasted more than a month. Dashes (-) indicate that insufficient studies were found that contributed evidence for this moderator subgroup.

specific target populations and outcomes studied, while the overall degree of overlap in confidence intervals between intervention types meant no conclusive judgement could be made about the superiority of one type over the other.

The results describing the impact of interventions that originate from positive psychology, tested here with a large number of studies, concur with previous reviews, which have demonstrated positive results from global studies on wellbeing<sup>18–20,40</sup>. We found that PPIs led to small effect sizes, regardless of whether they were tested in clinical or non-clinical populations. The PPIs were used in various different settings such as workforces, schools, the general community and clinical settings, and were offered in various different formats and intensities. This review deliberately split PPIs into multi-component and singular PPIs, to provide better insight into different intervention formats. In this way, the effects of individual building blocks (individual activities and exercises) could be compared with those of complete programmes of PPIs. In line with previous research<sup>41</sup>, multi-component PPIs generally showed larger effect sizes compared with singular PPIs, which reached a small effect size at best. This finding is important, as positive psychologists often promote the use of simple, easy-to-perform PPIs as impactful in improving wellbeing<sup>42,43</sup>, whereas the results of our review support the use of higher-intensity multi-component programmes over singular activities and exercises. In addition, effect sizes differed amongst singular PPIs. This demonstrates that not all individual PPIs are equal and that attention needs to be paid to which exact singular PPIs should be included as part of multi-component interventions.

The review highlighted that non-PPIs can also significantly improve states of positive mental health. Previous reviews, except the one conducted by Weiss and colleagues<sup>18</sup>, generally excluded non-PPIs from their inclusion criteria. The significant impact of

non-PPIs is promising for health professionals and other stakeholders who are seeking and proposing new therapeutic avenues to build mental wellbeing. ACT-based interventions were effective in the general population, and the closely related mindfulness-based interventions were effective in the general and mentally ill population, strengthening their appeal for clinicians who wish to offer interventions that focus on building wellbeing in addition to being able to positively impact symptoms of psychological distress<sup>44</sup>. That cognitive therapy- and CBT-based interventions were impactful in improving wellbeing in mentally ill populations, but not in the non-clinical population, adds to the existing evidence base supporting the utility of cognitive therapy and CBT approaches in building mental capacity in the mental healthcare setting, and strengthens the case for CBT models of wellbeing and resilience in clinical populations<sup>45</sup>. As CBT is currently the most empirically supported and practised therapeutic approach<sup>46</sup>, these results support practitioners to start looking at implementing wellbeing interventions for their patients using familiar paradigms and therapeutic methods.

Our moderator analysis indicated that improvement in mental wellbeing seems to be related to effort. While the review did not find a clear linear dose–response effect, with more exposure leading simply to better treatment outcomes<sup>47</sup>, the results do indicate that more intense interventions seem to lead to more pronounced changes, particularly in the general and mentally ill populations. These results need to be placed in the context of the overlap in confidence intervals between intensities, which means that it is not possible to definitively state that higher-intensity interventions provide superior results. The difference in impact of higher-intensity interventions may also be explained by the way the higher-intensity interventions are structured. They are typically complex, combining a multitude of psychological and behaviour-change elements<sup>48</sup>. Similar to the conclusions by Weiss, et al.<sup>18</sup> in their review on

interventions to build psychological wellbeing, our evidence is consistent with the use of higher-intensity psychological interventions to facilitate the reinforcement of practices in everyday life.

Overall effect sizes were often larger in mentally ill and physically ill populations. The ability of psychological interventions to exert more influence when symptoms of problematic mental health are more severe (that is, surpass sub-clinical levels) is supported<sup>49</sup>, but it is important to note that the effect on wellbeing in these populations cannot solely be attributed to severity of clinical distress symptoms, as wellbeing is a state that appears in the absence of psychological distress<sup>10,12</sup>. For instance, recent evidence suggests that most people improve in either wellbeing or psychological distress after receiving psychological interventions that target both outcomes<sup>50</sup>. The difference in effect size found between clinical and non-clinical populations points to a more complex interrelationship between clinical symptoms, distress and levels of wellbeing, as well as their unique and common predictors, and the role of other moderators such as intervention intensity<sup>10,51</sup>. Similarly, the review showed differences in effect sizes between different intervention types within clinical versus non-clinical populations, for example, cognitive therapy- and CBT-based interventions. This highlights the need to further explore the utility of using common therapies to underpin interventions in the general population. Further research on dual-factor models such as the one posited by Corey Keyes<sup>11</sup> and recovery frameworks such as CHIME<sup>52</sup> may in future help to untangle the exact interplay between wellbeing and clinical symptoms and its treatment.

Although the evidence presented in this review includes non-Western populations (mostly from Asia), and includes youth and adult populations, the majority of studies identified in this review come from Western adult populations; a well-documented phenomenon in research, including wellbeing research<sup>53</sup>. Though the evidence may have application in different cultures and ages<sup>40,54</sup>, generalizations of the evidence impact beyond the Western and Asian context should be considered with caution. Similarly, the application of interventions in practice will still require further nuancing. The review points to the utility of different interventions at the population level, but it does not determine which individuals benefit most from each intervention, and which conditions need to be met to make them work optimally. Researchers are increasingly calling for personalized approaches to intervention delivery<sup>55</sup>—first, to optimize the impact of the interventions, and second, to determine which factors impact at the individual level as opposed to the group level. Technological advances and maturing of the field of wellbeing science should lead to more traction in the upcoming decade<sup>56–58</sup>.

The field of wellbeing science and the evidence quality in syntheses of studies in the field will benefit from improvements in rigour. Factors contributing to the downgrading of the quality of evidence included high rates of unclear and high risk of bias, small sample sizes, lack of published protocols or trial registries, and inconsistent reporting between studies, with a large proportion of studies failing to adhere to standard reporting guidelines such as the CONSORT statement<sup>59</sup>. This made it challenging at times to determine the precise components or the theoretical background of the intervention being studied, or to assess quality indicators such as implementation fidelity. Nevertheless, by taking a rigorous approach to inclusion in our meta-analyses, the review provides considerable high-quality evidence to suggest that application of mindfulness-based interventions and PPIs in particular can be reliably judged to be beneficial in clinical and non-clinical populations.

This systematic review took a broad approach in aiming to synthesize the evidence of all psychological interventions, which involved going through over 23,000 citations and assessing close to 2,000 full-text articles. The search that was constructed for this review was designed to be broad, picking up on any article that made reference to wellbeing, interventions (or synonyms) and mentioned the word ‘random’ to pick up on randomized controlled designs.

Specific search terms related to intervention types were also used, based on words used in articles identified before starting the review. These terms were not accompanied by an extensive list of synonyms or related constructs, which might have had a small effect on identification of relevant studies. Scanning of existing reviews and reference lists would have helped mitigate against missing studies.

The magnitude of the search was influenced by the incoherent nomenclature surrounding wellbeing<sup>30,60</sup> and mental health research. Findings from this review are closely related to the quality of the current state of the wellbeing literature. This is the most important limitation of this work, as reporting standards varied widely, particularly in writing of titles and abstracts; the first step in screening for reviews. This may have led to relevant studies being excluded, although this was minimized by the screening of studies included in the reference lists. Furthermore, the review was limited by the pragmatic necessity to exclude Masters or PhD theses and grey literature, which can include references to unpublished work, and could therefore potentially result in publication bias.

Nonetheless, the review used a combination of rigorous methodological approaches used in systematic reviewing and meta-analyses, including the use of quality indicators for individual studies, indicators for quality of overall effect of meta-analyses, statistical methods to infer heterogeneity and random effects analysis to counter methodological heterogeneity, drawing on accepted standards in both psychological and medical research methods. By taking a strict approach to inclusion of studies, restricting study designs to randomized control trials, using validated scales of only positive states of mental health to determine (mental) states of wellbeing, excluding all studies with additional components other than psychological interventions and using only peer-reviewed research, the identified evidence base was coherent. Intervention types fell largely within existing classifications or therapeutic approaches, delivery formats were fairly similar and, while heterogeneity in results was present, it was lower than expected.

This review did not include studies that investigated head-to-head comparisons of different types of psychological interventions, which has implications for its conclusions. For instance, studies that simply compare interventions with waitlist-control groups may overestimate effect sizes<sup>61</sup>—this has to be taken into account when interpreting the findings. However, the exclusion of direct comparisons does not affect the meta-analytic results specifically, as data belonging to these studies could not be added to the pool of data. This leaves the investigation of direct comparisons as an opportunity for future evidence syntheses.

It could be argued that the categorization of psychological interventions is not beneficial for deliberations on the effect psychological interventions on wellbeing. Various authors have pointed to problems in distinguishing between positive and negative interventions or outcomes in mental health<sup>16</sup>. They argue that any positive traits can be also be negative and vice versa, and that positive interventions can have a negative impact if specific preconditions have not been met. Similarly, psychological interventions are typically complex<sup>48</sup> and often borrow techniques from other therapeutic paradigms, which makes it difficult to categorize ‘pure’ interventions and their subsequent impact on outcomes. We used classification of interventions based on their overarching therapeutic background and the description of their components as a necessary starting point to map the breadth of different interventions that can be used to build wellbeing.

Despite current estimates of the burden of mental illness being gross underestimates<sup>62</sup>, mental illness is projected to become the largest contributor of disease by 2030. Integration of evidence-based positive mental health interventions within established models of care can be an innovative and cost-effective consideration<sup>63</sup>, and can help improve chances of recovery or prevent people from needing care for their mental illness down the line<sup>6,64</sup>. This review points to

various effective psychological interventions that practitioners can consider if they want to address mental states of wellbeing in their care provision. Implementing these interventions can be done safely without interfering with future therapist approaches, can be delivered in group format or via online or telehealth solutions and does not (necessarily) require the need for a clinical or registered psychologist, making it a potentially cost-effective addition to current referral pathways and treatment modalities. It is important to stress the importance of intensity and giving the specific building blocks to interventions considerable thought, as not all intervention components have the same impact. Future research can further stimulate the uptake of these interventions, particularly when it begins to focus more on moderators and preconditions that influence intervention efficacy, which will need to be done in well-powered studies with high reporting standards<sup>43</sup>. For many of the interventions studied here, the evidence quality is in need of improvement, which is particularly important in light of the replication crisis<sup>65</sup>. However, several intervention types (PPIs and mindfulness in particular) are captured well and the need to conduct new (pilot) studies is limited if the sole aim is to determine whether the interventions have an impact. Researchers need to look further to answer important questions, for example, to determine person-to-intervention fit<sup>66</sup> or to improve fidelity of interventions.

Determining the effect of pooled psychological interventions should be only the precursor to determining which intervention components are effective, and in which contexts<sup>67</sup>. Psychological interventions are complex and consist of a lot of different elements, as can for instance be seen in the case of multi-component PPIs, which often include different combinations of individual PPIs. A possible next step is to disentangle interventions into their building blocks, to begin to determine which combination of techniques leads to optimal outcomes. One way to achieve this is by coding interventions via behaviour-change taxonomies, which outline effective components to psychological interventions<sup>68,69</sup>. Although the approach of coding according to taxonomies has its own limitations<sup>70,71</sup>, it can bring us a step closer to more effective personalized delivery of wellbeing intervention.

## Methods

This systematic review was registered in the PROSPERO International prospective register of systematic reviews with number [CRD42018109059](https://doi.org/10.1186/1745-6215-109059). A detailed protocol of the review is provided in the Supplementary Information, with the main methodological considerations discussed below.

**Study selection criteria.** Studies were eligible for inclusion in this review according to five criteria. First, the studies needed to evaluate a psychological or behavioural intervention only. Second, only experimental studies using a randomized controlled design, including cluster and crossover designs, were eligible for inclusion. Interventions could be compared to (1) assessment only or waitlist, (2) a passive or active control group as long as the control group does not focus on trying to improve mental health, and (3) treatment-as-usual in the case of physical or mental illness. Comparing different psychological interventions types head-to-head was not the focus of this review, as the principle aim was to establish the impact of the independent variable: being in receipt of different types of psychological intervention. Therefore, studies comparing psychological interventions to one another were excluded from the current review. Third, measurement of at least one validated measure of mental wellbeing was required. Studies using single-item wellbeing measures were excluded. Accepted measures for mental wellbeing and psychological distress are presented in Table 2. Fourth, articles written in any language other than English were excluded. Finally, studies investigating populations with cognitive impairment were excluded, as the application of generic intervention psychological interventions in this population was not deemed equivalent; that is, the degree of adaptation was expected to be too high.

**Search strategy, study selection and data extraction.** The data sources for the current meta-analysis were peer-reviewed journal articles published up to July 2020, as sourced via PsycINFO, PsycARTICLES, Scopus, Medline and CINAHL. The search, constructed by professional research librarians, is current up to July 2020. It was designed to be broad, so it could pick up any psychological intervention or treatment looking at outcomes of positive mental health studied via a randomized control trial; the full search is described in the Supplementary Information part 2,

pages 6 to 10, and an overview of the measures is described in Table 2. In order to pick up any missed studies, existing systematic reviews that arose from the search on related interventions or topics, as well as reference lists of included studies were also screened. Two authors independently screened all titles and abstracts returned from the database search for eligibility and performed the subsequent full-text screen. Disagreements between review authors were resolved through discussion. Inter-rater reliability was calculated for the full-text screen, resulting in a Kappa of 0.85, which indicates very high overall agreement<sup>72</sup>. No contact was made with study authors. Four reviewers extracted data to a custom, standardized form in Microsoft Excel, based on formats used by the authors in previously completed reviews. All extracted data were independently checked by co-authors.

**Data synthesis and analysis.** Outcome data were standardized to Hedges' *G* (ref. <sup>73</sup>), their 99% confidence intervals, as well as their associated *P*-values, using Comprehensive Meta-Analysis software<sup>74</sup> version 3. Meta-analysis was conducted only in cases where five studies or more were included. Hedges' *G* of 0.2 indicated a small effect, 0.5 indicated a moderate effect and 0.8 indicated a large effect. Effect sizes were deemed significant at the 0.01 level and were conducted using two-tailed tests. A 0.01 level was chosen based on the recommendations of Borenstein et al.<sup>75</sup> to correct for meta-analysis multiplicity<sup>76</sup>. In other words, a correction was applied to compensate for the increased probability of a type II error (falsely rejecting the null hypothesis) by performing a large number of meta-analyses within one study. Where individual studies caused considerable heterogeneity in a meta-analysis (that is, they were an outlier), they were removed from the analysis.

For each of the meta-analyses, a power calculation was performed<sup>77</sup>. An overall effect size on mental wellbeing was calculated for the meta-analysis, as research points to the existence of an overarching wellbeing factor<sup>78</sup>. In order to compare results to previous reviews<sup>17,18,20</sup> and to provide intervention designers with insight into the performance of individual psychological interventions on aspects of hedonic versus eudaimonic aspects of wellbeing, separate scores for subjective and psychological wellbeing were calculated. Table 2 outlines all measures used in the present study and whether they were counted as measures of subjective or psychological wellbeing.

Intervention types were not collapsed into an overarching 'psychological interventions' category, but rather were added as subgroups. Due to the common use of complex multi-component interventions, a posteriori categorization of included interventions was conducted, as described in Table 1. Studies were classified according to the descriptions provided in the papers and the supplementary material to the papers. Interventions were grouped into distinct categories if there was a minimum of two studies for each category. Singular studies were grouped in an 'other' category. Interventions that largely contained techniques or components stemming from a specific therapy (for example, cognitive behavioural therapy) were allocated under the description of that therapeutic approach. Interventions that specifically focused on testing a specific method (for example, goal setting or expressive writing) were classified as interventions based on that type of method. A specific group called 'multi-theoretical interventions' was created for interventions that deliberately combined therapeutic elements or did not provide sufficient information to distinguish between categories.

Interventions were analysed and presented per population group (non-clinical, mentally ill and physically ill). This analysis per intervention was done to justify the considerable differences between intervention implementation for general versus clinical populations and the differences between the psychological interventions.

As it was unlikely that the studies were functionally equivalent (for example, due to differences in exact formats used), the overall effect size was calculated using random effect models<sup>79</sup>. Where multiple intervention or control groups existed within a single study, which would fall within one category of study types as laid out in Table 1, a combined weighted mean effect size was calculated<sup>80,81</sup>.

**Quality of effect size estimate and included studies.** The quality of evidence provided in each meta-analysis was assessed using the five GRADE considerations<sup>82</sup>. GRADE provides an estimate of the quality of combined meta-analyses, as opposed to individual studies. Each meta-analysis is graded for five considerations, with downgrades being made when one of the five considerations has not been adequately met. In brief, the considerations focus on general study limitations (for example, presence of confounders), consistency of effect (that is, heterogeneity in results), imprecision (for example, wide confidence intervals), indirectness (for example, very different populations tested) and publication bias. Based on the considerations, the evidence quality for each meta-analysis can range from very low to high. Forest plots were coloured to reflect the evidence quality showing red (very low quality), orange (low quality), yellow (moderate quality) and green (high quality) colours. In addition to GRADE, the Cochrane risk of bias assessment<sup>83</sup> was used to determine the risk of bias for the included studies. The *I*<sup>2</sup> statistic and Cochran's *Q* were calculated to determine the heterogeneity of the results.

**Methodological moderators or subgroup analyses.** A central aim of the review was to examine the influence of various universal moderators on the effect size of interventions<sup>82</sup>. The first type of moderator was intervention-specific moderators. These included the type of intervention (Table 1) and were used as subgroups to

investigate their differential effect. Furthermore, the review examined the mode of delivery and intensity of the intervention. Delivery mode was split into individual, technology-based and group formats. Intensity was split into interventions lasting up to a week (low-intensity interventions), those lasting between a week and a month (moderate-intensity interventions), and those that lasted more than a month (high-intensity interventions), in line with previous review categorizations<sup>50</sup>. The second type of moderator included study-specific moderators such as the impact of different control group types, assessment follow-up and study quality. Control groups were divided into assessment-only, waitlist-versus-passive or active-comparison groups. Length of follow-up looked at post-intervention (up to one month after the intervention), between 1 and 3 months, between 3 and 6 months, between 6 and 12 months and between 12 and 24 month after the intervention. Study quality was based on risk of bias, where studies scoring four or more low-risk-of-bias categories were deemed high quality. It considered population-specific moderators by splitting the results for the general population, those with a mental illness and those with a physical illness. Finally, it rated the overall quality of the evidence provided and aimed to discuss the implications of the evidence for future research and mental healthcare delivery in practice.

**Reporting summary.** Further information on research design is available in the Nature Research Reporting Summary linked to this article.

### Data availability

The datasets that were used in this review are available from the corresponding author on reasonable request.

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## Author contributions

J.v.A.: review methodology, screening of literature, data extraction, risk of bias, meta-analysis and writing. M.I.: review methodology, screening of literature, data extraction, risk of bias and writing. L.L.: screening of literature, data extraction, risk of bias and writing. J.B.: data extraction, risk of bias and writing. Z.K.: risk of bias and writing. M.C.: data extraction and writing. M.K.: input into methodology, focus of review and writing.

## Competing interests

The authors declare no competing interests.

## Additional information

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