A Meta-Analysis of Confidence and Judgment Accuracy in Clinical Decision Making

Deborah J. Miller, Elliot S. Spengler, and Paul M. Spengler
Ball State University

The overconfidence bias occurs when clinicians overestimate the accuracy of their clinical judgments. This bias is thought to be robust leading to an almost universal recommendation by clinical judgment scholars for clinicians to temper their confidence in clinical decision making. An extension of the Meta-Analysis of Clinical Judgment (Spengler et al., 2009) project, the authors synthesized over 40 years of research from 36 studies, from 1970 to 2011, in which the confidence ratings of 1,485 clinicians were assessed in relation to the accuracy of their judgments about mental health (e.g., diagnostic decision making, violence risk assessment, prediction of treatment failure) or psychological issues (e.g., personality assessment). Using a random effects model a small but statistically significant effect ($r = .15; CI = .06, .24$) was found showing that confidence is better calibrated with accuracy than previously assumed. Approximately 50% of the total variance between studies was due to heterogeneity and not to chance. Mixed effects and meta-regression moderator analyses revealed that confidence is calibrated with accuracy least when there are repeated judgments, and more when there are higher base rate problems, when decisions are made with written materials, and for earlier published studies. Sensitivity analyses indicate a bias toward publishing smaller sample studies with smaller or negative confidence-accuracy effects. Implications for clinical judgment research and for counseling psychology training and practice are discussed.

*Keywords:* assessment, overconfidence bias, clinical judgment, meta-analysis

Given that judgment is fallible, our beliefs about our own judgmental ability are likely to be seriously in error. —Hillel J. Einhorn

Counseling psychologists are responsible for making optimal judgments about client problems, course of treatment, and future behavior among several other decisions (Spengler, Strohmer, Dixon, & Shivy, 1995). They may also be rewarded for displaying a high degree of confidence in their decision-making accuracy as confidence may lend them increased credibility with clients and colleagues. Price and Stone (2004) called this phenomenon the confidence heuristic, whereby people prefer decision-makers “who make extreme confidence judgments” (p. 39). Across many applications extreme confidence has been associated with higher credibility, whether it is children’s perceptions of adults (Tenney, Small, Konrad, Jaswal, & Spellman, 2011), eyewitness’ accounts of a crime (Semmler, Brewer, & Douglass, 2012), or jurors’ perceptions of psychologists as expert witnesses (Cramer, DeCoster, Harris, Fletcher, & Brodsky, 2011). But does confidence equate with accuracy in the realm of psychological assessment?

Conventional wisdom might lead one to believe that counseling and other psychologists who display more confidence in their judgments are also more accurate; however, behavior decision-making theory and research appears to provide support for an overconfidence bias, which occurs when individuals report higher confidence in their judgments than is warranted by their actual accuracy (Fischhoff, Slovic, & Lichtenstein, 1977; Kahneman & Tversky, 1973; Koriat, Lichtenstein, & Fischhoff, 1980; Nisbett & Ross, 1980). Overconfidence studies typically assess the relation between judgment confidence and judgment accuracy. For example, in one such study (Carlin & Hewitt, 1990) psychologists made judgments about random versus true responding from psychological test data. Confidence ratings were high whereas accuracy was close to chance resulting in a correlation between confidence and accuracy of $-.22$. By contrast some studies show a positive association between confidence and judgment accuracy. Leli and Filskov (1984) provided neuropsychologists with test data from actual patients whose diagnoses had been verified through medical tests, surgery, or brain autopsy and were to describe if the patient was unimpaired, or as having diffuse or right-side–left-side lateralized impairment. The correlation between confidence and hit rates (accuracy) was $.28$. Leli and Filskov’s study reflects confidence that is moderately calibrated with accuracy, whereas Carlin and Hewitt’s study reflects the commonly hypothesized overconfidence effect resulting in a negative correlation.

Before addressing further the role of confidence in clinical judgment it may be helpful to briefly describe how clinical judg-
ment researchers establish judgment accuracy. Many studies of neuropsychologists’ decision making compare their judgments with the results of brain autopsies or other solid evidence as a clear criterion for measuring judgment accuracy. Other measures for establishing decision-making accuracy are also used. Desmarais, Nicholls, Read, and Brink (2010) assessed forensic mental health professionals’ confidence related to their predictions of future violence. Follow-up data a year later based on review of legal and psychiatric records determined a 44% recidivism rate. The assessors were overall confident in their predictions although confidence was statistically unrelated to predictive accuracy. Additional methods for establishing a criterion for judgment accuracy include direct behavioral observations, standardized interviews, and objective measures. For example, Haderlie (2011) found that therapists were generally overconfident in their ability to predict client progress from session-to-session when compared with clients’ responses to an objective measure (Outcome Questionnaire-45; Lambert et al., 1996). Other studies may not directly measure accuracy but their findings imply disproportionate confidence by clinicians in their intuitive powers (Lilienfeld, Lynn, & Lohr, 2015). A recent sample of 129 clinicians in practice found that the average clinician believed he or she performed at the 80th percentile in terms of client outcomes and a full 25% self-assessed as being at the 90th percentile (Walfish, McAlister, O’Donnell, & Lambert, 2012). Not a single clinician self-rated as being below the 50th percentile. Clearly such flawed self-assessment reflects overestimation of one’s professional abilities.

Overconfidence is usually thought to occur with more difficult judgment tasks, whereas underconfidence is another form of flawed self-assessment thought to occur with easier tasks (Lichtenfeld & Fischhoff, 1977). Confidence in clinical decision making has also been hypothesized as a positive quality (Glidewell & Livert, 1992). In actuality there are four different possible relations (see Figure 1). Researchers are not always clear in their description of which of the four quadrants they are testing. Boyle (2000) for example hypothesized a negative correlation, which could represent quadrants c (underconfidence) and b (overconfidence). Out of 36 mental health clinical judgment studies, we found the majority of authors conceptualized the relation between confidence and accuracy as prone to overconfidence. Garb (1986) in his review referred to the appropriateness of confidence in relation to accuracy. Because problems with appropriate calibration of confidence ratings can be due to overconfidence or to underconfidence, we use the more inclusive term of confidence bias.

The confidence bias has been found to generalize to several types of judgments routinely made by counseling psychologists. For instance, in studies of confirmation bias, or the tendency to seek confirming rather than disconfirming evidence of a clinical hypothesis, judges who were more confident were also more likely to recall confirmatory evidence that supported their hypothesis (Koriat et al., 1980). In an accumulated body of research, counseling psychologists and counselors have been found to be prone to overconfidence associated with confirmatory hypothesis testing strategies (e.g., Martin, 2001; Owen, 2008; Strohmer, Shivy & Chioldo, 1990). Nickerson (1998) noted, “Perhaps the confirmation bias should be thought of as the tendency to seek evidence that increases one’s confidence in a hypothesis whether it should or not” (p. 186). Kahneman and Tversky (1973) discussed the “illusion of validity” as occurring when “people are prone to experience much confidence even in their highly fallible judgments” (p. 249), especially when given consistent or extremely consistent information.

Clinical judgment scholars frequently discuss how confidence circumvents the use of a scientific process of assessment (Spengler et al., 1995). Kahneman (2011), in his book Thinking, Fast and Slow, noted that confidence is highly associated with intuitive thought processes and less with scientific methods of assessment; he aptly observed “Sustaining doubt is harder work than sliding into certainty” (p. 114). Several examples exist where clinicians inaccurately believe they can form more accurate predictions using clinical (intuitive) compared with statistical (scientific) methods of prediction (see Spengler, 2013), sometimes leading to dramatic reductions in accuracy to no better than chance for such important issues as prediction of violence and recidivism (Harris, Rice, Quinsey, & Cormier, 2015). Misplaced confidence in clinical decision making may be a significant threat to the scientist-practitioner model of training, supervision and practice resulting in

![Figure 1. Possible relations between judgment confidence and decision-making accuracy.](attachment://figure1.png)
practitioners adhering to what Lilienfeld et al. (2015) have termed pseudoscientific assessment and treatment methods.

The relation between clinicians' confidence and mental health clinical judgment accuracy has been studied for over 60 years. From the outset, researchers uncovered evidence that the most confident judges were oftentimes among the least accurate (Goldberg, 1959; Holopple & Phelan, 1954; Oskamp, 1965). In Oskamp's (1965) seminal study, psychologists were asked to make clinical judgments about a fictional case with subsequent assessments made as more information was provided in four separate stages. Psychologists reported their burgeoning confidence at each stage of additional information. Confidence and accuracy were poorly aligned from the beginning, but as judges received more case information their confidence increased (a shift from 33% to 53% confidence) whereas accuracy levels remained poor (from stage one 26% to stage four 28% accuracy).1 Oskamp concluded, “. . . So-called clinical validation, based on the personal feelings of confidence of a clinician, is not adequate evidence for the validity (accuracy) of clinical judgment in diagnosing or predicting human behavior” (p. 265).

Results from subsequent studies on the confidence bias led to the general belief by scholars that counseling and other psychologists are unable to make appropriate confidence ratings (Arkes, 1981; Smith & Dumont, 2002). Garb (1986) reviewed 18 studies on the relation of mental health professionals' confidence to the accuracy of their judgments. Though he did not use statistical methods to aggregate the data, he concluded there was actually mixed empirical support for the confidence bias. Garb commented on a possible relation between accurate confidence ratings and two factors: when the stimulus materials used had high validity and when the judges were more experienced. Oskamp (1965) also concluded that more experienced clinicians appropriately moderated their confidence by reporting greater tentativeness in their assessment of accuracy. By contrast, Smith and Dumont (2002) asserted that overconfidence is more ubiquitous because clinical judgment is fallible as an underlying cause for overconfidence. Dunning, Heath, and Suls (2004) concluded in a comprehensive review that laypersons and professionals, across a wide variety of occupations including health care providers, researchers, educators, lawyers and public policy decision-makers, are inherently prone to overestimating the accuracy of their judgments with few specific exceptions.

To assess the magnitude and variability of the confidence bias by mental health professionals we sought to synthesize clinical judgment research in which confidence and mental health-related judgment accuracy have been studied. This study, which is an extension of the larger Meta-Analysis of Clinical Judgment (MACJ) project (Spengler, White, Ægisdóttir, Maugherman, Anderson, et al., 2009), used meta-analytic techniques to synthesize findings about clinician confidence and mental health clinical judgment accuracy. Meta-analysis is a statistical technique whereby data are pooled from individual studies and an analysis of these analyses is conducted, thus the term meta-analysis. Meta-analyses on the confidence bias outside the field of mental health suggest that confidence produces weak to modest correlations with accuracy: correlations from various meta-analyses (a) for eyewitness accounts range from .08 to .20s (Sporer, Penrod, Read & Cutler, 1995), (b) for expert law enforcement and forensic professionals’ ability to detect deception equal .05 (Aamodt & Custer, 2006), and (c) for athletes’ assessment of their performance equal .24 (Woodman & Hardy, 2003). This possible poor confidence-accuracy calibration reminds us of Garrison Keilor's (2014) reference to the mythical town of Lake Wobegon, “Where the women are strong, the men are good looking, and the children are all above average” (p. xxviii). In short, there may be a pervasive human tendency to overestimate one's personal capabilities (see Dunning et al., 2004) and this tendency may be no different for counseling and other psychologists' assessment of their clinical decision-making skills.

Although the confidence bias has been extensively researched in various realms of human decision making, and is thought to be a core impingement upon accurate mental health decision making, there has been no empirical synthesis of this phenomenon in the mental health field. In response to this absence, and in light of the considerable emphasis by clinical judgment scholars on the confidence bias, we sought to synthesize this area of mental health judgment research and to test relevant moderators suggested in the literature. Moderators are essentially interaction effects assessed in meta-analytic studies. Consistent with other clinical judgment meta-analyses (Spengler & Pilipis, 2015) we sought to assess two classes of moderators: (a) conceptual/theoretical and (b) methodological. The conceptual moderators are rationally selected on the basis of our reading of the confidence-accuracy research and behavior decision-making theory (Kahneman, Slovic & Tversky, 1982; Nisbett & Ross, 1980). The methodological moderators are ones commonly assessed in meta-analyses (e.g., study quality; Cooper, Hedges & Valentine, 2009). As this is one of only a few existing meta-analyses of clinical judgment research (see Ægisdóttir et al., 2006; Grove et al., 2000; Spengler et al., 2009; Spengler & Pilipis, 2015; White et al., 1995) we believe it is relevant to test an array of potential moderators. We also sought to implement a sensitivity analysis strategy (Greenhouse & Iyengar, 2009) by examining such factors as the impact of the quality of the data on the overall analysis (zero effects, outliers included or excluded) and commonly considered threats to validity in meta-analyses (publication bias, file drawer analysis, funnel plot). A sensitivity analysis in short determines if the findings are robust to design and analysis decisions used in the meta-analysis.

Several factors have been studied which may affect the relation between confidence and mental health decision-making accuracy, including whether concurrent or predictive judgments are made. Because of the well-known decline in predictive validity compared with concurrent validity (Cronbach & Meehl, 1955) there might be a higher confidence-accuracy relation for judges making concurrent decisions. Researchers have examined the accuracy of unassisted clinical judgment compared with mechanical methods, such as statistical and actuarial formulas, with mechanical prediction being slightly superior to unassisted clinical judgment (d = .12; Ægisdóttir et al., 2006; Grove et al., 2000). Clinicians provided access to mechanical judgment aids, such as statistical and actuarial formulas, test score cut-offs, and other statistical assistance of their choice may have better calibrated confidence in their accuracy, presuming they would use these tools (Meehl, 1957). Schol

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1 In Oskamp's (1965) study 20% accuracy represented accuracy at a chance level.
ars have found that confidence increases with the amount of information a judge is given but that accuracy generally does not (Oskamp, 1965; Ryback, 1967). The perceived incremental validity of additional information has also been found to influence judges’ confidence in their decisions (Koriat et al., 1980). In this regard, we assessed the impact of when judges were given freedom to engage in assessments using their preferred methods with the availability of additional information.

A key variable proposed by Spengler and Pilipis (2015) is that improvement in decision making is contingent upon receiving feedback. We sought to assess both the impact of training and of feedback on the confidence bias. One might assume that training in a task in close proximity to the moment when the judgment is made would calibrate the confidence-accuracy relation (see Ericsson, Krampe, & Tesch-Römer, 1993). Most confidence-accuracy studies involve repeated judgments made by clinicians. Based on behavior decision-making theory (Nisbett & Ross, 1980) and Os-kamp’s (1965) original findings, of increasing confidence without increases in accuracy, we anticipated that repeated judgments would fatigue judges and negatively affect the confidence-accuracy relation. Nisbett and Ross (1980) proposed that knowledge of base rates could enhance decision-making accuracy and appropriate calibration of confidence. Even without base rate information more frequent occurring behaviors should be easier to assess and associated with better confidence calibrations. Similarly, confidence may be better calibrated when criteria are highly valid (Cronbach & Meehl, 1955).

One of the most important potential moderating variables may be clinician experience. Garb (1986) speculated in his narrative review that more experienced clinicians acquire better confidence calibration. By contrast, others have suggested that more experienced clinicians become more confident but actually no more accurate (Faust & Faust, 2012). Still other researchers have reported more experience with a specific judgment task actually fortifies overconfidence for developmental levels ranging from preschoolers (Lipko, Dunlosky, & Merriman, 2009) to experienced bankers (Lambert, Bessière, & N’goala, 2012). Garb (1986) also proposed that the validity of the stimulus material would moderate the confidence-accuracy effect. Lastly, publication bias may occur in the most competitive journals, such as those published by the American Psychological Association (APA), because reviewers prefer studies that report statistically significant results (Rothstein, Sutton, & Borenstein, 2005).

In accordance with behavior decision making theory, where clinicians are thought to be prone to unconsciously invoke judgment heuristics or cognitive shortcuts, and overconfidence findings across other domains of decision making (Dunning et al., 2004), we hypothesized for the overall effect that confidence would be poorly aligned with accuracy for a variety of judgment tasks. If confidence is poorly aligned this would result in a negative effect or a null effect where the 95% CI crosses zero. The considered importance of the confidence bias is highlighted by recent APA (2015) ethical guidelines for clinical supervision; supervisors are presumed to “overestimate their competence and grow in confidence about their abilities, even though it is not necessarily matched by corresponding increases in ability” (p. 39) and therefore cautioned to collect structured supervisee feedback. For counseling and other psychologists, miscalibrated confidence may lead to hasty conclusions, rigid treatment plans, and failure to correct errors, resulting in potentially negative consequences for clients (Smith & Dumont, 1997, 2002). Our hope is that the results of this meta-analysis inform research and education on clinical judgment and enhance practitioners’ assessment of their accuracy resulting in better client assessments.

**Method**

We combined published and unpublished studies from our search of 1997 to 2011 with confidence-accuracy studies archived in a database from the comprehensive MACJ (Spengler et al., 2009). The MACJ project exhaustively screened and coded over 30,000 studies from 1970 to 1996 related to mental health clinical decision making, and from that time period likely identified every possible study on confidence and clinical judgment accuracy. This database contained 46 confidence-accuracy studies where confidence was treated as a predictor and judgments made by mental health professionals were assessed. An additional 83 clinical judgment studies in the archive treated confidence solely as a criterion (e.g., Hirsch & Stone, 1983) and were not analyzed in the present study. To extend the MACJ database we applied the same strenuous search process to identify confidence-accuracy research from 1997 to 2011. Standardized MACJ definitions of key variables (e.g., judgment accuracy) and moderators (e.g., criterion validity) were used paired with moderator codes specifically identified as having potential relevance to confidence bias research.²

**Coders and Training**

The three authors were the coders for this study. Training procedures used in the MACJ project were used to train coders for study characteristics and statistics. The authors reached agreement on definitions by coding practice articles during six 2-hr training sessions. Practice coding occurred on less challenging, and then more challenging, studies until 90% agreement was reached across each step of coding.

**Study Search and Inclusion**

The first and second authors searched for published and unpublished research on the confidence-accuracy effect from 1997 to 2011. The authors reviewed each identified study to reach consensus on inclusion or exclusion. The same MACJ inclusion criteria and 207 search terms were used to search electronic databases, namely PsycINFO, ERIC, Dissertation Abstracts, MEDLINE, and Social Science Index, crossed with variations on the terms confidence, overconfidence, underconfidence, uncertainty and calibration. We also used forward-search (studies citing) and backward-search strategies (references) for the 46 MACJ confidence-accuracy clinical judgment studies and for studies found from 1997 to 2011. This strategy identified 106 mental health clinical judgment studies from 1970 to 2011 that assessed confidence as a predictor in relation to mental health clinical decision making. To be included, each study had to assess some type of mental health judgment (e.g., diagnosis, violence risk assessment, prediction of treatment) and establish what constituted an accurate judgment. Studies were excluded when all of the participants were undergraduates or

² Training manuals and methods materials are available upon request.
nonmental health professionals (e.g., physicians, nurses, law enforcement). To be accepted, a study had to include professionals or graduate students in mental health fields, such as counseling (mental health, school, rehabilitation, and pastoral), psychiatry, psychiatric nursing, social work or psychology. Included studies had to provide statistics necessary to calculate an effect size. If a study did not report statistics the authors were contacted (e.g., Regehr, Bogo, Shlonsky, & LeBlanc, 2010). From this pool of 106 studies a total of 34 met inclusion criteria. These 34 studies produced 36 effects because two publications reported two experiments with independent samples (Carroll, Rosenberg, & Funke, 1988; Greenfield & Haaga, 2011).

Coding Procedures

The authors independently coded each study using standardized instructions and code sheets for study characteristics, a priori planned moderator variables, and statistics for effect sizes. Discrepancies were resolved by team consensus. The moderator (categorical) codes for each study are provided in Figure 2. Study statistics were reported most commonly in the form of correlation coefficients (Pearson, Kendall, point-biserial), and in some instances p values or chi-square distributions. Cohen’s kappa for coding the study characteristics, moderators and statistics ranged from .69 to .95 reflecting substantial to near perfect agreement (Landis & Koch, 1977).

Independent Measure: Confidence

Confidence was most frequently assessed using a single-item Likert-type scale. For example, Boyle (2000) used a 0 to 10 point scale where 10 reflected that judges were 100% confident in their accuracy. Cantor, Smith, French, and Mezzich (1980) used a seven-point scale, ranging from 1 (the patient fit poorly in the category) to 7 (the patient fit optimally into the category). The most common measures for confidence were 5-, 6-, 7-, and 10-point Likert-type scales. Other researchers used percentage ratings reflecting confidence from a low value up to 100% certainty (e.g., Haderlie, 2011). Most researchers maintained continuous measures although others used categorical splits (e.g., Douglas & Ogloff, 2003). Although there are limitations to using a single-item measure for confidence, the vast majority of studies assessed hit rates through repeated clinical judgments of confidence paired with judgment accuracy. The number of confidence-accuracy judgments per participant ranged from 2 to 166 with a mean of 37.84 (SD = 48.47; excluding 1368 judgments reported by Twaites, 1974).

Dependent Measure: Judgment Accuracy

Judgment accuracy reflected the accuracy of clinicians’ judgments related to various mental health constructs, such as diagnosis, classification, prediction of behavior, and assessment of client progress. The way researchers established accuracy varied from study to study with some authors maintaining high levels of accuracy standards (e.g., verification of neuropsychological diagnosis by brain autopsy; Boyle, 2000) or verifiable behavior observations to establish judgment accuracy (e.g., measurable blood alcohol levels; Carroll, Rosenberg, & Funke, 1988). Other studies used less concrete verification of accuracy through expert a priori validation of a vignette, empirical findings, or accepted practice standards (e.g., confirmation of accurate schizophrenia diagnosis through multiple sources; Walker & Lewine, 1990). We evaluated judgment accuracy, however operationalized, as a form of criterion validity (high or low) based on our assessment of the rigor in establishing accuracy. Highly valid and objective standards were rated as having high criterion validity. Less objective methods, such as Kalichman and Craig’s (1991) use of a logically constructed clinical vignette portraying sexual or physical abuse, were coded as low criterion validity. This was because logic or consensus rather than an objective measurable criterion was used. In this regard, criterion validity (high, low) for measures of accurate judgment was also treated as a moderator.

Definitions of Moderators

For categorical moderator analyses we established a priori that three studies must have examined a moderator sublevel to test its effects (see Table 1). Clinician experience (high, medium, low, mixed) was coded as high for postgraduate level mental health professionals including psychologists, psychiatrists, and mental health counselors; medium for doctoral level trainees including psychology interns; low for master’s level trainees; and mixed for participants across these levels of experience. Judgment timeframe (concurrent, predictive) reflected whether judges formed concurrent classifications or predictions of future behavior. Whether or not clinicians were given access to mechanical prediction aids (yes, no) such as statistical and actuarial formulas was coded. We were interested in whether or not judges were given freedom to engage in assessments using their preferred or personally selected methods (yes, no) or were constrained by research methods. Studies varied in the amount of training provided to the judges before or during the judgment task and were coded accordingly (no training, before judgment task, before and during). The type of decisions judges made was coded, including diagnostic, brain injury, violence risk, abuse risk, substance abuse, malingering and prediction of therapeutic change. A general judgment category of “other” was formed that included mixed types (e.g., scoring confidence on WAIS-III, Hopwood & Richard, 2005; Ryan & Schnakenberg-Ott, 2003; race-based recall accuracy for content of psychotherapy sessions, Pedley, 1994). As a form of publication bias (Rothstein, Sutton & Borenstein, 2005), we assessed for differences between publication outlets (American Psychological Association [APA], non-APA, dissertation). Three continuous conceptual moderators were also coded: (a) number of judgments made, (b) base rate (occurrence) of the target behavior, and (c) age of the study. We initially hoped to code other moderators discussed in the confidence bias literature but they were not sufficiently studied (e.g., validity of stimulus material, Oskamp, 1965; feedback on accuracy, Ericsson et al., 1993; informing judges about base rates, Nisbett & Ross, 1980).

In the context of a sensitivity analysis Greenhouse and Iyengar (2009) suggest that methodological moderators also be assessed. If study quality, for example, is a significant moderator it may be relevant to examine only studies with higher quality as a means of estimating the confidence-accuracy effect.
We also assessed research design and validity issues related to the stimulus material and criterion validity used to establish judgment accuracy. We coded study quality as acceptable, good, or excellent using a global rating of methods and analyses based on Shadish, Cook, and Campbell’s (2002) threats to validity. Cooper (1998) provides a good discussion of the advantages and disadvantages of such a global rating; compared with multidimensional ratings global ratings tend to have better interjudge agreement and equivalent heuristic value. The studies analyzed for this meta-analysis utilized experimental, quasi-experimental, and correlational research designs and were coded as such. The type of stimulus provided to judges was coded. Some judges were presented with direct client stimulus (through videotape or live observation). Other judges were given indirect client stimulus (written case material or test score cut-offs). Each study was assigned a rating of high or low

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### Figure 2. Random effects (r) between confidence and accuracy with forest plot and study moderator characteristics. Positive r effects indicate confidence is calibrated with accuracy. For each study r effects are represented by squares proportionately sized to inverse-variance weights used in calculating the overall effect. Lines represent the 95% confidence intervals (CIs) for each study. The diamond reflects the mean weighted overall confidence-accuracy effect; 95% CI is reflected by the width of the diamond. Categorical moderator variables and codes: Judgment timeframe (1 = concurrent, 2 = predictive, 3 = retrospective); mechanical prediction aids (1 = yes, 2 = no); freedom in assessment (1 = yes, 2 = no); training provided (1 = no, 2 = before judgment task, 3 = before and during); judgment outcome (1 = abuse risk, 2 = brain injury, 3 = malingering, 4 = substance abuse, 5 = therapeutic change, 6 = other, 7 = violence risk, 8 = diagnosis); publication source (1 = non-American Psychological Association [APA], 2 = dissertation, 3 = APA); study quality (1 = acceptable, 2 = good, 3 = excellent); research design (1 = experimental, 2 = quasi-experimental, 3 = correlational); stimulus materials (1 = written case material, 2 = test protocol, 3 = videotape, 4 = more than one source, 5 = live observation); criterion validity (1 = high, 2 = low); standard for accuracy (1 = a priori validation, 2 = observed behavior, 3 = test score cut-offs, 4 = clinical record of diagnosis, 5 = other).
### Table 1

*Categorical Models for Overall Confidence-Accuracy Effects*

<table>
<thead>
<tr>
<th>Moderators and levels</th>
<th>Between-class effect $Q_p$</th>
<th>$p$</th>
<th>$k$</th>
<th>Mean weighted effect size $r$</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
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<tbody>
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<td><strong>Conceptual moderators</strong></td>
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<td>Clinician experience</td>
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<td>High</td>
<td>6.51</td>
<td>.09</td>
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<td>Medium</td>
<td>6.08</td>
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<td>Low</td>
<td>4.08</td>
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<td>Mixed</td>
<td>4.07</td>
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<td>Judgment timeframe</td>
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<td>Concurrent</td>
<td>.11</td>
<td>.74</td>
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<td>Predictive</td>
<td>2.24</td>
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<td>.05</td>
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<td>Mechanical prediction aids</td>
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<td>Yes</td>
<td>1.10</td>
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<td>No</td>
<td>1.19</td>
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<td>Freedom in assessment</td>
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<td>Yes</td>
<td>0.41</td>
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<td>No</td>
<td>0.27</td>
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<td>Training provided</td>
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<td>No training</td>
<td>3.88</td>
<td>.14</td>
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<tr>
<td>Before judgment task</td>
<td>4.17</td>
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<td>Before and during</td>
<td>5.21</td>
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<td><strong>Judgment outcome</strong></td>
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<td>Abuse risk</td>
<td>16.93</td>
<td>&lt;.05</td>
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<td>Brain injury</td>
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<td>Malingering</td>
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<td>Substance abuse</td>
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| **Method moderators** |                             |     |     |                               |               |              |
| Study quality         | 1.57                        | .46 |     |                               |               |              |
| Acceptable            | 3.00                        |     |     |                               |               |              |
| Good                  | 15.18                      |     |     |                               |               |              |
| Excellent             | 3.11                       |     |     |                               |               |              |
| Research design       |                             |     |     |                               |               |              |
| Experimental          | 1.57                        | .46 |     |                               |               |              |
| Quasi-experimental    | 3.17                        |     |     |                               |               |              |
| Correlational         | 1.13                       |     |     |                               |               |              |
| Stimulus material     | 22.93                       | <.001|     |                               |               |              |
| Written case material | 12.34                       |     |     |                               |               |              |
| Test protocol         | 11.02                       |     |     |                               |               |              |
| Videotape             | 7.12                       |     |     |                               |               |              |
| More than one source  | 3.21                       |     |     |                               |               |              |
| Live observation      | 3.12                       |     |     |                               |               |              |
| Criterion validity    |                             |     |     |                               |               |              |
| High                  | .01                        | .98 |     |                               |               |              |
| Low                   | 15.03                      |     |     |                               |               |              |
| Standard for accuracy |                             |     |     |                               |               |              |
| A priori validation   | 3.13                       | .21 |     |                               |               |              |
| Observed behavior     | 15.06                      |     |     |                               |               |              |
| Test score cut-off    | 7.01                       |     |     |                               |               |              |

*Note.* Positive effects indicate confidence is calibrated with accuracy. Only categories with three or more effects were included in moderator analyses. Experience effects were calculated using subgroup analyses. CI = confidence interval; APA = American Psychological Association.
Calculation of Correlation Effects

Study effects were reported differently across manuscripts but mostly in the form of correlation coefficients. When an overall $r$ was reported we used that as the effect size. When provided other metrics (e.g., $p$ value) these were entered into the meta-analysis software program Comprehensive Meta Analysis 2.0 (CMA; Borenstein, Hedges, Higgins, & Rothstein, 2005) and converted to $r$. In all instances CMA transformed correlations to the Fisher’s $z$ scale for analysis, using Hedges and Olkin’s (1985) $r$-to-$z$ transformation, and then the analyses were converted back to correlations for ease of interpretation. Converting from $r$ to Fisher’s $z$ for meta-analytic calculations is generally considered necessary to correct for skewed population distributions as $r$ departs from zero (Rosenthal, 1984; for further discussion, see Hafdahl, 2010). For some studies we had to calculate an effect size; for example, Cantor et al. (1980) provided a table with accurate or inaccurate judgments paired with 7-point Likert-type confidence ratings and we calculated an overall point-biserial correlation. When an overall effect was not provided, we combined effect sizes within studies by first converting correlations to Fisher’s $z$, averaging, and then converting back to an overall correlation (Corey, Dunlap, & Burke, 1998). Four studies reported statistically nonsignificant results, with data unavailable from the authors, and these were coded as zero effects (Carroll et al., 1988, Study 2; Nadler et al., 1994; Walker & Lewine, 1990; Walters et al., 1988). Only one moderator (experience) could be assessed using subgroup analyses, otherwise for the overall analysis and the moderator analyses one effect size per study was used. In calculating the overall effect size study effects were weighted by their inverse variance related to sample size (Borenstein, Hedges, Higgins, & Rothstein, 2005).

Results

Overall Analysis

The overall analysis was conducted using a random effects model based on the assumption there would be differences in effect sizes because of the various applications and ways in which studies were conducted. A random effects model is most appropriate in such an instance when the goal is to generalize to a number of scenarios (Borenstein et al., 2009). Across the 36 studies and multiple judgments made by 1,485 participants, the random effects weighted average effect size ($r = .15$) indicating a small relation between confidence and accuracy. The 95% confidence interval (CI [.059, .238]) does not include zero meaning this is a statistically significant effect ($p = .001$). The studies, types of prediction tasks, and aggregated confidence-accuracy correlations are presented along with a forest plot in Figure 2. The forest plot is a method used widely in the medical sciences and provides an overview of meta-analyses in a readily understandable visual mode (e.g., see Cochrane Library, 2015). Effect sizes ranged from $- .42$ indicating poor calibration between confidence and accuracy to $+ .68$ indicating good calibration. A positive skew was found with 69% of the studies reporting a positive relation between confidence and accuracy. The effect size estimate demonstrated variability as evidenced by a statistically significant homogeneity index, $Q_{(35)} = 69.52$, $p < .001$. The I-squared index was $I^2 = 49.66$, which means that approximately 50% of the total variance between studies is due to heterogeneity and not to chance; this is considered a moderate level of heterogeneity (Higgins, Thompson, Deeks, & Altman, 2003).

Sensitivity Analyses

Greenhouse and Iyengar (2009) recommend several steps subsumed under the concept of sensitivity analyses designed to examine the robustness of meta-analytic findings related to methodological and analysis decisions. To this end, we assessed the impact of including or excluding outliers and studies where we assigned zero effects in the absence of available data. To assess for outliers we utilized the outlier-labeling rule suggested by Tukey (1977) and refined by Hoaglin and Iglewicz (1987). With a lower critical value ($r = -0.479$) and an upper critical value ($r = .696$) no outliers were present, indicating no need to assess the overall effect with removal of outlier studies. Zero effects were entered for four studies when authors said the confidence-accuracy analyses were statistically nonsignificant and we were unable to obtain their data. Removal of these studies from the analyses results in a random effects ($r = .178$; CI [.083, .270]), $Q_{(32)} = 57.70$, $p = .002$, and $I^2 = 46.27$, reflecting relatively similar findings compared with the more conservative overall correlation with the zero effects. We consider the more conservative correlation with the zero effects to represent the overall confidence-accuracy effect.

Categorical Moderator Analyses

Testing moderators is an essential part of an overall sensitivity analysis, particularly when 50% of the variance is unaccounted for due to heterogeneity between studies (Higgins et al., 2003). The overall effect size was further analyzed as a function of mixed-effects moderator analyses using a procedure analogous to analysis of variance (ANOVA; Hedges & Olkin, 1985). The between-class effect ($Q_{(b)}$) is conceptually equivalent to the main effect in ANOVA with each variable having more than one level. Mixed-effect models are thought to provide a more stringent test of moderators than fixed effects models by reducing the possibility of Type I errors (Overton, 1998). We treated each study as the unit of analysis meaning that an average of effects occurred when there were multiple judgments, or in some instances effect sizes reported for subgroups within a study were averaged into one aggregate study effect, weighted by the number of participants (Cooper, 1998). Studies either systematically varied clinician experience, or we were able to code studies for levels of experience; therefore but only for this moderator we were able to conduct subgroup analyses. As seen in Table 1, the type of stimulus used and the type of judgment made were statistically significant moderators of the confidence-accuracy effect. To assist in interpretation, moderators
are statistically significant when the 95% CI does not cross zero, and differences between levels of moderators are statistically significant when there is no overlap in their respective 95% CIs (Borman & Grigg, 2009). Stimulus material was found to moderate the relation between confidence and accuracy, $Q(4) = 22.93$, $p < .001$. Written case material was found to produce the largest effect size ($r = .34$), with more naturalistic stimulus materials such as live observation ($r = -.12$) and videotape ($r = .12$) producing effect sizes whose confidence intervals crossed zero, indicating no true relation. A difference was found based on the type of judgment, $Q(7) = 16.93$, $p < .05$. Abuse risk had the largest effect size ($r = .37$) and was the only effect with 95% CI not crossing zero, but is not statistically significant from several of the other judgments (because of overlap of 95% CIs).

**Regression Moderator Analyses**

Three moderator variables, number of judgments made, base rate of the target behavior, and age of study, were continuous and therefore analyzed using mixed effects (maximum likelihood) meta-regression (Borenstein et al., 2009). For number of judgments three studies were not included in this moderator analysis due to omission of information about the number of judgments (Haderlie, 2011; Hopwood & Richard, 2005; Pedley, 1994). We also excluded Twaites (1974) who had participants make 1,368 judgments as we considered this to be an outlier. Consistent with our assumption as the number of judgments increased the relation between confidence and accuracy worsened, $Q(30) = 4.16$, $p < .05$. Second, as the base rate of the target behavior increased so does the positive relation between confidence accuracy, $Q(19) = 10.82$, $p = .001$. This finding is qualified by only 21 of the 36 studies reported base rates. Finally, we had no specific hypothesis for the age of the study but did find that older studies had larger positive confidence-accuracy effects, $Q(34) = 3.68$, $p = .05$.

**Publication Bias**

As part of a sensitivity analysis strategy we also assessed for publication bias. Publication bias occurs when editors and reviewers are more inclined to publish statistically significant as opposed to statistically nonsignificant findings (Rothstein et al., 2005). A fail-safe analysis (Rosenthal, 1979) resulted in a two-tailed Z value for the observed studies of 5.04 ($p < .00001$). To obtain a statistically nonsignificant Z value, under the cutoff of 1.96, 203 zero-effect studies would be needed which seems unlikely. The fail-safe analysis has been criticized because it assumes missing studies would have zero effects and does not take into consideration study weights (Becker, 2005). To provide a more comprehensive assessment we visually inspected a funnel plot with confidence-accuracy effect sizes on the horizontal axis and a measure of study sample size, or precision (one standard error) in this case, on the vertical axis (see Figure 3). Larger studies cluster toward the top of the funnel, usually closer to the mean effect size, whereas smaller studies are distributed at the bottom of the funnel. The bottom of the funnel shows asymmetry, with smaller studies toward the left, reflecting possible publication bias to publish small or even negative effects. Egger et al. (1997) recommend using the inverse of the standard error (precision) to predict the confidence-accuracy effect, in this case represented by Fisher’s $r$ to $z$, which results in a two-tailed, $t(34) = 3.46$, $p = .001$, supporting the statistical significance of this asymmetry. These analyses suggest there may be a bias of publishing small sample confidence-accuracy studies with small or negative effects, reflecting poorly calibrated confidence accuracy.

**Discussion**

There are three things extremely hard: steel, a diamond, and to know one’s self.—Benjamin Franklin, Poor Richard’s Improved Almanack (1750)

Contrary to prevailing assumptions our analysis of over 40 years of research on the appropriateness of confidence uncovered that clinicians’ confidence has a small but statistically significant relation with psychological assessment judgment accuracy ($r = .15$). This is a statistically significant effect because the 95% CI does not cross zero, but it is also an unreliable effect due to heterogeneity in variance between studies. This positive effect reflects a small improvement in accuracy associated with greater confidence. It could also reflect better calibration of confidence with accuracy where low confidence is associated with lower accuracy. A small effect is not without impact on current ways of thinking about the confidence bias in clinical decision making. Scholars consistently stress lowering confidence in one’s judgments as a debiasing strategy to increase the likelihood of accurate judgments (Arkes, 1981; Borum et al., 1993; Ridley et al., 1998; Smith & Agate, 2004; Smith & Dumont, 1997; Spengler et al., 1995). In accordance with behavior decision-making theory (Kahneman et al., 1982; Nisbett & Ross, 1980), laypersons and professionals alike are theorized to be overconfident in the accuracy of their judgments due to unchecked use of judgmental heuristics and other cognitive shortcuts. On the basis of these assertions, we expected confidence to be uncalibrated with accuracy, which is not supported by this meta-analysis. Do the findings suggest that counseling and other psychologists should trust their feelings of confidence in their clinical decision making? On the one hand an $r$ of this magnitude in psychotherapy process-outcome studies (e.g., Norcross & Lambert, 2011) is considered a beneficial effect. Alternatively an $r$ of .15 reflects that confidence accounts for 2% of variance in judgment accuracy ($r^2 = .0225$), which by any standard seems inconsequential. If counseling and other psychologists do in reality have the ability to appropriately gauge the accuracy of their own judgments, one would expect the aggregated effect size to be much larger. In practical terms, this means that while counseling and other psychologists may think they are very accurate (and indeed, in most studies clinicians reported that they were quite confident in their judgments), the feeling of confidence should continue to be viewed as marginally indicative of decision-making accuracy. In addition to awareness of the overconfidence bias, counseling psychologists should be aware of the closely aligned confidence heuristic (Price & Stone, 2004), or the environmental press to express high levels of confidence and the internal tendency to be influenced by highly confident decision-makers (e.g., Cramer et al., 2011; Semmler et al., 2012; Tenney et al., 2011). Apparently, human tendency is to

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3 Graphs of continuous moderators regressed on Fisher’s $Z$ scores are available upon request.
trust more confident decision makers. Based on our meta-analysis, and similarly small effect sizes from confidence-accuracy meta-analyses in other domains (Aamodt & Custer, 2006; Sporer et al., 1995; Woodman & Hardy, 2003), the tendency to trust confident decision-makers, whether self or other, should probably be tempered.

Moderator Analyses

Few statistically significant moderators of the confidence-accuracy effect were found. This finding may in part be an artifact of low statistical power related to a modest sample size of 36 studies with a mean of 41.25 participants per study. With these values and assuming measurement error varying across studies, Sackett, Harris, and Orr’s (1986) Monte Carlo computer simulation suggests that statistical power to detect moderator effects ($r = .1, .2,$ and .3) in the present study was, respectively, .104, .316 and .760. Thus, smaller moderator effects may not be detected (for further discussion, see Hedges & Pigott, 2004). We found that older studies had the largest effect sizes, indicating better calibration of confidence-accuracy judgments, which might explain Garb’s (1986) earlier narrative review where he concluded there is only mixed support for the confidence bias. We also found that confidence-accuracy calibration became worse over the course of repeated judgments, consistent with Oskamp (1965). In the absence of judges receiving feedback we assumed repeated decision making would fatigue judges and increase error. A body of research establishes the slight superiority of statistical prediction over clinical prediction (Spengler, 2013), with a gain in accuracy reflected by a reliable effect ($d = .12$; equivalent $r = .06$; $p = .09$) where experienced clinicians produced a larger and the only reliable effect size ($r = .25$) of the experience groups. In a comprehensive meta-analysis of experience related to clinical decision-making accuracy, Spengler and Pilipis (2015) reported an overall random effects ($d = .12$; equivalent $r = .06$), reflecting some improvement in accuracy with clinical or educational experience. The results of the current meta-analysis suggest that experience and improvement in decision making may also include modest gains in confidence calibrations, but further research is needed to test this assumption.

Given resistance to the use of mechanical prediction techniques, we were not surprised that providing access to these decision aids, thought to be a key method for improving clinical decision making, failed to moderate the confidence-accuracy effect. A robust body of research establishes the slight superiority of statistical prediction over clinical prediction (Spengler, 2013), with a gain in accuracy reflected by a reliable effect ($d = .12$; equivalent $r = .06$; $p = .09$) where experienced clinicians produced a larger and the only reliable effect size ($r = .25$) of the experience groups. In a comprehensive meta-analysis of experience related to clinical decision-making accuracy, Spengler and Pilipis (2015) reported an overall random effects ($d = .12$; equivalent $r = .06$), reflecting some improvement in accuracy with clinical or educational experience. The results of the current meta-analysis suggest that experience and improvement in decision making may also include modest gains in confidence calibrations, but further research is needed to test this assumption.

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see Ægisdóttir et al., 2006; Grove et al., 2000). Use of statistical reasoning in clinical decision making, however, commonly meets with resistance by practitioners and may only occur under certain compelling conditions perhaps not present in this body of confidence bias research. One such application where statistical prediction has been found to far outweigh clinical prediction is violence risk assessment and the plausible argument has been made that it may be unethical to confidently present clinical (vs. statistical) judgments in this realm of decision making (Harris et al., 2015). Contrary to our expectations training (without feedback) and the amount of information provided had no moderating effect. Finally, higher base rate (percentage occurrence) behaviors were associated with improved confidence-accuracy calibrations.

Given restrictions in how the data are reported the vast majority of moderator analyses were conducted on a between-studies basis in comparison to the more powerful within-studies or subgroup basis. This produces comparisons with lower certainty because the moderator represents an attribute of an entire study. Wood and Eagly (2009) argue that such a strategy reduces statistical conclusion validity because the moderator can be a proxy or a covariate with other study attributes. The alternative is to analyze subgroup comparisons within studies, as were able to do for experience. This became an intractable problem for other moderators, however, as there was inconsistency between studies in terms of comparisons made not allowing for subgroup analyses. In other areas of research, such as meta-analyses of randomized controlled psychotherapy trials, where research is more systematic than we observed in this body of research, this type of subgroup or within-study moderator analysis is possible.

**Research Implications**

We found substantive heterogeneity between studies indicating there may be unidentified subclasses of studies that differ in the confidence-accuracy population effect (Matt & Cook, 2009). Future researchers should heed this finding by systematically studying potentially relevant moderators within studies, rather than assessing the mere correlation between confidence and accuracy, to better understand the confidence bias. The magnitude of heterogeneity found means that the included studies have genuinely different results not related to chance, reducing confidence in the findings and producing a lower grading of the evidence (Higgins et al., 2003). We also found publication bias with a disproportionate number of small sample studies producing effect sizes smaller than the overall effect \( r = .15 \). Based on publication bias, and the fact that 32 of the 36 studies have 95% CIs that cross zero (see Figure 2), no wonder clinical judgment researchers perceive there is overall support for the confidence bias.

The most prominent shortcoming in extant confidence bias research is the need for stronger theory-driven studies, especially given the weight scholars put on the notion that reducing confidence improves decision-making accuracy. Many studies provided no rationale for collecting confidence measures (e.g., Carlin & Hewitt, 1990; Ryan & Schnackenberg-Ott, 2003). Others included measures of confidence but no analysis of data (Dauber, 1980; Regehr et al., 2010). Dauber (1980), for example, only provided visual plots of their data and no analyses. Several moderators we wished to test could not be tested due to insufficient studies or an absence of research. These include (a) the validity of the stimulus material (Garb, 1986), (b) feedback about accuracy of decision making (Ericsson et al., 1993), (c) whether the judges were informed about the base rate (Nisbett & Ross, 1980), and (d) when predictive accuracy is assessed the length of time of the outcome from the time of judgment. Related to being informed about base rates (not just higher base rates), the third author has served on the Division 17 Society for Counseling Psychology Programming Committee where decisions are made about proposals for presentations at the annual convention of the APA. Committee members are told the base rate of acceptance (e.g., 50%) and instructed to accept no more than 50% of the reviewed proposals unless there is something unusual about that sample. This type of base rate information assists with decision making (Ægisdóttir et al., 2006) and would presumably help calibrate the confidence-accuracy correlation.

Future research should also consider that the relation between confidence and clinical judgment accuracy might be more complex than a simple correlation (Olsson & Justlin, 2003). While nearly all studies included in this meta-analysis examined the confidence-accuracy relation in terms of a linear correlation, there is the possibility that confidence and accuracy have a curvilinear or other polynomial relation. That is, a certain level of confidence aids in accuracy but those benefits may decrease as confidence increases or decreases past certain points. Olsson and Justlin (2003) provided alternative metrics for researchers to use for assessing confidence and accuracy by eyewitnesses and earwitnesses and concluded that the point-biserial correlation coefficient may underestimate a stronger relation between confidence and accuracy. Additionally, we were unable in our review to determine in all instances the direction of correlations reported in studies. A positive correlation might reflect high confidence paired with high accuracy, or low confidence paired low accuracy, obfuscating the relation (see Figure 1).

**Practice and Training Implications**

We recognize that counseling and other psychologists do not rely solely on the feeling of being confident when making judgments. In fact, they should not as this would lead to mere impressionistic assessments. Although there is a statistical relation between confidence and accuracy, it is small and certainly not enough to allow counseling psychologists to disregard function like scientists in their assessments. Decision-making research reveals other factors that have empirical support as aids to forming accurate psychological assessments, such as the use of mechanical prediction techniques (for a comprehensive review, see Spengler, 2013), or the use of objective measures of change in psychotherapy (for a meta-analysis, see Shimokawa et al., 2010), but these approaches are not widely adopted by practitioners. Nonetheless, some increase in confidence does relate to an increase in accuracy. Therefore, it might be helpful for counseling psychologists to learn how to estimate appropriate levels of confidence in their judgments.

For instance, using the scientist-practitioner model of psychological assessment (Spengler et al., 1995), counseling psychologists could be taught to engage in a rigorous, structured method of scientific hypothesis testing using empirical evidence and debiasing techniques. In this way, they could learn to rely on empirical strategies for gauging their accuracy instead of relying on gut-level
instincts, such as confidence, which are strongly associated with the use of heuristics and biased judgments (Nisbett & Ross, 1980).

Other variables linked to the confidence bias are the use of dispositional (as opposed to situational) explanations of client problems (Smith & Dumont, 2002) and engaging in confirmatory bias when information gathering (Martin, 2001). Combining this information with other known factors that increase accuracy (such as receiving feedback about accuracy; Ericsson et al., 1993) and decreasing reliance on other biased decision-making techniques (e.g., Smith & Agate, 2004), the counselor as scientist-practitioner might better calibrate confidence in her or his ability to make accurate judgments. Appropriate confidence would allow scientist-practitioners to move forward with a clinical decision while consistently acknowledging alternative possibilities, assessing for disconfirming evidence, and adjusting decisions as needed. In short, although our review is limited to a modest number of studies, and mostly to diagnostic and prognostic judgments, our advice for counseling psychologists based on this meta-analysis is “don’t be so sure” in your unique clinical decision-making skills. Confidence is apparently not a good proxy for accuracy.

References

References marked with an asterisk indicate studies included in the meta-analysis.


Arkes, H. R. (1981). Impediments to accurate clinical judgment and diagnostic and prognostic judgments, our advice for counseling psychologists based on this meta-analysis is “don’t be so sure” in your unique clinical decision-making skills. Confidence is apparently not a good proxy for accuracy.

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