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"*This* is Why you've Been Suffering": Reflections of Providers on Neuroimaging in Mental Health Care

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Abstract Mental health care providers increasingly confront challenges posed by the introduction of new neurotechnology into the clinic, but little is known about the impact of such capabilities on practice patterns and relationships with patients. To address this important gap, we sought providers' perspectives on the potential clinical translation of functional neuroimaging for prediction and diagnosis of mental illness. We conducted 32 semi-structured telephone interviews with mental health care providers representing psychiatry, psychology, family medicine, and allied mental health. Our results suggest that mental health providers have begun to re-conceptualize mental illness with a neuroscience gaze. They report an epistemic commitment to the value of a brain scan to provide a meaningful explanation of mental illness for their clients. If functional neuroimaging continues along its projected trajectory to translation, providers will ultimately have to negotiate its role in mental health. Their perspectives, therefore, enrich bioethical discourse surrounding neurotechnology and inform the translational pathway.

Keywords Neuroethics · Mental health · Psychiatry · Neuroimaging

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Introduction

Psychiatry has always been a definer of boundaries, a delegator, and a steward of those beset with "maladies of the soul." The field's clinicians, or providers, by virtue of their expertise in diagnosis and treatment, are bestowed with the moral authority to distinguish mental health from mental illness and chart appropriate interventions. Providers thus bear a burden of proof to justify the medical and scientific validity of their clinical recommendations. In other branches of medicine, a diagnosis depends on known biological mechanisms; in psychiatry, however, the underlying neurobiology of diagnosis remains elusive. Diagnoses are determined based on subjective reports of symptoms by patients and families, and by how these reports correspond to consensus-built checklists in systems of psychiatric classification such as the Diagnostic and Statistical Manual of Mental Disorders (DSM) and the International Classification of Diseases (ICD).

Recent advancements in biotechnology are moving mental health care into a new era of boundary-drawing and toward the incorporation of neuroscience research, particularly neuroimaging, into practice. Many scientists and health care providers anticipate that unraveling the neurobiological correlates of mental disorders will improve the diagnostic process by linking diagnostic constructs with neurobiology and neurophysiology (Insel and Wang 2010).

These developments present challenges for bioethics within and beyond the psychiatric clinic. Given that mental health providers have obligations to treat their patients or clients[1] beneficently and alleviate suffering, ethics is a running narrative in clinical medicine. Although a discussion of ethical issues in psychiatry have been the focus of a long and distinguished scholarship (Bloch et al. 1999), neuroethics issues in mental health are becoming particularly pronounced in several debates.[2] Discussions include, for example, how neuroscience knowledge transforms physical bodies and individual identities into "at-risk" brains; how the interpretation of neuroimages are poised to re-shape diagnosis; and how emerging neurotechnology may impact perceptions of mental illness by the public, individuals and families living with mental illness, and healthcare providers.

Historically, the introduction of new biotechnologies in health care have challenged existing disease constructs, produced new concepts of disease, created new kinds of relationships, constructed new ontologies, and even led to new ways of thinking about responsibility (Vos and Willems 2000). Clinicians are the guardians of biotechnology in medicine, and are responsible for performing clinical assessments, ordering and interpreting medical tests, initiating and continuing treatment, and engaging with patients and families concerning these practices (Klitzman 2006).

[1] Mental health providers often use the term "client" to refer to individuals who receive healthcare services, usually in lieu of the term "patient." This paper will use the term client in the same way, however client may be used interchangeably with patient in the narratives of the mental health providers highlighted in our text.

[2] For reviews of the current thinking in psychiatric ethics, please see: Murphy and Illes 2007; Levy and Clarke 2008; Hoop and Spellecy 2009; Buchman and Illes 2010.

The Neuromolecular Gaze

The twentieth century hosted an explosion of novel practices, technologies and knowledge from the neurosciences, a set of disciplines with a history tracing back the eighteenth and nineteenth centuries. Abi-Rached and Rose (2010) speak to the history and genealogy of the neurosciences, and argue that an epistemological shift occurred in the 1960s that gave birth to what the authors term the "neuromolecular gaze." Following Foucault, the neuromolecular gaze frames how people see, approach, and explain a common vision of life in neuromolecular terms (Abi-Rached and Rose 2010). The neuromolecular gaze, which emerged through the technological developments of the neurosciences, has had a major influence on views within the psychiatric profession. In fact, in Guze's (1992) defense of a medical model of psychiatry, he stated that in the late 1970s many psychiatrists announced: "[t]he neurobiologic basis of psychiatric practice is becoming a reality" (307). In addition to significant biocultural events such as the DSM-III revolution of the 1980s (Young 1995), and the creation of the "neurochemical self" in the 1990s (Rose 2003), the Western world has become attuned to the emergence of the neuromolecular gaze and its corresponding style of thought shaping psychiatry.

In 1998, neuroscientist-psychiatrist Eric Kandel (1998) published his influential paper, *A New Intellectual Framework for Psychiatry*, which aimed to "place psychiatric thinking and the training of future psychiatrists more centrally into the context of modern biology" (457). Kandel's contribution represents the views of a thought community that emphasizes the neurobiological basis of the mind, and an effort that seeks to reclaim psychiatry's place in a post-psychoanalytic world. Indeed, in early 2010, *Nature* Editor Philip Campbell proclaimed the next 10 years as the "decade for psychiatric disorders" arguing that insights from neuroscience and genome-wide association studies will transform the understanding of mental illness and "the crudity of current psychiatric diagnoses" (Campbell, 2010, 9). Accordingly, there is an emerging view amongst practicing psychiatrists that the future of the field will be a branch of clinical neuroscience (Reynolds et al. 2009).

Kandel's proposal for a modern (neuro-) biological psychiatry has extended well beyond medical schools

and has penetrated discourses, training programs, and practices of allied mental health professionals as well (Finnell 2000; Matto and Strolin-Goltzman 2010). Farmer (2008) even described neuroscience as the "missing link" in social work practice. This diffusion is an effect of the modern "neuroculture," which includes the intense media hype surrounding neuroimaging (Giovanni and Anker 2009; Racine et al. 2005). Certainly, the Western world in the twentieth century is witnessing how "the dissemination of neuroscience theories, the availability of psychotropic medications and the latest neurotechnologies, such as functional magnetic resonance imaging (fMRI) are influencing healthcare strategies and legal policies" (Giovanni and Anker 2009, 815). The emerging neurocultural discourse in mental health care situates providers in new relationships with one another, and establishes a common language for communicating across disciplines.

Rose (2007) proposes that advancements in molecular (neuro-) science are changing the conceptualization and discourse around mental health and mental illness. Mental illness was once conceived as a disruption in the ebb and flow of psychic energy amongst the three posited domains of psychic material that constitute the mind, which required interpretation using a technological intervention (i.e., psychoanalysis). A "mind-less" behaviourism followed psychoanalytic theories of mental illness at the beginning of the twentieth century, and in due course a new theoretical perspective emerged, in which mental illness was conceived as a physical disease located inside the brain. Recent advancements in science, technology, and medicine have cemented this perspective by characterizing mental illness as a neurotransmitter dysfunction requiring interventions from pharmaceutical technology managed by those with biopsychiatric expertise. Kandel's proposed framework is thus aptly situated within this discourse among professionals who are highly anticipating the arrival of the latest incarnation of the DSM—one that is likely to be greatly informed by the knowledge of neuroscience (Hyman 2007).

A singular focus on neurobiology reduces the complexities of human thought, action, and behaviour to brain function. Proponents of this type of neuroreductionism extol its value for explaining causality in mental illness, and scaffold arguments for the appropriateness of neurobiological explanations with the essentialist claim that "you are your brain." However, neuro-reductionism in mental illness is a contentious topic in the philosophy of mind and neuroethics (see e.g., Bennett and Hacker 2003; Glannon 2009; Pardo and Patterson 2010; Reiner 2011). Critics of neuroreductionism argue that, while neurobiological underpinnings are at play in mental illness, reductionist perspectives over-simplify mental illness and ignore the significance of its impact on a person's behaviour and relationships with others (Gillett 2010). Thus, one can imagine how a neuroimage may indeed encourage a narrowed clinical gaze and elevate neuroimages as "portraits of the self" (Vidal 2009, 27).

Mental Health Care in Practice and Research Today

Today, mental health care is an interdisciplinary endeavor in which clients are treated with a range of techniques and by a diverse array of practitioners who draw upon both biological and psychosocial approaches (Lennox 2009). Current research in psychiatry employs a number of technologies and methods, and relies heavily on neuroimaging techniques that give measures of metabolic activity and blood flow in the brain such as fMRI. These technologies are expected to have a major clinical impact given their anticipated potential to improve the specificity of diagnosis (Huber 2009). Although the use of functional neuroimaging is virtually nonexistent in standard psychiatry practice today, the possibilities for clinical translation are being met with some unguarded enthusiasm as suggested by this comment from Kendell (2000): "As functional magnetic resonance imaging becomes a routine diagnostic tool, and changes in cerebral blood flow in response to mental tasks come to be measured in much the same way as electrocardiogram responses to exercise are monitored by cardiologists at present, psychiatry will come to seem less different, both to patients and to other doctors" (7).

This optimistic quote raises two points. First, Kendell suggests that fMRI may elevate psychiatry's status as a medical specialty that possesses cutting-edge tools similar to other medical specialties such as cardiology. Second, Kendell's quote is reminiscent of earlier historical accounts of technology in psychiatry introduced without explicit ethical reflection: Egas Moniz' prefrontal lobotomies, for example, were

initially met by an ardent fervor that was later muted upon the realization of the profound deleterious effects of the procedure on personality (Valenstein 1986; Mashour et al. 2005).

In *The Birth of the Clinic* (1963/2010), Foucault demonstrates how the increasing ability to dive into the human body via surgical advances in the eighteenth century was central to the development of the modern clinical subject, and signified a shift from surface to depth in clinical medicine (Edwards et al. 2010). Similarly, incorporating neuroimaging into the clinical space may catalyze a change in mental health practice culture with the ability to peer into the "depths" of the living brain. This would be a dramatic shift from the current emphasis on patient narratives and psychosocial interpretations (Lennox 2009). Clinically, this epistemological shift may challenge the practice orientations of providers who were traditionally trained to view the individual as being composed of complex, cybernetic systems. Indeed, a neuromolecular gaze may obfuscate the realties in which the client lives, the technologies that fashion the client's identity, and his or her engagement with the world.

Challenges notwithstanding, the move toward a culture change is already under way. In a recent literature review, psychiatry resident Erick Cheung (2009)[3] queried: "Will neuroimaging prove to be useful in validating psychiatric diagnoses? What impact is neuroimaging likely to have on clinical practice? Will neuroimaging lead to predictive and preventive psychiatry?" (393). These questions suggest that some mental health providers within the psychiatric system (at least those in training) are anticipating the arrival of novel technologies to refocus their clinical gaze from the psyche to the BOLD signal.[4]

How will the anticipated clinical context affect the provider–client relationship? Such a relationship is ideally one of mutual trust, but ultimately the client is vulnerable to the provider and the knowledge claims upon which the relationship is built. Past research has shown that mental health providers are highly receptive to incorporating data from neurotechnology, such as imaging, as a valuable adjunctive tool for the diagnosis of major depression as one example of mental illness (Illes et al. 2008). As provider and client are intertwined in a discursive web of power, and since these relations of power are often negotiated in the clinic, we sought to examine the thoughts and concerns of providers working in the mental health care system on the potential use of neuroimaging techniques to predict and diagnose a wide range of adult mental illnesses.

Methods

The philosophical and theoretical approach to this study is both ontological and rhetorical. We bring forward the interpretations and perspectives of mental health providers in interviews with us to advance thematic categories. In our analysis, we highlight the specific language used by the participants to describe the contextual realities of their clinical practice.

Recruitment

Participants were recruited from community mental health teams in a metropolitan area in the Pacific Northwest of Canada. Notice of the opportunity to participate was distributed by mass email to all professionals who held an address within the local health authority system. Additional participants were recruited through one-time advertisements placed in two separate North American professional association newsletters. Respondents were screened by telephone or email to determine eligibility, defined by the following criteria: working as a care provider with adults diagnosed with psychotic, mood, or anxiety disorders, and fluent in English for the purpose of clear interview communication. Eligible respondents were sent a copy of the informed consent form by fax or email, and verbal consent was obtained at the time of interview.

Data Acquisition

Telephone interviews were conducted between February 2009 and February 2010, and were approximately 30 min in duration. The semi-structured interviews probed providers' perceptions of the potential use of neuroimaging in mental

[3] The *Journal of Psychiatric Practice* lists Cheung's paper as the "Winner of the Resident Paper Award 2008–2009."

[4] Blood oxygen level-dependent. In the MRI, the BOLD signal is correlated with changes in deoxyhemoglobin in the brain.

health care, in addition to the providers' receptivity to neuroimaging technology. Each interview was audio recorded and transcribed. Our interview included open-ended questions such as, "what are your understandings of the terms 'neuroimaging' and 'brain scan?'" and the presentation of scenarios such as, "In the future, a physician may request a brain scan that could help diagnose mental health conditions such as bipolar disorder, major depression, and schizophrenia. If the research supported the reliability and validity of fMRI data in diagnosing these mental health conditions, what is your perspective on using this kind of information in your practice?"

Analysis

Interview sections relating to providers' views on prediction and diagnosis of mental illness were examined in depth. Raw data were analyzed using *constant comparative analysis* (Glaser 1965; Boeije 2002) that involves taking a segment of data such a phrase, sentence or short paragraph, then labeling or coding that section. The process was interpretive and iterative; analysis involved coding and critically conceptualizing the data to convey the most important themes and dimensions within textual themes.

Results

Sample Characteristics

Table 1 summarizes the characteristics of the respondent sample.

Prediction

The purpose of predictive neuroimaging is to estimate the susceptibility of individuals with certain risk factors to developing mental illness in their lifetime. In current practice, assessment of the predisposition of a client to mental illness involves collecting a detailed family history and speculating on the relative weights of genetic influence and environmental interaction. In the present study, providers propose that predictive neuroimaging might further raise awareness of individual susceptibility, and promote client involvement in prevention, regular follow-up, and future planning. For example:

> It's the same thing if you know that you're susceptible, you can get tested for the gene for breast cancer. I mean, you just know that you are more susceptible, so you should be aware of the risk factors that make you more likely to get the disease, and maybe get more frequent testing and check-ups. That would be the one way I could see [neuroimaging] being helpful (Jeanette,[5] Nurse).

Jeanette, like many other providers, draws a parallel between the use of neuroimaging technology for prediction and the familiar examples of genetic testing for disorders such as breast cancer. For these mental health providers, the utility of predictive imaging lies in its anticipated ability to personalize prediction. Although a focus on the individual may be clinically useful for purposes of tailoring prevention and follow-up regimens, providers also raise concerns about how the personalization of prediction would impact the self-image of patients, decision-making, and their sense of hope. Lucas, a Family Physician cautions:

> If we find that there are anatomical or functional innate predispositions that can be detected even, perhaps, before a disease shows up … [Clients] might feel they have more of a battle because it's more nebulous right now, what you're dealing with. And if they think of it more as structure, they may feel that they have less control over it—less chance to deal with the issue (Lucas, Family Physician).

While the extent to which structural or functional abnormalities can accurately predict the eventual onset of mental illness remains unknown, providers still anticipate that disclosure of any brain anomaly would disturb patients' perception of self-identity in both the present and future. To describe their thoughts on how a predictive neuroimage may be interpreted by their clients, participants often invoke metaphorical language likening mental illness to physical objects. Often, these metaphors relate participants' anticipation that clients will perceive a disruption in the brain as a disruption of the self:

> But others, because they do have a mental health problem, may feel that they're kind of

[5] All names of participants are pseudonyms.

Table 1 Provider demographic information. Allied health professionals included nurses, nurse practitioners, social workers, occupational therapists, and mental health and addiction counselors

		Total	Male	Female
Number of participants		32	14	18
Median age		43	46	48
Education	College diploma	2	1	1
	Undergraduate degree	9	2	7
	Master's degree	13	4	9
	Professional degree	8	7	1
Profession	Psychiatrist	5	5	0
	General Practitioner	1	1	0
	Psychologist	2	1	1
	Allied Health Professional	24	7	17
Site of practice	Canada	29	11	18
	United States	3	3	0

> built wrong, like there's a broken piece in them or an error in them (Martin, Psychiatrist).

Martin's description suggests that neuroimages may encourage clients to commit a *mereological fallacy*: "ascribing to a part of a creature attributes which logically can be ascribed only to the creature as a whole" (Bennett and Hacker 2003, 29). The mereological fallacy stands in opposition to perspectives that reduce the self to brain structure or function. In Martin's narrative, the brain is not just a localized "broken piece" within one's self, but rather the "broken piece" might represent the self.

Gillett (2009) remarks that human identity reflects a complex and dynamic reality of obligations and relationships, and the way in which individuals negotiate and understand these complexities within the context of his or her life. Indeed, mental health providers suggest that being an individual with an at-risk brain for mental illness "changes the space of possibilities for personhood" (Hacking 2004, 107). Internalization of predictive findings could fracture self-understanding and lead to a clinical or disordered identity even before onset of symptoms. Providers are concerned that at-risk individuals may cede not only their self-image to predictive neuroimages, but also their hope for the future, self-determination, and sense of control:

> I think people might feel a sense of inevitability that I'm doomed. You know, I've got this sort of structural deficit and it's beyond my control (Lucas, Family Physician).

Faced with predictive potential, reflection on the impact of prophylactic or early pharmacological intervention on the basis of slight structural impairments or abnormal measurements of blood oxygenation yielded by fMRI is necessary. As one allied health professional states:

> My preference would be to not predict those things [with neuroimaging]. It sets people up and my concern then would be that there would be a desire to medicate people, just because they might get a disorder (Helen, Mental Health and Addictions Counselor).

Helen's point has important implications for diagnoses such as schizophrenia and bipolar disorder, given the serious side effects of antipsychotics and mood stabilizers often used to treat these conditions. Initiating treatment with psychopharmaceuticals on loose predictive grounds could result in the emergence of an iatrogenic condition, thereby inducing more harm for the client (Glannon 2007). Early treatment, particularly in children, by pharmaceuticals that have serious side effects based on a vague interpretation of risk is unsupported (Singh and Rose 2009). If at-risk individuals do, in fact, succumb to a sense of inevitability and loss of control as practitioners' caution, they may be particularly impressed by prescription of early or prolonged medication and less likely to advocate against unwanted side effects and harms.

Using neuroimaging tools to screen for psychopathology may inadvertently elevate levels of fear and anxiety about developing a mental illness. The fear of being at risk for a self-altering disorder such as schizophrenia may affect choices a person makes for

education, employment, or other social and life plans. For example:

> As our society exists right now, if that information were to be known, it could be stigmatizing or it could be ostracizing or damaging to someone in their life. They might not have a chance for the same kind of promotions and the same kind of job opportunities or educational advancement opportunities (Mark, Nurse).

> The downside is [mental illness] could be seen an absolute fate, that people may choose to live their lives accordingly (Mary Anne, Nurse Practitioner).

The assumption underlying such concerns is that fear would divert a person identified as at-risk from prior goals or values. Although the risk identified by predictive imaging may not progress to disorder in the way imagined or at all, a person's decision-making in response would have immediate affect on his or her life. Client fear may alter client reality.

Given concerns about inducing client fear, providers underscore a duty for appropriate risk communication and question whether predictive neuroimaging should even be offered in the absence of an available treatment:

> I'd want to make sure that the information and the way it was communicated was not damaging in some way to a sense of hope and possibility. This field, as well as in many fields, there's often been quite a debate about whether or not we should order tests for conditions for which there is no treatment. So I think we have to be sensitive to that, with the neuroimaging information (Antonio, Clinical Psychologist).

If neuroimaging continues along its current projected trajectory to translation, the discussion must shift to whether benefit will counterbalance threat to patient identity, future wellbeing, and hope.

Diagnosis

Due to the lack of objective criteria guiding diagnosis, diagnostic ambiguity has, historically, been problematic for psychiatry. This is because the idea of an underlying neurobiological component is only one part of the complex dysfunction that characterizes mental illness (Gillett 2010). In a neuroscience-informed DSM, diagnostic constructs may be re-classified if common neural pathways or polygenic variations exist in risks for mental illnesses that were previously conceptualized as categorically distinct. Schizophrenia and bipolar disorder are two examples (The International Schizophrenia Consortium 2009). The incorporation of empirical evidence derived from more objective tools than professional consensus is aimed to increase diagnostic certainty. However, as Davis (2010) reminds us, "the epistemological and ontological category of a particular diagnosis rests on its derivation from the DSM, but the DSM cannot itself provide anything resembling certainty, although it aspires to certainty" (228).

Many mental health providers in our study speak to their frustration with the subjectivity of current diagnostic process in psychiatry, and voice their desire for more "objective" tools to produce physical and perhaps standardized representations of mental illness. As Dumit (2000) notices, "photographically, [a neuroimage] appears as an objective snapshot unmediated by subjective impressions or manipulations" (221). One nurse recounted:

> Psychiatry is so subjective … I can have patients that come in here and say that I've been to six different psychiatrists with six different diagnoses. It would be very beneficial to say, you might have some alterations on your diagnosis, but truly you have a predisposition or you have what would represent bipolar illness because of the frontal lobe damage and the chemical shifts (Alice, Nurse).

Dissatisfaction with the current diagnostic tools of psychiatry may be reflective of, on the one hand, the eagerness amongst certain members in the profession for psychiatry to obtain medical legitimacy amongst the other medical specialties, and on the other, a desire for autonomy in clinical practice. Whooley (2010) invokes Merton's (1976) concept of sociological ambivalence to explain such tensions among psychiatrists. Ian, a psychiatrist, expresses his own professional tensions in this regard:

Ian:	Right now how things are, [clients] really can't tell that by taking an antidepressant or taking an antipsychotic that they're healing and getting better.
Interviewer:	They can't tell?

Ian: They can't. Yeah. Whereas with other medical specialties, say like, oncology, they have a tumour and they're taking chemotherapy and you can get imaging to show that the tumour is shrinking. I think that's kind of analogous to what we don't have yet in psychiatry.

The presumed objectivity of the brain scan thus carries a more epistemic conviction for the psychiatrist than the subjective self-reports from the client. In this light, according to the provider, the client is indeed suffering from a distinct mental disorder, whether the client realizes it or not (Jacobs 2009). The clinical gaze directed upon the client is set against a "background of objectivity" (Foucault 1963/2010). The enthusiasm towards the certainty of the neuroimage may reflect the fact that there is currently no laboratory analysis that can diagnose mental illness. In the exchange above and other narratives highlighted earlier, the image becomes the expert and reinforces to the client the notion of somatic individuality: a re-shaping of personhood along somatic lines (Novas and Rose 2000). The concept of the somatic individual was originally proposed in the context of genetics, in particular for the person who has been deemed "genetically at risk" for a particular condition. Novas and Rose suggest that somatic individualization is reflective of a wider mutation in concepts of personhood where new relations are being established between body and self. Neuroscientific advances are penetrating both the mental health clinic and public imagination in similar ways, such that neuroscientific language is "actually reorganizing [personhood] … according to new values about who we are, what we must do, and what we can hope for" (Novas and Rose 2000, 488).

Somatic individuality may be understood as a positive phenomenon for the client; a self-understanding on brain-based terms ought to produce beneficial health outcomes due to the creation of "accepted identities" such as treatment seeking (Fry 2009). Rosenberg (2006) argues that a somatic concept of self is necessary if mental illness is to be recognized as "a physical ailment no different from diabetes or cancer" (412). One of the participants in this study states:

> We have a lot of clients who think that there's nothing wrong with them. A brain scan or an fMRI might actually show them that, yes, there's something going on, and that might push them to seek treatment. I think more people would believe their diagnosis then … I think much the same way that a blood test confirms diabetes. We can't always feel diabetes, but if we had actual confirmation, I think more people would be likely to seek treatment, effective treatment (Michelle, Mental Health Counselor).

Offering a medical test to provide more certainty to diagnosis may be reassuring as it allows a client to embrace a disease category and not simply experience unexplained symptoms. The hope extends such that, in embracing a diagnosis, a client may realize not only existential relief but also move closer to finding relief from symptoms with effective treatment. Thus, one goal is for brain imaging to potentially demonstrate to a client that the illness is really in her brain and that it necessitates treatment adherence, somewhat paternalistically:

> I think right now, the idea of having a psychiatric illness is somewhat nebulous, and I think if people saw their brains and how the mental illness is affecting the actual brain structure, I think it would give them a greater understanding of [the diagnosis], and maybe their adherence to treatment would go up (Ian, Psychiatrist).

Several decades before the advent of neuroimaging, Wittgenstein (1953) wrote that if the right technology existed, one could determine from peering into another person's brain exactly what that individual was thinking or feeling. He stated, for example, "…we should be able to say when we looked into his brain: 'Now he has read this word, now the reading connexion has been set up'—and it presumably must be like that … That it is so is presumably a priori … But if it is a priori, that means that it is a form of account which is very convincing to us" (§158). The image of the brain thus serves as a form of certainty: It is to *see* and to *know* concurrently:

> If [the client] has been suffering a lot, but hasn't been diagnosed yet, and the MRI or brain imaging is able to diagnose them and say, you know what? This is why you've been suffering. A lot of people get a lot of relief from that (James, Mental Health Counselor).

Mental health providers speak to the potential benefit of neuroimaging in alleviating responsibility and blame. This creation of the somatic individual in neuroscience terms generates a new form of responsibility—one that emphasizes the power, so to speak, of people who are identified as being neurobiologically at risk to take control and overcome their illness:

> So [a diagnosis from imaging] can be an empowering thing in that it's a condition that is not the patient's fault. You know, that it's natural or it's normal for someone to have a mental health condition. And that's empowering patients to seek treatment, and take this illness on as something that they can conquer themselves (Karim, Nurse).

Karim's reflection is indicative of the modern rhetoric around the potential benefits of biological (or "natural") explanations of mental illness, particularly in terms of neuroscience threatening common sense intuitions of moral responsibility. Often, biological explanations of mental illness are believed to reduce public stigma and self-blame (Phelan et al. 2002), based on the assumption that if mental illness develops, it occurs beyond the individual's control:

> I think [neuroimaging] would be helpful, because often clients don't know they've ended up with a mental illness. Sometimes they blame themselves; sometimes they blame their parents … so it would be helpful information just to be able to look at it in the scope of illness, just like having diabetes or a heart condition. That it's not a sign of weakness or it's not a defect in terms of somebody bringing it upon themselves or not trying hard enough, or maybe I'm not putting enough effort in to feel better … it would help them to understand that [mental illness] is more of an organic issue that can be treated through a combination of medication and other therapies (Diana, Mental Health Counselor).

Schnittker (2008) and recently Pescosolido and colleagues (2010) reminds us, however, that the rise of a genetic or neurobiological models of mental illness, respectively, model of mental illness has not convinced the public that mental illness is an illness-like-any-other (e.g., diabetes or a heart condition as suggested by Diana above) or, more importantly, increased public tolerance. In fact, there is a growing body of research that suggests that biogenetic explanations of mental illness actually increase certain aspects of stigma, which include social distance and fear (Corrigan et al 2009; Read 2007; Angermeyer and Matschinger 2005; Phelan 2005). As such, promoting a biological concept of mental illness may be antithetical to anti-stigma efforts.

Conclusions

We found that mental health providers are highly receptive to incorporating data from neuroimaging into their diverse practice contexts. Regarding predictive imaging, providers recognized the potential utility of personalized prediction for prevention and planning, but balanced these forecasted benefits against weighty risks of their client's internalization of supposedly abnormal neuroimages. In particular, providers cautioned for careful navigation of perils associated with disruptions in client self-understanding and decision-making, early medication, and risk communication. When prompted for their views on diagnostic imaging, practitioners shifted their focus from risk assessment to illness representation. In particular, providers indicated an epistemic commitment to the value of a brain scan to provide more meaningful explanations of mental illness for their clients than possible using current diagnostic methods.

At this time, functional neuroimaging is not a standardized practice tool in mental health care. In this study, designed to elaborate on work by our group in the past (Illes et al. 2008), we asked providers to imagine possible future translations of functional neuroimaging and to anticipate the potential impact of this technology on their practice and clients. Thus the language of providers reflects the anticipation of future clinical uses of neuroimaging, rather than the technology's current research application. Accordingly, this is a limitation of our study, since provider responses to hypotheticals are not based on actual experience with the technology in practice. A second limitation is that we queried individuals from a diverse range of provider types and theoretical orientations. Provider responses encompass a broad range of perspectives and therefore do not necessarily reflect those of any one particular provider type or orientation.

It is uncertain at this time how emerging technologies such as functional neuroimaging will contribute

useful clinical information to the prediction and diagnosis of mental illness or provide a causal explanation of the pathogenesis of mental illness. At this time, only limited correlations have been made between neural activity interpreted from a functional neuroimage and symptoms associated with specific mental health diagnoses, such as major depressive disorder (MacQueen 2009). Misunderstandings about the limits of the technologies are abundant, and occur due to unrealistic expectations, hope, media hype, and lack of familiarity with the nuances of technology (Klitzman 2006). Neuroimaging studies also exist against a backdrop of recent allegations made by researchers about the validity of protocols common to sociocognitive neuroscience studies and exaggerated "voodoo" statistics (Vul et al. 2009).

Neuroscience has made important strides towards understanding the contribution of genomics and neural circuits in mental illness, but tremendous work remains (Schleim and Roiser 2009). Even those who anticipate the arrival of predictive and diagnostic imaging on the clinical horizon caution against over-simplifying the emerging technology as a Polaroid prediction in which a neuro-snapshot directly maps on to the probable life course of an individual.

Pursuit of combined technologies, like that of imaging genetics, will refine predictive and diagnostic capabilities and extend the influence of the neuro-molecular gaze in mental health care. Still, social consequences may arise as much from the actual use of neurotechnology as from how technology lends to and even reconfigures the definitions of disease, normality, and well-being. Given the concerns raised by the providers interviewed, neurotechnological advances must be integrated with explicit sensitivity to how the perception of these advances shapes the clinical gaze. Especially if the widening scope of neurotechnology in the clinical space comes to lead, rather than trail, neuroscience research, upstream incorporation of both provider and client perspectives will be key to minimizing harms, defining benefit, and promoting wellbeing in mental health care.

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