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Cover Page Footnote

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Neuroscience Attitudes, Exposure, and Knowledge Among Counselors

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■ The purpose of this study was to explore the attitudes, exposure, myths, and knowledge regarding neuroscience among counselors at various stages of their careers. Descriptive statistics were used to highlight the current state of neuroscience attitudes, exposure, myths, and knowledge among a sample of counselors. The results showed that participants held positive attitudes towards neuroscience, experienced exposure to neuroscience information through various methods, believed neuroscience should be integrated in over half of the counselor education curriculum, and possessed high levels of neuroscience knowledge and average levels of neuromyths endorsed. The results provide insights that can guide the infusion of neuroscience into the counselor education curriculum.

Keywords: neuroscience, neurocounseling, neuromyths

The importance of neuroscience for the future of the counseling profession has been well documented (e.g., Beeson & Field, 2017; Ivey, Ivey, & Zalaquett, 2018; Myers & Young, 2012). Neuroscience is guiding the creation of new theories related to cognitive behavioral therapy (Field, Beeson, & Jones, 2015, 2016; Field, Beeson, Jones, & Miller, 2017) and emotional decision-making (Collura, Zalaquett, Bonnstetter, & Chatters, 2014), approaches to non-technological forms of biofeedback (Crocket, Gill, Cashwell, & Myers, 2017), conceptualizations of outcomes in creative arts therapy (Perryman, Blisard, & Moss, 2019), and conceptualizations of the relational components of addiction (Luke, Redekop, & Jones, 2018). More broadly, the influence of neuroscience on the research and classification of mental functioning through the National Institute of Mental Health's Research Domain Criteria (NIMH, n.d.) is growing (Beeson & Field, 2017), and counselors will increasingly need to find and evaluate this research as they become "practice standards of the future" (Myers & Young, 2012, p. 22).

The Council for the Accreditation of Counseling and Related Educational Programs (CACREP, 2015) has included more standards regarding the neurobiological foundations of the human experience, and the American Men-

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tal Health Counselors Association (AMHCA) has published standards related to the biological bases of behavior (AMHCA, 2018) to guide clinical mental health counseling training and practice. In addition, models for the integration of neuroscience into counselor training have emerged (Busacca, Sikorski, & McHenry, 2015). In sum, these assertions support the idea that neuroscience can complement, enhance, and promote the core values of counseling with a focus on wellness and human development (e.g., Myers & Young, 2012; Beeson & Field, 2017; Field, Jones, Luke, & Beeson, 2018; Luke, Miller, & McAuliffe, 2019); however, this assertion is not exempt from criticism. Some have stated that the expansion of neuroscience in the counseling field poses potential threats to our humanistic values (Wilkinson, 2018), while others have highlighted the risk for neuro seduction, realism, and enchantment (Coutinho, Perrone-McGovern, & Goncalves, 2017; Weisberg, Keil, Goodstein, Rawson, & Gray, 2008), in which neuroscience information is assumed to have more merit even when inaccurate or overstated.

The growing emphasis on neurobiological foundations in our training standards creates a challenge for counselor educators seeking additional training to infuse neuroscience into the counselor education curriculum competently and ethically. This challenge then impacts the training of students and the practices of counselors and supervisors. Counselors at all stages of their careers must learn how to access and evaluate neuroscience literature with the same degree of scrutiny as any other body of knowledge (Myers & Young, 2012). As counselors develop the necessary skills to digest neuroscience literature, we increase our ability to ethically translate neuroscience findings into our practices. Without a critical evaluation of basic neuroscience, we also run the risk of being seduced by the allure of neuroscience findings (Weisberg et al., 2008). To do so would be a disservice to the clients we serve and the field as a whole. If neuroscience is to play a role in the training and practice of professional counselors, it is important to explore counselor attitudes towards neuroscience, how they access neuroscience information, and the accuracy of their neuroscience knowledge to promote the ethical translation of neuroscience to counselor education, supervision, research, and practice.

Attitudes Towards Neuroscience

It is important to explore attitudes given their potential to influence the accuracy of neuroscience knowledge. Specifically, Kim and Zalaquett (2019) found that undergraduate students with more positive attitudes towards neuroscience also had more accurate neuroscience knowledge and more willingness to integrate neuroscience in their work. The exploration of counselors' attitudes towards neuroscience has been primarily anecdotal and conceptual. For instance, counselors have voiced their opinions regarding the infusion of neuroscience in the counseling field (e.g., Beeson & Field, 2017; Myers & Young, 2012; Wilkinson, 2018). The most common debate revolves around the alignment of neuroscience with counseling values. While some contend that the increased infusion of neuroscience threatens the humanistic values of the counseling profession (Wilkinson, 2018), others have argued that neuroscience is complementary to the wellness model that underscores the counseling profession (e.g., Beeson & Miller, in press; Cashwell & Sweeney, 2016). Despite their value to the ongoing dialogue about the infusion of neuroscience in counseling, the attitudes of those in the field generally have little empirical exploration.

Only one study was found that explored the infusion of neuroscience in clinical practice and training. Field et al. (2018) suggested that nearly 80% of participants believed neuroscience moved the profession closer to the core values of the profession. This study also found that most participants (over 40%) viewed themselves as novices and identified training cost and availability, self-efficacy, and time needed to learn as the biggest barriers to infusing neuroscience in their practices. Despite the benefits of this study, the findings are purely descriptive and potentially influenced by participants' biases related to the importance of neuroscience.

Although not conceptualized as a study of attitudes, Luke, Beeson, Miller, Field, and Jones (2019), which focused on perceived ethical concerns posed by the integration of neuroscience in counseling, found that 80% of participants believed there were ethical concerns related to the integration of neuroscience in counseling. Although 3% of these participants reported it would be unethical not to integrate neuroscience counseling and another 3% stated the ethical concerns are just like any other intervention being used, most of the participants reported ethical concerns around four primary themes: misalignment with counseling identity, outside the scope of counseling practice, challenges with neuroscience research, and potential for harm.

Exposure to Neuroscience Information

Attitudes towards neuroscience are influenced by when and how people are exposed to neuroscience information. Research related to the exposure of counselors to neuroscience information is limited, but at least one study identified the most common sources of neuroscience training as conference educational workshops, journal articles, and webinars/online training (Field et al., 2018). Although this study did not evaluate the effectiveness of these methods, previous research in the field of education identified the method of exposure as being a significant predictor of accuracy in neuroscience knowledge. For instance, one study of international educators found that reading popular science magazines was a significant predictor of accurate neuroscience knowledge, whereas reading scientific journals and taking in-service training were not (Dekker, Lee, Howard-Jones, & Jolles, 2012). Conversely, another study of educators in the United States found that completing college-level neuroscience coursework and reading scientific journals were strong predictors of accurate neuroscience knowledge (Macdonald, Germine, Anderson, Christodoulou, & McGrath, 2017). Similarly, Kim and Zalaquett (2019) found that college courses were the most common source of neuroscience information and that they were significantly related to accuracy in neuroscience knowledge among undergraduate students enrolled in rehabilitation counseling, psychology, and education programs. These studies show that exploring the source of exposure to neuroscience information is important, but the results are limited to the field of education and allied undergraduate programs; thus, they may not be generalizable to the counseling field.

Accuracy of Neuroscience Knowledge

Some of the most common ethical concerns regarding the integration of neuroscience in counseling involve keeping up with neuroscience literature that changes rapidly, interpreting neuroscience research, and overstating or overgeneralizing neuroscience findings (Field et al., 2018; Luke et al., 2019). Researchers in allied fields have expressed concern that neuroscience findings may have a "seductive allure" (Weisberg et al., 2008, p. 1) that leads some to overstate and overgeneralize results (Lilienfeld, 2014). Evidence suggests that people tend to have more belief in information attached to neuroscience principles even when that information is inaccurate (Coutinho et al., 2017). These findings provide a rationale for the need to explore the accuracy of neuroscience knowledge held by professional counselors.

The growth of neuroscience in the counseling profession is reminiscent of previous trends in the field of education that witnessed similar growth in the infusion of neuroscience into training and practice (e.g., Macdonald et al., 2017). In response, the Brain and Learning Project of the Organization for Economic Cooperation and Development (OECD, 2002, 2008) focused on identifying and dispelling what they deemed to be neuromyths. The OECD (2002) defined a neuromyth as a "misunderstanding, a misreading and in some cases a deliberate warping of the scientifically established facts to make a relevant case for education or for other purposes" (p. 71). The potential for neuromyths led to a body of literature aiming to assess attitudes towards neuroscience, neuroscience knowledge, and neuromyths among diverse samples of educators and students from the United Kingdom to China (Deligiannidi & Howard-Jones, 2015; Dekker et al., 2012; Gleichgerrcht, Lira Luttges, Salvarezza, & Campos, 2015; Karakus, Howard-Jones, & Jay, 2015; Macdonald et al., 2017; Papadatou-Pastou, Halious, & Vlachos, 2017; Simmonds, 2014) as well as coaches in the United Kingdom and Ireland (Bailey, Madigan, Cope, & Nicholls, 2018). The accuracy of neuroscience knowledge ranged from 47% to 70% (Kim & Zalaquett, 2019; Bailey et al., 2018; Dekker et al., 2012; Gleichgerrcht et al., 2015; Papadatou-Pastou et al., 2017), and the percentage of neuromyths endorsed ranged from 30% to 73% (Kim & Zalaquett, 2019; Bailey et al., 2018; Deligiannidi & Howard-Jones, 2015; Dekker et al, 2012; Gleichgerrcht et al., 2015; Karakus et al., 2015; Macdonald et al., 2017; Papadatou-Pastou et al., 2017). The results of this research revealed a high interest in infusing neuroscience into training and practice, low levels of accurate neuroscientific knowledge, and high rates of neuromyths.

These findings serve as a warning to those in all fields, including counselor education, that are witnessing increased infusion of neuroscience in their work. Although no direct harm has been empirically linked to the prevalence of inaccurate neuroscience knowledge, the potential for the assumed methodological superiority of neuroscience findings and passive acceptance of these findings could lead to inaccurate applications in counselor education and practice. If neuroscience findings continue to inform practice standards (Myers & Young, 2012), the inability to understand these findings could increase this risk of harm and the ability of the counseling profession to contribute to the evolving conceptualization of mental health and wellness.

Despite the exploration of neuroscience attitudes, knowledge, and myths in the broader field of education, there has been little exploration in the United States and even less in counselor education. A replication of this line of research in the United States has only recently been explored (Kim & Zalaquett, 2019). Although Kim and Zalaquett (2019) included a sample of undergraduate psychology, rehabilitation counseling, and education students, no studies exploring neuroscience knowledge or neuromyths among counselor educators, practitioners, or students were found during the development of the current study. As the role of neuroscience in counseling continues to grow, it is essential to address this gap in the literature. Given the paucity of current research, it is important to first assess and describe the current status of counselors' attitudes and exposure to neuroscience as well as their neuroscience knowledge before undertaking future inferential studies aimed at identifying strategies to enhance neuroscience knowledge and application.

The purpose of this study was to describe neuroscience attitudes, exposure, and knowledge among counselors at various stages of their careers. Establishing a baseline for the profession can guide the future infusion of neuroscience in counselor education and practice. The following research questions guided this study:

- What are counselors' attitudes towards neuroscience?
- How are counselors exposed to neuroscience information?
- How accurate is counselors' knowledge about neuroscience?

Methods

Procedure

The target population of the study was counselors in various stages of their careers (e.g., students, practicing clinicians, educators, supervisors). Given the exploratory nature of the study and the need to obtain diverse perspectives across the career lifespans of professional counselors, a broad range of counselors was chosen for this study. In addition, counselors often fill many roles, so it was important to have broad inclusion criteria to recruit counselors at various stages

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of training, in various roles, and with varying levels of interest in neuroscience to increase the study's generalizability to the field as a whole.

After receiving institutional review board approval, participants were recruited using convenience and snowball sampling methods. A recruitment email was sent to four neuroscience listservs and message boards for the American Counseling Association (ACA), the Association for Counselor Education and Supervision (ACES), the AMHCA, and the Brainstorm neurocounseling community (https://sites.google.com/view/brainstormlive) and to 359 CACREP coordinators identified from the CACREP Directory (CACREP, n.d.). CACREP coordinators were asked to forward the recruitment email to their current faculty, students, and alumni. The recruitment email, which was sent three times over the course of eight weeks, included information regarding the study as well as a link to an anonymous Qualtrics survey created for the purpose of this study. Given these methods, we could not calculate a response rate or verify the identity of participants.

Participants

In all, 416 people responded to the online survey. The mean age of participants was 37.97 (*SD* = 13.39). The participants predominately identified as female (*n* = 346; 84%), with 16% (*n* = 64) identifying as male and 1% (*n* = 3) identifying as another gender not listed. Most participants identified as White/Caucasian (*n* = 317; 77%), followed by Black/African American (*n* = 39; 9%), Hispanic/Latinx (*n* = 31; 8%), Another (*n* = 13; 3%), Asian/Pacific Islander (*n* = 9; 2%), American Indian/Alaskan Native (*n* = 2; 1%), and Middle Easterner (*n* = 2; 1%). Of the "Another" responses, 10 indicated multiple races or ethnicities.

In terms of primary role, counselors-in-training (CIT)/students made up 67% (*n* = 276) of the participants. Of the non-students, most participants were practitioners (*n* = 85; 21%), followed by counselor educators (*n* = 42; 10%), supervisors (*n* = 9; 2%), and researchers (*n* = 3; 1%). One participant did not report their primary role. Counselor educators further identified their statuses as adjunct (*n* = 7; 2%), part time (*n* = 1), and full time (*n* = 33; 8%). For the remainder of this manuscript, "students" will be used to refer to participants who selected CIT/students as their primary roles (*n* = 276; 67%) and "professionals" will be used to refer to participants who selected practitioner, counselor educator, supervisor, or researcher as their primary roles (*n* = 139; 33%). It is important to note that a portion (*n* = 15) of the participants identified student as their secondary roles (i.e., they work primarily as a practitioner but are also enrolled in a doctoral program). When combined, 291 participants reported being a student as their primary or secondary roles, but participants who reported CIT/student as their secondary roles were included in the "professional" group given their primary role designations. In addition, 364 (87.5%) of the respondents indicated two roles.

At the time of this study, 52% (*n* = 214) of the participants reported their highest degree earned was a bachelor's degree, 35% (*n* = 144) reported earning a master's degree, 12% (*n* = 48) reported earning a doctoral degree (*n* = 48), and 2% reported "other" (*n* = 6). The average time since the attainment of participants' most recent degrees was 7.69 years (*SD* = 8.23) with a range of zero to 39 years. Given the skew in this data, the median amount of time since the participants' most recent degrees was four years. Specialty areas were defined according to the program types accredited by CACREP. The largest specialty area was clinical mental health counseling (62%), followed by school counseling (10%), other (8%), marriage, couple, and family counseling (6%), addiction counseling (6%), counselor education (3%), college counseling and student affairs (2%), career counseling (2%), and clinical rehabilitation counseling (1%).

Instrumentation

Participants completed a Qualtrics online survey created for the purpose of this study. The survey included four sections: demographics (e.g., age, gender identity, racial and ethnic identity, and primary

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and secondary role), neuroscience attitudes, exposure to neuroscience information, and neuroscience knowledge and neuromyths. Given the paucity of research on neuroscience attitudes, exposure, and knowledge in counselor education, items for the survey were informed by previous research where possible, the authors' experiences with the content area, and a review of existing neuroscience resources in the counseling field.

Attitudes. The core neuroscience attitudes section included five items measuring participants' perceived need for neuroscience, time requirements, and comfort integrating neuroscience informed by the Revised Science Attitude Scale for Preservice Elementary Teachers (RSASPET; Bitner, 1994). The RSASPET is a 22-item instrument measuring comfort, need, and importance for teaching science as well as perceptions of time and equipment requirements. Reliability and validity evidence were supported by a coefficient alpha of .82, moderate to high correlations among subscales, and a principal component analysis that accounted for 55.1% of the variance among a sample of 378 preservice elementary teachers. For the current study, RSASPET items were adjusted to reflect a focus on neuroscience rather than science in general; for example, the RSASPET item "I feel comfortable with the science content in the elementary school curriculum" was reworded to "I am comfortable explaining neuroscience concepts to my clients/students/supervisees/research." Participants were asked to rate their levels of agreement (see Table 2) using a Likert scale from one ("completely disagree") to five ("completely agree") with "neither agree nor disagree" at the midpoint. Items were recoded for statistical analyses so higher scores indicated more positive attitudes towards neuroscience. These revisions were consistent with previous research on attitudes towards neuroscience in undergraduate students (Kim & Zalaquett, 2019). Cronbach's alpha for responses to these five items in the current study was 0.59.

The RSASPET also included items measuring the participants' interest in, perceived importance of, perceived preparation for, and comfort in teaching science. For the current study, a secondary set of four items were created to describe comfort, interest, importance, and preparation among the current sample. Although conceptually linked to the core neuroscience attitude items above, the items included a different Likert scale response, and they were described individually.

Participants rated their comfort levels integrating and discussing neuroscience/neurocounseling in their practices on a scale of one ("not at all comfortable") to five ("extremely comfortable"). Participants were asked to rate their levels of interest in and perceptions of the importance of neuroscience/neurocounseling to their roles (e.g., educator, researcher) on a scale of one ("not at all") to five ("extremely"). These questions were also based on previous research focusing on comfort with and interest in neuroscience among psychiatrists (Fung, Akil, Widge, Roberts, & Etkin, 2014, 2015). Survey logic connected participants' primary roles to the question about the importance of neuroscience/neurocounseling to their practices. For instance, if a person selected researcher as their primary role, the item read "How important is neuroscience or neurocounseling to your practice as a researcher?" Data analyses focused on primary roles alone, and participants were not redirected to the same questions about secondary roles. Participants also rated the level of importance of neuroscience to various reference points (i.e., their practice, faculty, supervisors, and colleagues) on a scale of one ("not at all important") to five ("extremely important"). In addition, participants rated their levels of agreement with statements about how well their institutions prepared them to infuse neuroscience in their practices on a scale of one ("completely disagree") to five ("completely agree") with "neither agree nor disagree" as the midpoint. These items are based on previous research exploring the attitudes of psychiatrists towards neuroscience (e.g., Fung et al., 2014, 2015); however, due to the differences in Likert-scale labels and the individualization of questions based on primary role, no

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reliability analysis was conducted.

Exposure. Previous research also explored ways in which participants were exposed to neuroscience information (Dekker et al., 2012; Macdonald et al., 2017). We extended this line of research by asking participants how they have been exposed to neuroscience information, how often they use these sources of information, and how prevalent neuroscience was during their training. Participants were asked to rank-order nine sources of information (i.e., college course, neuroscience interest networks, television, internet search engines, social media, conferences/workshops, books, scientific journals, and newspapers/magazines) with lower scores indicating more frequent utilization of the resource. Participants did not have the option to remove a source if it was not used. Lower scores or rankings indicated a more frequently used resource or source of information.

Participants were asked about their participation in various neuroscience groups (e.g., neuroscience interest networks) in the counseling profession on a scale of one ("never") to five ("very frequently") with an option of zero if they did not know the group existed. Participants responded to several items to assess the number of pre-selected neuroscience-related textbooks they had read; participants also had the option to enter additional textbooks that were not listed. Participants were asked about how often they read the "Neurocounseling" section of the *Journal of Mental Health Counseling* (*JMHC*) and the "Bridging Brain and Behavior" column in *Counseling Today* (*CT*) on a scale of one ("never") to five ("very frequently"), with an option of zero if they did not know the resource existed. Participants also rated how frequently they attended neuroscience/neurocounseling sessions at professional conferences on a scale of one ("very rarely") to five ("very frequently"). Finally, participants were asked specific questions regarding their views of neuroscience preparation in counselor education. Participants responded to several items measuring their perceived presence of neuroscience in the counselor education curriculum and rated how much of their counselor education curricula they perceived to include neuroscience-related content as well as how much they believed a counselor education curriculum should include neuroscience using a scale of zero percent to 100 percent.

Accuracy of neuroscience knowledge. The accuracy of neuroscience knowledge was assessed using items from previous research on neuroscience knowledge and neuromyths in education (e.g., Deligiannidi & Howard-Jones, 2015; Dekker et al., 2012; Gleichgerrcht et al., 2015; Karakus et al., 2015; Macdonald et al., 2017; Papadatou-Pastou et al., 2017; Simmonds, 2014). Given the ever-changing landscape of neuroscience knowledge, the exact items included in prior research has fluctuated. Dekker et al. (2012) created the first measure of neuromyths and neuroscience knowledge; the measure included 32 items (17 general knowledge and 15 neuromyth) that participants responded to as "Correct," "Incorrect," or "I don't know." Macdonald et al. (2017) made several changes to the Dekker et al. (2012) survey, including revising for a U.S. audience, changing response options to "True"/"False," removing the "I don't know" response choice, and rephrasing item selections to indicate advances in research regarding accuracy of items. Dekker et al. (2012) reported no reliability evidence for their study, and Macdonald et al. (2017) suggested the potential for a seven-item "classic neuromyth" (p. 6) factor that yielded a KR-20 = 0.63. They stated that the remaining items had some conceptual linkage but limited internal consistency; therefore, scores for each item were reported individually in addition to the percentage of correct neuroscience knowledge and neuromyths endorsed.

For the current study, we used the most recent iteration of response options and scoring of the 32-item survey created by Macdonald et al. (2017); however, given the lack of compelling evidence for an alternative factor structure and the need to compare with previous research, the original classification of items by Dekker et al. (2012) was used. Participants were asked to respond to 32 items (17 general knowl-

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Table 1

Neuroscience Knowledge and Neuromyths Among Participants

Knowledge		Neuromyth	
Item	% Correct	Item	% Correct
3. Boys have bigger brains than girls on average. *(True)*	26.9	29. Short bouts of motor coordination exercises can improve integration of left and right hemisphere brain function. *(False)*	4.8
13. Learning is due to the addition of new cells to the brain. *(False)*	72.6	26. Children have learning styles that are dominated by particular senses (i.e., seeing, hearing, touch). *(False)*	7.1
5. When a brain region is damaged, other parts of the brain can take up its function. *(True)*	74.2	14. Individuals learn better when they receive information in their preferred learning style (e.g., auditory, visual, kinesthetic). *(False)*	8.5
9. The brains of boys and girls develop at different rates. *(True)*	79.6	24. Exercises that rehearse coordination of motor-perception skills can improve literacy skills. *(False)*	9.1
18. Normal development of the human brain involves the birth and death of brain cells. *(True)*	82.0	17. A common sign of dyslexia is seeing letters backwards. *(False)*	17.2
23. Circadian rhythms ("body clock") shift during adolescence, causing students to be tired during the first lessons of the school day. *(True)*	82.2	22. Children are less attentive after consuming sugary drinks and/or snacks. *(False)*	20.7
16. Academic achievement can be negatively impacted by skipping breakfast. *(True)*	85.3	32. Listening to classical music increases children's reasoning ability. *(False)*	35.6
12. Information is stored in the brain in networks of cells distributed throughout the brain. *(True)*	88.8	8. Some of us are "left-brained" and some are "right-brained," and this helps explains differences in how we learn. *(False)*	37.2
7. The left and right hemispheres of the brain work together. *(True)*	89.6	4. If students do not drink sufficient amounts of water, their brains shrink. *(False)*	56.4
20. Vigorous exercise can improve mental function. *(True)*	91.1	21. Children must be exposed to an enriched environment from birth to three years or they will lose learning capacities permanently. *(False)*	63.0
15. Learning occurs through changes to the connections between brain cells. *(True)*	95.4	6. We only use 10% of our brain. *(False)*	68.2
28. Production of new connections in the brain can continue into old age. *(True)*	95.4	2. It is best for children to learn their native language before a second language is learned. *(False)*	73.1
19. Mental capacity is genetic and cannot be changed by the environment or experience. *(False)*	96.4	11. There are specific periods in childhood after which certain things can no longer be learned. *(False)*	81.3
10. Brain development has finished by the time children reach puberty. *(False)*	97.1	27. Learning problems associated with developmental differences in brain function cannot be improved by education. *(False)*	88.6
1. We use our brains 24 h a day. *(True)*	97.3	25. Extended rehearsal of some mental processes can change the structure and function of some parts of the brain. (*True)*	95.2
20. There are specific periods in childhood when it's easier to learn certain things. *(True)*	97.6		
31. When we sleep, the brain shuts down. *(False)*	99.5		

Note. When looked at together, participants had an average of 66.21% (*SD* = 8.09) correct answers.

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Table 2
Descriptive Statistics for Neuroscience Attitudes

	n	*M*	*SD*
I am willing to integrate neuroscience findings in my practice/teaching/supervision/research.	384	4.45	.75
I am comfortable explaining neuroscience components to my clients/students/supervisees/research.	383	3.16	1.28
I believe learning neuroscience takes too much time and effort.	383	1.84*	1.01
I believe neuroscience is playing an important role in our field and will continue playing the same role.	383	4.42	.79
I believe utilizing neuroscience may be harmful to my clients/students/supervisees/research.	382	1.33*	.71
Total		4.17	.60

Note. *Mean scores presented are not transformed to reverse scores. Lower scores on these items equal more positive attitudes.

Table 3
Professional vs. Student Attitudes Towards Neuroscience

Professionals				Students			
How important do you believe neuroscience or neurocounseling **was** to your…				How important do you believe neuroscience or neurocounseling **is** to your…			
	n	*M*	*SD*		*n*	*M*	*SD*
faculty?	132	2.03	1.04	faculty?	256	3.06	1.09
supervisor(s)?	131	1.94	1.03	supervisor(s)?	246	2.81	1.04
colleagues?	384	2.85	1.00	colleagues?	254	2.84	0.98

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edge and 15 neuromyth) with either "True" or "False." Correctness of items was evaluated using the instructions suggested by Macdonald et al. (2017). The percentage of neuromyths endorsed and correct neuroscience knowledge items were calculated from participants' responses. Each item can be found in Table 1.

Data Cleaning and Preparation

After recruitment ended, all responses were exported to IBM SPSS Statistics 25 for exploration and analysis. Exploration of box plots identified three potential outliers with low neuromyths and one potential outlier with low knowledge. Upon closer examination, these cases were included in data analysis since no identifiable characteristics in these participants were found to exclude them from the study. User- and system-missing data were identified, and missing data were excluded pairwise; therefore, the exact sample size per analysis varied. Finally, the neuroscience knowledge and myth questions (Macdonald et al., 2017) were transformed into variables capturing the percentages of correct neuroscience knowledge and neuromyths endorsed as identified in previous research.

Results

Neuroscience Attitudes

As can be seen in Table 2, the average of the core neuroscience attitude items was 4.17 (*SD* = .60), which indicated very positive attitudes towards neuroscience. Participants reported the most agreement to their willingness to integrate neuroscience in their practices. Participants rated the least agreement with their comfort explaining neuroscience in their practices, which also had the most variability.

Interest and importance. The average interest in neuroscience rating of participants ($n = 410$) was 4.15 ($SD = .94$), which showed that participants reported very high interest in the topic of the current study. Participants rated their perceived importance of neuroscience/neurocounseling to various reference points: their practices, faculty, supervisors, and colleagues. The average importance rating for all participants in their practices ($n = 406$) was 3.89 ($SD = 0.99$). As seen in Table 3, the ratings of professionals and students indicated very similar views of the importance of neuroscience/neurocounseling to their colleagues, but the importance ratings for the faculty and supervisor items were higher in the student group than the professional group. These mean differences were evaluated using an independent samples *t*-test. The results showed a statistically significant difference between students' and professionals' ratings of the importance to faculty ($t(386) = 8.93$; $p < .001$ with a large effect size using Cohen's $d = .97$) and importance to supervisors ($t(375) = 7.80$; $p < .001$ with a large effect size using Cohen's $d = .84$).

Perceived preparation. Participants rated their level of agreement with statements about how well their institutions prepared them to infuse neuroscience in their counseling practices. In addition, counselor educators rated their levels of agreement with how well their institutions prepared them to infuse neuroscience in their teaching. The word "institution" was not defined. Participants' average reported agreement that their institutions prepared them to infuse neuroscience in their counseling practices was 2.99 ($SD = 1.21$), and 27% of the respondents indicated "somewhat agree." In addition, participants' average reported agreement that their institutions prepared them to infuse neuroscience in their teaching was 1.95 ($SD = 1.21$). The largest percentage (55%; $n = 23$) of counselor educators reported complete disagreement with this statement.

Comfort. Participants rated their comfort levels integrating and discussing neuroscience/neurocounseling in their practices. Participants reported an average comfort integrating neuroscience in their practices as 3.09 ($SD = 1.20$) and discussing neuroscience as part of an interdisciplinary team as 2.60 ($SD = 1.13$). Most participants ($n = 126$; 31%) reported being moderately comfortable integrating neuroscience, and 42 (10%) of participants reported being not at all comfortable. In terms of comfort discussing neuroscience, 127 (31%) participants reported being slightly comfortable and 73 (18%) reported being not at all comfortable.

Researchers (*M* = 3.33; *SD* = 2.08) and practitioners (*M* = 3.33; *SD* = 1.02) were most comfortable integrating neuroscience/neurocounseling in their practices, and students were the least comfortable (*M* = 3.01; *SD* = 1.22). Researchers (*M* = 3.33; *SD* = 2.08) were also most comfortable discussing neuroscience/neurocounseling with interdisciplinary teams, whereas students were the least comfortable (*M* = 2.41; *SD* = 1.09).

Exposure

Most participants (*n* = 362; 87%) reported having learned or been exposed to some aspect of human biology or neuroscience in the past. College courses (*M* = 2.24; *SD* = 2.24) were rated as the most used source of neuroscience information, followed by scientific journals (*M* = 3.78; *SD* = 2.04), books (*M* = 3.86; *SD* = 2.04), the internet (*M* = 4.27; *SD* = 1.75), conferences/workshops (*M* = 5.04; *SD* = 2.53), interest networks in the counseling profession (*M* = 5.38; *SD* = 2.26), newspapers/magazines (*M* = 6.43; *SD* = 2.05), television (*M* = 6.71; *SD* = 1.84), and social media (*M* = 7.29; *SD* = 1.83).

The majority of the participants did not know about the neuroscience/neurocounseling interest groups offered by the ACA (*n* = 248; 60%), the ACES (*n* = 280; 67%), the AMHCA (*n* = 264; 64%), and the Brainstorm neurocounseling community (*n* = 274; 66%). The average frequency of participation in each group by participants who knew about the groups was as follows: ACA (*M* = 2.06; *SD* = 1.16), Brainstorm (*M* = 1.92; *SD* = 1.13), AMHCA (*M* = 1.90; *SD* = 1.10), and ACES (*M* = 1.63; *SD* = 0.96). Higher scores indicate more frequent participation.

The most commonly read book was Ivey et al. (2018; 29%), followed by Luke (2015; 8%); Field et al. (2017; 8%); Chapin and Russell-Chapin (2014; 7%); Other (7%); McHenry Sikorski, and McHenry (2013; 7%); and Collura (2014; 3%). The mean number of books read was .65 (*SD* = 1.02) with a range of zero to six, and 60% (*n* = 249) of the participants had not read any of the texts, nor did they enter any text in the free-text field. Many participants did not know the *JMHC* (*n* = 168; 45%) and *CT* (*n* = 162; 39%) sections existed. Among participants who knew of these resources, the average frequencies of use were 2.12 for *JMHC* (*SD* = 1.15) and 2.48 for *CT* (*SD* = 1.25). The average frequency of attendance of neuroscience sessions at professional conferences was 1.90 (*SD* = 1.04), and 45.6% (*n* = 166) of the participants selected the item stating "I would but they seldom exist."

Neuroscience coverage in the counseling curriculum. Participants varied in whether they had taken a standalone course in neuroscience, psychobiology, or a related field. Of the 383 participants who responded to this item, 212 (55%) had taken no neuroscience-related coursework, but 111 (29%) had taken coursework in their undergraduate programs and 40 (10%) had taken a standalone course in their graduate programs.

Participants rated their perceptions of how much of their counselor education curricula included neuroscience-related content using a scale of zero to 100 percent. This item measured general coverage in the curriculum rather than a standalone course. Among professionals (*n* = 113), the average infusion of neuroscience into their previous training programs' curriculum was 14.51% (*SD* = 12.25), with a median and mode of 10% and a range of 0 to 82%. Of the respondents, 10 reported zero coverage. Among those who identified as students and counselor educators in their primary roles (*n* = 262), the average infusion of neuroscience into their current programs' curricula was 24.93% (*SD* = 20), with a median of 20% and mode of 10% and range of 0 to 100%. Five participants reported zero coverage. Regarding future infusion, participants (*n* = 380) believed neuroscience must be infused into an average of 51.99% (*SD* = 23.57) of the curriculum, with a median and mode

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of 50% and a range of 0 to 100%. One participant reported zero.

Accuracy of Neuroscience Knowledge

The percentages of neuromyths endorsed and correct neuroscience knowledge items were calculated from participants' responses. Higher neuromyth percentage scores indicated more neuromyths endorsed, whereas higher knowledge percentage scores indicated more correct neuroscience knowledge. The average percentage of correct neuroscience knowledge was 84.88% (*SD* = 9.40), and the average percentage of neuromyths endorsed was 55.97 (*SD* = 13.70). Table 1 shows each knowledge and neuromyth item along with the "correct" response and the percentage of participants who got the answer "correct."

Discussion

The purpose of this study was to explore what counselors believe about neuroscience, how they are exposed to neuroscience information, and the accuracy of their neuroscience knowledge. The results of the current study provide a baseline understanding of neuroscience attitudes, methods of exposure to neuroscience information, and the accuracy of neuroscience knowledge among a broad sample of counselors at various stages of their careers. The findings are discussed below in the context of existing literature.

Attitudes Towards Neuroscience

Participants' attitudes toward neuroscience in the current study, namely their positive views, willingness to integrate, and some degree of comfort explaining various neuroscience concepts, are similar to the enthusiasm and comfort reported by practitioners in other fields, such as education (e.g., Dekker et al., 2012) and psychiatry (Fung et al., 2014, 2015). Participants believed that the time and effort required to learn neuroscience was justified and that this time and effort will play an important role in the future of the profession. These findings add nuance to previous findings in which counselors identified cost, time, and self-efficacy as the biggest barriers to infusing neuroscience in practice (Field et al., 2018). Although Luke et al. (2019) identified potential harm and misalignment with counseling values as ethical concerns with integrating neuroscience in counseling, other researchers showed that 80% of participants believed neuroscience moved the profession closer to core values, a sentiment that has been endorsed anecdotally by many counseling leaders (e.g., Myers & Young, 2012). It is important to continue to explore this debate because it is possible that counselors with more positive valence towards neuroscience could be more at risk of inappropriate integration, whereas those with a more negative valence could disregard advances in neuroscience that inform emerging best practices.

The results also support the reported growth of neuroscience interest within the profession. Although the reasons for this increase were not evaluated in the current study, this finding is consistent with the increased focus on neuroscience standards in the 2016 CACREP standards (2015) and the *AMHCA Standards for the Practice of Mental Health Counseling* (2018). If neuroscience interest and integration continue to increase, it is important to explore counselors' perceived preparation to ethically integrate neuroscience in their practices.

It was encouraging to see that the participants agreed their institutions prepared them to infuse neuroscience in their practices, but it was concerning that there was such strong disagreement regarding their preparation to infuse neuroscience in their teaching. This could mean neuroscience is being infused more at the master's level than in doctoral-level counselor education curricula, which is consistent with previous research (Field et al., 2018). When compared to past research exploring the perceived training of psychiatrists, most participants (62%) reported at least adequate training in their residency programs (Fung et al., 2014). The current study did not explore the specific ways in which neuroscience was infused in the participants' practices or teaching, but previous research focusing on educators indicated that neuroscience was

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most commonly infused in classroom practice, lesson planning, and the provision of special needs (Simmonds, 2014) as well as the assessment and session planning of coaches (Bailey et al., 2018).

Exposure to Neuroscience Information

The results of the current study revealed college courses, scientific journals, and books as the top three rated sources of information used by counselors. Field et al. (2018) showed that the most common sources of neuroscience information used by counselors included conference educational sessions, journal articles, and webinars/online training sessions; however, the study did not ask participants to rank order the frequency of their use of each source as was done in the current study. The sources of neuroscience information are important because previous research found that textbooks, college-level coursework, and scientific literature predict higher neuroscience knowledge and less neuromyths (Kim & Zalaquett, 2019; Gleichgerrcht et al., 2015; Macdonald et al., 2017). Therefore, the counselor education field could increase the use of existing neuroscience in counseling textbooks, create standalone neuroscience courses, and provide more space for neuroscience scholarship in professional journals, which is consistent with calls made by other neuroscience researchers in the counseling field (e.g., Beeson & Field, 2018; Zalaquett, Ivey, & Ivey, 2018).

One concerning finding was participants' lack of awareness of the various neuroscience and neurocounseling interest networks, groups, and publications. This lack of awareness is consistent with previous research that found over 70% of participants were not a member of any of these groups (Field et al., 2018). Assuming the current sample was already interested in neuroscience, it is even more concerning that those interested in neuroscience were unaware of and did not access the available neuroscience resources in the counseling field. Given that past research in psychiatry showed that expert-led small groups were the preferred learning strategy (Fung et al., 2014, 2015), it is important for the counseling field to create and evaluate various strategies to enhance neuroscience competencies among counselors throughout their careers.

This study also provided insights into the coverage of neuroscience in the counseling curriculum. Previous studies indicated that 39% of master's-level and 15% of doctoral-level counseling programs incorporated neuroscience to some degree (Field et al., 2018), but neither the breadth nor depth of this integration was explored. The current study offered a unique perspective on this question by exploring the perceived percentage of counseling curricula in which neuroscience was infused. Current students and educators indicated their perception that neuroscience was infused in an average of 25% of the curricula; however, current professionals indicated an average infusion of only 15% in their previous counseling programs. This again provides evidence for the perception of increased coverage of neuroscience in current counselor education programs. Interestingly, all participants believed neuroscience on average should be covered in around 52% of the total curriculum. This could indicate the need to infuse neuroscience content across the curriculum rather than standalone courses, much like the field saw with the infusion of other meta-concepts such as multiculturalism.

Accuracy of Neuroscience Knowledge

Participants in the current study had a larger average percentage of correct neuroscience knowledge (85%) than those in previous research, which ranged from 47% to 70% (Bailey et al., 2018; Dekker et al., 2012; Gleichgerrcht et al., 2015; Papadatou-Pastou et al., 2017). At least one study (Kim & Zalaquett, 2019) used a sample that more closely represented the participants in the current study and found the correct neuroscience knowledge of undergraduate students enrolled in psychology, rehabilitation counseling, and education majors to be 52% on average. These findings suggest that counselors in the current study had more accurate neuroscience knowledge than participants in previous research.

The average percentage of neuromyths endorsed in the current study was 56%. This outcome was similar to the findings in previous research, which showed a range of neuromyths endorsed from 30% to 68% (Bailey et al., 2018; Deligiannidi & Howard-Jones, 2015; Dekker et al., 2012; Gleichgerrcht et al., 2015; Karakus et al., 2015; Macdonald et al., 2017; Papadatou-Pastou et al., 2017). Kim and Zalaquett (2019) found an average of 73% of neuroscience myths endorsed in their study of undergraduate students. Although no previous research was found evaluating the impact of inaccurate neuroscience knowledge on practice, the potential for harm related to inaccurate understanding and application of neuroscience findings is at least conceptually possible (Luke et al., 2019). Future research should explore the impact of inaccurate neuroscience knowledge on counseling practice and establish benchmarks for a minimum level of neuroscience knowledge needed.

Limitations

The results of the current study must be interpreted within the context of several limitations. The study relied on self-reported data collected via online snowball and convenience sampling. Therefore, the responses are susceptible to response bias, especially considering that participants in the study had very high initial interest in neuroscience. In addition, there was no way to verify the true identity of the participants, and the sampling methods did not allow a true response rate to be calculated. Given these limitations, it is possible these results are not generalizable to counselors who do not have an interest in neuroscience.

The sample was over-representative of people who identified as female (83%), White/Caucasian (76%), and specializing in clinical mental health counseling (62%). Despite this limitation, these frequencies are consistent with the demographics in previous research on neuroscience in the counseling field (Field et al., 2018). Furthermore, the sample of participants mirrors the demographics of the field. The CACREP *Annual Report 2016* (2017) indicated that 83% of all students identified as female and 59% of students identified as Caucasian/White. The data could further be confounded by the distribution among specialty areas because it is possible that some specialty areas (e.g., clinical mental health) could include and require more neuroscience than others (e.g., career). The secondary role was also not explored in the current study.

Additional opportunities are noted to reduce the potential for measurement error. Except for the neuroscience knowledge and neuromyth measures, the remaining survey items were loosely based on previous research. Individualizing responses and differing response options limited the potential to accurately assess the reliability and validity of constructs being measured. Although this could limit the generalizability of results, these methods are consistent with early research exploring neuroscience attitudes in other fields, such as psychiatry (e.g., Fung et al., 2014; 2015). In terms of exposure to neuroscience information, participants did not have the option to remove sources that were not used, which potentially skewed the lesser-used sources.

This study also relied on descriptive data, and the significance of comparisons was not evaluated. Although this follows the trend in neuroscience attitude research in other fields (e.g., psychiatry; Fung et al., 2015), which was warranted given the current status of neuroscience research in the counseling field, future research should focus on inferential statistics to predict attitudes, knowledge, and myths regarding neuroscience. Finally, some of the comparisons of the findings from this study to previous neuroscience knowledge and myth research are difficult because participants were not given the “I don’t know” option as in previous research.

Implications for Counselor Education

Neuroscience in the training (CACREP, 2016) and practice standards (AMHCA, 2018) and professional discourse of counselors is increasing (e.g., Beeson & Field, 2017). This increase has been met with not only optimism but also some concerns regarding its impact on the humanistic traditions of the field (Wilkinson, 2018). This created the need to explore the attitudes, exposure, and knowledge about neuroscience among counselors at various stages in their careers. The results of the current study have several implications for the training and practices of professional counselors.

These results provide a baseline picture of attitudes towards neuroscience that can be used to inform future research evaluating the impact of attitudes on access to sources of neuroscience information and accuracy of neuroscience knowledge. The increasing interest and gap between the current versus ideal coverage in counselor education curricula provides a rationale to counselor educators aiming to infuse neuroscience into their classes or build standalone neuroscience courses. If attitudes towards neuroscience and perceived preparation are trending more positively, there is a need for counselor educators to better prepare themselves to bring neuroscience concepts into their classrooms and use neuroscience concepts to enhance their instructional methods. However, there is also an equal need to explore less-positive attitudes towards neuroscience, especially if neuroscience findings continue to inform standards of care in the broader mental health care system.

It is necessary for future research to explore how neuroscience is integrated in counselor education and practice. At the master's level, the 2016 CACREP standards (2015) provide a general reference to neurobiology being included in curricula, but no specific knowledge or skills are listed. It is also not feasible to continue adding new required standards for CACREP-accredited programs. Therefore, there is a need to explore the minimum level of neuroscience knowledge and skills needed for entry-level practitioners as well as in advanced training after graduation. The AMHCA is the only counseling association to produce standards related to neuroscience in the counseling field (AMHCA, 2018), but more work is needed from the broader counseling field. Master's-level training programs can explore the outcomes of standalone courses versus infusion across the curriculum, similar to what the field has witnessed in terms of other meta-standards (e.g., multiculturalism). At the doctoral level, these results support the rationale to infuse neuroscience-informed instructional strategies in the classroom (Whitman & Beeson, 2018). At the practice and supervision levels, it is important to explore what counselors mean by the integration of neuroscience in practice. Doing so would inform future research to explore the effectiveness of strategies and how they can best be taught.

The frequency and type of exposure to neuroscience knowledge needs to be further evaluated in terms of predicting accuracy in neuroscience knowledge. Although some prior research offered insight into the most effective sources of information to increase accurate neuroscience knowledge, there is a need to explore these findings in the counseling field. The current study identified the frequency of use of certain resources but did not evaluate their relationships to the accuracy of neuroscience knowledge. Future research should explore this potential relationship to guide counselors in their selection of textbooks, training materials, and other resources to enhance their accuracy of neuroscience knowledge and ethical practices. Counseling associations can also use these results to inform the creation of future continuing education programs and advanced training credentials to fill in the gaps and extend what can be taught in master's-level training.

Although the accuracy of participants' neuroscience knowledge was greater than that shown in previous research in other fields, there is currently no benchmark to evaluate essential neuroscience knowledge in the counseling field. Therefore, future research needs to identify and evaluate potential neuroscience competencies and attitudes that could identify potential barriers to infusing neuroscience. As more counselors and professional associations respond to the need to evaluate the integration of neuroscience in counseling, these benchmarks will establish standards of practice to guide future educational programs, training programs, and potential credentials.

The significance of the findings of the study are limited to the awareness of the accuracy of neuroscience knowledge. It is unknown whether accuracy of knowledge leads to practices that produce any more- or less-effective outcomes. If inaccurate neuroscience knowledge leads to the unethical integration of neuroscience and client harm, counseling associations should create clear standards that can be taught and validated. This justifies the need to continually evaluate innovative practices that is at the core of the ACA's *Code of Ethics* (2014). Until this happens, the counseling profession should use restraint when integrating neuroscience in practice until clear standards and training are validated. If the accuracy of neuroscience knowledge has little impact on practice outcomes, this discussion becomes less important, and future research efforts can focus on other lines of inquiry.

Finally, these findings call upon professional associations to address emerging trends in the broader mental health field. For instance, allied fields, such as psychiatry, began their explorations of neuroscience integration with large-scale descriptive studies of professional association members (e.g., Fung et al., 2014, 2015) that guided future studies, set policy, and informed training. To this point, only small-scale studies of counseling professionals have emerged. Professional associations should commission task forces to evaluate the broader perspective across large-scale samples of counselors across their careers.

Other fields have dedicated portions of their refereed publications to the debate and study of neuroscience integration (Beeson & Field, 2017); however, this is just starting to emerge in the counseling field led by AMHCA and the *JMHC*. Although some might argue that neuroscience is more relevant to mental health counseling than other specialty fields, it is important for the broader professional field to create space for this inquiry to explore if and how neuroscience integration fits into counselor identity, training, and practice.

The interest and infusion of neuroscience in counseling is growing, but the evaluation of this integration has just begun. If neuroscience integration continues, recommendations for standards of practice need to be grounded in science rather than opinion. For this to happen, the counseling field as a whole must provide support for this research and space for its dissemination. This study offers a baseline for this inquiry that can guide future studies aiming to craft a vision for what ethical neuroscience integration in the counseling field means moving forward.

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