

SOCIETAL IMPLICATIONS OF fMRI AS A TOOL TO DETECT A
PREDISPOSITION FOR SEXUAL AGGRESSION

An Interactive Qualifying Project

Submitted to the Faculty

of the

WORCESTER POLYTECHNIC INSTITUTE

in partial fulfillment of the requirements for the

Degree of Bachelor of Science

by



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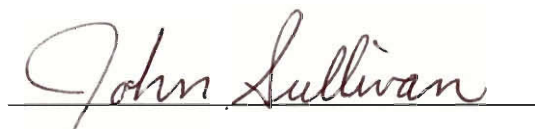


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Date: April 27, 2004



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Abstract:

Functional Magnetic Resonance Imaging (fMRI) might have the ability to detect a predisposition for sexual aggression. Preliminary fMRI studies of primates that live within a family structure clearly demonstrate cognitive behavior and learning associated with sexual taboos, such as incest. This IQP explored the question: Can fMRI be used to detect a predisposition for inappropriate sexual motivation in humans? Further, what are the implications (legal, moral, ethical, etc) associated with this situation?

An in-depth analysis of sexually aggressive behavior and current treatment strategies were documented along with the history and rapid advancements in MRI technology. Functional MRI is used to illuminate numerous cognitive processes. If this scientific advancement can detect a predisposition to sexual aggression, early treatment might benefit society, potential victims, and the individuals exhibiting abnormal behavior. However, like other scientific advances (lie detectors, DNA analysis) the conclusions are not definitive, quantitative, and absolute. Misuse, type casting, and anticipatory judging can do devastating harm to innocent subjects.

Consequently, a process which protects the privacy rights of those subject to fMRI scans is required. These safeguards were formulated into an “fMRI Non-Disclosure Act”. This Act promotes the scientific advancements within the field of fMRI and other medical imaging strategies. It encourages numerous studies to increase the reliability of the technique and transition the qualitative observations into quantitative results. Advances in the fMRI field might have a direct benefit to society for the detection and early treatment of deviant anomalies and illnesses. The consequences of this technology upon society are enormous. However, this scientific advancement can also be used to harm society. Premature implementation of this technique by employment, enforcement, and/or insurance agencies can foil the development and refinement of this technology. The fMRI non-disclosure act protects individual subjects while the scientific technique matures. Ultimately, this process ensures that society will reap the benefits of this scientific advancement through ethical use of this technology.

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1. INTRODUCTION

Sexual aggression can be defined as any inappropriate or violent act involving unwanted sexual advances, sexual abuse, and/or rape. Sexual aggression is currently under the scrutiny of the public eye and law enforcement, due to the recent scandal in the Catholic Church (26), increased law enforcement and the current treatment of sexual offenders. (22, 8) Fear of sexual abuse has caused many individuals within society to speak out and find new ways to increase public protection and promote better legislation.

Sexual aggression is frequently characterized as a heinous act of molestation, incest, or rape that has the potential to destroy victims' lives. Men, in most cases, will deceive, lie, and physically force themselves on innocent woman and children in order to satisfy their own selfish desires. Evidence exists supporting the pattern of child molesters entering relationships for the sole purpose of molesting a woman's child, if the child fits their needs. (16) Rapists often times scope out a vulnerable woman, then attack them violently in order to control their victim and gratify themselves. Sexually aggressive individuals cause a fear that can strongly influence the remainder of an injured party's life. Community members and authorities have grown less tolerant of these kinds of individuals. These groups have enacted more laws and regulations to protect society. (25) The effectiveness of these societal changes is a highly debated topic. Several primary questions need to be addressed to help quantify, document, and justify the newly enacted regulations.

What motivates an individual to commit such heinous acts? Psychologists have documented many correlations among the different types of sexual offenders, but the genetic and environmental factors are very complex. Given the substandard treatment methods currently enforced upon conviction, it is easier (but not necessarily less expensive) to incarcerate offenders, than to provide the individual attention required to diagnose and help them. Less than 15% of imprisoned sex offenders report that their sentence included court ordered psychological or specialized sex-offender treatment during incarceration. (27)

The ethical considerations become clearer when the perspective of the sexual aggressor is taken. Virtually all perpetrators were raised in emotionally deprived and

extremely physically or sexually abusive environments. (28) This situation causes a malevolent cycle. A child is repeatedly molested, physically abused, and controlled with fear only to be hated and incarcerated as an adult, performing similar molestations.

Few mechanisms exist for proper analysis, treatment, and ultimately, a behavior modification to end these aggressive desires. This proposal analyzes how functional Magnetic Resonance Imaging, fMRI, might provide quantifiable data to detect this behavior and provide a useful tool to mitigate this cycle of abuse. The focus is on the potential to assist both the aggressor and their victims or society. Currently, recidivism for violent offenders remains high and a predisposition to such behavior has been an increasingly important topic among researchers. (23) Treatment methodologies are frequently categorized by sexual aggression type. There are three primary classifications of sexual offenders; pedophiles, rapist, and incest offenders.

Pedophiles – These individuals show many characteristics of sexual deviance.

(23) They often manipulate adults and children in order to place themselves in a position to molest children. (16) Once the position to molest is established, trust is built; and then control is exerted to secure a child’s silence and compliance. Often pedophiles tell a child that “the abuse was either normal or the fault of the child”. (19) They are generally passive and often times believe that their actions do not harm children. They have usually been found to be lonely, have low self-esteem, and lack the ability to maintain socially acceptable intimate relationships. Early developmental factors have been shown to be a major contributor to these characteristics. (16) During the onset of puberty, many pedophiles lack the ability to deal with the sudden increase of sexual desires. (28) Pedophiles exhibit a tendency to view themselves as unlovable and other society members as rejecting. “Although they desire intimacy, they experience a high level of interpersonal anxiety and seek to maintain distance in relationships.” (19) Once they are caught, they usually acknowledge a need to seek treatment. (28) Recidivism is high among pedophiles, and effective treatment has not been well established.

Rapists – These men typically commit sexual offences against adult woman.

They commonly deny their actions and claim their innocence. A tendency toward

violent behavior frequently results in arrests for offenses other than rape as well. Recidivism for crimes involving rape is not as common as pedophiles, but the tendency to be arrested for other violent crimes is very high. (28) Rapists typically fit into one of four styles or a combination therein. (24)

Power Re-Assurance

These men are usually cowardly figures in society and rape to reassure their masculinity. They tend to sneak into bedrooms, hide outside an apartment, or behind a car in the parking lot.

Power Assertive

These men exhibit generosity to women, for which they feel sex is owed. They might drive muscle cars and have macho dogs as pets. They rape to prove that a man can take what he wants and also because he wants to satisfy his need for control.

Anger Retaliatory

This type of rapist attacks a woman outdoors in a violent manner. They have a build up of anger toward women in general and want to pay them back. They beat and rape women due to a strong feeling of anger.

Anger Excitation/ Sexual Sadist

These rapists are the most dangerous. They usually plan in advance, abduct, and even kill. They get particular satisfaction from seeing their victim suffer emotionally and physically. They often target women with low self esteem and torture them excessively.

Rapists have a stronger tendency toward violence than sex. The ability to inhibit these thoughts and actions is difficult. (23)

Incest Offenders – These men commit sexual offenses against children in their immediate family. They are typically passive and have difficulty relating to other adults in social and intimate situations. Other difficulties related to inadequacy

and distorted attitudes about relationships and sexuality exist. As with pedophiles, incest offenders have difficulty inhibiting their behavior. (16, 10)

This summary delineated commonalities for each particular offender type. However, each individual can display many unique and unusual personality traits complicating the psychoanalytical process. The development of imaging techniques that allow a visual projection of behavioral commonalities and the inhibitory processes appears to be obtainable through fMRI scans.

Medical research has shown that the ability for a person to inhibit behavioral actions is located in the frontal lobe of the brain. (28) This information is a key factor in the analysis and treatment of potential aggressors. We believe that fMRI could be used to monitor the progress of certain treatments, such as drugs, by analyzing the activity in this region of the brain. A database of information could be formulated with specific characteristics accessible to all necessary physicians. This technique might also help researchers to determine how the inhibitory process can be controlled while further treatment methods are developed. Functional MRI allows the process to be actively monitored to ensure that progress is being made. There is no current quantitative monitoring system related to prescription drug therapy. We envision a substantial societal impact from this type of application. The treatment methods of sexually aggressive individuals could progress much more efficiently to help eliminate an initial offense and recidivism.

Many sexual abuse crimes are not reported. Frequently, those crimes that are reported do not result in an arrest. A good example of not reporting sexual crimes is the recent sexual abuse in the catholic churches. The majority of the victims came forward only after an initial complaint was placed and an investigation was conducted. It was also found that church leaders covered up significant evidence of abuse in order to prevent a negative image of the church. (26) Most sexual offences lack sufficient evidence to convict an individual. Less than half of all sex offense arrests result in a conviction, and the few offenders that are convicted are not given proper therapeutic treatment. (27) The effectiveness of these treatments, both psychological and physiological for sexually aggressive people is not effective. (28) However, these

treatments (and research) are targeted at previous crimes and do not explore the possibility of treating sexually aggressive behavior in advance. Studies have shown that sexual aggression can be a learned behavior due to environmental factors. (28) Consequently, what cues, symptoms, or signs can be used to indicate a predisposition for sexual aggression? If these potential violators can be identified before criminal acts have been carried out, perhaps alternative treatment strategies can mitigate the criminal actions.

With rapid advancements in Magnetic Resonance Imaging (MRI) technology, a clinical method for detecting sexually aggressive behavior might be possible. If these techniques are validated, they will clearly affect society's desire to access such information. Research conducted by the Center of Comparative Neuro-Imaging (CCNI) has successfully detected brain activation of Marmoset monkeys during sexual arousal using functional Magnetic Resonance Imaging (fMRI). (12) This research has advanced the study of sexual aggression from a social science, to a medical science, by combining quantitative data with psychological theory. In this IQP, the possibility of detecting predisposition to sexual aggression using fMRI in humans is explored. In addition, ethical and legislative considerations are taken into account. The ultimate goal is to determine a method in which the knowledge of predisposition to sexual aggression will benefit society, while protecting the individual privacy rights of those subjected to the fMRI studies.

Currently, personal health care information and medical records are protected under federal privacy laws. (42) Given that DNA is capable of detecting susceptibility to genetic disease, separate legislation regarding the human genome was a necessity. The Genetic Nondiscrimination Act of 2003 added another level of protection to the individual. The early detection of susceptibility to behavioral disorders requires similar additional legislative considerations. Perfect accuracy of the detection of behavioral disorders is not attainable in the foreseeable future. Further, those subjects with a possible predisposition might exercise free will to counter socially unacceptable behavior. The Employment Polygraph Protection Act (EPPA) of 1988 acknowledges the fact that polygraph testing is not perfectly accurate, due to differing physiological

responses in individuals. A brain imaging privacy act combining current legislation, ethical considerations, as well as individual patient rights, appears to be warranted.

Functional MRI shows a significant capability for identifying a predisposition to sexual aggression. This scientific development requires a long period of study to validate the effectiveness of this process. The potential benefits to society are enormous, but this advantage will be lost completely if alternate agencies intervene, especially during development. The focus of our IQP is to develop a means of protecting subjects from legal, social, and other forms of discrimination while the fMRI technique is validated. Consequently we review MRI, fMRI, Sexual Aggression, and ethical considerations, leading to a non-disclosure act for the protection of patients and researchers.

2. MAGNETIC RESONANCE IMAGING

2.1 The Discovery of Magnetic Resonance Imaging (MRI)

MRI was developed in the early 20th century. In 1946, two scientists, Felix Bloch of Stanford University, and Edward Purcell of Harvard University, discovered Nuclear Magnetic Resonance Imaging (NMR), while exploring the magnetic properties of cell nuclei. In 1977, Waldo Hinshaw of the International Society of Magnetic Resonance Imaging developed the first image of a human wrist. Later that year, the first image of a human brain was also produced by Hinshaw and his team. After these ground breaking steps in the field, the advance in MRI was extremely prompt. This advance was so rapid that the first MRI machine was placed in the Helsinki University Central Hospital in 1982, only 5 years after Hinshaw's team made an image of a human wrist. MRI developed quickly over the following years to become what it is today. MRI is being used extensively in society for many different procedures ranging from cancer detection, determination of blood clots and even as a means of lie detection.

2.2 Current Utilization of MRI

Today, MRI scans are performed at high and low resolutions. The high resolution scans are used for anatomical delineations, and more importantly, to look for defects in a patient's anatomy. The low resolution scans are used for determining reactions and changes in the body, such as the reaction in the brain, due to a stimulus. In the brain, low resolution scans can be used to show the change in blood flow in a certain area of the brain, the more blood flow, the more active that area of the brain.

MRI is used diagnostically to observe soft tissue, blood vessels and blood flow in virtually any part of the human body, non-invasively. A typical MRI apparatus is shown in Figure 2.1.

MRI is favored over most methods of diagnostic imaging because it is non-invasive and uses non-ionizing radiation. MRI does not present the risk of infection or allergy to the patient. MRI involves the work of many different disciplines including radiology, technology, clinical, and scientific studies. (41) MRI can provide images of soft tissues, organs or lesions

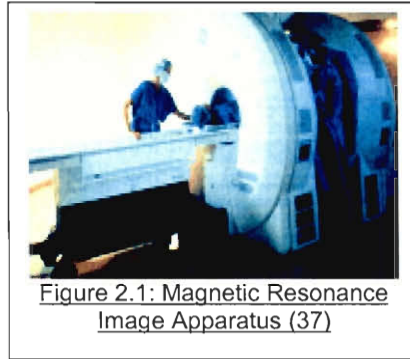


Figure 2.1: Magnetic Resonance Image Apparatus (37)

within the human body in a short amount of time, and with great accuracy. It is used to analyze brain and bone marrow structure, in order to detect multiple sclerosis. MRI is also used to detect Parkinson's disease through the examination of joints and ligaments in the human body. In general, MRI is used to diagnose disease in advance, detect malignant tissue, monitor blood flow, and observe bone structure in the human body. Diagnostic use of MRI is generally conducted at 1.5 Tesla, but trial studies using a higher strength magnet have been done on humans to increase resolution and signal to noise ratio (SNR). MRI is used for a variety of individual medical conditions, and may also be used anonymously for research and scientific exploration of the functional human body. It is estimated that 22,000 MRI units are used worldwide, carrying out a total of 60 million scans each year. (31)

2.3 Application of MRI

MRI provides detailed images of brain anatomy and other soft tissues, such as organs. This technique might be useful in evaluating the compatibility of organs for transplant. Doctors may gain insight into the health of prospective organ donors, and how well the organ is functioning after transplant, using imaging techniques. It is hoped that MRI may be able to detect and provide evidence of degenerative diseases such as muscular dystrophy, as well as mental disorders such as depression, anxiety, stress, and anger. (37) It is most apparent that MRI holds great promise in future diagnosis of behavioral disorder. In the future, MRI could provide clinicians with powerful insight for determining appropriate behavioral treatment methods, and ideal pharmaceutical therapy.

Thus, individuals affected by mental disorder, will be provided the necessary medical attention, based on the results and analysis of their imaging history. (7)

MRI has shown great advances in the mere twenty years of its clinical use to the medical community, the most notable being the discovery and utilization of functional Magnetic Resonance Imaging (fMRI), which provides transient, and multidimensional images of the human body.

3. FUNCTIONAL MAGNETIC RESONANCE IMAGING

3.1 The Significance of Functional Magnetic Resonance Imaging (fMRI)

The human brain contains neurons with dendrites that receive messages from other neurons transmitting electrical impulses along their axons. These electrical impulses release chemical neurotransmitters into the synapse and onto the dendrites of nearby neurons. After the neurotransmitters have been released, they require a certain amount of energy to reenter the neuron. Many mammals require an increased blood flow (hemodynamic response) to the sites releasing/absorbing the neurotransmitters, in order to supply them with enough oxygen for successful process completion. (38) Functional MRI can detect this change in blood flow. Consequently, fMRI allows us to identify different areas activated within the brain, as a function of the task being conducted. For example, listening to music stimulates the auditory cortex, and visual stimulation affects the occipital cortex.

Functional Magnetic Resonance Imaging (fMRI) illuminates which sites of the brain are active during specific tasks and behaviors *in vivo*. Charles Sherrington, a psychologist at Oxford University, first observed functional imaging when he discovered that when the brain of a cat was stimulated electrically, an influx of blood flow occurred. (18) He hypothesized that the brain requires an increased supply of blood to regions “activated” during stimulation. Functional MRI performs repetitive scans of the tissue, during which time, the stimulus is either present or absent. As various areas of the brain change their activity, the tissue properties fluctuate due to changes in blood flow. These tissue property changes can be detected and quantified via multiple, sequential MRI scans. As shown in Figure 3.1, analysis of fMRI data allows imagers to

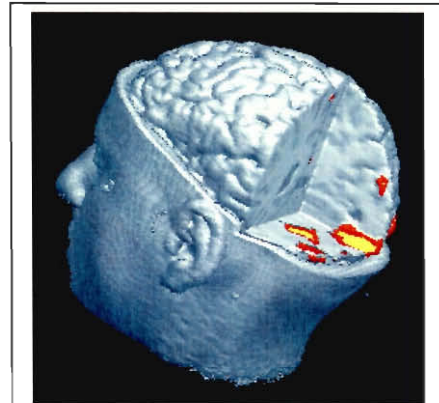


Figure 3.1: 3D rendered image after Fourier transformation of an fMRI (38)

identify active sites in the brain (yellow areas), less active sites (red areas), and inactive sites (remaining grey matter), based on an individual's response to specific stimuli or tasks *in vivo*. (38) The coloring process is done by skilled technicians after scans are produced, to provide a quick visual reference of activated areas. Consequently, the spatial locations of brain activity can be quantified as a function of stimulus applied. (41)

3.2 The Study of Marmosets

The Center for Comparative NeuroImaging (CCNI) is a joint consortium between Worcester Polytechnic Institute and the University of Massachusetts Medical School. It explores the etiology and pathophysiology of mental disorders using non-invasive and non-ionizing imaging technique, namely fMRI. The CCNI uses ultra-high field magnets (4.7 and 9.4 Tesla) which are 3 to 5 times the field strength

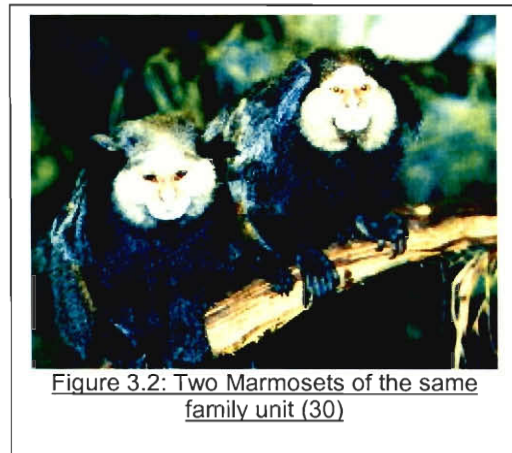


Figure 3.2: Two Marmosets of the same family unit (30)

of clinical human magnets. These high powered systems allow greater resolution, to help delineate the specific areas of the brain associated with an activity and/or thought process. CCNI hopes the field of neuro-imaging will help the medical community to understand human disorders and behaviors such as stress, depression, drug addiction, and sexual aggression. (7)

CCNI studies mammalian marmosets, as shown in Figure 3.2. Marmoset offspring are usually born as fraternal twins. Marmosets live in a family structure which frequently consists of a mother, father, young adults (teenagers), and offspring. Several adults and teenagers are required within the family unit to raise the offspring. Marmoset offspring do not nest, but remain on the backs of the care providers. The teenagers carry the offspring for a significant amount of the time. This type of family structure allows the parents to search for sustenance in order to maintain their body weight. The mother in the family unit is the only female that ovulates. The ovulation of teenage female marmosets is suppressed until they leave the family unit. Teenage male and female

marmosets brought up together in a family unit do not copulate with one another while in the family unit, nor anytime thereafter. (30) However, copulation does occur between biologically related marmosets if they were raised separately and introduced after having left their respective family units. CCNI, along with other primatologists, believe that copulation among cohabitating siblings is discouraged among marmosets through a learning process within the family unit. Functional MRI data supports this theory. (12) Humans follow a similar familial structure and sexual preferences, leading experts in the field to believe that sexual aggression is also learned. (28) This belief suggests that experts can correlate the idea of sexuality being learned through cognition, in order to use these findings among human subjects. Functional MRI is an ideal tool for measuring sexual responses. Figure 3.3 demonstrates a visual representation of sexual responses through olfactory stimulation, in marmosets. Responses to ovulatory scents are shown red, while the blue illustrates the introduction to a non-ovulating scent. As illustrated in figure 3.3, the polarity in responses may be duplicated in humans, given the appropriate stimulation. In a study done at University of Massachusetts Medical School, this relation was confirmed. Teenage girls were shown pictures of their boyfriends, and similar areas of their brains' showed sexual arousal as in the marmoset studies. (13)

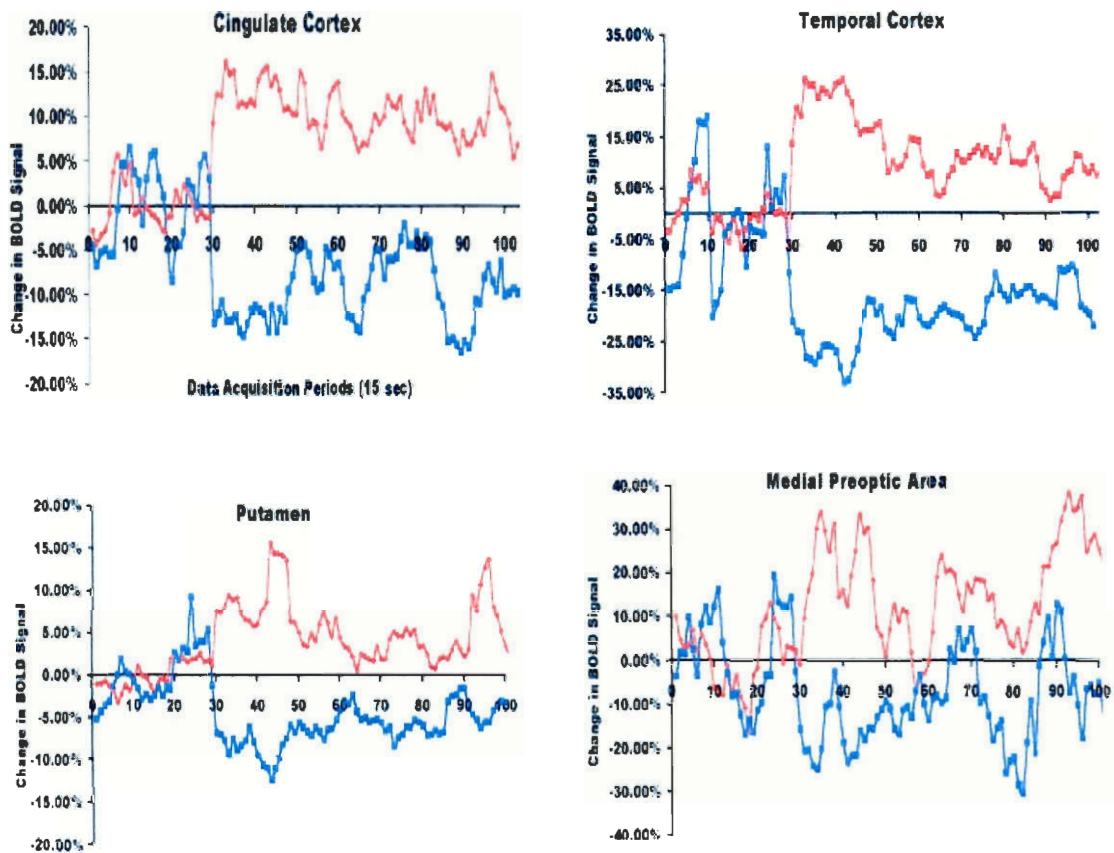


Figure 3.3: Change in BOLD Intensity over Time: Ovulatory scent introduced at the 30th time segment (7)

In this marmoset study, the researchers used Blood Oxygenation Level Dependency (BOLD) imaging to monitor brain activity. BOLD imaging is a measure of the body's natural response to neural activity. When an area of the brain is highly active, it requires additional oxygen. The body responds by increasing the amount of oxygenated hemoglobin in the specific brain area. This change in oxygenated hemoglobin flow is detected via fMRI imaging, allowing clinicians to identify which regions of the brain are activated during stimulation. (41) Similarly, BOLD (Blood Oxygenation Level Dependency) imaging of a human subject can identify active or inactive regions of the brain during stimulation and displayed graphically versus time or three dimensionally as shown in Figure 3.1. (38)(41)

When the male marmoset is presented with the scent of an ovulating female marmoset at the 30th time slice of Fig 3.3, several areas of the brain are clearly activated (shown by the red change in BOLD signal in Figure 3.3). The blue change in BOLD

intensity (Figure 3.3) indicates the deactivation of the same region of the brain in the presence of a non ovulating scent. When the male Marmoset is subjected to the scent of an ovulating female marmoset, it is clear that at least four different areas of the brain are stimulated. These areas include the cingulated cortex, temporal cortex, putamen, and the medial preoptic area. Figure 3.3 illustrates a clear delineation between activated and deactivated responses in particular regions of the brain. The close relationship between both marmoset and human brains, and the clarity of the fMRI data excite researchers with the possibility for accurate behavioral detection.

3.3 Advancement of fMRI

The information that fMRI might provide the medical community is astounding. Functional MRI may be able to detect predispositions to ailments, diseases and cancer. This IQP focuses on the possibility of detecting predispositions to behavioral disorders, particularly sexual aggression. Functional MRI might be able to detect the onset of mental disorders, and provide insight into the best remedial and clinical therapy for those individuals diagnosed. These diagnostic and clinical monitoring strategies could greatly benefit society, and be life-saving to individual patients. However, significant issues such as legality, privacy of medical records, and legislation need immediate attention. The diagnosis of a mental or behavioral disorder carries with it a certain discomfort, which might provoke unexpected responses, affecting the well-being of the patient. It is anticipated that the patient will want to protect the outcome of their individual fMRI analysis from public scrutiny. Thus, legality is a pertinent issue when dealing with fMRI analysis. Lawmakers must consider the medical field, society, and individual patients in deciding how the fMRI data will be used in the future. They must decide who will have access to the data, and how to protect society and the individual. Are health insurance providers entitled to this data? Can this information be used to increase/decrease premiums, or deny health coverage to certain individuals? Will employment agencies have access to this data, and how will they use it? Will job salaries, promotions, and placements be made based on fMRI findings, and if so, is this moral and ethical? What will the effects be on a person who is found to be predisposed to sexual aggression or

other behavioral disorders via fMRI tests? Will fMRI data be admissible in courts, and distributed among federal and local law enforcement agencies? How will the privacy of the individual be protected, if their fMRI data is in circulation? How will predisposition be remedied? These are examples of the many questions that must be addressed concurrently with the advancements of technologies, such as fMRI.

We believe that the answers to these questions will only increase in magnitude over time. The impact of fMRI technology is likely to affect society in unprecedented ways. Researchers anticipate that fMRI will have the ability to significantly help individuals and advance the field of neurology, but precautions must be made to avoid financial gain based on scanned individuals. A preliminary solution regulating the distribution of fMRI data would decrease the possibility of unethical use. This IQP focuses on the safety measures necessary to allow fMRI technology to advance while protecting society from possible negative outcomes.

4. SEXUAL AGGRESSION

4.1 Current Laws Associated with Sexually Aggressive Crimes

Many of the Federal laws associated with sex crimes fall under the Civil Rights Act. A few recent Acts target particular types of sexual and violent crimes, such as The Violence Against Women Act, 1994, The Violence Protection Act, 2000, and The Campus Sex Crimes Protection Act, 2000. A registry for criminals, described in Megan's Law, adds more constraints and requirements for criminals. (22) Federal laws are usually designed to provide a template associated with a type of crime, and then individual states augment legislation, in order to address more specific details. Historically, sexual offenders have faced jail sentences and are rarely offer treatment. Criminals are eventually released with a probation period that offers little support toward the initial condition. The most recent and debated legislation has been Megan's Law. (22) The controversy over this law has induced a debate over the sacrifice of privacy rights for better security. Political leaders have elected to further limit the rights of convicted felons in exchange for improved community safety. Other community members fear the law is another small step toward privacy infringement since the offenders' penalty has already been served. Megan's law enables members of the community to take part in a proactive approach against sexual offense, rather than the historically reactive approach. In addition, this law requires extensive cooperation among convicted sex offenders, through continual registration processes.

Megan's Law

Massachusetts modified its sexual offender laws and programs in 1994 after the kidnapping, rape and death of seven-year-old Megan Kanka. Megan was killed by a convicted sex criminal, who lived in her area. This offender had been released into society without notice to the community. This terrible incident precipitated the state's establishment of a sex offender registry. Within this registry, all convicted sexual offenders are placed on a list which members within

the local community can access. A list of all current state laws associated with sexual offender registration can be seen in Appendix 11.1.

The law states that any person convicted of being a sexual offender must register within two days after being released from incarceration (or no more than 10 days if not incarcerated, or if moving to Massachusetts from a different state). Once registered, the person is listed as a level 1-3 offender (3 relating to the worst sex offenses). All registered sexual offenders must supply a current place of residence every year (homeless people must register every 90 days with area of current residence). All persons on this registry are listed for a period of 20 years, and may petition for relief after 10 years.

Megan's Law allows community members to contribute in a proactive manner, regarding their family safety. In addition, this law requires continual observance of convicted sexual offenders, in order to provide for public safety. As more community members are able to access information regarding local sexual offenders, it is expected that they will exhibit greater precaution around convicted individuals.

This law has raised controversy, as some interpret it as an infringement on the privacy rights of released criminals. Public notification of local sexual offenders may promote discrimination towards an individual who has served their jail sentence, and are in remedial therapy. In some cases, discrimination results in harassment and violation of released sexual offenders. It is imperative that this type of behavior be discouraged, in order to prevent further crime. In addition, Megan's Law requires additional funds in order to enforce regulations, and ensure that all sexual offenders are properly registered.

4.2 Current Treatments for Sexual Offenders

Currently, numerous treatments are being explored and tested on sexual offenders including, a wide variety of pharmaceuticals, surgical procedures, and remedial therapy. Drug therapy involves the use of antiandrogens and Triptorelin, both of which reduce testosterone levels. Antiandrogens have shown the highest potential for treatments

associated with violence, but little support for sexual aggression. (19) Pedophilic behavior is reduced most significantly by Triptorelin, and somewhat by anti-depressants. (3, 8) The complexity of the origins of sexually aggressive behavior and the degree to which this behavior is displayed prevents consistent drug therapy for all patients. Functional MRI would provide a method to determine the level of sexually aggressive intentions for each case, to ensure appropriate treatment is provided. Surgical procedures primarily involve castration. The testes provide 95% of the testosterone, and removal reduces pedophilic responses and behaviors significantly. Psychological factors are not addressed in this procedure, and there is evidence that androgens can replace much of the lost testosterone levels, nullifying the effects. (3) The drug therapy and castration treatment are elaborated in Appendix 11.2. Psychological treatment allows for behavioral, cognitive, and group therapy. It is a time consuming method of treatment, but it helps determine some of the initial conditions of sexually aggressive behavior, which is where the solution will ultimately be found. Since drug therapy is personalized for each individual, fMRI would be an ideal monitoring technique for determining a patient's progress.

Psychotherapy

Hundreds of therapies currently exist for the treatment of sexual offenders. The most effective treatments to date involve a comprehensive behavioral and cognitive approach targeting specific risk factors in individuals, which lead to offensive behavior. (16) These risk factors include low self-esteem, sexual deviance, poor communication and social skills, abnormal attitudes toward sexuality, inappropriate attitudes toward women, alcohol and drug abuse, and child sexual abuse. This approach has shown most significance is the determination of which risk factors apply to specific individuals. Unfortunately, this is a time consuming process, which is rarely followed through. (27) Relapse prevention methods are developed using behavioral and cognitive analysis, in order to help offenders cope with the temptation to re-offend. Aversion therapy attempts to have the patient associate a deviant stimulus with an aversive stimulus. This type of therapy is commonly implemented by associating an

electrical shock with the presentation of a deviant stimulus. Though this has shown some success, the tests have only been done in small groups and has either, not been accompanied by follow-ups, or the follow-ups have been done no more than one year after the end of the treatment process. Aversion therapy shows potential to reduce deviant arousal, but documentation is still being completed. (3) This study also suggests that pairing deviant fantasies with negative social consequences may help eliminate cognitive distortions. Some programs also attempt to help offenders replace their deviant sexual fantasies with more appropriate ones. Sex education is sometimes used to teach offenders about normal sexuality.

Social skills training is often provided through role playing. Child molesters tend to have poor social skills; training in this area may assist them in developing peer relationships, so that they will no longer turn to children. Such training may also address cognitive distortions. Currently, there is only correlative evidence that improving social skills will reduce sexually offensive thoughts.

Reducing cognitive distortions is an important component of an effective treatment program. Cognitive distortions include incorrect perceptions of cues from others, and incorrect beliefs about the effects of sexual activity with children. When offenders verbalize cognitive distortions, they are challenged, their negative consequences are emphasized, and they are offered pro-social views instead. Offenders are also challenged to empathize with their victims, in order to reduce cognitive distortions.

In the past, sexual offenders were often placed in treatment programs that did not directly relate to particular individuals. The cost of providing individualized analysis and treatment would be significant, which is one of the main reasons this type of treatment has not been implemented extensively.

4.3 Detection of Sexual Aggression

The most common way sexual offenders are identified is through the police department. After a crime has been committed, a court proceeding is followed by a

penalty and an occasional treatment requirement. Therapists then analyze the prisoner and determine the likelihood of recidivism through psychoanalysis and personality profiling.

Psychological profiling is an empirically based measure for determining specific psychological traits. It involves a comparison of answers to seemingly unrelated questions, with a large database of personality characteristics. The Minnesota Multiphasic Personality Inventory (MMPI) is among the most popular of such tests and has been shown to provide consistent information about a patient's personality. (20) A test such as this may help identify sexually aggressive behavior. In combination with a physical brain imaging analysis, the cross correlation could help pinpoint the proper assessment for detection and treatment.

Brain imaging technology has advanced rapidly in the past two decades. For instance, functional MRI has recently gained substantial accuracy in resolution at improved speeds. (34) The spatial resolution of fMRI imaging can be improved by eliminating large vascular contributions and improving SNR (signal-to-noise ratio) by increasing the magnetic fields. This technique has also shown great promise in creating faster scans, which could be limited only by the time response given by individuals undergoing behavioral observation. (34) This substantial progression allows researchers to analyze immediate responses to stimuli displayed to patients. The capability of actively monitoring the human brain, non-invasively, provides a tool that was unavailable just a few years ago. These advancements in fMRI touch the surface of what is likely to develop. Behavioral detection is already being analyzed and quantified for both sexual and aggressive behaviors. (13) Although this document focuses on fMRI technology in current brain imagery, there are several other scanning devices that might extract information, including: PET (Positron Emission Tomography), EEG (ElectroEncephaloGraph), SCQID (Super Conduction Quantum Interference Devices), and MEG (MagnetoEncephaloGraphy) scans. All of these methods image the brain, and extract/infer functional brain activity. (28)

5. SEXUAL AGGRESSION PREDISPOSITION DETECTION

5.1 Introduction

The detection of a predisposition to sexual aggression prior to an offense would provide significant clinical opportunities for researchers and psychologists, and might greatly benefit society. In order to gain an abundance of insight into the medical communities view's on fMRI advancement, a number of interviews were conducted prior to the development of a proposed Non-Disclosure Act. These interviews provided our IQP document with the most advanced insight of fMRI technology directly from experts in the field. Among those interviewed were Craig F. Ferris, PhD, Jean King, PhD, and David Olson, MD, PhD. Dr. Craig Ferris is a professor at the University of Massachusetts Medical School, in Worcester, MA. Dr. Ferris is the director of the Center for Comparative Neuro-Imaging (CCNI). CCNI is a joint collaboration between the University of Massachusetts Medical School and Worcester Polytechnic Institute. The goal of CCNI is to invest in research which will provide insight into the nature of mental disorder. CCNI studies a variety of mental conditions, including behavioral disorders and drug abuse, by utilizing high-field imaging. In addition, Dr. Ferris specializes in psychopharmacology, sexual aggression, and violence, studying the use of pharmaceuticals in treating aggressive behavior. Dr. Jean King is also a professor at the University of Massachusetts Medical School, and contributes to the CCNI. Dr. King specializes in the therapeutic and pharmaceutical treatment of children affected by post-traumatic stress disorder and depression. Dr. David Olson is a psychiatrist and professor at McLean Hospital in Belmont, Massachusetts. Dr. Olson specializes in magnetic resonance imaging and spectroscopy of mental disorder and substance abuse.

A few of the key topics discussed included the nature of sexual violence, developments in imaging technology, treatment strategies, and the future of fMRI, including possible legislation. The estimated time frame for obtaining an accurate detection of predisposed behavior is ten years, although researchers vary in this estimation. Dr. Craig Ferris conservatively believed it could take much longer, while Dr.

David Olson thought, “a ten year horizon may be even generous.” Though the doctors’ opinions vary on the time frame of such detection, they believe that a means of behavior predisposition detection will be available in the near future. In light of this estimate, a proposal for a non-disclosure act was created. The non-disclosure proposal implements a legislation that would regulate the process of fMRI scanning including predisposition detection. Historically, legislation has been initiated prior to major scientific discoveries, allowing public relations to be less controversial. (1, 40) Cloning and stem cell research quickly became controversial due to limited prior standards, while the Human Genome Project was able to augment existing legislation for unforeseeable consequences. These consequences included the ability for insurance companies to gain access to individuals’ DNA, and profit from that knowledge.

Possessing a predisposition to sexual aggression is an extremely sensitive topic. It is imperative that key factors such as privacy and experimental accuracy are addressed. This will ensure that fMRI data is given to, and interpreted by, the appropriate individuals.

5.2 Validity of a Predisposition to Sexual Aggression

Certain regions of the brain are known to control specific functions in the body. Dr. David Olson correlated the onset of violent behavior with brain abnormalities, “People who have had other types of head injuries, sometimes have a predisposition to violence.” (28) In addition, Dr. Olson described the connection between sexual aggression and the frontal lobes of the brain: “Kluberducy Syndrome” involves significant degeneration of the frontal lobes, and those people lose the ability to inhibit almost anything. In the worst case, we typically see these patients in the back wards of state hospitals. Anything they see they have to touch, and anything they touch they have to taste, and that involves sexual abuse, too. So they couldn’t inhibit the desire. Anything that attracted their interest, basically, they were sort of stimulus bound to.”(28) Individuals that have this syndrome also provide insight into the inhibitory process, where adverse behavior is restricted. When an electrode contacts a particular point along the primary motor cortex, a specific muscle will contract, allowing an observer to

correlate a location in the brain and a physical location of the body. The topography of the brain differs slightly between individuals, but general physical and behavioral areas can be localized. Another method, that is less invasive, is the use of fMRI to detect a correlation between a region of the brain and a certain act. This is done by placing a patient in an MRI device and instructing them to move a certain muscle/body part, such as their index finger. The patient's brain is scanned before, during, and after the movement process. The areas of the brain that were used to a greater extent during this process will show up on the MRI images. These areas can then be correlated to the action of moving one's index finger, or any other body part that was tested. This second method, which utilizes MRI, is very similar to the way researchers are attempting to detect behavioral responses. This form of testing involves educated analysts as well as MRI machines that can take multiple images in a short period of time. By taking these images, it is possible to determine which areas of the brain are stimulated during the scanning period. In the case of a patient moving their finger, the brain response is due to a physical movement only, whereas when testing for behavioral responses, the brain response is due to thought process. This will allow researchers to correlate neural arousal to a patient's personality and/or thoughts.

Through research, it has been found that the frontal lobe of the brain encompasses the personality of an individual. Within this area, the ability to inhibit behavior, such as violence exists (28). Furthermore, stimuli in this area can be observed using an fMRI scan. There is a strong link between sexual aggression and violent behavior. (13) Both of these behaviors are being studied in hopes that a detection of an abnormality can be quantified. Currently, a study of patients with ADHD (Attention Deficit Hyperactivity Disorder) is being conducted, which demonstrates an advancement being made in behavioral detection. (21)

Researchers at U-Mass Medical School have made significant progress in determining ADHD. Using fMRI, they have found that it is not necessarily a matter of whether an individual has the disorder, but to what degree the individual is affected. Functional MRI allows researchers to quantify behavioral activity, and use this data to provide the proper treatment. As this process is implemented, patients will require less diagnostics, as well as a more precise medical prescription, to minimize the effects of this

disorder. Prior to this treatment method, patients were typically given a prescription based on psychological traits, reanalyzed after a three month period, so alterations can be made to their treatment. Dr. Jean King believes that “fMRI will not only help determine what drugs to use, but also help develop more effective drugs.”

Another substantial study using fMRI has shown some correlation between sexually inappropriate behavior, and variations in brain structure. Antisocial behavior is common to most pedophiles, and a recent study by Adrian Raine, was done using MRI to detect the amount of grey matter that individuals with APD (Antisocial Personality Disorder) have compared to a control (a “normal” non-clinical subject.) In this study, it was determined that patients with APD have an 11% deficit in prefrontal gray matter as compared to the non-clinical control subjects (32). Further studies can accurately determine a physical difference in brain structure. This would provide professionals with another factor for cross correlating the existence of a predisposition to sexual aggression.

As researchers are able to store additional brain imaging data, scan patterns illustrating a predisposition to sexual aggression will become more detailed and in-depth. The Minnesota Multiphasic Personality Inventory (MMPI) has similar methods in storing data, as it has for determining personality traits. (20) If researchers can quantify physical and behavioral tendencies using fMRI in combination with personality profiles, a multilevel determination of behavioral activity might be made. As stated by Dr. David Olson, “We can say, in certain individuals based on certain kinds of profiles, that they are more likely to in a given situation, be involved in an aggressive act.” (28)

5.3 fMRI Testing Format

While researchers are exploring the use of fMRI to detect predispositions to sexual aggression, there must be a standardized testing format that is generally accepted. This standardized format relates to the procedure guidelines, however, the content of each test, may vary, depending on its purpose. Some of the general MRI testing methods currently used can be incorporated into a testing method for use in detecting sexual aggression predisposition. David Olson described two general testing methods which

could be implemented in determining a predisposition to sexual aggression. There are two different ways one can use MRI. One mode is structural. A high resolution anatomy image of the brain can be taken, which provides greater resolution than a CAT scan and it does not introduce radiation complications. Alternately, functional imaging identifies increased or decreased levels of activation in certain parts of the brain, in the context of certain kinds of stimuli. This latter mode is usually at a lower image resolution. (28) Though we do not attempt to compile a testing format, we do acknowledge that one is necessary and a uniform testing method is a guideline in our proposed fMRI act.

While using this uniform testing format, researchers are still able to vary the content of the tests while still complying with the testing format. For example, individuals can be shown images through a headset while they are in the MRI scanner. A series of psychosexual pictures and activities (carefully selected by specialists), are viewed until a pattern of sexually aggressive behavior can be documented. (16) The metabolism for a specific part of the brain will be detected by the scanner to determine the degree of activity displayed by the patient. Patients are generally asked to remain very still during the procedure, and a brace can also be used to prevent movement. This brace does not, however, inhibit their ability to answer questions verbally. Both verbal and visual stimuli could give insight into the behavioral desires of an individual.

5.4 Analysis of Test Results

The rapid speed at which the fMRI can be done diminishes the chances that a conscious choice to inhibit certain thoughts (by the patient) can be made. However, techniques for altering an accurate analysis must be taken into account. Similar to polygraph testing, methods to handle inaccurate results needs to be addressed. These methods would involve multiple tests by independent radiologists or technologists as well as other procedures to ensure or increase the confidence and validity of the results.

Tests performed on convicted sexual offenders would provide a database for characteristic traits. Scans could then be run through a program similar to fingerprint identification, to determine if parallel patterns existed in non-offenders. This testing would provide a great advancement opportunity in the behavioral detection field. By

having an act to protect the individuals participating in this study, it would enable the advance of research, without affecting the test subjects in a negative manner.

Given the many levels of sexually aggressive behavior and variations in brain structure, conflicts with accuracy would be expected. It is also a conscious choice of the individual to inhibit an action, even if it may be strongly desired. However, fMRI scanning can be expected to become more accurate as more corollary data is collected. If the desire to act inappropriately is significant, an individual could access a treatment program to prevent crime. If the privacy of fMRI scans were ensured, a potential offender would be more likely to obtain a scan to assess an accurate treatment. This illustrates the importance of protecting fMRI data in the initial stages during which this technology is used as a behavioral indicator. If privacy of individual patients is secured, more patients will be open to receiving treatment, and in effect, there is a less chance that those predisposed to sexual aggression, to act on their disorder, given early treatment.

6. OUTCOMES OF fMRI ANALYSIS

6.1 Introduction

The analysis of an fMRI screening shows a great potential for quantifiably diagnosing a predisposition to sexual aggression. Researchers are currently developing techniques that would have a positive impact on sexual aggressors, victims, and society as a whole. (21, 28) Current treatment methods for offenders are not implemented with enough regularity to determine an accurate success rate; however, if early diagnosis is possible, perhaps better treatment strategies could be developed. (4) Based on the impacts of such a detection method, it is imperative that some type of legislature be implemented to help control some of the unforeseen conflicts that will inevitably arise. A description of the potential impact on sexual offenders, victims, and society are based on prior technological advancements, and the corresponding legislation associated with the transition.

6.2 Impact on Sexual Offenders

The ability to detect a predisposition to sexual aggression might significantly improve the treatment methods of a convicted offender and provide a quantitative analysis for regulating their release. When a criminal is convicted and placed in jail, research has shown that most offenders are not assessed with enough detail, and therefore are not provided with a treatment program unique to their behavior. Criminals are usually required to attend programs that do not directly relate to their individual symptoms. This can lead to a source of frustration during treatment and recidivism upon their release from incarceration. (3) An fMRI scan combined with a psychiatric analysis would significantly improve the assessment of their condition and lead to a more appropriate treatment for recovery and control. An fMRI scan might also provide the tool necessary for measuring their progress and determining an appropriate time for release. MRI is currently a very effective tool for monitoring cancer treatments and determining

which treatment works best for a given patient. If fMRI could be used in a similar fashion to monitor the effects of the treatments of sexual aggressors, it could greatly help psychologists to correctly diagnose patients and prescribe appropriate medication doses and/or place them in the correct treatment program. The progress of the patient(s) during a given treatment program could also be monitored in this way. The state of Florida currently uses polygraph tests to help determine the likelihood for recidivism in registered offenders. (3) Due to the new advancements in collecting fMRI data in real time, the ability to deceive the assessment of their progress could be greatly reduced. As the criminal realizes that they are predisposed to inappropriate behavior, and that they cannot lie about their intentions, they may start to view their condition as a disease and have strong incentives to aid in their recovery.

It was recently discovered that ADHD should not be viewed as a positive or negative diagnosis. Rather, it is evaluated on a sliding scale to show the extent to which a person displays this behavior. (21) It is reasonable to suggest that sexually aggressive behavior should be diagnosed in the same manner. Treatment could be improved if this scale of behavior could be quantified. The free will of a human prevents the correlation of behavioral detection and action from being 100% accurate, but it may suffice as a tool for proper treatment assessment and help pinpoint the root causes of inappropriate behavior. Another tool MRI could be used for, although not quite as readily, would be the detection of a person exercising free will. There may be an area of the brain that is illuminated when a patient is using free will and not acting upon a predisposition.

The accuracy of detecting a behavioral predisposition could impact sexual offenders and potential sexual offenders greatly. If an individual is scanned and falsely categorized as an offender the impact could be devastating. The same is true with the opposite case, in which an offender is categorized as a safe individual. The progression of fMRI analysis will be very sensitive to individuals' privacy rights, but precautions can be made. The accuracy of this MRI testing is of great concern and is similar to the accuracy possessed by polygraph tests. Polygraph tests are not 100% accurate, therefore legislation was required to assure proper use. The Employee Polygraph Protection Act became necessary due to this inaccuracy, and allowed this tool to be used while still protecting those being evaluated. Privacy and independent testing would have to be

prioritized with respect to fMRI, and therefore, a legislative Act seems to be appropriate for addressing these concerns. When researchers take advantage of technology to help individuals in society, there is inevitably a negative side unforeseen to good intentions. An Act to protect individuals before this technology is fully implemented could easily be amended and reduce potentially devastating effects.

The use of fMRI in the courtroom needs to be addressed. As the accuracy of fMRI improves, it is likely that this form of analysis will be further analyzed with respect to its courtroom use. In the development stage of this technology, it is imperative to focus on the protection of individuals as well as society. Polygraph is inadmissible in court due to the potential for inaccurate results, and it follows that fMRI should be as well. It is important to protect fMRI data until this type of technology matures. The appropriate protection will not only affect the individual, but will also benefit society. Protection of fMRI will provide a safeguard against inappropriate use of this data in legal decision making, and individual treatment by insurance companies and employment agencies. Protection of fMRI in its initial stages as a behavioral indicator will also protect against public scrutiny of an individual who may or may not be predisposed to a mental disorder. After the technology has reached a mature state, it is certainly possible that society will want to gain access to, and use fMRI data in deliberation processes. Additional safeguards must be implemented at that time. Many pedophiles and incest offenders show a desire to get help. If they are assured that the test data will not be used against them, the number of subjects could be increased and potential therapeutic results might be established. By using this testing, an appropriate treatment plan could be prescribed which might mitigate the potential for a future crime. From a sexual aggressor's perspective, support for treatment prior to offense is almost nonexistent. It seems unreasonable that a potential offender would want to discuss their intentions given the strong negative stigma associated with those thoughts. It is frequently found that pedophiles, rapists, and sexual aggressors are often victims of sexual abuse and domestic violence themselves, especially during childhood. (28) This pattern of abuse is a malicious cycle, in which the onset of abuse is so damaging, that the individual is left perpetuating violent and aggressive acts, during adulthood. It is evident that individuals predisposed to sexual aggression would be most apt to follow and be successful in

treatment programs, which account for their privacy. In this manner, the pressures of the stigma of their predisposition will diminish, as they are more able to focus on private therapy, such as individual psychological counseling.

6.3 Impact on Victims and Individuals at Risk of Sexual Abuse

Functional MRI analysis will allow for individuals with a predisposition to sexual aggressive behavior to become aware of their disorder before it has the chance to fully progress. Functional MRI analysis will accommodate such individuals, by allowing clinicians to provide specific therapeutic treatment for each case. This advanced notice might decrease the chances of these individuals committing sexually deviant crimes. This strategy might provide a safer environment for victims, ensuring that offenders receive treatment, in hopes to decrease initial aggressive behavior and recidivism. Organizations geared towards childcare, such as day care centers and schools, may want to access fMRI information from their employees. In receiving fMRI analysis data, employers would judge that they are better able to assess whom they believe is appropriate for certain jobs. It is important to protect the privacy rights of individuals screened to avoid unlawful accusations. Due to the fact that fMRI lacks a certain degree of accuracy, it would be unjust for any persons to exclude or discriminate against an individual, based on predispositions detected that are designed to provide support.

Victims of previous sexual offense may gain insight into the behavioral and social characteristics of sexually aggressive individuals. Hopefully, the medical community and the public will be able to detect warning signs among individuals, before any crime is committed.

Research has shown that the majority of sexually aggressive individuals are victims of sexual abuse themselves. Functional MRI scanning could be offered to any victim of sexual abuse, regardless of whether or not they are a criminal. For example, young children who have been sexually abused may be analyzed using fMRI to detect any neurological abnormalities, or signs of future deviant behavior. This will allow ample time for these victims to receive treatment, in order to prevent recidivism for themselves, and others. Early detection will provide insight into the factors that cause

sexual aggression, and conditions that harbor it. If a predisposition is detected in advance, psychologists will be given the opportunity to help individuals, by mitigating the situation in advance.

6.4 Impacts on Society

The ability to accurately detect a predisposition to behavioral acts such as sexual aggression will have a very large impact on society. One of the major ways that this detection could be used would be for employment purposes. A good example of a place society may want this screening to be used might be in the screening of employees who will be working closely with children, such as in school or day-care programs. Employers might want to require screening of all applicants and would reserve the right to dismiss any employee who does not pass the screening. Many sexual crimes against children in schools and other organizations could be avoided in this way. However; at this time, it is imperative to protect all individuals that have been screened until the fMRI screening method is proven accurate enough for use in society.

There are many other cases in which this ability to detect a predisposition to behavioral acts could be useful in our society. There are however some ways in which this detection ability could be damaging to our society. The major issue in this case would be false information generated by the screening. This false information could say that a person is predisposed when they are not, or vice versa. In either case, there could be damaging effects. In the first case, where somebody is detected to be predisposed but are actually not, job screening would be a very large problem. A normal person, who may be perfect for the job, is unable to get it because the screening provided false information. In the second case, it could be the complete opposite; a person who is actually predisposed may not be detected as such and could be dangerous to fellow employees and/or to whomever they are working with. In the interviews with researchers in the MRI field and psychiatrists working with sexual offenders and victims many of these issues were addressed. It was found that they feel it would be better to have the screening than not. (21, 28) A psychiatrist working with sexual aggression victims stated that it would be better to have an applicant not be able to get a certain job because of a

false hit, than to have a person predisposed to sexual aggression working in a place where this would be a major problem, such as working with children. For these reasons, it is necessary for all individuals who have fMRI screenings to be protected until the accuracy of this detection method is at an acceptable level.

7. PURPOSE OF AN fMRI NONDISCLOSURE ACT

7.1 Need for such an Act

When and if the ability to determine a predisposition to behaviors such as sexual aggression using fMRI is implemented, there will be a great need for guidelines and regulations. Due to the rapid growth of this field in the past few years, we feel it is necessary to have guidelines created now, to avoid misuse, and to support continued growth and enhancement of the technique. These regulations must address key issues such as privacy of the patient, standardized data collection procedures, and ways in which the data can be used for research, once collected. Though this detection of behavioral predispositions is something that is still on the horizon, many people are currently in the process of experimenting and developing this idea. We feel it is necessary to implement predetermined guidelines and regulations regarding this technology, to ensure that when it does become common, the chances of eliminating controversy will be considered well in advance.

7.2 Issues to be addressed

It is imperative that the privacy of patients be addressed during the development and early stages of this type of technology. It is understandable that early implantations of the technology will require additional revisions, based on the outcome of fMRI scanning and data analysis. Implementation of legislation during these early stages, is most critical, so as to ensure that no action is taken based on the initial analyses of fMRI data.

Through interviews with numerous researchers in this field regarding the need for guidelines and regulations, it was determined that there should be some general guidelines and regulations for this field of research. (21, 28) In strong support, Dr. Jean

King explained, “The good thing is, you’re ahead of the game, which is the time to start thinking about it. That’s where we are pushing the technology, so it’s good to address these questions, because that is what will be done at some point.” On the topic of releasing information, there were mixed results on whether or not the patient should even be told of the results (at least in the development stages of the process). An example of a problematic outcome of releasing the information to the patient would be if a normal person was tested and falsely detected to have a predisposition to sexual aggression. When the information was given to the patient they may in fact commit a crime that they would not otherwise. The reason for this may be best described by the self-fulfilling prophecy. This prophecy states that if a person is informed that they will do something then eventually they will in fact do it. On the other hand, if a patient is predisposed and is detected to be predisposed, the patient can seek treatment and would in fact not commit a crime that he/she might otherwise have committed. Researchers differ in the expert opinion of when information regarding fMRI analysis should be given to the patient, and what data should be included in the patient report. Despite this fact, they all agree that legislation is imperative, in order to ensure the safety and future advancement of this type of technology. Though the need for these guidelines are being raised because of the topic of behavioral detection using fMRI, the guidelines should be very generalized and should be able to be applied to other types of scanning such as PET scanning. After investigation and discussion, it was determined that a non-disclosure/non-discrimination act would be the best way to create a set of guidelines and regulations for behavioral prediction devices. After investigating some current acts it was decided that this act being created should be modeled after both the Employee Polygraph Protection Act (EPPA) and the S.1053 which is the Genetic Information Non-Discrimination Act. The reason for choosing these two acts is quite straightforward. The Employee Polygraph Protection Act focuses on the rights of employees who are given polygraph test(s) by their employer. It is thought that when the behavioral prediction is available, it will be used in a work environment similar to how polygraph is used today. For this reason, it should be modeled somewhat after this EPPA. The Genetic Information Act should also be used as a model because it is different from other acts because it focuses on information that will show a predicted event in the future, such as the probability that a

person will get a certain kind of cancer. This prediction is what makes it different from any other information currently available. If and when this new MRI scanning is available, it will also predict what somebody may do in the future or what they are 'predisposed' to. For this reason, the Behavioral Prediction Act (BPA) will also be based on the Genetic Information Act.

The MRI scanning to determine predicted behaviors can also cause many other problems that are not related to behavioral prediction. For instance, a person could get screened for sexual aggression and the scans could show that the person has a large blood clot in their head. Without any guidelines or regulations, an insurance agency could get this information and increase the person's premium due to the blood clot (which would not have been known otherwise). This is only one example of how these tests for behaviors can cause other problems not even related to the information being tested for. These other issues must also be brought into consideration when drafting the (BPA). A list of the key features of the proposed BPA as well as a similarity/difference comparison to the Genetic Information Non-Discrimination Act and the EPPA can be found in Appendix 11.3

8. FUNDAMENTAL IDEAS OF THE fMRI NON-DISCLOSURE ACT

The fMRI Non-Disclosure Act was based on the principles of the Fourth Amendment rights for all Americans. The security of unwarranted search and seizure also supported the Employee Polygraph Protection Act, Medical, and DNA Privacy Acts. As fMRI analysis continues to develop, legislation required to neutralize misuse and monitor advancements, will increase. The topics covered in this act are designed to serve as a template for behavioral predispositions based on functional imaging devices.

Information obtained through the ability to determine behavioral responses in given situations would require the most advanced privatization measures possible. The sensitivity of this type of assessment should lie in the qualified clinicians and imagers. fMRI technology is still in the developmental stages, and at this point, should not be released to patients or insurance and employment agencies. At this time, it is necessary for fMRI analysis to be self-protected, until further development has deemed it suitable for access to patients, for the purpose of receiving medical treatment. In addition, as fMRI gains more accuracy, the evaluation of the most ethical use to benefit society can be determined and amendments to an existing act could be made.

Discrimination based on fMRI analysis should also be avoided and protected by law. As DNA analysis was beginning to show significant accuracy, it soon fell into the hands of insurance companies seeking to maximize profits based on this data. An act was soon designed, but private information had already been compromised. It is the intention of the fMRI Non-Disclosure Act not to allow similar discriminatory violations that would allow a private party to profit. Current and potential employment should also be fully shielded from using fMRI data to influence employment decisions.

It must be clarified that modalities specific to security practice are beyond the scope of this IQP, yet the need for regulations regarding fMRI analysis is warranted. It is imperative that patient specific data should be withheld from all agencies at the current time, due to the frequent changes being implemented in fMRI technology on a regular basis. There should be a method of access for research based on characteristics not

reducible to individual traits. Scanned individuals should authorize all other access. In the case of disabled persons and minors, a guardian should assume the role of access ability and data duplication.

Rapid growth in fMRI must also be addressed with respect to private data. As new advancements are developed, it should only be applied to existing scans by authorized people. If existing fMRI scans were found to determine physiological and behavioral traits not initially intended, individual privacy would be compromised. Individuals have the right to know exactly what they are being scanned for the related conclusions. It is also the patients right to a full description of the procedures and the ability to decline fMRI analysis at any time, including the destruction of existing scans. A complete version of the fMRI Non-Disclosure Act can be seen in Appendix 11.4.

9. CONCLUSIONS

Functional Magnetic Resonance Imaging (fMRI) has the ability to detect predisposition for behavioral disorders, specifically sexual aggression. This ability creates an abundance of ethical, legal, social, and moral issues. As this technology progresses, it must be determined which individuals and groups should have access to analyzed fMRI data for legal and ethical protections. Lawmakers must decide under what circumstances fMRI data may be used in legal decision making, and to what extent will fMRI data be allowed to influence insurance premiums, employment placements, and benefits in the workplace. Socially, the impact of fMRI data on an individual predisposed to sexual aggression must be considered. How will a predisposition to a threatening behavioral disorder affect the rights and treatment of such an individual? In addition, the possibility that this individual will be a victim of harassment due to the stigma of their predisposition must be addressed.

Current treatment strategies targeted at combating sexual aggression have proven unsuccessful. Functional MRI provides a powerful tool in determining the magnitude and specifics of an individual's predisposition to sexual aggression. Not only can fMRI give insight into the best treatment strategy, but additional scanning can provide an accurate assessment of the progress of ongoing treatment.

As the technology of fMRI matures, protection strategies and legislation must be implemented. This ensures that during preliminary stages of use, fMRI data will be focused on scientific advancement in the cure for sexual aggression, and not on unwarranted use, in its initial stages. In order for the advancement in fMRI detection to benefit society, individuals must be protected in order to be open to testing and treatment procedures, to address their predisposition.

In the future, fMRI technology may be used to analyze younger subjects, in order to detect a predisposition early, before its onset. This will help to combat against the cyclic pattern of abuse, being that sexual aggressors were often sexually abused as children. Children, who are victims of abuse, will be able to receive the proper treatment,

determined by fMRI analysis, in order to prevent their participation in future abusive behavior.

These issues, along with many others, are addressed in the proposed fMRI Non-Disclosure Act of this IQP. The Non-Disclosure Act provides a compilation of proposed strategies and preliminary solutions in dealing with the complex issues that will inevitably arise with advancement in fMRI technology. It is hoped that future legislation relating to fMRI will advent from this thorough investigation, and ultimately benefit society as a whole.

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11. APPENDIX

11.1 Appendix 1: State Laws Associated with Sexual Offenses

Review of State Sexual Assault Laws, 1998 Codes

State	Rape Shield Law	Sex Offender Register	Civil Commitment	Web Registry	Offender AIDS Testing	Medical Exam Costs	Evidence Protocol/ Kit	Training	Rape/Victim Counselor Privilege
AL	Yes	Yes		Yes	Yes	No	No	No	Yes
AK	Yes	Yes		Yes	Yes	No	Yes	Yes	Yes
AZ	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
AR	Yes	Yes				Yes?	Yes	No	No
CA	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes
CO	Yes	Yes			Yes	Yes	No	No	Yes
FL	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
GA	Yes	Yes		Yes	Yes	Yes	No	No	No
HI	Yes	Yes			Yes	No	No	No	Yes
ID	Yes	Yes			Yes	Yes	No	No	No
IL	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes
IN	Yes	Yes		Yes	Yes	Yes	No	No	Yes
IA	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
KS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
KY	Yes	Yes			Yes	Yes	No	No	Yes
LA	Yes	Yes	Yes		Yes	No	No	No	No
ME	Yes	Yes			Yes	Yes	Yes	No	Yes
MD	Yes	Yes			Yes	Yes		Yes	No
MA	Yes	Yes	Yes		No	Yes	Yes	Yes	Yes
MI	Yes	Yes			Yes	No	Yes	No	Yes
MN	Yes	Yes	Yes		Yes	Yes	No	No	Yes

MS	Yes	Yes			Yes	Yes	No	No	No
MO	Yes	Yes	Yes		Yes	Yes	No	No	No
MT	Yes	Yes			Yes	Yes	No	No	No
NE	Yes	Yes	Yes		Yes	Yes	No	No	No
NV	Yes	Yes			Yes	Yes	No	No	No
NH	Yes	Yes			Yes	Yes	Yes	No	Yes
NJ	Yes	Yes	Yes		Yes	No	No	No	Yes
NM	Yes	Yes			Yes	Yes	No	Yes	Yes
NY	Yes	Yes			Yes	Yes	Yes	Yes (DA)	Yes
NC	Yes	Yes		Yes	Yes	Yes	No	No	No
ND	Yes	Yes	Yes		Yes	No	No	No	No
OH	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Limited
OK	Yes	Yes		Yes	Yes	Yes	No	No	No
OR	Yes	Yes			Yes	Yes	No	No	
PA	Yes	Yes			Yes	Yes	No	No	Yes
RI	Yes	Yes			Yes	No	No	No	No
SC	Yes	Yes	Yes		Yes	Yes	Yes	No	No
SD	Yes	Yes			Yes	Yes	No	No	No
TN	Yes	Yes			Yes	Yes	No	No	No
TX	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
UT	Yes	Yes		Yes	Yes	Yes	No	No	Yes
VT	Yes	Yes			No	Yes	No	No	Yes
VA	Yes	Yes		Yes	Yes	Yes	No	No	No
WA	Yes	Yes	Yes		Yes	Yes	No	Yes	Yes
WV	Yes	Yes			Yes	Yes	No	No	No
WI	Yes	Yes	Yes		Yes	No	No	No	No
WY	Yes	Yes			Yes	Yes	Yes	No	Yes

11.2 Appendix 2

Current Drug and Surgical Treatments for Sexual Offenders

Drugs (Chemical Castration)

Antiandrogens: Depo Prevera (Medroxyprogesterone Acetate) and Androcur (Cyproterone Acetate)

These drugs are designed to reduce testosterone and diminish sexual preoccupation, sexual arousal, and urges. The effect of the drugs lasts only as long as the patient continues to take it. Levels of hormones return to previous levels within weeks of discontinuous use. The results have shown some positive effects for sexual offenders and even better results for violent offenders.

Decapeptyl-CR (Triptorelin)

This drug also reduces testosterone serum levels, although through a different method. All patients showed significant testosterone serum reduction and reported significant reduction in sexual interest, fantasies, and abnormal sexual behavior. The results have shown a particularly positive effect for pedophiles. There was not as great an effect for suppression of violence.

Anti-Depressants: Fluoxetine

This drug helps enhance the transmission of serotonin in the brain. Although normally taken for depression and obsessive-compulsive disorder, there is some evidence that it can reduce sexual fantasies. The results have shown some significance for pedophiles, but little effect on rapists.

Surgical Castration

This procedure also removes the testes which produces 95% of testosterone in men. It has shown significant results in suppressing paraphiliac fantasies and behaviors. It has not significantly removed the desire to offend. The act of sexual aggression does not always require that an offender still possess his own physical parts. Replacement androgens are also available to restore testosterone levels, thus nullifying the effects of this procedure in psychologically.

11.3 Appendix 3: Similarities and Differences Between fMRI Non-Disclosure Act, EPPA, and Genetic Information Non-Discrimination Act

(Similarities to Title 1 of S.1053):

1. Prohibit health insurance discrimination based on MRI information or MRI services.
2. Prohibit discrimination in premiums based on MRI information
3. Limitations on suggesting MRI testing, and requesting MRI information on the part of the health insurance issuer.
4. Abide by confidentiality standards to prevent unwanted disclosure of private information
5. A health insurance company may request MRI information needed for treatment, payment, and health care. The health insurance company may deny coverage if this information for the prior concerns is withheld.
6. 'MRI Information' should include the sex, age, test results, and analysis of the patient

(Differences to Title 1 of S.1053):

1. 'MRI Information' should not include MRI tests of family members, and occurrence of disease and disorder in the family of an individual.

(Similarities to Title 2 of S.1053):

1. Employers do not have the right to discharge an individual based on their MRI information.
2. Employment agencies have a right to qualification standards, in determining whether an individual may pose a threat to the company and/or employees based on MRI information.
3. Employers may not expel or exclude individuals from the company on the basis of MRI information.
4. Employers may not segregate and/or classify individuals based on their MRI information.

5. Employers may not cause or attempt to cause discrimination/harassment against an individual based on MRI information.
6. Employment agencies must have limitations on the disclosure of MRI information, in order to protect the privacy of the employees.
7. Disclosure limitations may be neglected if the MRI information is requested by the individual themselves, health researchers (if they have the proper authorization to use the information), Federal and State courts, law enforcement, and government officials.

(Differences to Title 2 of S.1053):

1. Employers have the right to refuse to hire an individual based on their MRI Information.

Similarities/Differences of the 'Employee Polygraph Protection Act of 1988' (EPPA) and the 'MRI Nondisclosure Act':

(Similarities to EPPA):

1. The employer must obtain a copy of the MRI Nondisclosure Act.
2. The employer must provide a written statement addressed to the employee including a description of investigation or need for MRI testing/information.
3. The Employer may contain MRI information six months after the start of an employees term.
4. If MRI testing is requested by an employment agency, they must provide a written and signed statement to the employee including the date, time, and location of the test.
5. In addition to an MRI scan, an interview prior to the test should be conducted with the employee to observe their behavior.
6. There should be monetary and civil penalties for violations of the MRI Nondisclosure Act.
7. 'MRI Information' should not contain any irrelevant or unnecessary information.

(Differences to EPPA):

1. The employer must provide one week's notice prior to MRI testing.
2. The clinician administering the test may be required to retest each individual, especially in the case of an initial sign to predisposition in the first MRI testing.
3. Each MRI test should be conducted under the same time period and conditions for individuals being tested for similar abnormalities.

11.4 Appendix 4: fMRI Non-Disclosure Act

Disclosures of Private fMRI Information

Sec. 1 DISCLOSURE OF PRIVATE FMRI INFORMATION

- (a) No person in ordinary course of business may disclose, distribute, or receive private fMRI information, unless written authorization is given.
- (b) Private fMRI information cannot be used in a discriminating fashion against any individual, group, or organization
- (c) Any persons disclosing private fMRI information must be properly authorized to do so.
- (d) The disclosure should include only the information necessary to the purpose of viewing a patient's private fMRI information. Any information failing to pertain to the subject at hand, may not be distributed.
- (e) Upon receipt of private fMRI information, persons may not relay this information to any other source unless given the proper authorization by both the imager and the patient.

Sec. 1 describes the methods of disclosing private fMRI information. No persons including clinicians, imagers, researchers, insurers etc. may disclose private fMRI information to any source without valid written authorization. There are no breaches of contract in this act regarding emergency situations, except in the case that the proper authorization has been granted.

Sec. 2 AUTHORIZATION FOR DISCLOSURE OF PRIVATE fMRI INFORMATION

(a) WRITTEN AUTHORIZATION

- (1) Written permission to distribute and disclose private fMRI data must be given by the patient, in the presence of a notarized official.
- (2) Authorization must clearly identify all individuals permitted to disclose fMRI information.
- (3) The patient's relationship to the source, or the purpose for the source's inquiry into fMRI information must be stated in the authorization.
- (4) A description of the information being disclosed must be provided to the patient during authorization.
- (5) The patient must be notified of all sources being given their private fMRI information.
- (6) A copy of the authorization and other documentation pertaining to disclosure must be given to the patient.
- (7) The authorization should be dated. After 60 days, the authorization becomes invalid and must be reissued if private fMRI information is to be disclosed.

(b) All private fMRI information disclosed to a source(s) must include a written statement including:

“This medical information is being provided to you under the fMRI Non-Disclosure Act. Any further disclosure of this information will be penalized.”

(c) The authorization may be withdrawn, provided substantial reason given by the patient, at any time prior to disclosure

Sec. 2 states private fMRI information may not be used in a discriminating fashion by clinicians, researchers, counselors, employment agencies, businesses, insurance companies, or any other institution. A patient may not be denied health insurance coverage, or be subject to raised premiums on account of their private fMRI information.

A patient may not be denied employment, or be discriminated by an employment agency on account of their private fMRI information. Sec. 2 serves to protect the privacy of the individual patient, and to insure no discrimination of any kind against these patients.

Sec. 3 INSPECTION AND COPYING OF RECORDS CONTAINING PRIVATE FMRI INFORMATION

- (a) All private fMRI information must be traced back to a number or identifier. The identity of the individual patient should not be given to those sources inspecting the information.
- (b) Only qualified individuals such as clinicians and imagers may have the information necessary to correlate numbered data with an individual.
- (c) Copying of private fMRI information may only be done if written authorizations are given by the patient and imager/clinician.
- (d) A copy of private fMRI information may be made 60 days after receiving written authorization. Failure to do so within this time-frame, will result in the need for reauthorization.
- (e) No persons, businesses or other sources receiving copies of private fMRI information may use this information in a discriminating fashion against a patient.
- (f) There will be no fee for the copying of fMRI information, if proper authorization has been granted.
- (g) Copying of fMRI information must be done strictly for research purposes only.
- (h) Only qualified individuals, those licensed to view fMRI information or those granted permission through authorization, are permitted to inspect a patient's records.

Section 3 describes the need for patient's privacy upon inspection of private fMRI information. Information should be given on a no-name basis, in which each piece of imaging or scan is given a correlating number or label, rather than the patient's

identification, prior to inspection. Copying of private fMRI information is prohibited unless properly authorized, and must be copied by the imager or researcher at no fee. This insures that multiple copies of private fMRI information containing the patient's name, will not be distributed.

Sec. 4 AMENDMENT OF FMRI RECORDS

- (a) A researcher has the right to correct any fMRI information if there is reason to believe the information is incorrect, and valid authorization is granted by the patient.
- (b) If a patient believes their fMRI information is incorrect, and can provide valid reasons why the suspect inaccuracies, they may give authorization to the medical community to amend such information
- (c) A patient has the right to refuse amendment of their private fMRI information
- (d) A patient must provide written authorization for their fMRI records to be studied further in the future, with more advanced technology.
- (e) Any source denied upon requesting amendment of fMRI records must receive a written statement explaining the disagreement of the patient or researcher.
- (f) Amended fMRI information must be protected and viewed only by qualified personnel or those granted authorization, in order to maintain patient privacy.

fMRI information should be corrected if it is found to contain any falsehoods or inaccuracies. The patient should be notified of any changes in their fMRI record, and have the right to receive a copy of the new information. As technology in the field of MRI is rapidly advancing, new technologies may not be applied to previous fMRI records and findings, unless specific permission is requested by the researcher, and granted by the patient. The amended information should be protected, and be viewed only by authorized personnel to insure patient privacy.

Sec. 5 DISCLOSURES OF fMRI INFORMATION PURSUANT TO LEGAL PROCESSES

- (a) Private fMRI information cannot be used for prosecution of a patient in court.
- (b) All sources viewing fMRI data, including the patient, must be informed that it is not 100% accurate.
- (c) Law enforcement agencies and individuals may not discriminate against a patient based on their private fMRI information.
- (d) FMRI information may be used in favor of a patient when determining the success of rehabilitation.
- (e) Government agencies have the write to request fMRI information, if the need for such information is stated.

As technology in the field of fMRI advances it will be tempting for the public and law enforcement agencies to utilize private fMRI information in a court of law, or in a claim against an individual patient. It must be noted however, that fMRI imaging as of now, is not 100% accurate, and may be viewed as similar to polygraph testing which is not admissible in a court of law. FMRI information must not be used in any type of discriminating fashion in legal aspects as well.

Sec. 6. FMRI PRETEST PROCEDURES

- (a) The patient should be thoroughly examined in order to determine that they are eligible and appropriate for fMRI examination.
- (b) The examinee must be provided written notice of where and when the exam will be, by the imaging staff.
- (c) The examinee has a right to consult with a counselor, before and after fMRI examination.
- (d) The examinee should be written authorization within between within 48 hours of the test, but before 24 hours within the test. This allows time for the examinee to make any necessary consultations.
- (e) The examinee should be able to consult privately with an attorney prior to and after each phase of the fMRI examination.

(f) The examinee should be informed orally, and in writing, of the physical operation of the test, and the nature and characteristics of fMRI equipment.

(g) Only qualified imagers with a license may administer the test.

The procedure of administering an fMRI on a patient in order to detect predisposition, contains many factors that must be taken into account. It is the imager's responsibility to inform the patient of the methods and risks involved in the procedure, as well as the actual administration of the procedure. The patient must be examined, and determined to be fit for fMRI testing, and should be granted the right to withdraw from testing at any time.