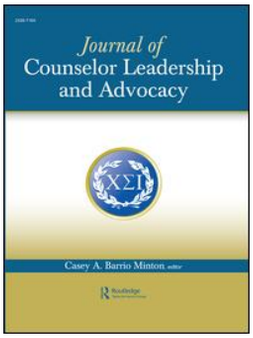

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Neuroscience research, training, and practice: adding to or subtracting from counselor identity?

Eric T. Beeson[a,b], Thomas A. Field [c], Jennifer L. Reckner[a,b], Chad Luke[d], and Laura K. Jones[e]

[a]Department of Counseling@Northwestern, The Family Institute at Northwestern University, Evanston, Illinois, USA; [b]Center for Applied Psychological and Family Studies, Northwestern University, Evanston, Illinois, USA; [c]Department of Psychiatry, Boston University School of Medicine, Boston, USA; [d]Department of Counseling & Psychology, Tennessee Tech University, Cookeville, Tennessee, USA; [e]Department of Health and Wellness, University of North Carolina at Asheville, Asheville, USA

ABSTRACT
The purpose of this exploratory and descriptive study was to explore the awareness, perceived competence, and application of an emerging framework to guide neuroscience research among professional counselors (*N*= 358). The results indicated that most counselors had not heard of, were not implementing, and perceived themselves as very unprepared to use the RDoC framework. The implications for counselor identity, training, practice, research, and advocacy are discussed.

KEYWORDS
Neuroscience; neurocounseling; RDoC

The counseling profession and our professional identity are ever evolving. Grounded in a developmental and wellness model (e.g., Barrio Minton, Myers, & Paredes, ; Mellin, Hunt, & Nichols, 2011; Myers & Sweeney, 2008), the counseling profession strives to solidify a unified vision for the profession, expand practice privileges, and create an independent body of literature (Kaplan & Gladding, 2011) that capitalizes on our unique professional values. The vision for the counseling profession must acknowledge trends within the larger mental health field, which strives to refine the classification, identification, and treatment of conditions that impair mental health and wellness. An emerging trend in both the counseling and broader mental health field is the emphasis on neuroscience.

The Emergence of Neurocounseling

The influence of neuroscience on the training and practice of counselors is becoming clearer. The late Dr. Jane Myers was an early advocate for the infusion of neuroscience in counseling (Cashwell & Sweeney, 2016; Myers & Young, 2012; Nichols & Carney, 2013). Chi Sigma Iota honored Dr. Myer's contributions with a special edition of the *Journal of Counselor Leadership and Advocacy* in 2016. This publication identified neuroscience as one of her five primary areas of scholarship that she viewed "…as a logical extension of her wellness interests" (Cashwell & Sweeney, 2016, p. 9). Dr. Myers' advocacy for the infusion of neuroscience in counseling has had a tremendous impact on recent counseling scholarship.

In the past five years, counseling leaders have expanded the definition and use of the term *neurocounseling* (Beeson & Field, 2017a; Erk, 2000; Russell-Chapin, 2016), created a Neurocounseling column in *Counseling Today*, established a "Neurocounseling" section in the *Journal of Mental Health Counseling* (Beeson & Field, 2017a), developed neuroscience interest networks in the Association for Counselor Education and Supervision (ACES), American Counseling Association (ACA), and American Mental Health Counselors Association (AMHCA), published several textbooks (e.g., Beeson & Aideyan, 2016), and

CONTACT Eric T. Beeson eric.beeson@northwestern.edu Department of Counseling@Northwestern, The Family Institute at Northwestern University, 618 Library Place, Evanston, IL 60201

solidified training standards related to the biological bases of behavior in the training of counselors (American Mental Health Counselors Association, 2018; Council for the Accreditation of Counseling and Related Educational Programs (CACREP), 2015). Chi Sigma Iota has also contributed to the proliferation of training and webinars focusing on the infusion of neuroscience and neurofeedback (Longo, 2017a; Longo, 2017b; Longo, 2017c) as well as the neuroscience of play therapy (Jayne, 2016). Despite these advancements, the expansion of neuroscience in the counseling field is not without criticism.

Researchers in allied fields have expressed concern that neuroscience findings may have a "seductive allure" (Weisberg, Keil, Goodstein, Rawson, & Gray, 2008, p. 1) that leads some to overstate and overgeneralize results (Lilienfeld, 2014 ; Gonçalves & Perrone-McGovern (2014)). Evidence suggests that people tend to have more belief in the information attached to neuroscience principles even when that information is inaccurate (Coutinho, Perrone-McGovern, & Gonçalves, 2017). These concerns have revived the debate about the alignment of neuroscience with the humanistic foundations of counselor identity (Beeson, Kim, Zalaquett, C. P & Fonseca, 2019; Wilkinson, 2018). This debate has aided the counseling field in a deeper reflection on its foundational principles within the context of the broader mental health industry that is becoming increasingly more focused on the neurobiological foundations of human functioning (Insel et al., 2010).

Notwithstanding the empirical and philosophical concerns, Myers and Young (2012) contended that neuroscience-based interventions are "consistent with counseling's wellness perspective" (p. 21) and have the potential to objectively show evidence of therapeutic outcomes in counseling. Although many of the peer-reviewed neurocounseling publications have been conceptual (e.g., Beeson & Field, (2017a)), these innovative ideas have elevated the alignment between counselor identity and emerging neuroscience while creating a solid foundation for future research hypotheses to be empirically tested (Field, Beeson & Jones, 2016; Beeson & Field, 2017b). Also, counseling researchers have started to address concerns regarding the seductive allure of neuroscience by evaluating the accuracy of neuroscience knowledge and presence of neuromyths to aid in the ethical translation of neuroscience in training and practice ([Authors,]). This increased enthusiasm regarding neuroscience in the counseling field has been fueled by the advocacy of leaders such as Dr. Jane Myers as well as shifts in the broader mental health field in the last decade.

Advancing Neuroscience in the Mental Health Field

The 1990s were affirmed as the "decade of the brain" by the United States Congress (1989). In 2008, the National Institute of Mental Health (NIMH) released a strategic plan to create an organizational system to guide research into the neurobiological processes underlying human functioning. Former President Barack Obama announced the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative in 2013, and the National Institutes of Health (NIH) responded with an ambitious research agenda. As outlined in *Brain 2025: A Scientific Vision* released by the NIH (2014), the next decade of neuroscience research will: (1) empirically evaluate brain cell type role in health and disease; (2) generate brain maps of circuits from synapses to the whole brain; (3) improve methods to evaluate the functioning brain; (4) link brain activity to behavior; (5) develop new theoretical and data analysis tools to conceptualize an understanding of the biological bases underlying mental processes; (6) develop technologies to understand and treat the brain; and (7) integrate outcomes to discover the neural correlates of cognition, emotion, perception, and action in health and disease.

The NIH emphasized the importance of interdisciplinary collaborations that are necessary to foster a holistic view of mental health research and practice. In order to guide this process, the NIMH began the Research Domain Criteria (RDoC) Initiative in 2009 to be a fluid, organizing system for neuroscience research with the goal to explore the neurobiological underpinnings of the human experience in order to identify new targets for treatment, detect subgroups of mental illness, inform treatment selection, and facilitate a more direct link of research to practice (Insel et al., 2010). Although the RDoC is an organizing framework for research, the emphasis is on translation to practice. In that spirit, the RDoC also provides a framework to conceptualize and guide clinical application.

During the ongoing dialogue about incorporating neuroscience in counseling and the continuing influence of the NIMH's RDoC, there has been little coverage of the RDoC in the counseling literature. Myers and Young (2012) urged the counseling field to embrace neuroscience given the likelihood that practice standards will stem from these initiatives; however, the RDoC has only been mentioned in a handful of publications (e.g., Beeson & Field, 2017a; Beeson & Aideyan 2016) in the counseling field and none were found that incorporated the RDoC framework in their research design. Therefore, the purpose of this article is to review the existing literature related to the RDoC and present the results from an exploratory and descriptive study that explored counselor awareness, competence, and application of the RDoC.

The NIMH Research Domain Criteria

The NIMH created the RDoC in 2009 as a part of their strategic plan to find novel ways to research mental disorders (National Institute of Mental Health [NIMH], 2016). The RDoC aims to be a fluid organizational system for neuroscience research using the RDoC Matrix (NIMH, n. d.). The RDoC matrix contains rows and columns (see Figure 1) that visually organize domains, constructs, subconstructs, and units of analysis. At the time of this writing, the RDoC Matrix was in its fourth iteration (NIMH, n. d.) and included six domains (negative valence system, positive valence system, cognitive system, system for social processes, arousal/regulatory system, and sensorimotor system) and over 30 constructs (e.g., perception and understanding of self) and subconstructs (e.g., agency) organized in rows as well as seven units of analysis (e.g., physiology) and various research paradigms (e.g., fear conditioning) organized in columns. Each cell in the RDoC Matrix provides researchers with targets to guide research design and implementation.

Figure 1 provides an example of how a researcher studying *social processes* could use the RDoC matrix to guide the design of their study. Using the RDoC matrix, the researcher could narrow their focus to the construct of *perception and understanding of self* or the subconstruct of *the agency*. In looking at the units of analysis, there were no genes, molecules, or cells identified for the study of the agency at the time of this publication. However, the researcher would find circuits (e.g., right-insula), physiological measures (e.g., scalp motor potentials), behavior (e.g., evidence of ownership for one's body, thoughts, and behaviors), and self-report (e.g., Perceptual

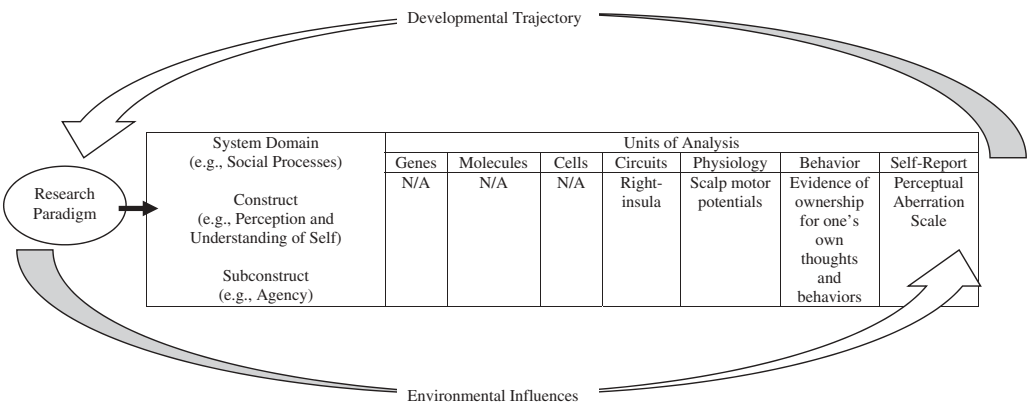

Figure 1. This figure shows how the RDoC Matrix is organized. There are six domains (e.g. social processes) and over 30 constructs and subconstructs. Each construct or subconstruct can be measured across the seven units of analysis. For instance, the subconstruct of "agency" can be measured at the genetic, molecular, cellular, neuro-circuit, physiological, behavioral, and/or self-report levels. The NIMH recommends using as many methods and units of analysis as possible. The RDoC Matrix also provides example research paradigms to design studies for each domain of interest. Finally, the RDoC considers developmental trajectory and environmental influences as meta-principles that are important in the study of all domains. N/A means that there is no available evidence for the study of this construct using the designated unit of analysis.

Aberration Scale; Fonseca-Pedrero et al., 2009) variables to consider in the research design. Some constructs have established research paradigms to guide the study of specific constructs, but the agency did not at the time of this publication. Although specific developmental and environmental influences are not outlined in the RDoC Matrix, their inclusion as meta-principles align well with a professional counselor identity and opens the research design to a variety of contextual variables related to one's experience of agency.

Each RDoC construct aims to capture the full range of human behavior and mental health from normal to abnormal (Kozak & Cuthbert, 2016), and developmental and environmental considerations are considered meta-principles in all RDoC-oriented research. These two factors as well as the interdisciplinary nature of RDoC oriented research align well with a professional counselor identity and provides a tremendous opportunity for counselors to contribute to the emerging body of knowledge (Beeson & Field, 2017a; Beeson & Field, 2017b).

Although the RDoC provides researchers with a framework to guide research design, the intention is that this research will hasten translations of research to practice (Insel, 2014). Therefore, the utility of the RDOC extends beyond research and scholarship to clinical practice. Using the above example of social processes, counselor seeking to integrate RDoC into their practice might draw on the example provided by Lebowitz, Gee, Pine, and Silverman (2018) for addressing anxiety disorders in childhood. The authors highlight the dilemma counselors encounter in treating the comorbidity of anxiety disorders in childhood, as well as the reality that these disorders represent the overactivation of otherwise adaptive systems. The RDoC matrix includes Systems of Social Support as critical to treating anxiety disorders, of which affiliation and attachment is a primary process. RDoC explores and explicates the neurobiological processes of childhood anxiety disorders vis-à-vis threat detection and stress regulation (Lebowitz et al., 2018). While discussion of the specifics of brain circuitry, molecules, and genes is beyond the scope here, knowledge of these processes can inform the treatment of childhood anxiety disorders through modifications of parental behaviors, currently referred to in the literature as family accommodation (Flessner et al., 2011).

Another important implication of the RDoC to future research and clinical practice is the relationship between the RDoC and the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association [APA], 2013). This relationship has been debated (e.g., Cuthbert, 2014; Regier, 2015; Weinberger, Glick, & Klein, 2015; Yee, Javitt, & Miller, 2015) amidst concerns regarding the validity and heterogeneity of *DSM* categories. Although many have advocated for alternative methods of classifying mental disorders, the RDoC is not meant to be or replace current diagnostic systems; rather, the RDoC aims to expand our *integrated* knowledge of the connection between neurobiology, brain functioning, and human behavior (Insel & Landis, 2013). The intention of RDoC was to incite change and promote the incorporation of transdiagnostic and interdisciplinary criteria into mental health research (NIMH, 2016). For instance, rather than promoting research in post-traumatic stress disorders, RDoC research might explore a more homogenous clinical manifestations (e.g., hypervigilance) that occurs across several mental illnesses as defined by the *DSM* (APA, 2013). This manifestation could then be conceptualized through a RDoC domain (e.g., negative valence system) and studied across several units of analysis (e.g., physiology and self-report). This research needs expertise in a variety of fields, thus promoting interdisciplinary collaboration. Ultimately, the collective hope is that this approach leads to more precise identification and treatment of mental health concerns (Insel, 2014). The fluid nature of the RDoC provides a classification system that is regularly updated as new findings emerge. One example of the fluid nature of the RDoC was the recent decision to remove references to specific genes (NIMH, 2017) due to a lack of comprehensive evidence for the link between individual genes to each construct.

Criticisms of RDoC

Despite the proposed advantages, the RDoC has received some criticism. Many researchers have expressed concern that the framework is too reductionistic by overemphasizing the biology of the

brain (e.g., Lilienfeld & Treadway, 2016; Paris & Kirmayer, 2016) and minimizing the need to understand the subjective experience of mental illness (e.g. Kozak & Cuthbert, 2016; Lieblich, Castle, & Everall, 2015). For example, five out of the seven units of analysis focus exclusively on biological indicators. This leads to the argument that the dimensions within the RDoC do not cover all clinically relevant information (e.g., social, environmental, and developmental factors that contribute to mental illness) or attempt to integrate the mind and brain, a deviation from the psychosocial model (Paris & Kirmayer, 2016). As the search for causes and treatments of mental disorders becomes more biologically oriented, there is a concern that these measures will be viewed as superior to traditional methods of data collection such as self-report and psychometric instruments (e.g., Lilienfeld, 2014) despite their own methodological limitations (Lilienfeld & Treadway, 2016).

Despite these limitations, the RDoC invites unity and conciliation between medical and wellness models by highlighting biology, behavior, developmental and environmental conditions, and self-report. RDoC oriented literature and research is moving forward and showing promise as a complementary and integrated manner of conceptualizing mental health research, training, and practice. Furthermore, given the fluid nature of the RDoC model, such criticisms are being addressed as the model progresses.

Existing RDoC Literature

Early RDoC literature focused on conceptual descriptions, definitions, rationale, and clarifications in the purpose of the RDoC (e.g., Insel et al., 2010). Many fields such as psychiatry (e.g., Insel et al., 2010) and general psychology (e.g., Cohen, Najolia, Kim, & Dinzeo, 2012) have dedicated a portion of their publications to explore, debate, and apply the RDoC to their research and practice. Given the emphasis on physiology as a unit of analysis in the RDoC Matrix, the journal *Psychophysiology* even dedicated an entire special issue to the exploration of RDoC (Patrick & Hajcak, 2016).

The existing RDoC literature also includes several editorials both for and against the new research framework, which triggered response articles from the directors of NIMH. More recent articles within psychiatry and psychology have used the RDoC framework to operationalize variables such as auditory hallucinations, childhood anxiety, and panic attacks, to name a few (Ford, 2016; Hamm et al., 2016; Lebowitz et al., 2018). Additional articles have even started to conceptualize and design treatment using the RDoC constructs (e.g., Blom et al., 2014) and describe the RDoC as a tool to enhance clinical assessment (Sharp et al., 2016). This early era of RDoC research has provided sound hypotheses to guide future research, but the intended outcomes of the RDoC, namely a better understanding of the underlying systems of the human experience that guides targeted treatments, are just beginning to emerge.

RDoC in General Psychotherapy

The general psychotherapy literature has extensively covered the evolution of RDoC as well as the potential benefits and consequences. Hershenberg and Goldfried (2015) discussed the evolution of criteria for evaluating the effectiveness of psychological interventions and described the RDoC as the "fourth generation" of outcome research (p. 160). They highlighted the potential challenges (e.g., increased reductionism) and benefits (e.g., dimensional perspective) to guide future psychotherapy research. Several authors have highlighted concerns regarding an evolving biomedical model that could threaten the future of psychotherapy research and practice as well as the profession as a whole (Goldfried, 2016; Hershenberg & Goldfried, 2015; Plakun, 2017). These concerns have also been balanced with the potential of the RDoC to support new theories of human functioning from a dimensional and translational approach to psychotherapy (e.g., Blom et al., 2014, 2017).

Four articles were found (Alexopoulos & Arean, 2014; Blom et al., 2014, 2017; Gros, 2015) that proposed innovative models of psychological intervention grounded in the RDoC for the treatment of

veterans with affective disorders, depression in older adulthood, and adolescents with difficulties in depression and anxiety. Gros (2015) discussed practical challenges and strategies to design RDoC oriented transdiagnostic research. Using an ongoing study examining affective disorders among veterans, they highlighted the challenges transdiagnostic research poses in sampling and selecting participants as well as designing control and experimental groups and selecting appropriate measures of the variables.

Alexopoulos and Arean (2014) proposed an innovative psychotherapy project grounded in the neurobiological constructs defined by the RDoC to study depression in older adulthood. They claimed that RDoC oriented practice could streamline psychotherapy practice and alter intervention design and evaluation. They highlighted the process to create new interventions as follows: conceptualize the targeted dysfunction using RDoC constructs, prioritize constructs based on their occurrence and severity in the dysfunction, create individualized treatments that target the previously created hierarchy, identify additional behavioral and environmental targets to enhance implementation, and use each component as both treatment and assessment to continue to evolve the progressive treatment of the constructs. Finally, perhaps the most influential study described a treatment approach guided by the RDoC constructs that demonstrated promising initial outcomes in the treatment of adolescents with challenges related to anxiety and depression (Blom et al., 2014, 2017). It is clear that the general psychotherapy field is challenged by the shifting landscape in the conceptualization of mental functioning as well as the potential impact on research funding and training; however, there are emerging models using the RDoC to create translational approaches to psychotherapy that demonstrate optimism for the future of psychotherapy research and practice in an RDoC era.

RDoC in Counseling

The concerns from the general field of psychotherapy are not lost in the counseling field. Despite ongoing philosophical debates regarding the general infusion of neuroscience in counseling (& Miller, in press; DeRobertis, 2015; Wilkinson, 2018; Wilks, 2018), the discourse related to the RDoC specifically has been fairly positive. The field of counseling has started to mention and discuss the RDoC in professional literature (Beeson & Field, 2017a; Crockett, Gill, Cashwell, & Myers, 2017; Hall, Jones, Tyson, Woods, & Keltz, 2016; Miller, 2016) and a few textbooks ([Authors et al., 2017]; Ivey, Ivey, & Zalaquett, 2018), but all have been conceptual. Only a few resources provide a framework to begin conceptualizing counseling research using the RDoC.

Many have elevated the need and ability for counseling values to enhance neuroscience research and applications (e.g., Beeson & Field, 2017a; Cashwell & Sweeney, 2016; Myers & Young, 2012). At the same time, works like that of Shen et al. (2017) emphasize the value of neurobiological understandings in shifting research and treatment foci from disease management to health promotion. This scholarship, primarily from the *Journal of Mental Health Counseling* and *Journal of Humanistic Counseling*, has set the tone for discourse regarding the integration of neuroscience as a whole and the infusion of the RDoC more specifically. Although *Counseling Today* has published at least one article outlining the infusion of the RDoC Beeson & Aideyan, 2016 Beeson & Field, 2017a, the RDoC has been absent from the *Journal of Counseling and Development* and *Counselor Education and Supervision*. Given this coverage, it seems like specialty fields are engaging in the discourse, but the broader counseling profession has yet to debate the importance of the RDoC to the future of the counseling profession. Nonetheless, the broader context of neuroscience-informed practice continues to evolve, and it is important for counselors to not only be aware of such research but also contribute to this emerging body of literature (Beeson & Field, 2017a).

RDoC in Clinical Practice

While the name might suggest that the RDoC is used for research purposes solely, the RDoC can also be useful to guide the creation of new interventions (e.g (Blom et al., 2014, 2017) and as a clinical tool for assessing clients (Sharp et al., 2016). Many counselors already collect clinical assessment data

from self-report and behavioral observations, two units of analysis included in the RDoC (Sharp et al., 2016). While useful, these forms of data provide incomplete information about client functioning. Self-report data can be problematic because of social desirability and recall bias (Althubaiti, 2016) alongside client potential to overemphasize or underemphasize problems (Glenn, Cha, Kleiman, & Nock, 2017). Some clients may alter their reporting deliberately (called "faking good" or "faking bad" in practice settings) or may be unaware of their emotional states and under or overreport without intending to do so (Glenn et al., 2017). The counselors' own skill may influence the accuracy of behavioral observations. Taken together, the counselor's clinical assessment of client functioning has the high potential for error and inaccuracy when the counselor relies solely on self-report and behavioral observations.

The RDoC framework encourages clinicians to collect multiple forms of data when assessing clients (Sharp et al., 2016). Adding clinical assessment data from the RDoC units of analysis, such as physiological measures (e.g., heart rate, skin temperature), to counselors' existing methods of self-report and behavioral observations could provide a more holistic picture of client functioning that aids in the differential diagnosis (Myers & Young, 2012). Unlike self-report and behavioral observations, the counselor and client's own approach to the assessment procedure has a less direct impact on the measurement of physiological functioning. For example, even if the client is attempting to underreport anxiety, their elevated heart rate and low peripheral skin temperature still indicate the presence of anxiety. A client may not know they had a traumatic brain injury (e.g., chronic concussions during soccer) that is leading to some of their symptoms, but a quantitative electroencephalography (qEEG), also known as a brain map, could reveal the potential presence of that condition, thus promoting more accurate differential diagnosis (Myers & Young, 2012). Other clients may report deficits in attention and hyperactivity during the intake interview. The use of self-reported psychometric assessments, standardized tests such as the Test of Variables of Attention (Fitzgerald, 2001; Leark, Wallace, & Fitzgerald, 2004), and a qEEG assessment would together clarify whether the client is likely to have attention-deficit problems. These are just a few examples of how multiple methods and multiple sources of information can enhance clinical practice. The RDoC provides clinicians with a useful tool to explore additional methods of clinical assessment that ultimately guide practice.

Neuroscience and the Vision for the Future of Counseling

The counseling profession has long embraced a scientist-practitioner model in the training of counselors (e.g., Borders & Bloss, 1994; Haring-Hidore & Vacc, 1988). Despite this value, best-practices continue to be "dictated to counselors by other mental health professions" (Kaplan & Gladding, 2011, p. 371). This reality has elevated the need for more rigorous evaluation of counseling outcomes. Given that RDoC research will likely become "practice standards of the future" (Myers & Young, 2012, p. 21), it is incumbent on counselor educators to remain aware of emerging research trends to aid students' evaluation and application of neuroscience research in their practice as well as develop studies that further justify the effectiveness of counseling. The RDoC provides one lens to aid counselors, researchers, and educators to meet the address key issues related to advancing the profession (Kaplan & Gladding, 2011).

The philosophical and empirical debates regarding the general infusion of neuroscience in counseling have aided students, practitioners, and scholars to cast a vision for the future of counseling identity that elevates phenomenological experiences, human development, and wellness alongside all emerging research, including that with a neuroscience focus. However, the lack of scholarly discourse regarding the infusion of neuroscience in counseling research, specifically, raises questions regarding how the counseling field will respond to the broader mental health research agenda outlined by the NIMH and creates uncertainty regarding how the broader neuroscience research agenda in the mental health field will impact counselor identity, research, training, practice, and the future of the profession. Therefore, the purpose of the current study was to explore the awareness, preparation, and current use of the NIMH RDoC principles in the counseling field.

Methods

A cross-sectional exploratory design was used to evaluate the following research questions: are counselors aware of the RDoC, prepared to use the RDoC in future research design, and using the RDoC to design research?

Participants

The inclusion criteria for the study were counselors at various stages of their career (e.g., master'-s-level counseling students, doctoral-level counseling students, counseling practitioners, counselor education faculty members). This inclusion criteria were chosen because of the wide applicability of the RDoC for research, training, and practice as well as the need to create a baseline for the counseling profession at many stages of professional development. Participants were excluded from analyses if they were not members of a counseling association, did not graduate from a counseling program, and did not possess counseling credentials (e.g., LPC, NCC). The researchers identified this exclusion criterion to ensure that the sample comprised individuals who identified with the counseling profession specifically.

Sampling

The researchers used convenience and snowball sampling methods to recruit participants. Participants were recruited through emails to CESNET-L, the ACA Neuroscience Interest Network, the ACES Neuroscience Interest Network, and the AMHCA Neuroscience Interest Network. The researchers also sent recruitment emails to faculty of counselor education programs accredited by CACREP. The researchers sent emails to program faculty identified using the CACREP database (http://www.cacrep.org) and state counseling organizations. Two state organizations did share this information, while others declined or required a fee that was not affordable for the project. Three reminder emails were sent, each approximately 10 days apart. The recruitment email contained the informed consent documentation and anonymous link to the survey. Participants could opt into a raffle for two signed copies of neuroscience in counseling textbooks.

Procedure

The researchers collected data for the current study as part of a larger survey focusing on various aspects of neuroscience in counselor training and practice. The authors used Patton's (2014) guidelines to develop the survey, to ensure that survey items addressed different properties of the constructs evaluated (e.g., knowledge and familiarity, perceptions, feelings, actions, and behaviors). The survey questions were added to a secure online survey platform. After receiving Institutional Review Board approval, the research team first tested survey questions during a pilot administration that used a similar sampling method to the approach used in the current study (i.e., convenience sampling, with a recruitment email sent to the CESNET-L listserv). The sample size for the pilot administration was 77 participants. The researchers adjusted the survey, based on responses from the first pilot administration. A few questions were removed for redundancy, and questions were added to clarify initial findings from the first administration. The second version of the survey was further refined after graduate students associated with the second author's institution took the survey and provided feedback.

After receiving a second Institutional Review Board approval, the researchers sent recruitment emails to national counseling listservs, faculty contacts at CACREP-accredited programs, and contacts at state counseling organizations. Participants were asked to answer four questions about whether they had heard of the RDoC, where they had learned of the RDoC, their current use of the RDoC, and perceived preparedness to design research using the RDoC framework. The first three questions used dichotomous (yes/no) response options. The fourth question used a 5-point Likert

scale for preparedness, from 1 (very unprepared) to 5 (very prepared). Qualitative data were not collected for the RDoC questions, as the researchers discovered during the pilot administration that the overall survey contained too many open-ended questions and was burdensome for respondents, and thus only a select few qualitative questions were used for the overall survey. If participants had not heard of the RDoC, Skip Logic was used, and they were not asked about current use or perceived preparedness to use the RDoC.

Descriptive and inferential statistics were computed for the sample using SPSS 24.0 (IBM, 2016). We used chi-square and *t*-tests to compare responses by demographic variables. We followed Campbell's (2007) and Richardson's (2011) guidelines regarding the use of N-1 chi square tests. The estimated sample size needed for 80% power at the .05 alpha level was computed using G*Power 3 (Faul, Erdfelder, Lang, & Buchner, 2007), following Cohen's (1992) recommended guidelines of .80 power. A sample size of 31 was needed for chi-square tests and 64 for *t*-tests. We exceeded these sample size criteria for the overall sample (N = 358) and the subsample that had heard of the RDoC (n = 87).

Results

Of the original 458 participants in the larger study, 358 responded to the question about whether participants had heard of the RDoC. For this study, the data set was cleaned to only report on data from participants who responded to the RDoC questions. Table 1 depicts the demographic makeup of the sample. All but one respondent provided demographic information (n = 357). Regarding gender, participants identified as female (76.2%, n = 272), male (22.4%, n = 80), and trans and non-binary (1.4%, n = 5). For ethnicity, participants identified as Caucasian/White (79.8%, n = 285), Asian-American (7.3%, n = 26), African-American (6.2%, n = 22), Hispanic/Latinx (3.6%, n = 13), Multiracial (3.6%, n = 13), American Indian and Alaska Native (0.8%, n = 3), and Arab-American (0.3%, n = 1). The average age of participants was 43.74 years (SD = 13.74), ranging from 21 to 84. The average years of experience was 10.10 years (SD = 10.81), ranging from 0 to 40. The most common work role of participants was practicing counselor (n = 158, 44.1%), followed by counseling student (n = 100, 27.9%), full-time faculty member (n = 61, 17.0%), and part-time faculty member (n = 39, 10.9%). Students were mostly master's level (n = 71) rather than doctoral level (n = 29).

Table 1. Demographic representation of RDoC exposure, use, and preparedness.

	Sample Representation		Heard of RDoC		Currently Using RDoC		Prepared to Design RDoC Research	
	n	%	*n*	%	*n*	%	*M*	*SD*
Gender[a]								
Female	272	76.2	52	19.1	5	1.8	1.81	1.02
Male	80	22.4	28	35.0	3	3.8	1.96	1.15
Trans[a]/non-binary	5	1.4	5	100	3	60	2.17	1.17
Ethnicity[a]								
African-American	22	6.2	0	0	0	0	-	
Arab-American	1	0.3	0	0	0	0	-	
Asian-American	26	7.3	0	0	0	0	-	
American-Indian+	3	0.8	1	33.3	0	0	2.00	-
Caucasian/White	285	79.8	85	29.8	11	3.9	1.87	1.07
Hispanic/Latinx	13	3.6	0	0	0	0	-	
Multiracial	13	3.6	1	7.7	0	0	2.00	-
Practicing counselors	158	44.1	33	20.9	4	2.5	1.50	0.76
Counseling students	100	27.9	21	21.0	4	4.0	2.00	1.20
Master's level	71	19.8	12	16.9	1	1.4	1.91	1.38
Doctoral level	29	8.1	9	31.0	3	10.3	2.13	1.38
Full-time faculty	61	17.0	21	34.4	1	1.6	1.90	1.00
Part-time faculty	39	10.9	12	30.8	2	5.1	2.58	1.31
Overall	**358**		**87**	**24.3**	**11**	**3.1**	**1.87**	**1.06**

Research Question 1

The first research question guiding this study was, are counselors aware of the RDoC? As depicted in Table 1, approximately one quarter of participants had heard about the RDoC (n = 87, 24.3%). A larger percentage of full-time counselor education faculty members (34.4%, n = 21) reported hearing about the RDoC compared to practitioners (20.9%, n = 33), though a N-1 chi-square test revealed this difference was not statistically significant (p = .28).

We found a difference among demographic groups regarding RDoC awareness. Participants identifying as Caucasian/White (n = 85, 29.8%) were far more likely to have heard of the RDoC than other ethnic groups. Caucasian/White represented 97.7% of the sample who had heard of the RDoC. The remaining ethnic groups contained no more than one participant who had heard of the RDoC. A N-1 chi-square test for differences between Caucasian/White (29.8%) and all other combined ethnic groups (2.6%) was highly significant, $\chi^2(1) = 21.50$, $p < .0001$, $\varphi = .25$. This represented a small-to-medium effect size. No other significant differences were found among demographic variables, such as gender, work role, age, and years of experience (all ps > .05).

Participants were exposed to the RDoC through several mediums. Most participants who had heard of the RDoC (n = 87) heard about the RDoC by reading an article (60.9%, n = 53). Respondents were also introduced to the RDoC through attending a training (13.8%, n = 12), faculty and coursework (8.0%, n = 7), conference presentations (6.9%, n = 6), subscribing to the NIMH newsletter and/or attending the NIMH summer conference (4.6%, n = 4), discussions with colleagues and in message boards (4.6%, n = 4), independent research (2.3%, n = 2), involvement in current research projects and grant proposals (1.1%, n = 1), and hearing about the topic on National Public Radio (1.1%, n = 1).

Research Question 2

The second research question guiding this study was, to what extent are counselors prepared to use the RDoC in future research design? As might be expected, participants who were using the RDoC as part of their current practice reported feeling much more prepared (M = 2.91, SD = 0.58) to create a research proposal using the RDoC framework when compared to participants without this experience (M = 1.71, SD = 0.94). This difference was statistically significant, $t(86) = 4.11$, $p < .001$, $d = .89$, representing a large-sized effect. However, it is worth mentioning that even counselors who were currently using the RDoC still felt neutral on average about their preparedness (i.e., a rating of "3" on a 5-point Likert scale), rather than somewhat or very prepared. As can be seen in Table 1, the majority of participants (72%) expressed some degree of feeling unprepared.

Research Question 3

The third research question guiding this study was, are counselors using the RDoC to design research? While a sizable minority of counselors had heard of the RDoC (n = 87, 24.3%), only nine participants (2.5%) were using the RDoC in their current research projects. Only one full-time faculty member reported using the RDoC in their research or teaching (1.6% of full-time faculty), compared to two part-time faculty (5.1% of part-time faculty), four practitioners (2.5% of practitioners), and four doctoral students (13.8% of doctoral students).

Intriguingly, belonging to professional associations and having neuroscience training in one's preparation program appeared to have some relationship to the current use of the RDoC. Table 2 depicts that all participants using the RDoC (100%) were members of counseling associations, compared with 95.4% of participants who had heard of the RDoC and 86.3% of the overall sample. Similarly, participants currently using the RDoC had the highest rates (72.7%) of belonging to neuroscience interest networks in counseling, when compared with participants who had heard of the RDoC (49.4%) and the overall sample (26.5%). Participants using the RDoC were also most

Table 2. Pathways to RDoC exposure.

	Demographics[a]		Heard of RDoCb		Currently Using RDoC[c]	
	n	%	*n*	%	*n*	%
Counseling Association Membership	309	86.3	83	95.4	11	100
NIN Membership	95	26.5	43	49.4	8	72.7
Neuroscience in Training Program	161	45.0	37	42.5	7	63.6

commonly exposed to neuroscience in their training programs (63.6%) compared with those who had heard of the RDoC (42.5%) and the overall sample (45.0%). These differences are important to note, but they were non-significant, because of the small sample sizes. Further studies could evaluate whether the link between professional association membership and prior training in one's preparation program is associated with statistically significant differences in the use of the RDoC.

Discussion

The purpose of the current study was to begin scholarly discourse regarding the infusion of neuroscience in counseling. Using the RDoC as a method informing broader neuroscience research and practice, we aimed to set a baseline for counselors' awareness, perceived preparation, and application of the RDoC in their practice. The results showed that most counselors had not heard of, perceived themselves as very unprepared to use, and were not implementing the RDoC framework. Although many have advocated for the expansion of neuroscience in counseling practice and research (e.g., Cashwell & Sweeney, 2016; Myers & Young, 2012), these results suggest that this vision has yet to be realized.

The reasons for these findings are hard to deduce given the exploratory nature of this study, but if we compare the coverage of the RDoC in counseling to other allied fields, we may be following a similar trajectory. For instance, the trajectory of scholarship regarding the RDoC in allied fields such as psychology and psychiatry can be summarized as follows: understanding of the RDoC, debating the pros and cons of the RDoC for research and practice, conceptualizing research and operationalizing variables using the RDoC, testing new treatments grounded in RDoC conceptualizations, and contributing to revisions of the RDoC Matrix. In the counseling field, it appears we are still in the early phases of RDoC integration; there have only been a few mentions of the RDoC, limited conceptual frameworks, and now this study, which provides an exploratory analysis that establishes a baseline for the counseling field that can be used to guide future research regarding the RDoC in counseling research, training, and practice.

These results identify a need to continue advocacy and education to increase the infusion of neuroscience in general, and the RDoC specifically in counseling research and practice. If we follow the trajectory of allied fields, then the next phase for the integration of RDoC in counseling is to enhance the clinical application of RDoC to conceptualize client scenarios and interventions; however, this is difficult to do if counselors are not aware of or prepared to do so. Therefore, the first step could be to increase training opportunities regarding the RDoC. Given that reading journal articles was the most common medium of RDoC exposure, it is encouraging that this article is being published; however, more training regarding the RDoC is needed, and since those in professional associations and those with neuroscience training in their educational program were more likely to use the RDoC, professional associations and training programs should intentionally increase opportunities for RDoC exposure. This could include the development of a Neuroscience Task Force to outline training standards for both practice and research. These standards could then guide the creation of training and resources to increase the infusion of the RDoC into counseling research. Other strategies to increase RDoC exposure could be to address this model in future revisions to the *CACREP Standards*. At the time of this publication, the *AMHCA Standards for the Practice of Clinical Mental Health Counseling* (2018) were the only counseling standards found that included

a reference to the RDoC. This also makes sense given that the majority of RDoC references in the counseling literature were from the *JMHC* (Beeson & Field, 2017a), which could indicate the RDoC has more relevance to counseling specialties than the profession as a whole.

The lack of perceived preparedness to use the RDoC seemed logical given the lack of awareness found in the data; however, the lack of preparedness among those who were aware was somewhat surprising given the clear organization of the RDoC matrix. For instance, the RDoC matrix provides researchers with the means to operationalize variables in studies, identify ways to measure these variables, and explore possible experimental paradigms to aid in study design. The NIMH also published a comprehensive list of self-report measures that aligns with the RDoC domains. Although most counseling researchers may not be in a position to address some of the units of analysis (e.g., molecules and cells), the units of physiology, behavior, and self-report already align with our professional identity and areas of competence (American Mental Health Counselors Association [AMHCA], 2018). With additional training, research support, and fostering interdisciplinary research teams, the exploration of circuits and other units of analysis will likewise be within reach. It is possible that the lack of preparation is related to the neuroscience topics themselves rather than the use of the RDoC Matrix. For instance, a person might be able to use the matrix to identify the variables in their study but lack the technical knowledge and skill to interpret complex neuroscience literature regarding cellular and molecular information related to their variables. Although not all participants would engage in research, as Myers and Young (2012) affirmed, if neuroscience advances become practice standards, then it is imperative to at least provide focused training to enhance skills in accessing and interpreting neuroscience research. Consistent with the findings in this study, as more people use the RDoC, it is likely that perceived preparation will increase as well, perhaps expanding the research base and notoriety of the counseling profession.

It was also surprising that rates of RDoC use were lowest among full-time faculty members. Given that research is typically conducted by academics rather than non-faculty counselors, the reasons for this finding are unclear. Previous research (Field, Jones, Luke, C & .Beeson, 2018) suggested that current students were exposed to more neuroscience in their counselor education program than former students who are already working in the field. Therefore, it is possible that existing faculty had less neuroscience training during their educational program, leading to less use in their careers as faculty. As newer counselors in training are exposed to neuroscience principles, it is essential for faculty to increase their neuroscience competencies. In fact, training in the biological bases of behavior is recommended for all faculty teaching in clinical mental health counseling programs (AMHCA, 2018). Even though not all counselor educators conduct research, at least being aware of the RDoC seems needed to align with a scientist-practitioner model in the training of counselors (e.g., Borders & Bloss, 1994; Haring-Hidore & Vacc, 1988), especially if the research will propogate emerging best-practices (Myers & Young, 2012).

In this study, the authors found no significant difference between counselor education and practitioner awareness and use of the RDoC. In both groups, relatively few professionals had heard of the RDoC and less than 10% reported using it in practice. Because the RDoC has utility for clinical assessment in addition to the selection of outcome measures in research design (Glenn et al., 2017; Sharp et al., 2016), training is needed for practitioners in addition to counselor education researchers. Of the counselor educators who have familiarity with the RDoC, it seems important for those counselor educators to share their knowledge of the RDoC with their students to help future practitioners become familiar with the clinical assessment tool. RDoC training could occur during the master's-level curriculum as part of an assessment and testing course, in addition to a research and program evaluation course. Training counselors and counselor educators in integrative clinical assessment tools such as the RDoC can potentially reduce the overreliance on error-prone assessment procedures such as self-reported information and behavioral observation (Glenn et al., 2017; Sharp et al., 2016). These assessment procedures have value when combined with the objective data of physiological measures, though have the potential for inaccuracy when solely used rather than as part of a holistic assessment battery.

The findings of the current study suggested interesting differences in RDoC awareness according to demographic groups. Specifically, participants that identified as White/Caucasian were significantly more aware of the RDoC than other participants. It is possible that this finding is an example of a larger trend regarding the lack of diversity in advanced STEM degrees (National Center for Education Statistics, 2016). This is an important consideration for counselor education programs when considering the existing degrees of applicants. If the field is called to expand neuroscience research, then students will need to be equipped to do so, and these findings raise potential concerns regarding the access to training among various demographic groups. For instance, although these demographics were not obtained, perhaps people with higher degrees could have higher income, which provide more opportunities to seek out and attend trainings not regularly offered in the counseling field. Future research should explore differences in access to education and training regarding neuroscience integration in counseling research and practice and provide intentional resources to increase the diversity in training programs.

Although the findings of this study may not be surprising given the current status of counseling literature, they do provide some empirical support for the lack of integration of neuroscience, at least via the RDoC, in counseling research among this sample. However, these findings do not provide evidence regarding the valence of these findings. For instance, some may view these findings as positive if they do not wish to see neuroscience infused in counseling research and practice or believe that neuroscience does not align with a professional counselor identity whereas others may believe that the infusion of neuroscience is a way to enhance integrated approaches that foster wellness and aligns with our professional values and not infusing neuroscience research could be an alarming sign that the counseling field is not keeping up with the broader mental health field and losing relevance. Either way, these findings illuminate the need for ongoing discourse regarding what, if any, role neuroscience in general, and the RDoC specifically, should play in counseling research, training, and practice.

Limitations

The results from the current study are best interpreted within the context of the following limitations. The study design was a small-scale cross-sectional survey of counselors that were recruited via convenience and snowball sampling. As with all online research, there was no way to verify the actual identity of participants or the overall size of the population that was reached to calculate response rates. Therefore, it is impossible to assess the true generalizability of these results, although the demographic variables in the current study were similar to that from the CACREP *Annual Report 2016* (2017) indicating that 83% of all students identified as Female and 59% of students identified as Caucasian/White.

It is also possible that this sample had a positive valence of neuroscience, which could have increased threats to validity due to response bias. This study relied on self-report to evaluate competency rather than some objective measure. Certain biases such as overrepresentation of counselors from a particular agency or university setting may also have existed in the data. The size of the sample (N = 358) may have granted some protection in this regard.

Given exploratory and descriptive nature of this research, the reliability and validity of the survey created for the purposes of this study were only evaluated with simple face validity determined by the authors who are active in the neuroscience scholarship and advocacy in the field. This limitation also reduced the opportunity for inferential statistics, thus limiting the strength in conclusions that can be drawn from the results.

Finally, conducting research is not an essential function for all counselors. Therefore, the sample recruited for this study could have reduced relevance to the purpose of the study. However, the authors assert that being aware of emerging trends in research and being able to access and evaluate research is an essential function to all counselors. Additionally, the applicability of the RDoC to both research and practice further addresses potential limitations in the chosen sample for this study.

Implications for Future Training, Research, and Advocacy

The results of the current study provide a baseline for the counseling profession's current awareness, use, and competencies related to the RDoC. The *20/20: A Vision for the Future of Counseling* highlighted an all too familiar trend that best-practices tend to be "dictated to counselors by other mental health professions" (Kaplan & Gladding, 2011, p. 371). The lack of awareness, preparation, and use of the RDoC as well as the general absence of the RDoC in the counseling literature increases the chances that this pattern continues, that standards of practice will be dictated to the counseling profession rather than created by counselors. If the counseling profession is to keep up with an ever-changing conceptualization and treatment of mental disorders as well as the promotion of wellness and peak performance, then it is essential to increase training opportunities that facilitate awareness and competency in integrated neuroscience research methodology such as the RDoC.

The relative newness of the RDoC creates an opportunity for professional counselors to influence future iterations of the matrix by infusing our professional values in the emerging RDoC discourse and research. This newness also raises concerns regarding the stability of the RDoC and the potential that it will be replaced with another model in the future. Nonetheless, neuroscience research in the broader mental health field appears to only be increasing, and it is important for the counseling profession to continue to debate all emerging research trends, including those related to neuroscience, and determine what, if any, influence they should have on our scholarship, practice, and professional identity.

In the spirit of the visionary leadership and advocacy of Dr. Jane Myers, the authors of the current study contend that the professional identity of counselors, grounded in human development and wellness, runs parallel to the spirit and potential of the RDoC that focuses on the full spectrum of human functioning, elevates developmental and environmental influences, encourages multivariate evaluation, fosters precision-based individualized care, and remains flexible to innovation. This echoes Dr. Myers view of neuroscience as an extension of the wellness orientation (Cashwell & Sweeney, 2016) that is at the foundation of the counseling profession.

In order for counselors to increase their awareness of, competencies in, and implementation of the RDoC, all counselors have a role to play. Counselor educators can remain aware of emerging neuroscience research methodology and build interdisciplinary partnerships to elevate the wellness orientation in neuroscience research. Counselor educators can also infuse emerging neuroscience competencies, such as the *AMHCA Standards for the Practice of Clinical Mental Health Counseling* (2018), into their teaching and research. Chi Sigma Iota can continue to offer continuing education opportunities and elevate the contributions of leaders in the neurocounseling movement through publications. Professional associations should continue to develop competencies and standards to ensure the ethical integration of neuroscience in training, research, and practice.

While the philosophical and empirical concerns regarding neuroscience research are warranted and need to be a part of the conversation, the authors of the current article assert that the RDoC is just like any other new model of conceptualizing the human experience and needs to be written about, debated, and evaluated in order to capitalize on the benefits and minimize the risks. As more RDoC literature is published, it is essential for counselors to be able to digest this literature to consider meaningful translations of research to practice as well as generate original research designs to evaluate it. In doing so, the counseling profession will infuse our unique professional values and identity into a brain-based era of mental health and wellness.

Disclosure statement

No potential conflict of interest was reported by the authors.

ORCID

Thomas A. Field http://orcid.org/0000-0002-0833-5038

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