

AHA SCIENTIFIC STATEMENT

Psychological Outcomes and Interventions for Individuals With Congenital Heart Disease: A Scientific Statement From the American Heart Association

Adrienne H. Kovacs, PhD, Chair; Judith Brouillette, MD, PhD; Patricia Ibeziako, MD; Jamie L. Jackson, PhD; Nadine A. Kasparian, PhD; Yuli Y. Kim, MD; Tracy Livecchi, LCSW; Christina Sillman, MSN; Lazaros K. Kochilas, MD, MS, FAHA, Vice Chair; on behalf of the American Heart Association Council on Lifelong Congenital Heart Disease and Heart Health in the Young; and Stroke Council

ABSTRACT: Although resilience and high quality of life are demonstrated by many individuals with congenital heart disease, a range of significant psychological challenges exists across the life span for this growing patient population. Psychiatric disorders represent the most common comorbidity among people with congenital heart disease. Clinicians are becoming increasingly aware of the magnitude of this problem and its interplay with patients' physical health, and many seek guidance and resources to improve emotional, behavioral, and social outcomes. This American Heart Association scientific statement summarizes the psychological outcomes of patients with congenital heart disease across the life span and reviews age-appropriate mental health interventions, including psychotherapy and pharmacotherapy. Data from studies on psychotherapeutic, educational, and pharmacological interventions for this population are scarce but promising. Models for the integration of mental health professionals within both pediatric and adult congenital heart disease care teams exist and have shown benefit. Despite strong advocacy by patients, families, and health care professionals, however, initiatives have been slow to move forward in the clinical setting. It is the goal of this scientific statement to serve as a catalyst to spur efforts for large-scale research studies examining psychological experiences, outcomes, and interventions tailored to this population and for integrating mental health professionals within congenital heart disease interdisciplinary teams to implement a care model that offers patients the best possible quality of life.

Key Words: AHA Scientific Statements ■ anxiety ■ depression ■ heart defects, congenital ■ psychotherapy ■ psychotropic drugs ■ quality of life

As a result of significant medical advances in recent decades, >90% of newborns with congenital heart disease can now survive to adulthood. There are currently >2.4 million Americans living with congenital heart disease, and adults now outnumber children.¹ Although reductions in mortality and morbidity are appropriately extolled, living with the challenges of congenital heart disease is associated with a higher prevalence of emotional, behavioral, and social difficulties compared with healthy peers. The lifetime prevalence of depression and anxiety in this patient population is as high as 50%^{2,3} and has been associated with higher medical costs in addition to greater morbidity and mortality.^{4,5} The importance of this messaging is not limited to physicians and health

care professionals who specialize in congenital heart disease. Awareness of psychological sequelae is necessary for every clinician who takes care of individuals with congenital heart disease, including those who specialize in heart failure, electrophysiology, coronary artery disease, and surgery. Pediatric cardiology and adult congenital heart disease programs have established clear referral and treatment pathways for patients with other clinically significant symptoms or organ dysfunction (eg, referral to pulmonologists, neurologists, or hepatologists), yet the psychological needs of individuals with congenital heart disease have been largely unmet in comparison. The onus on accessing psychological care should not be placed solely on the shoulders of patients and families.

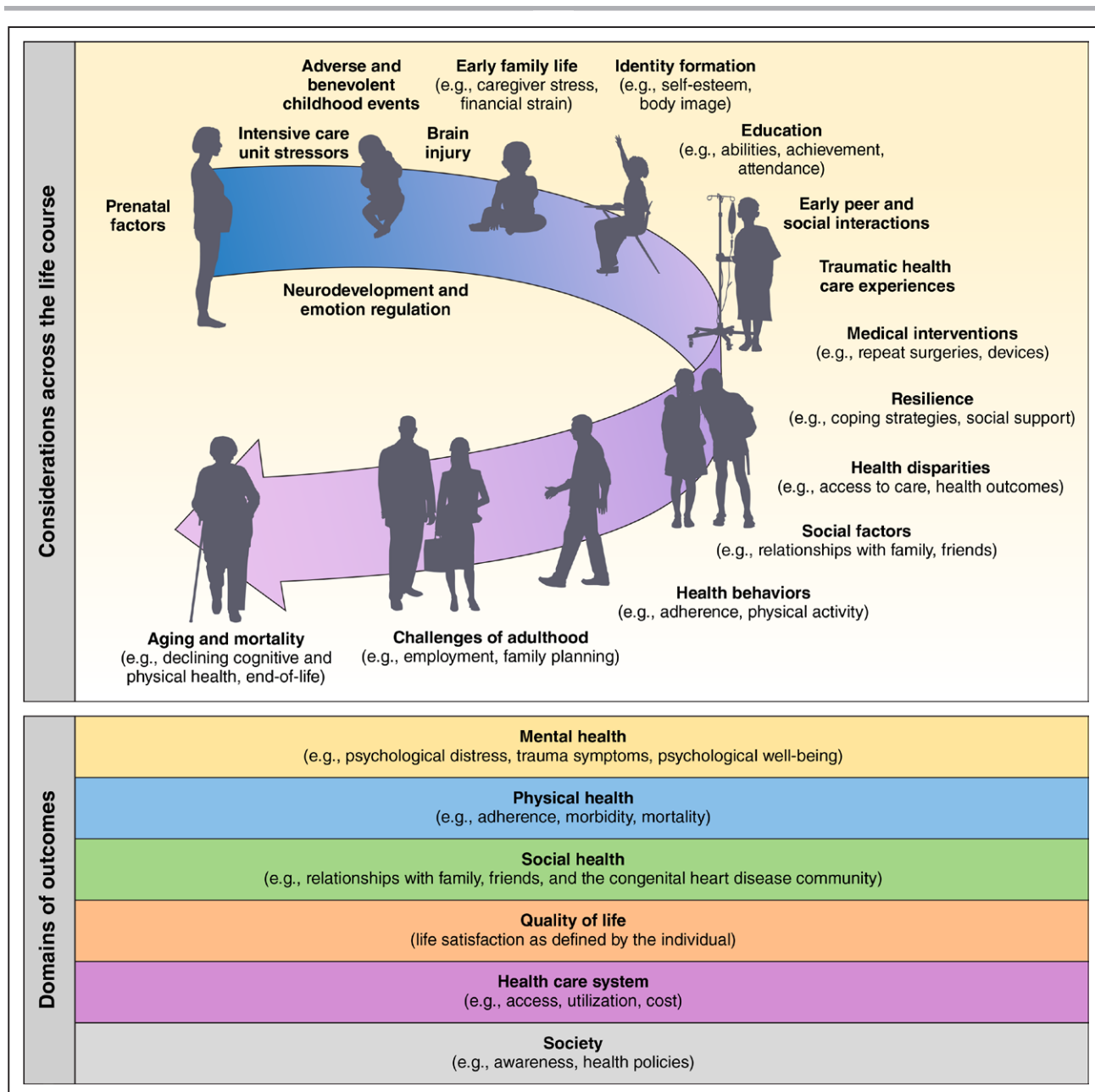


Figure. Diagrammatic representation of contributing factors and domains of outcomes for the psychological well-being of individuals with congenital heart disease.

Such factors and outcomes are multiple, interrelated, and cumulative across the life span with significant individual, family, and societal effects.

Furthermore, it is no longer sufficient to focus primarily on awareness among congenital heart disease clinicians of the challenges that patients and families encounter in maintaining psychological well-being. Collectively, clinicians, their institutions, and health systems are now called on to engage in implementation of strategies to prevent and alleviate significant distress and to support resilience and mental health as part of routine care.

This scientific statement summarizes the psychological outcomes of infants, children, adolescents, and adults with congenital heart disease and reviews mental health interventions, including psychotherapy and

pharmacotherapy. We occasionally use the term psychosocial to highlight ways in which congenital heart disease might affect both psychological and social outcomes and the bidirectional relationship between psychological and social factors. This scientific statement incorporates but does not significantly elaborate on neurodevelopmental outcomes because they have been effectively summarized in a previous scientific statement from the American Heart Association.⁶ Rather, ways in which psychological and neurodevelopmental or neurocognitive outcomes are intertwined across the life span are incorporated as appropriate.⁷

The statement is intended to serve as an urgent call to action for pediatric and adult programs to implement a proactive approach to integrating psychological care and improving emotional, behavioral, and social outcomes for individuals of all ages living with congenital heart disease.

PSYCHOLOGICAL OUTCOMES ACROSS THE LIFE SPAN

Shared Origins of Psychological and Neurodevelopmental Outcomes

Risk factors for adverse psychological and neurodevelopmental outcomes in individuals with congenital heart disease are multiple, interrelated, and cumulative (Figure) and may exert influence in utero and across the life course. Such factors include altered fetal circulation and cerebral hemodynamics, altered placental environment, hypoxia, brain dysmaturation, cardiac arrest, perioperative neurological injury (eg, seizures, stroke), use of mechanical cardiopulmonary support, medications (including anesthetics), pain, prolonged hospitalization, exposure to stress or trauma, genetic and epigenetic factors, and parental mental health.^{6,8} Data suggest that preoperative risk factors (eg, genetics, family socioeconomic hardship, low birth weight, gestational age, brain dysmaturation, neonatal transition), as well as cumulative morbidity and parental mental health, may contribute more strongly to adverse psychological and neurodevelopmental outcomes than intraoperative support techniques such as cardiopulmonary bypass.⁸ There is also growing recognition of the role of ecological factors acting on genetic predispositions, particularly the potential lifelong consequences of cumulative exposure to adversity and toxic stress in early childhood.⁹ Furthermore, there is evidence that sociocontextual, economic, and race and ethnicity disparities influence congenital heart disease surgical outcomes, lapses in care, and mortality across the life span^{10–12}; it is likely that such disparities may also affect psychological outcomes in congenital heart disease because socioeconomic status and mental health are linked in the general population.^{13,14}

Overall, the prevalence of neurodevelopmental delay or impairment in congenital heart disease is high,^{6,8} and the link between psychological and neurodevelopmental outcomes is well established.^{15–22} The Boston Circulatory Arrest Study, for example, demonstrated that neurodevelopmental difficulties exhibited by school-aged children (eg, attention)²³ and adolescents (eg, executive function, social cognition)²⁴ with dextro-transposition of the great arteries were associated with poorer psychosocial health status, as reported by their parents. Moreover, impaired cognitive functioning in children with dextro-transposition of the great

arteries at 8 years of age was found to predict subsequent psychosocial health at 16 years of age, with attentional difficulties one of the strongest predictors of future lower parent-proxy-reported psychosocial health status in this study.²⁴ Greater clinical severity of attention-deficit/hyperactivity disorder (ADHD) is associated with poorer psychosocial health^{25,26} and quality of life²⁷ in community samples, as well as a greater risk of graduation failure, juvenile justice system involvement, and mortality from suicide.^{25,28} These findings highlight the role of attentional difficulties, and neurodevelopmental impairment more broadly, as critical targets for interventions to reduce longer-term psychological suffering and adversity, including physical, mental, and financial health into adulthood.^{26,28} Among adolescents and adults, poorer executive functioning, less effective coping skills, and psychological distress are often intertwined.^{29,30}

Challenges and Outcomes During Infancy, Childhood, and Adolescence

Any serious medical illness may profoundly influence a child's developmental trajectory. A child's life can be affected by multiple stressors that may begin before or shortly after birth and continue into childhood, adolescence, and beyond. Infants who undergo cardiac surgery show high levels of stress and distress. Babies with congenital heart disease are often hypersensitive to stimuli and may experience difficulties with early neurobehavioral and regulatory capacities such as feeding, sleeping, settling, and soothing,³¹ as well as autonomic and motor organization.³² For critically ill infants within the intensive care unit, stressors can originate from the physical environment (eg, bright lights, loud sounds, noxious smells), clinical exposures (eg, painful and invasive procedures, neurotoxic medications),³³ and psychosocial environment (eg, high parental emotional distress, limited opportunities for bonding and attachment).³⁴ Early nutritional deficiencies from unrecognized or uncompensated heart failure can lead to failure to thrive, which in general has been associated with poorer cognitive development and educational deficits among children.³⁵ In the context of congenital heart disease, it can be difficult to separate the additional burden of failure to thrive from the confounding effects of the underlying morbidity that can lead to the nutritional deficits in the first place, but it likely poses an additional risk factor among these children. Additional challenges across early childhood can include periods of separation from caregivers and social supports, acute and persistent medical problems, exacerbations of disease, and the burden of care that may disrupt life consistency (eg, school, physical activity, early relational bonds) and place a financial burden on individuals and families.³⁶

As a group, children with more complex congenital heart disease and those with comorbid medical conditions are at greater risk of neurodevelopmental impairment⁶ and emotional and behavioral dysregulation.³⁷ Children with complex congenital heart disease may show early signs of social withdrawal,³⁸ and children and youth have elevated rates of internalizing (eg, anxiety, depression; 25%) and externalizing (eg, aggression, hyperactivity; 15%) difficulties.³⁹ A recent meta-analysis that included parent-proxy reports of psychological distress among children and adolescents with congenital heart disease (all of whom had surgical intervention at <2 years of age) reported an increased prevalence of behavioral difficulties, including aggression, opposition, and defiance.³⁹ For these reasons, it can often be valuable for pediatric congenital heart disease clinicians to collaborate and coordinate efforts with teachers and school counselors to optimize educational, psychological, and social outcomes. The goal should be to support individual patient needs without placing unnecessary limitations on children's activities.⁴⁰ Children and adolescents with single-ventricle congenital heart disease have been found to have a 5-fold higher rate of lifetime anxiety disorder diagnosis and an almost 6-fold higher rate of lifetime ADHD diagnosis, which can affect school and social functioning.⁴¹ This study reported a lifetime prevalence of any psychiatric disorder of 65% in this patient group.⁴¹ A higher prevalence of psychiatric diagnoses, including autism spectrum disorder, compared with the general population has also been reported for other congenital heart disease subgroups.⁴² A recent meta-analysis of health-related quality of life among individuals with a Fontan circulation synthesized findings from 50 articles reporting 2793 patients and 1437 parents-proxies.⁴³ The authors concluded that poorer emotional functioning was associated with older age at Fontan operation, whereas poorer social functioning was associated with the presence of hypoplastic left-sided heart syndrome. Despite this cumulative evidence, only a small fraction of children with congenital heart disease are offered or participate in formal psychological assessment or treatment.⁴⁴

A systematic review of 44 qualitative studies that analyzed patterns in the narratives of 995 children and young people with congenital heart disease from 12 countries identified 6 key themes that have implications for psychological outcomes⁴⁵: (1) disruptions to normal life (eg, fluctuations between sickness and health, destabilizing the family dynamic); (2) powerlessness during periods of deteriorating health (eg, vulnerability to complications, thoughts of mortality, exhaustion from medical testing); (3) enduring uncertainty and medical adversity (eg, trauma associated with invasive procedures, uncertainty and disappointment associated with treatment failure, a sense of displacement during transition to adult cardiac services, valuing empathy and continuity in clinical care); (4) warring with the body

(eg, fatigue, physical limitations, distorted body image); (5) hampered goals (eg, feeling disabled, limited goal attainment and maintenance of milestones); and (6) establishing one's own pace (eg, fostering hope and a determination to thrive, embracing the positives, finding personal enrichment and social or spiritual support).

Adolescents with congenital heart disease face the typical challenges of this developmental stage (eg, cultivation of self-identity, independence, autonomy, and social networks) and additional disease-related stressors. Typical adolescent development involves decreasing reliance on parental support and greater investment in peer relationships.²⁹ In the context of congenital heart disease, this process may be altered by multiple factors, including academic challenges, health-related school absenteeism, physical limitations that restrict activities, social anxiety, body image concerns (eg, related to surgical scarring), parental overprotection, and ambivalence about disclosing their congenital heart disease diagnosis to peers.^{40,46} Among adolescents with congenital heart disease, depressive symptoms and loneliness are closely linked and have been associated with poorer quality of life.⁴⁷

During adolescence, most individuals with congenital heart disease can ideally begin the transition process and develop knowledge and self-management skills to gradually assume increased responsibility for their health care and to prepare for transfer from pediatric to adult health services. There are unique considerations to ensure a respectfully tailored experience for individuals with neurodevelopmental disabilities. Inherent to this process are incremental shifts in patient-parent and patient-clinician relationships. Best practices for transition emphasize the importance of holistic, psychosocial assessment and early intervention, as well as disease-specific education and social support, to ensure success in disease self-management.⁴⁸ This transition may result in increased disease-related stress for adolescents with congenital heart disease who vary greatly in their preparedness for tasks such as speaking independently with health care professionals, overseeing medication regimens, and making decisions about treatment. Psychological distress has been linked to poorer treatment adherence among adolescents with other chronic illnesses,⁴⁹ and this association presumably also exists in congenital heart disease. Thus, at a time when medical teams typically transition responsibility for disease management from parents to adolescents, individuals with congenital heart disease are also especially vulnerable to psychological distress that might hinder adherence and contribute to lapses in medical care.

Challenges and Outcomes During Adulthood

For adults with congenital heart disease, heightened vulnerability to emotional distress and elevated rates of

mental health diagnoses persist. Disease-related stressors include awareness of the potential for future medical interventions and life-threatening complications, concerns about early mortality, potential restrictions on family planning, and financial challenges.⁵⁰ Medical outcomes (eg, major adverse cardiac events) in adolescents and adults with congenital heart disease are poorer among those with lower socioeconomic resources.⁵¹ With regard to financial stressors, in general, income and rates of employment are lower among adults with congenital heart disease.⁴⁰ Adult patients also might face disability-related discrimination and ableism in the workplace.^{40,52,53} Other factors that may contribute to psychological distress include traumatic memories of previous health experiences, vulnerability and disempowerment in hospital encounters (eg, revealing hospital gowns), advanced cardiac therapies (eg, cardiac device implantation, ventricular assist device, transplantation), invasive procedures, and medical emergencies.^{52,54} Stress may also arise from challenges accessing specialized adult congenital heart disease care attributable to insurance and financial barriers or the distance of a patient's residence from a qualified adult congenital heart disease clinician.⁵⁵ Last, advancing age carries a unique set of experiences that may affect psychological well-being, including sexual dysfunction, cognitive decline (including an increased risk of early-onset dementia), and declining health status and approaching mortality.^{8,56,57} Older adults with congenital heart disease often face acquired heart disease and heart failure, which have been associated with increased prevalence of depression and anxiety in the general population,^{58–60} including among older patients.⁶¹

Adults with congenital heart disease also face challenges unrelated or indirectly related to health (eg, relationships, work demands), as well as non-congenital heart disease-related health stressors (eg, other medical diagnoses, COVID-19 [coronavirus disease 2019] pandemic). Racism and racial discrimination are also adversely associated with physical and mental health outcomes.^{62,63} Health disparities in congenital heart disease exist, as demonstrated by evidence of lower rates of insurance among Hispanic patients.⁶⁴ Congenital heart disease-related challenges, therefore, must be considered within a broader framework of multiple, cumulative, and interactive stressors.

It is therefore unsurprising that, as a group, adults with congenital heart disease are at elevated risk of clinically significant psychological distress. A 2018 review of studies using self-report assessments found that rates of elevated depressive symptoms ranged from 6% to 34%, whereas elevated anxiety symptoms were reported by 34% to 42% of adults with congenital heart disease.⁶⁵ Studies from North America, Germany, and France that incorporated structured clinical interviews observed current³ or lifetime^{2,66} prevalence rates of mood or anxiety disorders of \approx 50%. Known risk factors for depression and anxiety among adults with congenital heart disease

include poorer neurocognitive functioning (eg, executive function),²⁹ loneliness,² limited social support,⁶⁷ poorer perceived health status,² and sedentary behavior.⁶⁸

Beyond depression and anxiety, additional mental health concerns warrant attention. For example, there is emerging evidence that adults with congenital heart disease have an increased risk of traumatic stress and posttraumatic stress disorder (PTSD), which is understandable given a lifetime of medical surveillance and often multiple invasive procedures. In a study using the self-report PTSD Checklist–Civilian version to assess symptoms in relation to any trauma, 21% of 134 adults with congenital heart disease met criteria for PTSD symptoms, a rate markedly higher than that reported in the general community.⁶⁹ Furthermore, in the context of specific genetic conditions such as DiGeorge syndrome (22q11.2 deletion) and 3q29 recurrent deletion, there is an incidence of other psychiatric disorders, including psychotic disorders, autism spectrum disorder, and ADHD.^{70,71} For example, individuals with 22q11.2 deletion syndrome, which is associated with conotruncal defects such as tetralogy of Fallot,⁷² face an elevated prevalence of psychiatric disorders; \approx 25% will develop schizophrenia, highlighting the necessity of interdisciplinary care.⁷³ Among individuals with Down syndrome, of whom approximately one-third to one-half will have cardiac malformations,⁷⁴ between one-quarter and one-third demonstrate maladaptive behavior, and the reported prevalence of psychiatric disorders (eg, autism, depression, ADHD) varies significantly, from 6% to >50%.⁷⁵ We are unaware of published studies of psychological outcomes focused specifically on individuals with both congenital heart disease and Down syndrome.

There is emerging evidence that health care use (eg, more emergency department visits and hospitalizations and costlier hospitalizations) and mortality risk are higher for adults with congenital heart disease and comorbid depression or anxiety.^{5,76} A recent study examining outcomes for 1146 outpatient adults with congenital heart disease found those with a history of major depression to be more likely to have severe complex congenital heart disease, cyanosis, and worse functional class.⁴ Furthermore, diagnosis of depression was associated with biomarkers indicative of systemic inflammation (eg, high-sensitivity C-reactive protein) and heart failure (eg, NT-proBNP [N-terminal pro-B-type natriuretic peptide]), as well as increased risk of mortality, even after adjustment for important confounders.⁴ A clinical diagnosis of depression was associated with an increased risk of mortality among both men and women, with no notable differences based on sex.⁴

Summary

Individuals with congenital heart disease face a range of potential adverse life experiences that may affect psychological, social, educational, vocational, and medical

outcomes across the life span. Awareness of patients' psychological needs is a necessary yet insufficient approach to comprehensive care. To use a medical analogy, within our field, it is accepted that one of the advantages of uninterrupted retention in specialized congenital heart disease care is the opportunity to detect cardiac symptoms and diagnoses that warrant prompt medical intervention. The assumption is that the avoidance of unnecessary delays in treatment can improve early and longer-term outcomes. A similar approach to timely mental health intervention is warranted, such that there is clear need for more timely recognition and treatment of significant psychological distress.

MENTAL HEALTH INTERVENTIONS

Given the widely documented challenges to mental health experienced by individuals with congenital heart disease across the life span, investment in psychological intervention is a high priority. Unfortunately, most children, young people, and adults with congenital heart disease who report clinically significant psychological distress in research studies have not received timely mental health treatment (psychotherapy or psychotropic medication) or other appropriate intervention.^{2,42} There are likely multiple reasons for this, including stigma and insurance barriers for many individuals. Social determinants of health must also be considered; a recent study demonstrated that non-Hispanic Black, Hispanic, and Asian American children (compared with non-Hispanic White children) and uninsured children with congenital heart disease are less likely to receive a diagnosis or to have treatment for a mental health condition.⁷⁷ If symptoms of emotional distress impede daily functioning or impair quality of life, treatment referral is clearly warranted. Mental health professional availability, however, varies between institutions and geographic regions.

We strongly advocate for the integration of mental health professionals within congenital heart disease teams or the "medical home." This has become standard in oncology settings; however, it is disappointingly uncommon in congenital heart disease. Embedding psychologists and other mental health professionals within congenital heart disease teams can normalize emotional reactions to health challenges, reduce stigma associated with seeking mental health treatment, and improve timely access to appropriate, specialized mental health care from experienced clinicians. Integration of mental health professionals within congenital heart disease teams allows a more comprehensive interdisciplinary approach to patient and family care. Mental health professionals may also develop or support other opportunities to enhance psychological well-being, including peer support groups and camps for individuals with congenital heart disease, which create a sense of belonging and acceptance and are highly valued by participants.^{78,79} Furthermore, they

may foster psychologically informed care within the congenital heart disease team, which includes promoting a soothing presence through voice and touch, creating a healing environment, supporting the psychological needs of the whole family, training clinicians to provide emotional support, and empowering patients.^{80,81}

Models for the integration of psychologists and psychiatrists within both pediatric cardiology and adult congenital heart disease care teams exist and have shown benefit.^{41,81–84} Within these clinical models, the frequency and duration of sessions and the application of specific therapeutic techniques are based on an individual's presenting psychological concerns; current coping abilities; and needs, values, and preferences. A retrospective review of 100 adults with congenital heart disease referred to an experienced psychologist integrated within an adult congenital heart disease team found that cognitive-behavioral therapy was associated with reductions in self-reported psychological distress.⁸³ Integration of psychologists and other mental health professionals within congenital heart disease programs (in contrast to referral to community clinicians) may offer multiple advantages, including the following:

- Timely provision of psychological care, which is grounded in an in-depth understanding of congenital heart disease and tailored to the unique needs of individual patients within a setting with which they are already familiar and engaged;
- Increased awareness among all congenital heart disease team members of consideration of psychological and social factors when making treatment recommendations, creating a culture of psychologically informed care;
- Greater opportunities to provide access to mental health care regardless of socioeconomic or insurance status;
- Knowledge about which forms of mental health treatment, including which approach to psychotherapy, are most appropriate for individual patients;
- Superior interdisciplinary health care coordination and communication (eg, shared electronic medical records, colocation of office and clinic space, attendance at medical rounds and case conferences, mental health care rounds);
- Increased comfort with and confidence in initiating discussions of patient and family psychological well-being among congenital heart disease physicians and nurses, knowing that they have a colleague to whom they can refer patients as appropriate;
- Education and skills-based training of congenital heart disease team members and trainees (eg, developmentally appropriate care, psychologically informed and trauma-informed care, delivering difficult news); and
- Interdisciplinary quality improvement and research collaboration.

Table 1. Psychotropic Drugs and Specific Considerations for Individuals With Congenital Heart Disease*

Psychotropic class	Pharmacological effects of cardiovascular significance	Specific considerations for individuals with congenital heart disease
SSRIs used for mood, anxiety, or obsessive-compulsive disorders (eg, citalopram, escitalopram,† fluoxetine,† fluvoxamine,† sertraline†) SNRIs used for mood, anxiety, or obsessive-compulsive disorders (eg, duloxetine,† desvenlafaxine, venlafaxine) SNRIs used for ADHD (atomoxetine‡)	CYP450 inhibition by SSRI/SNRI (fluoxetine, fluvoxamine, and paroxetine have a stronger effect than citalopram, escitalopram, sertraline, and venlafaxine) ¹⁰⁶ Potassium channel blockade: QTc prolongation (variable and overall modest) ¹⁰⁷ Noradrenergic side effects (SNRI): increased heart rate and blood pressure (modest)	Overall, SSRIs are considered safe and typically preferred as first-line pharmacotherapy for depression and anxiety in pediatric and adult populations. SNRIs are also considered safe for use in the management of depression and anxiety in adult patients. Duloxetine is the only SNRI approved for the management of anxiety in pediatric patients. SNRIs cause modest increases in heart rate and blood pressure, and similar considerations apply as with psychostimulants below. Caution is indicated when used with medications that interact with the CYP450 pathway, including anticoagulants (eg, warfarin) and β-blockers (eg, metoprolol). Caution is indicated in patients with hepatic dysfunction/heart failure and in the presence of electrolyte abnormalities. The unknown risk of arrhythmia should be weighed against risk of undertreating anxiety-depressive disorders. ^{108,109}
TCA (eg, amitriptyline, clomipramine, imipramine)	Sodium channel blockade: type IA antiarrhythmic effect causing electric conduction delay with prolongation of PR and QRS Potassium channels blockade: QTc prolongation (worse than SSRIs) ¹⁰⁷ α ₁ /α ₂ -Adrenergic receptor blockade and anticholinergic effects: orthostatic hypotension and sinus tachycardia	TCA are associated with a mild increase in risk of arrhythmias in the first month of treatment. They should be avoided or carefully monitored in patients with proarrhythmic conditions. Patients with postsurgical intracardiac scars or conduction abnormalities (Fontan procedure, tetralogy of Fallot repair, atrial switch, I-looped heart) are more prone to reentrant tachyarrhythmias and higher degree of heart block. Because of the unfavorable side effect profile, TCAs are considered second-line therapy for depression or anxiety in adults ^{106,110} and are not recommended for managing depression or anxiety in children and adolescents with congenital heart disease.
Mood stabilizers (eg, lithium,§ valproic acid, lamotrigine)	Sodium channel blockade: Lithium can cause dose-dependent inhibition leading to decreased intracellular potassium and related electrocardiographic abnormalities (including increased QTc dispersion but not QTc duration at therapeutic dose), bradycardia, conduction abnormalities, and ventricular tachyarrhythmias. ^{111,112} Lamictal exhibits class IB antiarrhythmic activity and can slow ventricular conduction.	Lithium can be associated with time-dependent decline in renal function. ¹¹³ It rarely induces bradycardia and should be used with caution with other bradycardia-inducing agents (eg, β-blockers). Thiazides can increase lithium levels and lead to toxicity. Hypokalemia should be avoided or corrected in patients taking lithium. Valproic acid can cause thrombocytopenia, hepatotoxicity, and increased toxicity in hypoalbuminemic states. ¹¹³ Both valproate and lithium can cause major congenital malformations in the fetus. Lamotrigine should be avoided in patients with cardiac conduction disorders (ie, second- or third-degree heart block). Concomitant use of other sodium channel blockers may increase risk of conduction abnormalities. ¹¹⁴
Benzodiazepine anxiolytics (eg, alprazolam, clonazepam, lorazepam, oxazepam, temazepam)	No direct pharmacological cardiovascular effects or electrocardiographic changes are seen, but indirect decrease in heart rate and blood pressure can occur as a result of their anxiolytic properties.	Indicated primarily as second-line therapy for acute anxiety management and for short-term use. ¹¹⁰ Can lead to reduction in anxiety-associated tachycardia and myocardial work. Continuous use for ≥4 wk is associated with possible tolerance and withdrawal symptoms. ¹¹³ Metabolized by the liver and can have long-acting metabolites; lorazepam, oxazepam, and temazepam undergo conjugation and are less dependent on global liver function. Caution is indicated when used with other medications metabolized by the liver and in the presence of hepatic dysfunction attributable to heart failure; lorazepam, oxazepam, and temazepam are safer choices in patients with polypharmacy or hepatic dysfunction.
α ₂ -Adrenergic receptor agonists (eg, clonidine,‡ guanfacine,‡ dexmedetomidine)	Central α ₂ adrenergic receptor stimulation decreases heart rate and blood pressure (modest). ^{115,116}	Patients on antihypertensive or diuretic drugs are at increased risk for hypotension, especially during initiation and after each dose increase.
Psychostimulants used to reduce ADHD symptoms (eg, amphetamine/dextroamphetamine mixed salts,‡ lisdexamfetamine,‡ methamphetamine,‡ methylphenidate‡)	Catecholaminergic effects: elevation of resting heart rate and increased systolic blood pressure (modest) ¹¹⁷	Caution is needed when used in patients with dynamic subaortic stenosis, dilated aorta, and severe left ventricular dysfunction or those at risk of severe arrhythmias. ^{118,119}
Antipsychotics (eg, aripiprazole,§ clozapine, haloperidol, olanzapine,§ quetiapine,§ risperidone§)	Potassium channel blockade: prolonged QTc prolongation (variable) ¹²⁰ α ₁ -Adrenergic receptor blockade: orthostatic hypotension	The unknown risk of arrhythmia should be weighed against risk of undertreating psychosis or bipolar disorder. Metabolic syndrome (weight gain, dyslipidemia, and diabetes). ¹²¹ Caution when used together with antihypertensive or diuretic drugs because of increased risk for hypotension, especially during initiation and after each dose increase.

ADHD indicates attention-deficit/hyperactivity disorder; SNRI, serotonin-norepinephrine reuptake inhibitor; SSRI, selective serotonin reuptake inhibitor; and TCA, tricyclic antidepressant.

*This table is not meant to be an exhaustive list of side effects for each medication.

†US Food and Drug Administration approved for management of major depressive disorder, generalized anxiety disorder, or obsessive-compulsive disorder in pediatric patients.¹²²

‡US Food and Drug Administration approved for management of ADHD in pediatric patients.¹²³

§US Food and Drug Administration approved for management of bipolar I disorder,¹²⁴ schizophrenia, or irritability associated with autism spectrum disorder in pediatric patients.¹²⁵

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Coordination of mental health care should not be considered a single event but rather an ongoing collaborative process of communication and shared care among congenital heart disease medical, nursing and allied health professionals; mental health professionals; and patients and families. During referral to psychological services, it is important to consider patient and family needs and values, including preferences for individual, family, or group psychotherapy; pharmacotherapy; or peer support.^{85,86} Selection of specific therapeutic approaches should be culturally sensitive, developmentally appropriate, and commensurate with the individual patient's cognitive abilities, given the known risks of neurodevelopmental and neurocognitive impairment in congenital heart disease.²⁹ We provide an overview of psychotherapy and pharmacotherapy approaches for the congenital heart disease patient population below.

Psychotherapy

There are many different approaches to psychotherapy (often referred to as talk therapy). Therapists working in medical settings may align mainly with one approach, yet they typically incorporate techniques of others as appropriate. The following is a nonexhaustive list of examples of approaches to psychotherapy that might be offered to individuals with congenital heart disease. Cognitive-behavioral therapy, with a focus on challenging and modifying maladaptive cognitions and behaviors, has a strong evidence base to support its use in the treatment of depression and anxiety with children and adults, including in the primary care setting, and among adults with cardiovascular disease.⁸⁷⁻⁸⁹ It was the chosen framework for a coping skills intervention developed for adults with congenital heart disease.⁹⁰ Acceptance and commitment therapy is an approach to cognitive-behavioral therapy that emphasizes psychological flexibility, and preliminary research indicates acceptability among adults with heart disease.⁹¹ Trauma-focused therapy typically includes exposure techniques and cognitive processing and has proved effective for children and adults with PTSD.^{92,93} Eye-movement desensitization reprocessing therapy is another treatment that targets trauma and PTSD.⁹⁴ Mindfulness-based interventions, which typically include meditation and relaxation techniques, have also demonstrated positive psychological outcomes for individuals, including those with cardiovascular disease.⁹⁵ Attachment-based psychotherapies often take a child-led approach and focus on supporting and strengthening the parent-child attachment relationship.^{96,97} Psychodynamically oriented therapies focus on patterns in an individual's thoughts, feelings, self-concept, relationship and life experiences using a developmental perspective to understand how early experiences may influence present psychological difficulties.⁹⁸ We draw on strong empirical support for psychotherapy in the general population and among

individuals with heart disease and on our collective clinical experiences to suggest that psychotherapy is likely beneficial within the congenital heart disease setting.

Published trials of psychological interventions for children, adolescents and parents affected by pediatric-onset chronic illness (including but not limited to congenital heart disease) have yielded encouraging results. Demonstrated benefits of these interventions include less procedure-related distress, greater disease-related knowledge, more appropriate health care use and improvements in a range of psychological outcomes.^{99,100} Short-term behavioral interventions (mean total duration, 7.5 hours) have been trialed most frequently and appear to have meaningful beneficial effect for up to 12 months after intervention.⁹⁹ Differences in intervention effects have been identified for age and sex, with women, older children and adolescents on average reporting greater emotional or behavioral benefits.

Unfortunately, published psychotherapy outcomes in congenital heart disease are scarce. Two recent systematic reviews synthesized evidence from controlled trials of psychological interventions in congenital heart disease. One focused specifically on interventions for parents of infants during intensive care unit admission,³⁴ and the other included interventions for patients of all ages with childhood-onset heart disease or their family members.¹⁰¹ For parents of children with congenital heart disease, interventions focused predominantly on education, parenting and coping skills training, parent-infant interaction and bonding, procedural preparation, child school readiness, or early pediatric palliative care. Tested interventions demonstrated significant reductions in maternal anxiety and improvements in maternal coping, family functioning, child school functioning and absenteeism but yielded mixed evidence of efficacy for other parental (eg, depression) and child (eg, neurodevelopment, feeding) outcomes. For adolescents and adults with congenital heart disease, interventions targeted mindfulness, resilience, cardiac rehabilitation, exercise and peer engagement, and none yielded evidence of changes in psychological outcomes. This finding signals the need to explore other therapeutic approaches and to identify potential barriers and facilitators to successful intervention and support for older patients.

More recently, a pilot study assessing the feasibility of group-based cognitive-behavioral therapy (eight 90-minute sessions) for adults with congenital heart disease identified several barriers to participation, including scheduling and transportation.⁹⁰ Intervention content included psychoeducation (eg, information about common psychological aspects of living with congenital heart disease), cognitive-behavioral strategies (eg, cognitive restructuring, relaxation training, behavioral activation, activity pacing, strategies to improve sleep), social interaction and communication skills training. Although the sample was small, a moderate effect size favoring the intervention was found for depressive

symptoms. Given the paucity of interventions for adults with congenital heart disease, extrapolation from acquired heart disease research may be informative. A Cochrane systematic review and meta-analysis of 35 randomized controlled trials of psychological interventions (including at least a 6-month follow-up) for adults with coronary artery disease (N=10 703) concluded that psychological interventions improved depressive symptoms, anxiety and stress and reduced cardiovascular mortality.¹⁰² Considerable uncertainty remains, however, about the magnitude of these effects, which approaches are most likely to yield greatest benefit, and for whom.

Across the developmental spectrum, the small number of existing trials in congenital heart disease is limited by the use of nonrandomized designs, substantial variability in the discipline, training and experience of individuals providing intervention, low response and high attrition rates, short duration of follow-up assessment, and limited diversity of study samples (eg, in terms of race, ethnicity, socioeconomic resources, congenital heart disease complexity). Large-scale studies with prespecified trial and intervention procedures, validated measurement techniques and greater participant engagement and diversity are needed to rigorously test the effects of protocolized psychological intervention for individuals with congenital heart disease and their families. Such trials should include well-defined outcomes monitored over at least 6 months (preferably 12 months) after the intervention to assess durability of benefits. Because accessibility is crucial to the success of psychotherapies, innovative delivery mechanisms, including the use of telemedicine and digital platforms, should be considered in future investigations, along with economic and process evaluations to provide evidence for sustainable implementation.¹⁰³

We advocate for the rigorous, empirical investigation of protocolized psychological interventions for individuals with congenital heart disease. At the same time, we recognize and value the unique nuances of psychotherapy practiced in the clinical setting, in which treatment goals, foci and therapeutic techniques vary between clinicians and patients. For example, the course of psychotherapy would appropriately differ among a parent-infant dyad to support bonding and attachment during an extended hospital stay, a child experiencing intense separation anxiety, an adolescent struggling with decision-making, a young adult facing a complex surgical intervention, and an adult facing the end of their life. An embedded mental health professional, familiar with common challenges faced by individuals with congenital heart disease, would make an informed decision about the therapeutic approach and techniques appropriate for use in each situation.

Pharmacotherapy

Just as congenital heart disease diagnosis and medical management entail great heterogeneity, so do pathways

to psychiatric pharmacotherapy. A first challenge for individuals with congenital heart disease is that symptoms related to their underlying cardiac condition may be misattributed to an emotional or behavioral problem. For example, shortness of breath secondary to cardiac dysfunction may be mislabeled as anxiety, and poor appetite and psychomotor retardation related to heart failure may be misdiagnosed as depression. Psychotropic medications should therefore be initiated only once evidence of a comorbid psychiatric disorder is clearly determined.

In childhood and adolescence, some disorders may be managed without medications through psychotherapy that may enlist support from family members; however, some individuals will benefit from psychopharmacological interventions for improved outcomes and functioning. More common indications for psychotropic medication prescription in the pediatric setting include severe internalizing (ie, anxiety and depression) and neurodevelopmental difficulties (eg, ADHD) associated with significant psychosocial or functional impairment. Among patients with heart transplantation seen at a US pediatric institution and referred to a transplantation psychology/psychiatry service, 23% included a psychopharmacology consultation.⁸⁴

Consistent with pediatric patients, some adults with congenital heart disease and sustained severe psychological distress may also benefit from augmentation with pharmacotherapy, particularly in instances of psychotherapy failure. We are unaware of published trials of psychotropic medication prescription for adults with congenital heart disease. In a retrospective cohort study from a single-center adult congenital heart disease program in the United Kingdom, 3.3% of patients had documented use of antidepressants in their medical record, most often selective serotonin reuptake inhibitors.¹⁰⁴ Patients who had a prescription for antidepressant medication were more likely to be women, older and suffering from more complex congenital heart disease. After propensity score matching for variables potentially affecting risk of death, men but not women who required antidepressants were found to have 44% excess mortality (hazard ratio, 1.44 [95% CI, 1.17–1.84]). Causes of death were generally thought to be unrelated to antidepressant use but may be linked to the severity of the underlying cardiac condition that drove the need to initiate antidepressants. This possibility is further strengthened by the lack of evidence of increased arrhythmogenic or sudden cardiac death in the group receiving antidepressants. It is also possible that antidepressant medications may have been prescribed as part of palliative care, given increasing involvement of psychiatry during end-of-life care.¹⁰⁵ The low rate of antidepressant medication use in this British study (<5%) highlights the difference in prescribing patterns between countries. In a similar study from the United States, the rate of documented antidepressant use in adults with congenital heart disease was 18%.⁴

Table 2. Clinical Directions for Pediatric Cardiology and Adult Congenital Heart Disease Programs and Clinicians

Identify psychological care and outcomes as essential components of routine congenital heart disease care within one's program
Improve the ability of all clinicians (including physicians and nurses) to recognize psychological distress indicative of the need for clinical intervention
Collaborate with teachers, counselors, and educational systems to enhance neurodevelopmental, academic, and psychosocial outcomes
Address stigma and other barriers that may be associated with reluctance to seek mental health care
Establish guiding principles and metrics for assessing psychological functioning and other patient-reported outcomes, as well as best practices for coordinating mental health care across the life span
Integrate short-term assessment and treatment for health-related psychological challenges within congenital heart disease care teams, and develop pathways for longer-term mental health treatment within the community as appropriate
Expand the care model to address the psychological needs of families, including parents, caregivers, siblings, and spouses/partners
Promote peer mentorship programs for patients and family members
Commit to the provision of psychological care that is culturally sensitive and cognizant of social determinants of both physical and mental health
Ensure that mental health care is individualized to the cognitive abilities of patients, being mindful of the unique needs of those with genetic syndromes that affect neurodevelopmental and psychiatric outcomes
Develop strategies and business models for sustainable integration of mental health professionals within congenital heart disease teams, with particular attention to ensuring equity of access to care regardless of insurance coverage
Engage in advocacy and promote social justice initiatives to ensure inclusion and health equity and to reduce ableism

Table 1 summarizes general and congenital heart disease-specific considerations for each class of psychotropic medications. Among them, the most frequently used in pediatric patients with congenital heart disease are central nervous stimulant and nonstimulant medications targeting ADHD. Although there is no definite contraindication to the use of psychostimulants, antidepressants, mood stabilizers, or antipsychotics in individuals with congenital heart disease as a whole,¹²⁶ the safety profile of proposed drugs should be evaluated in the context of the medical history and symptoms of each patient. Despite the reported effects of stimulant and nonstimulant ADHD medications on heart rate and blood pressure, multicenter studies have shown that stimulant use was not associated with increased risk of serious cardiac events,^{127,128} even in high-risk groups such as individuals with congenital heart disease,¹²⁹ who otherwise have no specific arrhythmogenic background.¹²⁶ Given the evidence that inadequate treatment of ADHD is associated with significant risks, including increased accidents, academic failure, and substance misuse,¹³⁰ a risk-benefit analysis should inform treatment decisions. Pharmacological treatment for ADHD has been shown to improve psychosocial health-related quality of life over time,¹³¹ and its use is considered safe in children with congenital heart disease.¹³² However, studies are still needed to assess whether diagnosis and treatment of ADHD in school-aged children with

congenital heart disease can improve their psychosocial well-being into adulthood.

Before psychotropic treatment is initiated, in addition to a psychological diagnostic evaluation, it is important to conduct a comprehensive medical evaluation, including physical and mental status examinations; history of and current cardiac symptomatology (eg, palpitations or syncope); and review of recent laboratory tests, electrocardiogram, imaging results, and current medications. Information about how long it takes for medications to reach full effectiveness and potential side effects should be shared with patients (and parents/caregivers in the pediatric setting).¹³³ A particular challenge in the use of such medications in children with congenital heart disease is the difficulty in assessing QTc in patients with depolarization/repolarization abnormalities, as is frequently the case among patients with a history of operated congenital heart disease. Careful monitoring and close collaboration between pediatric and adult congenital heart disease cardiologists and psychiatrists have been suggested for best outcomes.¹²⁶ Pharmacists with expertise in cardiovascular medications are also excellent resources.

Summary

Although individuals with congenital heart disease face an elevated prevalence of clinically significant psychological distress, mental health treatment for them is uncommon. There is not a one-size-fits-all approach to mental health treatment; optimal care reflects the individual's needs, cognitive abilities, preferences, and priorities. There are multiple approaches to psychotherapy and options for pharmacotherapy, although empirical investigation in congenital heart disease has been sparse. Mental health professionals with experience and expertise in congenital heart disease could facilitate personalized treatment decisions for each patient. We thus strongly advocate for a culture shift in which mental health professionals are deemed essential members of congenital heart disease teams.

CONCLUSIONS AND FUTURE DIRECTIONS

Infants, children, adolescents, and adults with congenital heart disease experience a range of adversities that can threaten their physical, emotional, neurodevelopmental and social health. Furthermore, as a reflection of the bidirectional relationship between medical and psychological well-being, emerging evidence suggests that sustained, elevated psychological stress or distress may affect congenital heart disease morbidity and mortality. The Figure provides an illustrative summary of some of the antecedents and consequences of psychological distress in congenital heart disease. Much scope remains to deepen our understanding of the nature, prevalence, predictors, and trajectories of mental health outcomes and to increase opportunities for

Table 3. Priority Areas of Future Research Investigation to Understand and Improve Psychological Outcomes of Individuals Living With Congenital Heart Disease

How do fetal and developmental origins, including parent-child bonding and attachment, influence physical and mental health outcomes across the life span?
How do individual and environmental factors affect psychological trajectories, outcomes, and access to treatment?
What are the psychological outcomes among those who also have significant developmental or cognitive differences or disabilities? How can we most effectively improve outcomes?
What factors influence family mental health outcomes (often beginning in the prenatal period), as well as family functioning and well-being?
How do racism and sociocontextual factors affect psychological outcomes and access to treatment, and how can we reduce disparities in access to and outcomes of mental health care?
How do systems of health care influence patient and family mental health outcomes?
What is the best way to identify significant psychological distress in the clinical setting?
Does routine screening for psychological distress improve mental health outcomes?
What is the prevalence of acute and prolonged traumatic stress, and what are the risk and protective factors?
What factors contribute to psychological resilience and well-being?
What is the prevalence of and factors associated with self-harm and substance use disorders, and how can we appropriately target physical and mental health care interventions?
Can we improve medical outcomes (morbidity and mortality) by reducing clinically significant psychological distress?
What is the effectiveness and safety profile of psychotropic medications across age groups?
Which protocolized psychological interventions, tested through large-scale randomized controlled trials with validated assessments, are most effective in the short and long term?
How do we most effectively engage patients across all elements of the research process to ensure that assessment approaches and interventions are acceptable and meaningful?
How can we best offer personalized approaches to mental health interventions, which may include psychotherapy or pharmacotherapy, or both?
Is teletherapy an effective modality for mental health intervention?
What are the benefits and limitations of integration of mental health professionals within congenital heart disease teams?

intervention to improve psychological health and well-being. We recognize that positive psychological adaptation and good quality of life are reported by many individuals with congenital heart disease, and we do not wish to minimize observations of tremendous resilience. Rather, we wish to increase the prevalence of psychological well-being of individuals with congenital heart disease. Table 2 provides clinical suggestions for congenital heart disease clinicians and programs. Table 3 highlights research areas that we consider of highest priority. We advocate for genuine patient engagement in the development of both clinical and research endeavors to ensure that initiatives are acceptable, meaningful, and of high priority to patients and families.

Although psychological well-being is fundamental to living a healthy, productive life, the health care system often falls well short of identifying, addressing, and treating

psychological distress among those living with congenital heart disease. This mental health crisis is certainly not unique to individuals with congenital heart disease. The lifelong effects of psychological disorders and related difficulties come at great cost, not only to individuals' quality of life but also to families and communities, with the global financial impact of mental disorders measured in the trillions of dollars.¹³⁴ Within congenital heart disease, depression and anxiety are costly to the health care system and are associated with greater risk of death. Although the field of congenital cardiology is certainly not in a position to improve access to mental health care around the world, it is definitely within reach to improve psychological outcomes within the congenital heart disease community, and there is an urgency to do so. This demands prioritization of psychological outcomes by program, hospital and community leadership.

Despite decades of research investigating psychological outcomes of congenital heart disease and strong advocacy by patients and families, a catalyst is clearly needed to move initiatives forward in the clinical setting. We presume that all stakeholders, including patients, families, those who saved the lives of infants and children born with congenital heart disease, and those who take care of adult patients, are motivated to implement a care model that offers these patients the best possible quality of life. It is the goal of this scientific statement to spur efforts to include dedicated mental health professionals within all pediatric cardiology and adult congenital heart disease interdisciplinary teams. It is time to move from awareness to implementation.

ARTICLE INFORMATION

The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

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Writing Group Disclosures

Writing group member	Employment	Research grant	Other re-search support	Speakers' bureau/honoraria	Expert witness	Ownership interest	Consultant/advisory board	Other
Adrienne H. Kovacs	Oregon Health & Science University; Equilibria Psychological Health (Canada)	NIH/NHLBI†	None	None	None	None	International Society for Adult Congenital Heart Disease Executive (unpaid)*; Conquering CHD Scientific Advisory Committee (unpaid)*	None
Lazaros K. Kochilas	Emory University; Children's Healthcare of Atlanta	Department of Defense†; NIH/NHLBI†	None	None	None	None	None	None
Judith Brouillette	Montreal Heart Institute and Université de Montréal (Canada)	Montreal Heart Institute Foundation*; Clinical Research Scholars - Junior 1 from the Fonds de recherche du Québec – Santé (FRQS)†	None	None	None	None	None	None
Patricia Ibeziako	Boston Children's Hospital	NIH/NHLBI†	None	None	None	None	None	None
Jamie L. Jackson	Nationwide Children's Hospital	NIH/NHLBI†	None	None	None	None	Adult Congenital Heart Association Medical Advisory Board (unpaid)*	None
Nadine A. Kasparian	Cincinnati Children's Hospital; Sydney Children's Hospitals Network (Australia); UNSW Sydney (Australia)	National Heart Foundation of Australia†; National Health and Medical Research Council (NHMRC) of Australia†	Cincinnati Children's Heart Institute Research Core†	None	None	None	Australian National Standards of Care for Childhood-onset Heart Disease Steering Committee (unpaid)*; Cardiac Neurodevelopmental Outcome Collaborative (CNOCC) Steering Committee (unpaid)*; Conquering CHD Scientific Advisory Committee (unpaid)*; Mended Little Hearts Medical Advisory Board (unpaid)*; Additional Ventures Catalyst to Independence Award and Project Singular Advisory Boards (unpaid)*; Surgeon General of California Perinatal ACES Task Force*	None
Yuli Y. Kim	Hospital of the University of Pennsylvania	None	None	None	None	None	Adult Congenital Heart Association Medical Advisory Board (unpaid)*; American Board of Internal Medicine*	None
Tracy Livecchi	Self-employed, Psychotherapy Practice	None	None	None	None	None	Mental Health Consultant for ACHA's Heart to Heart Peer Mentor Program*	None
Christina Sillman	Sutter Health Heart & Vascular Center, Sutter Medical Center Sacramento	None	None	None	None	None	International Society for Adult Congenital Heart Disease Leadership Team (unpaid)*	None

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*Modest.

†Significant.

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Reviewer	Employment	Research grant	Other research support	Speakers' bureau/honoraria	Expert witness	Ownership interest	Consultant/advisory board	Other
Lisa L. Giles	The University of Utah School of Medicine	None	None	None	None	None	None	None
Philip Moons	KU Leuven–University of Leuven (Belgium)	None	None	None	None	None	None	None
Liza Morton	Self-employed (Scotland)	None	None	None	None	None	None	None
Shabnam Peyvandi	UCSF	None	None	None	None	None	None	None
Annamarie Saarinen	Newborn Foundation	None	None	None	None	None	None	None
Erica Sood	Nemours Children's Hospital-Delaware	AHRQ*	None	None	None	None	Conquering CHD Scientific Advisory Committee (unpaid)*	None
Kamila S. White	Washington University and Barnes Jewish Heart & Vascular Center, University of Missouri	None	None	None	None	None	None	None

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*Modest.

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