Command hallucinations and violence: risk and factors influencing compliance

Rogers, Paul

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COMMAND HALLUCINATIONS AND VIOLENCE AND FACTORS INFLUENCING COMPLIANCE

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This thesis is submitted to the University of London for the degree of Doctor of Philosophy
Abstract

BACKGROUND: The associations between command hallucinations and violence are not well understood. Currently, all three possible hypotheses have support: no association, a negative association and a positive association. Studies that found positive associations took account of the content of the command hallucination. It was hypothesised that violent-content command hallucinations are associated with violence whereas command hallucinations of any content will have a decreased or null association.

STUDY DESIGNS: The associations between violent-content command hallucination and command hallucinations of any content were examined using a cross sectional design for historical and admission-based violence and a cohort design for longitudinally measured violence.

METHODS: Secondary analyses of the MacArthur Violence Risk Assessment Study were conducted. Participants were classified according to whether they had (i) violent-content command hallucinations, non-violent command hallucinations, auditory hallucinations without command hallucinations and non-auditory hallucinations and (ii) command hallucinations of any type, auditory hallucinations without command hallucinations and non-auditory hallucinations. Confounders were predetermined. Unadjusted and adjusted odds ratios with 95% confidence intervals
were computed using either a logistic regression model or a repeated-measures, logit model.

RESULTS: Violent-content command hallucinations are positively associated with previous violence to a family member, any aggression as reason for admission, homicidal threat/ideation as reason for admission, lethal weapon usage or threat as reason for admission and longitudinally measured violence. These associations were present after adjustment for confounders. They were not associated with prior arrest for crimes against the person or self-reported historical violence to others. These associations either disappeared or reduced for command hallucinations of any content.

CONCLUSION: Violent-content command hallucinations increase the risk of violence after adjustment for confounding. Previous studies that did not control for the content of command hallucinations reduced the likelihood that a positive association between command hallucinations and violence was found. Future studies should sample according to the content of the command hallucinations.
Acknowledgments

A special thank you to Allison, Ciara and Hannah.

I am indebted to Professor Kevin Gournay and Dr Nicola Gray for their supervision, help, support and guidance throughout.

I am also very grateful to Professor Glyn Lewis, Dr Andrew Watt, Dr Morven Leese, Dr Alan Montgomery, Professor Pamela Taylor, Professor Alec Buchanan, Dr Sue Plummer and Professor John Monahan. All of whom have offered invaluable guidance and support throughout.

This project was supported by funding from the Wales Office of Research and Development for Health and Social Care (S98/004).
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df Degrees of Freedom
D.O.H Department of Health
AHS Auditory Hallucination Scale
A.P.A. American Psychological Association
BIS-II The Barratt Impulsivity Scale-11
BPRS Brief Psychiatric Rating Scale
CBT Cognitive Behaviour Therapy
CH Command hallucinations
CHS Content of Hallucinations Scale
CHQ Command Hallucination Questionnaire
C.I. Confidence Interval
DIS Delusional Interview Schedule
FU1 1st follow up (10 weeks)
FU2 2nd follow up (20 weeks)
FU3 3rd follow up (30 weeks)
FU4 4th follow up (40 weeks)
FU5 5th follow up (50 weeks)
HPS Hallucination Predisposition Scale
IRR Incident Rate Ratio
MDT Multidisciplinary Team
MUPS Mental Health Research Institute Unusual Perceptions Scale
NCAH Non command auditory hallucinations
NH Non hallucinations
NVCCH Non-violent content command hallucinations
OR Odds ratio
PCL:SV Psychopathy Checklist: Screening Version
PERI The Psychiatric Epidemiology Research Interview
SADS Schedule for Affective Disorders and Schizophrenia
SCPS Strauss Carpenter Prognostic Scale
SPSS Statistical Package for the Social Sciences
VCCH Violent-content command hallucinations
$\chi^2$ Chi Square
STATEMENT OF CANDIDATE’S ROLE IN THIS STUDY

This study was developed from questions that I asked as a result of my own clinical practice and as a result of a preliminary observation study that I undertook at the beginning of my PhD. I then applied for a PhD studentship from the Wales Office of Research and Development and was successfully in winning this award. This research was supported by a Research Studentship Grant (PhD) provided by the Wales Office of Research and Development for Health and Social Care (S98/004).

My role in this study was as the lead investigator. I was responsible for defining the hypotheses, determining the research aims, determining the study designs, obtaining the secondary data, determining the variables of interest and conducting all statistical analyses. I have checked my planned methods and analyses by seeking advice from epidemiologists and statisticians who gave general advice and confirmation that my planned methods and analyses were correct. I solely wrote this thesis.

Paul E Rogers

I confirm that the above is a true statement of the candidate’s contribution to this study.

Kevin Gournay, CBE
Professor of Psychiatric Nursing
Health Services Research Department
Institute of Psychiatry

23/Feb/04
CHAPTER 1

INTRODUCTION
Introduction

This chapter will provide the background and rationale for this study and a brief overview of violent outcome research in schizophrenia. Thereafter a critical appraisal of the command hallucination literature will be presented with an interpretation of the literature. This interpretation leads to the study’s research aims and hypotheses.

1.1 Background and rationale for the study

The research questions posed within this study arose as a direct result of my previous experiences as a Clinical Nurse Specialist in Cognitive Behaviour Therapy (CBT). This role was within a Medium Secure Unit and involved referral and treatment of a number of patients who were experiencing command hallucinations of violent content. Furthermore, the majority of the patients seen in CBT clinical practice had described acting violently in response to command hallucinations. Paradoxically, at the time, the research studies which had been conducted had repeatedly found no positive association between command hallucinations and violent behaviour. The obvious discrepancies between clinical experiences and research led me to consider the importance of the research methodologies that have been previously employed as well as the nature of the content of command hallucinations. This led me to design a number of smaller exploratory studies before conducting the following PhD study.
1.2 Violence and symptoms of mental illness

There has recently been rising governmental concern in the United Kingdom that the public is experiencing a loss of confidence in mental health services and their ability to provide accurate risk assessment and management (D.O.H., 1998). One such area of concern has focused on violent assaults on members of the public by people with psychotic mental disorders. Command hallucinations are one of the main psychotic symptoms which have been the subject of investigation as to associations with violence.

In the United States, the American Psychological Association (A.P.A., 1986) reviewed the professional literature on the risk that individuals with command hallucinations posed on instruction from the U.S. Supreme Court. The A.P.A. concluded that there was clearly an insufficient quantitative body of knowledge to allow adequate appraisal of the dangerousness associated with command hallucinations and cautioned that the prediction of compliance with command hallucinations in individual cases could not be made with confidence.

Over the past 20 years, published reviews examining the evidence base for associations between violence and mental illness have reached differing conclusions depending on the design, samples and outcome measurements employed. For example, some have tended to conclude that mental disorder has a small or weak association with violence and/or criminal behaviour when compared to criminal
history factors (Bonta et al, 1998). Others have concluded that people with schizophrenia, albeit by virtue of the activity of a small subgroup, are significantly more likely to be violent than members of the general population (Walsh et al, 2002a). At present it is possible to cite studies which support all three possible hypotheses. For example, negative, null and positive associations between command hallucinations and violence.

The need to examine violence in specific mentally ill “subgroups”, as identified by Walsh et al., (2002a) has been a regular recommendation from studies and commentators over the past 15 years. Junginger (1996) questioned the validity of continuing research that examines broad categories of mental illness and proposed that analysis of individual psychotic symptoms might be more informative. Buchanan (1997) supported this position and pointed out that studies of risk using diagnosis alone have limited designs and that individual elements of phenomenology should be examined. These elements included persecutory beliefs, passivity phenomena and command hallucinations. Research into the association between psychotic symptoms and violence has resulted in positive findings for an association between delusions and violence (Taylor, 1998; Smith & Taylor 1999). However, despite a strong historical assumption that command hallucinations elevate risk (Bleuler, 1930; Schneider, 1959) such an association has not been found unequivocally for command hallucinations (Rudnick, 1999).
1.3 Command hallucinations and risk: Literature review

For the purposes of this study MEDLINE (1966-2002), PSYCHLIT (1974-2002) and key Mental Health and Forensic Mental health texts books were searched for literature pertaining to command hallucinations.

Numerous descriptive case reports were found which suggested a positive relationship between command hallucinations and the risk of: sexual offending (Parn & Rivera, 1995); violence to others (Good, 1997); self amputation of a limb (Hall et al, 1981); self amputation of the penis (Hall et al, 1981); swallowing objects (Karp et al, 1991); self mutilation of the eyes (Field & Waldfogel, 1995); self inflicted lacerations (Rowan & Malone, 1997); and suicide (Zisook et al, 1995). In addition, there is one single case study incorporating an experimental design into the long term outcomes of cognitive behaviour therapy (CBT) for a patient who had acted on violent-content command hallucinations and had been charged with manslaughter (Rogers & Curran, in press [enclosed as appendix 1 - written by PhD candidate].

Only limited information and conclusions can be taken from these non-comparison studies. Therefore, this review will focus on those studies where comparison has been made.

Rudnick (1999) completed a systematic literature review of all published studies of command hallucinations where a comparison group was available and identified 11 papers which could be classified as either being concerned with command
hallucinations and the risk of violence and/or self-harm (n=7) or concerned with the examination of factors associated with action on non dangerous command hallucinations (n=4). Since Rudnick’s review the literature search identified two further peer-reviewed studies which were both concerned with the associations between command hallucinations and the risk of violence and/or self-harm (one by PhD candidate). In addition, another study was identified through a book search (Monahan et al, 2001), known as the MacArthur Violence Risk Assessment.

This literature review is therefore based upon 10 studies, which have examined the relationship between command hallucinations and “risk”. This “risk” consisted of violence (n=6) or risk of violence and self-harm (n=3) and the risk of violence or self-harm (both outcomes examined independently (n=1).

Of these 10 studies examining violence and self-harm, six found a null relationship (Hellerstein, Frosch & Koenigsberg, 1987; Shore et al, 1989; Rogers et al, 1990; Zisook et al, 1995; Kasper, Rogers & Adams, 1996; and Cheung et al, 1997), one found a negative relationship (Thompson & Stuart, 1992), one found a positive relationship (McNiel, Eisner, & Binder, 2000), one found a positive relationship for violent content command hallucinations and a null relationship for command hallucinations irrespective of the content (Monahan et al, 2001) and one found both a positive relationship for self-harming behaviour and a null relationship with violent behaviour (Rogers et al, 2002 [enclosed as appendix 2 - written by PhD candidate]).
Thus, at first glance, the state of the research evidence examining the associations between command hallucinations and violence/and or self-harm appears to be as confusing as that of schizophrenia and violence as all three possible research hypotheses have support. However close examination of these studies offers the ability to better interpret such results.

1.3.1. Methodological limitations of command hallucination and violence studies

In a previously published paper, I recommended caution (Rogers et al, 2002) against drawing any firm conclusions from the available research evidence to date. Especially, where this relates to clinical decision making about the risk that an individual patient may pose to themselves or to others. This is because the current state of our understanding regarding the associations between command hallucinations and risk is problematic. Clinicians routinely evaluate the risk posed by patients to themselves and others. The presence or absence of command hallucinations along with other psychotic symptoms inevitably form part of such risk assessments. Yet, available evidence supports null, negative and positive relationships between command hallucinations and risk. It is therefore important to understand why these studies have reached different conclusions. It is important that the findings of each study be critically appraised in the light of the limitations inherent in research of this complexity. Especially when most of the studies employ designs that are not longitudinal in nature.
1.3.2. Definitions of command hallucinations

The use of unstandardised definitions of command hallucinations across studies limits the conclusions that can be drawn (Table 1). Only two studies have provided a definition of command hallucinations (Hellerstein et al, 1987; Rogers et al, 2002) and a variety of assessment techniques have been employed. Hellerstein et al, (1987) defined command hallucinations as auditory hallucinations that:

"Order particular acts, often violent or destructive ones and instruct a patient to act in a certain manner - ranging from making a gesture or grimace to committing suicidal or homicidal acts" (Hellerstein et al, 1987; pg 219)

Rogers et al, (2002) used the same definition to aid their study of command hallucinations. In all of the available studies, the presence of command hallucinations has been derived from casenotes, clinical interviews, or self-report measures. Casenote diagnoses are dependant on the nature of the clinical judgments at that time leading to the potential for misclassification due to clinician's differences in diagnoses. In addition, where psychometric measures were used, there is a lack of any conformity across studies. The use of one agreed diagnostic procedure in studies would allow comparisons of like with like and as can be seen in table 1, no study has of yet, used the same psychometric diagnostic measures.
<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Definition of command hallucination provided for the study?</th>
<th>Procedure for the detection of command hallucination assessment described?</th>
<th>Measure used to determine presence of command hallucinations?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shore et al, (1989)</td>
<td>Case-note survey</td>
<td>No</td>
<td>No</td>
<td>Psychology graduate reviewed clinical charts for presence</td>
</tr>
<tr>
<td>Rogers et al, (1990)</td>
<td>Case-note survey</td>
<td>No</td>
<td>Yes</td>
<td>SADS, HPS, CHS</td>
</tr>
<tr>
<td>Thompson et al, (1992)</td>
<td>Case-note survey</td>
<td>No</td>
<td>Yes</td>
<td>Documentation of the presence of a command hallucination at the time of offence</td>
</tr>
<tr>
<td>Kasper et al, (1996)</td>
<td>Case-note survey</td>
<td>No</td>
<td>Yes</td>
<td>SADS, CHQ</td>
</tr>
<tr>
<td>Cheung et al, (1997)</td>
<td>Case Control</td>
<td>No</td>
<td>Yes</td>
<td>MUPS</td>
</tr>
<tr>
<td>Monahan et al, (2001)</td>
<td>Longitudinal follow up</td>
<td>No</td>
<td>Yes</td>
<td>AHS</td>
</tr>
<tr>
<td>Rogers et al, (2002)</td>
<td>Case-note survey</td>
<td>Yes</td>
<td>Yes</td>
<td>Presence recorded in Psychiatric Court Report or 1st MDT Assessment report</td>
</tr>
</tbody>
</table>

SADS: Schedule for Affective Disorders and Schizophrenia (Spitzer & Endicot, 1989)
HPS: Hallucination Predisposition Scale (Launay & Slade, 1981)
CHS: Content of Hallucinations Scale (Larkin, 1979)
CHQ: Command Hallucination Questionnaire (Resnick, unpublished)
MUPS: Mental Health Research Institute Unusual Perceptions Scale (Carter et al., 1995)
PERI: The Psychiatric Epidemiology Research Interview (Dohrenwend ET AL., 1978)
AHS: Auditory Hallucination Scale
1.3.3 Measurements of exposure

Exposure within this thesis refers to the presence or absence of exposure to violent content command hallucinations or any command hallucinations. Some studies have included patients who do not have violent content command hallucinations (e.g., who have day-to-day, non dangerous command hallucinations [Zisook et al, 1995]), while others have specifically controlled for the content of the command hallucination and have controlled for violent or self-harming content (Rogers et al, 2002). Studies that have included patients with unspecified-content of command hallucinations (pre-1999) have a total sample size, across all studies of 237. This leads to a total of 253 separate commands as one study reported patients experiencing more than one command hallucination (Kasper et al., 1996).

In examining violence as the outcome and taking the higher figure for these studies (e.g., the number of commands where n=253), only 13% (32/253) of cases had reported commands directing violence (3 homicide, 9 violence to others and 20 had “violent content” which was defined as “violence to self or others”). This latter inclusion is somewhat ambiguous as it is impossible to determine whether all or any of the “violent content” group had commands of violence to others. Using a stricter criteria with those cases with definitive violent content which excludes violence to self. Only 5% (12/253) of patients had specified violent content commands (Table 2).
In examining self-harming as the outcome and taking the higher figure for these studies (e.g., the number of commands where \( n=253 \)), only 24% (69/253) of cases had reported commands directing self harm (20 of which had “violent content” which was defined as “violence to self or others”). Again, using a stricter criteria of those cases with definitive self-harming content which excluded violence to others. Only 17% (49/253) of patients have specified violent content (Table 2).
Table 2: Command hallucination studies: Sample size and results where exposure is uncontrolled

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample size of command hallucinators</th>
<th>Reported content of commands</th>
<th>Outcome Measure</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hellerstein et al, (1987)</td>
<td>58</td>
<td>30 suicide, 3 homicide, 7 self-harm, 8 non violent acts, 10 unspecified</td>
<td>Inpatient violence and suicide attempts</td>
<td>Null association</td>
</tr>
<tr>
<td>Shore et al, (1989)</td>
<td>19</td>
<td>Unspecified</td>
<td>Arrest for violent crime in a 9-12 year follow-up</td>
<td>Null association</td>
</tr>
<tr>
<td>Rogers et al, (1990)</td>
<td>25</td>
<td>Unspecified</td>
<td>Unspecified “Assaultative behaviour”</td>
<td>Null association</td>
</tr>
<tr>
<td>Thompson et al, (1992)</td>
<td>34</td>
<td>Unspecified</td>
<td>Violent crime as reason for admission</td>
<td>Negative association</td>
</tr>
<tr>
<td>Zisook et al, (1995)</td>
<td>46</td>
<td>20 violent (i.e. to self/others), 19 benign (e.g. go outside), 7 unspecified</td>
<td>“Impulsive action problems” as measured by the SCPS</td>
<td>Null association</td>
</tr>
<tr>
<td>Kasper et al, (1996)</td>
<td>27</td>
<td>20 harmless *, 12 violent to self *, 9 violent to others *, 2 unable to articulate</td>
<td>Self-reported violence and suicidal acts in preceding 12 months</td>
<td>Null association</td>
</tr>
<tr>
<td>Cheung et al, (1997)</td>
<td>28</td>
<td>Unspecified</td>
<td>Inpatients classified as violent if had 2 episodes of violence to people/property in an 8 week period &amp; had 1 episode per month for 6 months</td>
<td>Null association</td>
</tr>
</tbody>
</table>

*the reported content of commands is greater than the sample size as some patients had more than one type of command.

SCPS: Strauss Carpenter Prognostic Scale (Strauss & Carpenter, 1974)
The three studies post-1999 that have specified the exposure; which is the content of the command hallucinations have a total sample size of 114 across all studies (Table 3). Three of the four analyses within these studies supported a positive association between the exposure which is the content of the command hallucinations and the associated outcome measure with such exposures of either violence and/or self-harm.

### Table 3: Command hallucination studies: Sample size and results where exposure is controlled

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample size of command hallucinators</th>
<th>Reported content of commands</th>
<th>Outcome Measure</th>
<th>Findings of association</th>
</tr>
</thead>
<tbody>
<tr>
<td>McNiel et al, (2000)</td>
<td>31</td>
<td>31 to hurt others</td>
<td>Self-reported violence 2 months prior to admission based on items from the MacArthur Risk Assessment study</td>
<td>Positive association</td>
</tr>
<tr>
<td>Monahan et al, (2001)</td>
<td>29</td>
<td>29 command to be violent</td>
<td>Aggregated violence from self report, collateral informant, arrest and hospital records</td>
<td>Positive association</td>
</tr>
<tr>
<td>Rogers et al, (2002)*</td>
<td>54</td>
<td>34 Violence to others</td>
<td>Inpatient violence</td>
<td>Null association</td>
</tr>
<tr>
<td></td>
<td></td>
<td>37 Violence to self</td>
<td>Inpatient Self-harm measured by hospital incident forms</td>
<td>Positive Association</td>
</tr>
</tbody>
</table>

*This study examined violent and self-harming commands and violent and self-harming behaviours separately and the reported content of commands is greater than the sample size as some patients had more than one type of command

This review has examined the potential relationships between the content of command hallucinations and potential outcomes. The implications of the review are such as to suggest that the content of command hallucinations have an association
with corresponding violent or self-harming behavioural outcomes. This suggests that an association between command hallucination content and outcome measures may have been obscured in the previous studies where the nature of the commands in the command hallucination group was not fully specified.

However, one study (conducted by this PhD candidate [Rogers et al., 2002]), which did not find any association between violence to others command hallucinations and inpatient violence raises some doubt about such an hypothesis.

1.3.4 Definition and measurement of outcome

Tables 2 and 3 specify the outcome measures that were used in all controlled studies. All but the one (Monahan et al, 2001) have relied upon single source data for determining the presence of the outcome. How violence has been categorised has greatly differed across studies and the criteria used in two studies are debatable (Cheung et al, 1997 and Zisook et al, 1995). Cheung et al. (1997) examined the relationship between psychotic symptoms in inpatients who were categorised as being either violent or non-violent. The violent group consisted of patients who had perpetrated at least two episodes of in-patient violence during an eight-week period and at least one episode per month thereafter during the following six months. The definition of violence was broad and included violence to property as well as to people. Patients with lower levels of violence (e.g. once during the initial eight week period or who failed to have monthly violent episodes thereafter) were therefore
assigned to the non-violent group. This design may or may not have resulted in patients with relatively low rates of violence being grouped together with those who showed no violence. The subsequent conclusion that command hallucinations have a null relationship with risk using such a hybrid group should clearly be treated with caution. A further study used “impulsive action problems” as their sole dependent measure (Zisook et al, 1995). This measure was obtained using one item on the Strauss-Carpenter Prognostic Scale. This item is retrospective and patients were rated for “impulsive actions” on a 0-4 scale based upon case note data. Given that impulsive actions are not by themselves violent, this study found no difference in impulsive acts between command hallucinators and non-command hallucinators. Examination of the sample suggests that they had very low base rates for impulsive acts. The mean number of episodes of violence, self-harm or criminal conviction was less than one per patient in both groups. The authors acknowledged these problems and reported that the failure to find differences between the groups may be related to sampling bias.

The study which found a negative relationship between command hallucinations and violence is of significant interest as it is the only one to do so (Thompson et al, 1992). This study compared command hallucinators, auditory hallucinators without command hallucinations and non-hallucinators. The outcome measure was whether forensic patients' current police charge were crimes against the person or not. However, the data reported in this study is uninterpretable. On examination of the
data, the cumulative percentages presented in the table for the non-hallucinator comparison group exceeds 100% (i.e. 160%). Therefore, the $\chi^2$ test for independence used to test for differences is invalid. All previous reviews of command hallucinations have not noticed this error. The Thompson et al study becomes more confusing when in the discussion the authors discuss acquittal rates as opposed to crimes against the person. There are no tables or data relevant to acquittal rates within the paper so it is difficult to determine what the true outcome measure really was.

Outcome measurements that only use police contacts or arrest records can introduce a number of biases (Walsh et al, 2002a). These include the intensity and quality of policing, the behaviour of the suspect, the availability of court/arrest diversion systems and the severity of offence may vary. This can lead to differences in the proportion of violent acts which lead to police contact and arrest. For example Robertson (1998) found that offenders with major mental disorders are more easily detected than other offenders because they are more likely to stay at the scene of the crime and/or turn themselves into the police.

All but one (Monahan et al, 2001) of the studies used either a survey method or a retrospective cohort study where they collected a range of case-note data and then compared a command hallucination group to a comparison group for whichever outcome that was chosen. Five of the ten studies have examined inpatient violence/self harm. Yet all but one (Rogers et al, 2002) have failed to describe
whether the length of admission was the same for the two groups being compared. This is crucial as it is unknown whether length of stay has had any effect on the findings as one group may have been in hospital for a longer time period than the other group. This in turn would lead to one group being more likely to have been coded as having been violent as they had a greater inpatient admission time. A similar problem occurs with a further study (Shore et al, 1989), which examined violent arrest rates for patients 9-12 years following discharge. No discussion or consideration about the difference in follow-up time is provided and there is no suggestion that this has been taken into account in the statistical analyses that were performed.

As such, a number of discrepancies are apparent which limit the conclusions that can be drawn from these reviewed studies. The failure to detect significant episodes of violence can lead to the wrong conclusion about the association between violence and command hallucinations. How violence is measured varies greatly. Little consistency exists as to what types of violence to measure and how to do this from study to study.

1.3.5 Bias

Selection bias refers to a distortion in the estimate of effect resulting from (i) the manner in which the participants were selected for a given study and/or (ii) selective losses from the study population prior to data analysis (Gail & Benichou, 1999). This bias will result in an observed relationship between the exposure variable which is
command hallucinations and the violent outcome that is different among those who entered into the study than among those who were eligible but did not (Gordis, 2000).

Table 4 examines each study for the potential for bias. Only one of the 10 studies report a refusal rate (Monahan et al, 2001). Of the five studies that relied upon case note data, only two reported the number of patients who were included and excluded. One study (Zisook et al, 1995) recruited participants from an outpatient setting. This was a secondary data analysis of data originally designed for a different study. The description of the original study is unclear but the authors report that it was related to outpatient research protocols for individuals with schizophrenia. There are a number of difficulties that the researcher must overcome when conducting such secondary data analyses. For example, familiarisation with the dataset, data coding and missing values. It is common practice to report these difficulties and how they were overcome. These were not reported in this study.

Another study (Kasper et al, 1996) recruited patients from either an acute ward in a state hospital or from a community hospital in the United States. The definition or description of a community hospital was not provided so it is difficult to know whether this may have had an effect on the findings. For example, if the community hospital was a day-hospital where patients attended between the hours of 9am-5pm then this contrasts heavily with acute admission facilities. As the authors of this study did not report which patients in their comparison groups were recruited from which
location this becomes a potential area for bias. This study relied upon self-reported violence and suicidal behaviour in the preceding 12 months as the outcome measure. It is possible that those in the acute in-patient settings would have been at greater risk of exhibiting violence or suicidal behaviour as these are often reasons for admission. Yet due to the nature of inpatient decision making related to discharge, it is possible that such participants were less likely to self-report hearing command hallucinations. Consequently, without having taken into account or making adjustments for location, bias could have occurred.

Finally only one of the studies accurately reported whether the interviewers or raters were blind to the exposure and outcome conditions (Monahan et al, 2001). Non-blinding can lead to interviewer bias. This is where knowledge of the exposure group or outcome can result in an increase in selective probing at interview or greater scrutiny of case notes (Davey-Smith & Egger, 1998).
<table>
<thead>
<tr>
<th>Study</th>
<th>Were participant refusal rates reported? If case note data used, were non-included numbers provided due to insufficient data?</th>
<th>Where were participants recruited from?</th>
<th>What was the chosen control group?</th>
<th>Were refusal rates reported?</th>
<th>If case note data was used, what was the rate reported?</th>
<th>If case note data was used, were non-included numbers provided due to insufficient data?</th>
<th>Where were non-included numbers provided due to insufficient data?</th>
<th>Were interviewers/rater’s blind to the exposure and outcome conditions?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hellerstein et al, (1987)</td>
<td>Not applicable (case note data). No data reported on the quality.</td>
<td>Inpatient admissions</td>
<td>(1) Auditory hallucinations without command hallucinations (2) All other inpatients (without auditory or command hallucinations)</td>
<td>Not reported</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
</tr>
<tr>
<td>Shore et al, (1989)</td>
<td>Not applicable (case note data). No data reported on the quality.</td>
<td>Male patients who had been arrested for attending the White House</td>
<td>(1) All other inpatients (without command hallucinations)</td>
<td>Not reported</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
</tr>
<tr>
<td>Rogers et al, (1990)</td>
<td>No</td>
<td>Inpatient Forensic Assessment Unit</td>
<td>(1) Auditory hallucinations without command hallucinations (2) All other inpatients (without auditory or command hallucinations)</td>
<td>Not reported</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
</tr>
<tr>
<td>Thompson et al, (1992)</td>
<td>Not applicable (case note data). However, a random sample was taken and 106 omitted.</td>
<td>Inpatient Forensic admissions who were found not guilty of an offence by reason of insanity</td>
<td>(1) Auditory hallucinations without command hallucinations (2) All other inpatients (without auditory or command hallucinations)</td>
<td>Not reported</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
</tr>
<tr>
<td>Zisook et al, (1995)</td>
<td>Not applicable (case note data). 25% (35/140) were excluded as the documentation was insufficient.</td>
<td>Outpatient hospital records (recruited for an earlier completed)</td>
<td>(1) Auditory hallucinations without command hallucinations</td>
<td>Not reported</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
</tr>
<tr>
<td>Kasper et al, (1996)</td>
<td>No</td>
<td>An acute ward in a State hospital and a community hospital (not defined)</td>
<td>(1) Hallucinatory patients without command hallucinations (2) Psychotic patients without command hallucinations</td>
<td>Not reported</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
</tr>
<tr>
<td>Cheung et al, (1997)</td>
<td>No</td>
<td>“Chronic” Inpatients</td>
<td>Non-violent patients with schizophrenia</td>
<td>Not reported</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
</tr>
<tr>
<td>McNiel et al, (2000)</td>
<td>Not reported</td>
<td>Acute inpatient Unit</td>
<td>(1) All other inpatients (without command hallucinations)</td>
<td>Not reported</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
</tr>
<tr>
<td>Monahan et al, (2001)</td>
<td>Yes</td>
<td>3 Acute inpatient Units</td>
<td>(1) Other command hallucinators without violent content commands</td>
<td>Yes</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
</tr>
<tr>
<td>Rogers et al, (2002)</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient.</td>
<td>Inpatient Forensic Unit</td>
<td>(1) All other inpatients (without command hallucinations)</td>
<td>Not reported</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
<td>Not applicable (case note data). 18% (25/139) excluded as the documentation was insufficient</td>
</tr>
</tbody>
</table>
1.3.6 Confounding

Confounding occurs when a factor that is associated with the exposure which is command hallucinations or violent content command hallucinations and independent of this exposure, is a risk factor for the violent outcome (Gordis, 2000). Statistical relationships between command hallucinations and violence in any particular study are dependent on the investigator’s consideration and management of confounding (Gordis, 2000). Confounding is a difficult issue because uncertainty exists about the causal pathway between command hallucinations and violence. It is unclear what variables to consider as confounders. Walsh et al (2002a) recommended that in mental health research gender, age and ethnicity should be considered as likely confounders.

Consequently, it is difficult to truly determine which factors are potentially confounding and which are not. However, attempts at examining and adjusting for confounding are justified. These should include the areas of age, gender and race. All studies have attempted to examine whether there were any differences in the characteristics of the comparison groups. Identified differences were: age, race, onset of illness, past drug abuse, emotional responses to the voices and symptomatology. Only one study (Rogers et al, 2002) examined whether these variable of difference were also significantly different for the outcome measure in order to determine whether confounding, exists. Table 5 describes which potential confounders have been examined in the command hallucination studies.

35
Table 5: Command hallucination studies: analysis of potential confounders

<table>
<thead>
<tr>
<th>Study</th>
<th>Were confounders identified and examined?</th>
<th>Were differences in age, gender and ethnicity examined between the comparison groups?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hellerstein et al, (1987)</td>
<td>No</td>
<td>Yes but results unreported</td>
</tr>
<tr>
<td>Shore et al, (1989)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Rogers et al, (1990)</td>
<td>No</td>
<td>No (age, gender or ethnicity not examined)</td>
</tr>
<tr>
<td>Thompson et al, (1992)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Zisook et al, (1995)</td>
<td>No</td>
<td>No (ethnicity not examined)</td>
</tr>
<tr>
<td>Kasper et al, (1996)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Cheung et al, (1997)</td>
<td>No</td>
<td>No (gender and ethnicity not examined)</td>
</tr>
<tr>
<td>McNiel et al, (2000)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Monahan et al, (2001)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Rogers et al, (2002)</td>
<td>Yes</td>
<td>No (ethnicity not examined)</td>
</tr>
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</table>

1.4. Interpretation of the existing comparison studies

Prior to 2000, three systematic reviews were conducted. None of these reviews included meta-analytical procedures. All concluded that there was no evidence for an association between command hallucinations and violence and or self-harm. The first review was conducted 15 years ago (Rogers, Nussbaum, & Gillis, 1988) and was based upon one study. The review concluded that the relationship between command hallucinations and violent behavior was scarce and fragmented. More recently, two further reviews arrived at similar conclusions. The second was conducted by Hersh
and Borum (1998). This review allowed for a wide definition of the outcome measure and used "dangerousness". This ranged from nonviolent criminal behaviour (e.g., suicidal ideation) to life-threatening behaviour. The authors concluded that there was no association between command hallucinations and any form of dangerousness. Interestingly, despite their review findings they suggested that some patients do comply with command hallucinations and clinical risk assessment should include assessment about the presence of command hallucinations. The third review was conducted by Rudnick (1999). This review found nine studies. Rudnick again used "dangerousness" as an outcome that included violence toward others and violence toward self. Rudnick examined these separately. Rudnick concluded that there was no association between command hallucinations and either violence or self-harm. Rudnick reported that all of the controlled studies were methodologically weak which means that the conclusions drawn from them should be tentative. Rudnick presented the notion that future studies should scrutinize aspects of the content of the command hallucinations as well as the mere presence. Three studies have examined such associations since that recommendation.

Table 1 showed that where the content of the command hallucinations are not fully controlled, the findings of any association are either null or negative. Yet the sample size and issues of exposure classification warrant discussion. The sample size within and across studies is small. At best the evidence base over the last 15 years for either a negative or null relationship for command hallucinations and violence is based
upon a total sample of only 13% (32/253) of patients where the content of the
command hallucination is reported. At worst the evidence is based upon a mere 5%
(12/253) of patients. A similar finding occurs when examining self-harm and
command hallucinations. At best the evidence base over the past 15 years is based
upon 24% of patients (69/253) where studies have specified the command content. At
worst the evidence is based upon 17% of patients (49/253). It is debatable whether
clinical decision-making about risk has been well advised by these studies.

It was not until 2000 that a positive association between command hallucinations and
violence was found and 2002 until a positive association between command
hallucinations and self-harming behaviour was found. The striking difference
between the studies which have and have not found a positive association is that the
content of command hallucinations was fully taken into account in studies which
found a positive association.

Consequently a logical conclusion is that the nature of the samples and whether they
included all violent content command hallucinations or not accounts for the
differences in the studies. It is important to carefully consider the Rogers et al,
(2002) study further as this did include violent content command hallucinations but
did not find a positive association.
The Rogers et al study (2002) used data on all patients resident in a Welsh medium secure unit over a 51-month period from 1995 until 1999. Data was extracted from clinical and legal records. Patients were categorised as experiencing lifetime histories of command hallucinations if the psychiatrist reported either symptom in a court report, pre-admission assessment report or in the patient’s first case conference. The outcome measures were taken from the hospital’s untoward incident forms. These provided a description of untoward events with corroborating witness statements. Incident rate ratios (IRR) were calculated for inpatient violence and self-harm. Violence was defined as an assault on another person where physical contact occurred and verbal threats of impending violence resulted in the need for staff intervention. Self-harm was defined as successful or failed suicide attempt and successful or threatened self-injury requiring staff intervention. Negative binomial regression was used to analyse violent and self-harm incident rates over the study period due to the differences in the length of inpatient admissions between the groups and due to the over-dispersion within the data. Over-dispersion is where the analyses may be affected by either within-group or between-group variability. The presence of such variability may violate some of the fundamental assumptions made in the modelling process and lead to over-dispersion in the outcome. More specifically the majority of analyses assume that the outcome follow a Poisson distribution which may not be the case. This study controlled for the potential confounding variables of gender, a history of having had paranoid delusions, a history of having had a violent conviction, a history of alcohol abuse and a history of drug abuse.
The study found a greater incidence for the violent content command hallucination exposure group when compared with those who had not had such an exposure after adjustment for confounding (IRR, 1.39; C.I., 0.53-3.66). This means that patients with violent-content command hallucinations accounted for a greater incident rate ratio. Unfortunately, the confidence intervals are not informative as the lower limit is less than one and the upper limit is greater than one. This means that one can be 95% confident that the true odds would lie in this range. This suggests that violent content command hallucinations may be either protective (C.I., 0.53) or a risk factor more than three times greater than the comparison group (C.I., 3.66).

Other differences occur between the three studies which have examined only violent content command hallucinations. The Rogers et al study (2002) was the only one that examined inpatient violence. The McNiel et al. study (2000) examined self-reported violence occurring 3 months prior to admission. The MacArthur Violence Risk Assessment study examined community violence at 20-week and 50-week follow-up. The Rogers et al study (2002) controlled for confounding whereas the other two studies did not.

The MacArthur Violence Risk Assessment study examined longitudinal associations between command hallucinations and violence. The data was examined in two ways. Firstly whether any association occurred between violent content command hallucinations and any violence at either 20-weeks follow-up or at one year follow
up. This was examined through the use of the $\chi^2$ test for independence. Secondly whether any association occurred between those with command hallucinations, irrespective of their content and any violence at either 20-weeks follow-up or at one year follow up. This was again examined using the $\chi^2$ test for independence (Monahan et al., 2001, p79). The authors reported that there was no association between command hallucinations, irrespective of content and violence but that there was an association between participants with violent content command hallucinations and violence in the first 20 weeks following discharge and over the entire year follow up (20-weeks: $\chi^2 = 3.84$, df = 1, $p=0.05$; 1-year: $\chi^2 = 10.23$, df = 1, $p<0.001$).

Caution must be taken when interpreting the results of this analysis due to the assumptions, which underlie the use of $\chi^2$ with this data. Chi square does not make the best use of the available data as 5 follow-up time periods were available to the study team, yet the authors only chose to examine the associations at two time periods (20-weeks and 1-year). Additionally, such analysis assumes that there are no confounders and does not adjust for the potential confound of “time”.

It is plausible that it is the content of the command hallucinations which are important when attempting to interpret why some studies have found a positive association between command hallucinations and others have not. The Rogers et al study (2002) may not have found a positive association because it examined inpatient violence whereas the other two studies examined community violence. Alternatively the Rogers et al study (2002) may not have found a positive association because it
was the only one to adjust for confounding.

It is therefore apparent that all of the studies that have included only violent content command hallucination have significant flaws. Either by the nature of the environment or by the lack of adjustment for confounding.

1.5 Aims and importance of this research

Further research into this area is clinically important as a large degree of uncertainty about the relationship between command hallucinations and risk still exists. Clinician and academics alike face a number of issues when interpreting the existing literature. It is not uncommon for both clinicians and academics alike to dismiss command hallucinations as a risk indicator while citing one of the studies that found a null association (Rogers et al, 2002).

As shown with this review, the available evidence supports null, negative and positive relationships between command hallucinations and violence. It is difficult to know why this has occurred. It may be due to the selection of the samples, due to confounding or due to the statistical analyses which have been employed.

For example, the MacArthur Violence Risk Assessment Study is a well-designed and well-reported study of violence and found a positive association for violent content command hallucinations and violence. However, it did not report all follow-up
periods, used a limiting and inappropriate statistical analysis ($\chi^2$) and did not control for potential confounding. Therefore the question arises as to how reliable are the reported findings from the MacArthur Violence Risk Assessment?

Consequently additional secondary analyses of the Macarthur Violence Risk Assessment Study are required using appropriate statistical methods. This will improve the interpretations that can be made about command hallucinations and violence.

This thesis aims to conduct secondary analyses of the MacArthur Violence Risk Assessment Study and re-examine the associations between (1) violent content command hallucinations and violence and (ii) command hallucinations irrespective of content and associations with violence. The second aim is designed to assess whether not controlling for the content of command hallucinations affects the results. Therefore, the statistical analyses used to examine aim 1 will be replicated in examining aim 2. This will provide information as to whether violent content command hallucinations are associated with violence and whether this association weakens or disappears if replicated for command hallucinations containing any content. Both of these aims will be explored using both cross sectional and longitudinal data.
1.5.1 Aim 1

The first aim of this thesis is to compare historical, present and longitudinal violence between four exposure groups: (i) those having experienced violence to others command hallucinations; (ii) those having experienced non-violence to others command hallucinations; (iii) those having experienced non-command, auditory hallucinations; and (iv) those having never experienced auditory hallucinations.

1.5.2 Hypothesis to be tested

The hypothesis for Aim 1 is that a higher proportion of patients with violent-content command hallucinations will have engaged in violence prior to admission, as a reason for admission and at follow up when compared with other patients. The comparison groups are those who have experienced non-violent content command hallucinations, those who have experienced non-command auditory hallucinations and those who have never experienced auditory hallucinations.

It is hypothesised that the proportion of violent content command hallucination patients who have engaged in violence will remain higher than the comparison groups even after adjustment for potential confounders.

1.5.3 Aim 2

The second aim of this thesis is to replicate aim 1 with a different exposure group. Therefore to compare historical, present and longitudinal violence between three
exposure groups. These will be those having experienced command hallucinations irrespective of content, those having experienced non-command-auditory hallucinations and those having never experienced auditory hallucinations.

1.5.4. Hypothesis to be tested

The hypothesis for aim 2 is that the patients with all command hallucinations (irrespective of the content), will have engaged in reduced levels of violence prior to admission, as a reason for admission and at follow up, after adjustment for potential confounders when compared with the results obtained for those with violent-content command hallucinations as found from aim 1.
CHAPTER 2

METHODS
Methods

This chapter will provide details on the methods of the study. This includes the rationale and methodology for secondary analyses, the study designs for addressing aim 1 and aim 2, the study procedure, participant information, outcome measures, exposure classifications and confounders. The analytical procedures and power calculation are also presented.

2.1 Background

I had the opportunity to access the MacArthur Violence Risk Assessment Study as well as having support from the MacArthur research team for clarification of data and coding when necessary. Secondary data analysis of the MacArthur Violence Risk Assessment Study was conducted in order to examine the study aims. The MacArthur Violence Risk Assessment Study is the largest worldwide database that has examined violence and mental disorder and has sufficient study power to examine the aims. The MacArthur Violence Risk Assessment Study is a well-known longitudinal study within the field of psychiatry and has been widely analysed and reported (Monahan et al, 2001). The MacArthur Violence Risk Assessment Study was designed with three principles: (i) to improve the validity of clinical risk assessment, (ii) to enhance the effectiveness of clinical risk management and (iii) to provide information on mental disorder and violence which will be useful in reforming mental health law and policy. The Executive Summary of the MacArthur Violence Risk Assessment Study (2001)
"Despite the pervasiveness of violence risk assessment in mental health law, research continues to indicate that the unaided abilities of mental health professionals to perform this task are modest at best. Many have suggested that making available to clinicians statistical ("actuarial") information on the empirical relationships between various risk factors and subsequent violent behaviour is the only way to reduce the disconnect between what the law demands and what clinicians currently are able to provide." (page 2).

The MacArthur Violence Risk Assessment Study was designed to overcome a number of methodological obstacles that had occurred with previous risk assessment studies. These obstacles were (i) that the range of predictor variables previously studied have been narrow and usually contained only chart diagnosis and basic demographic information, (ii) the measures of the criterion variable (e.g., violence in the community) have been very weak, typically involving only one source of information: (e.g., arrest or rehospitalisation for a new violent crime), and (iii) the patient samples analysed have been highly restricted, usually to males with a prior history of violence (Monahan et al, 2001).

The previously identified problem of having samples which contained a narrowly selected group of patients was confronted pragmatically by the MacArthur team by studying a sample broadly representative of acute psychiatric admissions. These included both males and females patients; those with and without prior violence; those admitted on a voluntary or an involuntary legal basis, of all diagnoses (except mental retardation); and who were Caucasian, African American, or Hispanic
ethnicity. Subjects were between 18 and 40 years of age and all spoke English.

2.2 Rationale and methodology for secondary analyses

Secondary analysis is the examination of previously collected data (Black, 1995). A researcher may carry out a secondary analysis using their own data or data from another investigator (Black, 1995; Herron, 1989). The key characteristic of all secondary analyses is that the data being used were originally collected for some purpose other than to answer the research question under current consideration. This ensures that the original research teams' efforts are maximized and further developed.

The advantages of conducting secondary analyses are that it is considerably cheaper and less time consuming than undertaking original studies. This is especially so where large sample sizes are required with lengthy follow-ups and as in this case, where difficult to reach populations are being studied. If hypotheses can be tested using existing data sets then the cost of research is reduced as further data collection is not required.

The principal disadvantages of secondary data analyses are that the researcher has no control over the design or collection of the original data set and therefore the variables collected may not always be specific in allowing for secondary analyses. It is now becoming commonplace for large studies to collect a range of variables which
are not necessarily needed in order to test the original research hypotheses, such as
the MacArthur Violence Risk Assessment Study or in the case of national surveys,
where no a priori hypothesis exists as in the Office of National Statistics Psychiatric
Morbidity Surveys. Ordinarily recoding or transforming the dataset can often
overcome the problem of the data variables not being an exact measure of what is
required for the secondary analyses but this can lead to a lessening of the validity of
the research unless a good understanding of the dataset and coding methods is held.
This is particularly the case, as was found in this study where large samples are used
involving large numbers of coded variables. A further disadvantage is that it may be
difficult to identify errors or inconsistencies in the dataset if the procedures are not
well described or if access to the procedures used in the original research is not
forthcoming.

In order to overcome these disadvantages the original research team were contacted
and informed of the intention to use their data for the purposes of this PhD thesis.
Access to the procedures and coding rules was provided and these have also been
widely published. Additionally, the original research team offered support when
questions relating to the original dataset arose or where clarification was required.
The group responsible for conducting the original research consisted of: Henry J.
Steadman, Pamela Clark Robbins, John Monahan, Paul Appelbaum, Thomas Grisso,
Edward P. Mulvey, and Loren Roth.
2.3 Design

As this study is examining violence outcomes at three periods of time (historical, present and future) it incorporates two study designs (Table 6). These are a cross sectional survey design and a longitudinal design.

A cross sectional design is where exposures and disease outcome are determined simultaneously for each participant (Gordis, 2000), as was the case for historical violence and current violence in this study.

Cohort studies constitute a central epidemiological approach to the study of relationships between personal characteristics or “exposures” and the occurrence of a health related event or “outcome” (Gordis, 2000). Cohort studies have the advantage that a wide range of health events can be studied in relation to exposures, furthermore that prospective ascertainment of exposure data will be of higher quality than retrospectively collected data (Gordis, 2000). For this study it allows the individuals to be followed up over time making it possible to measure a new episode of violence prospectively. The MacArthur Violence Risk Assessment Study followed people up at approximate 10-week intervals over 1 year where repeat cross sectional measurement was taken. Longitudinal studies can either be classified as dynamic where new cases can enter the study or fixed whereby the population is defined at the onset and apart from losses to follow-up. It’s composition remains unchanged for the duration of the follow-up. The MacArthur study used a fixed population.
Table 6: study design, and outcome measures

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Time</th>
<th>Design</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A higher proportion of patients with violent-content command hallucinations will have engaged in violence prior to admission, as a reason for admission and at follow up when compared with those patients who have: experienced non-violent content command hallucinations; non-command auditory hallucinations; and those who have never experienced auditory hallucinations. It is hypothesised that the proportion of violent content command hallucination patients who have engaged in violence will remain higher than the comparison groups even after adjustment for potential confounders.</td>
<td>1. Prior to admission (historical)</td>
<td>Cross sectional</td>
<td>1. Prior Arrests for crimes against the person 2. Historical self-reported violence to others 3. Historical self-reported violence to family</td>
</tr>
<tr>
<td>2. The proportion of patients who will have engaged in violence prior to admission, as a reason for admission and at follow up will be no greater for command hallucination patients when compared to those patients who have: experienced non-command auditory hallucinations; and those having never experienced auditory hallucinations. It is hypothesised that the proportion of command hallucination patients who have engaged in violence will remain equal when compared with the other two exposure groups even after adjustment for potential confounders.</td>
<td>2. Reason for admission (current)</td>
<td>Cross sectional</td>
<td>1. “Any aggression” as reason for admission 2. “Homicidal threat/ideation” as reason for admission 3. “Lethal weapon usage/threat” as reason for admission</td>
</tr>
<tr>
<td></td>
<td>3. Follow-up violence (longitudinal)</td>
<td>Cohort study</td>
<td>Reconciled violence at follow up</td>
</tr>
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</table>
2.4. Participants

During the MacArthur study period 12,873 people were admitted to the research facilities, of whom 7,740 met the selection criteria. The selection criteria used in the MacArthur Violence Risk Assessment Study were: (1) civil admissions, (2) between the ages of 18 and 40, (3) English-speaking, (4) White, African American or Hispanic ethnicity and (5) a diagnosis of schizophrenia, schizophreniform, schizoaffective, depression, dysthymia, mania, brief reactive psychosis, delusional disorder, alcohol or drug abuse or dependence, or a personality disorder. The mean time between hospital admission and approach by the research interviewer to obtain informed consent was 4.5 days. Eligible subjects were excluded if they had been hospitalised for 21 days or more prior to being approached. Data collection began in mid-1992 and ended in late 1995.

Of the 7,740 who met the selection criteria, 1695 were randomly selected to participate of which 81% (1203/1695) agreed and 29% (492/1695) refused. Of the 1,203 who agreed the final sample consisted of 1,136 patients. Seventy-seven participants were not included as they were not interviewed within the designated time period following admission. Fifty nine percent (667/1136) were male and 41% (469/1136) were female. Sixty nine percent (785/1136) were White, 29% (330/1136) were African American and 2% (21/1136) were Hispanic. Monahan et al (2001) provide a more detailed description of the full original sample recruited in The MacArthur Violence Risk Assessment Study.
The original team examined the representativeness of the sample comparing responders with non-responders. This data is not contained within the database available for secondary analysis. The original team reported that demographic and clinical comparisons of those who agreed and refused to participate in the study showed that participants were significantly associated with being in the age group 18-24 as opposed to the age group 25-40 (p<0.05), less likely to have a chart diagnosis of schizophrenia (p<0.001) and more likely to have a chart diagnosis of alcohol/drug abuse (p<0.001) than the non-participants. There were no further significant differences between those who did and did not agree to participate. The original research team stated the following in respect to these differences (Steadman et al., 1998):

"An inevitable limitation of research in this area is that patient refusal or attrition can compromise the representativeness of the sample studied. Some of the biases we observed are in the direction of patients in our sample being more likely to be violent (e.g., patients who consented were younger than patients who refused) and other biases are in the direction of patients in our sample being less likely to be violent than other eligible patients (e.g., [patients followed up were less likely to have a documented history of violence than patients lost to follow up). It is impossible to estimate the precise effect of these countervailing biases on the results." (Page 400-401).
2.5 Procedure

2.5.1 Hospital Data Collection

Hospital data collection was conducted in two parts: (1) an interview by the research interviewer to obtain data on demographic and historical factors; and (2) an interview by a research clinician with either a Ph.D. or Masters Degree was carried out to confirm the chart diagnosis using the DSM-III-R Checklist or to confirm a personality disorder using the Structured Interview for DSM-III-R Personality when no eligible Axis I diagnosis was present. Each interview lasted approximately two hours. All research interviewers received three days of intensive training in the use of all instruments, including mock interviews and patient interviews supervised by an experienced psychiatrist within the study team. Checklist diagnoses corresponded to a chart diagnosis in 86% of the cases. A consultant psychiatrist at each site resolved discrepant diagnoses. Patients remaining in the hospital for more than 145 days were dropped from the study (n=3). Supplementary data were abstracted from patients' charts.

2.5.2 Post-Discharge Data Collection

Patients were recontacted in the community by the interviewers and interviewed 5 times which was every 10 weeks over 1 year from the date of discharge. Availability for follow-up interview varied over time. All baseline measures were readministered
with specific attention being paid to violence in the preceding 10 weeks prior to the follow-up interview.

Patient follow-up interviews were in person (89%) or by telephone (11%). One or more follow-up interviews were achieved for 84% of participants (951/1136), two or more follow-up interviews were achieved for 79% of participants (893/1136), three or more follow-up interviews were achieved for 72% of participants (818/1136), four or more follow-up interviews were achieved for 64% of participants (731/1136), with 50% (564/1136) achieved for all 5 follow-up interviews. A collateral informant was interviewed (in person: 45%; by telephone: 55%) on the same time schedule. During each follow-up the patient was asked to nominate a collateral who was the person who was most familiar with his or her behaviour in the community. If the nominee did not have at least weekly contact with the subject the interviewer suggested a more appropriate person based on a review of the subject's social network data. Collaterals were most often family members (47%), but were also friends (24%), professionals (14%), significant others (12%), or others (e.g., co-workers; 3%). Patients and collaterals were paid $10 for their participation. Collateral interviews were achieved for 94% (897/1136) for one or more follow ups, 88% (838/1136) for two or more of the follow-ups, 77% (735/1136) for three or more of the follow ups, 64% (609/1136) for four or more of the follow ups and 45% (425/1136) for all five follow up interviews.
Demographic and clinical comparisons of those who were followed up compared to those lost to follow up showed that patients in the follow up sample were significantly more likely to have a chart diagnosis of bipolar disorder ($p<0.01$), less likely to have a chart diagnosis or a chart history of alcohol/drug abuse ($p<0.05$) and less likely to have a legal status of "gravely disabled" ($p<0.001$) when compared with those patients who were lost to follow-up. There were no further significant differences.

2.5.3 Data Management/Quality Control in the MacArthur Study

The study developed a tracking system which allowed each of the three sites to systematically monitor the status of its enrolled participants and to provide a means for having a uniform set of variables which facilitated verification and cleaning of the tracking database. Data was sorted by numerical order at a central quality control centre. All forms were carefully reviewed for completion and accuracy according to the coding rules. All field researchers had been instructed to record any areas where the participant’s response did not fit easily into the assigned coding variables. All researchers had a codebook that was created for all instruments and data entry programmes. Where coding was ambiguous decisions were made at the quality control centre and not in the field in order that there were no variations across the three sites. Data entry and verification was completed for all forms received. The data were checked repeatedly through the study at the quality control centre using statistical analyses for outliers and other data problems.
2.6 Measurement

2.6.1 Measurements in the MacArthur Violence Risk Assessment Study

The risk variables chosen within the original study were both static and dynamic and can be conceptualised within four domains: (i) Dispositional or personal factors, (ii) Historical or developmental factors, (iii) Contextual or situational factors and (iv) Clinical or symptom factors.

2.7 Outcome measurement: Violence

A number of factors were used to examine violence. These can be conceptualised as either being historical violence, current violence and longitudinally measured violence. Analyses of historical and present violence utilises a cross sectional survey design. Analysis of longitudinally measured violence utilises a cohort design. An important consideration when identifying potential confounders for longitudinal violence is the possibility that historical violence may be a potential confounder. Consequently where there are associations between violent content command hallucinations and historical violence, further examination as to whether historical violence is also associated with longitudinal violence will be performed. Where this occurs consideration will be given to determine whether historical violence should be considered a confounder or whether it lies on the causal pathway for longitudinal violence.
2.7.1 Historical violence

Historical violence consisted of three outcome measures: (i) Prior arrest for crimes against the person; (ii) Self-reported history of violence to others; and (iii) Self-reported history of violence to own family (this included spouse/cohabitee, child, parental figure, and other family).

Prior arrests for crime against the person were obtained through official police arrest records. In the United States criminal charges are categorised as either being a crime against the person such as homicide, a crime against property or a crime that endanger the security of the nation.

2.7.2 Current violence

Current violence is whether violence was the reason for admission. The reason for the current admission was ascertained in the research baseline interview and involved a full review of all available information from the patient and a research interview with each participant. A number of very specific violent behaviour variables were available for selection as outcome measures such as hitting as a reason for admission, slapping as a reason for admission, pushing as a reason for admission.

Two were originally chosen. The first was any aggression as reason for current admission. This included any of the following as recorded incidents precipitating the need for admission: object thrown, pushed or grabbed someone, slapped someone,
kicked someone, bitten someone, choked someone, hit someone with a fist or object, sexual assault, threat with lethal weapon, the use of a gun or a knife and other unspecified acts.

The second was homicidal threat/ideation as reason for admission. The latter was chosen as it again represents the most extreme level of violence-risk and would be considered the highest life-threatening behaviour. It is possible that this may be a circular argument and that those with violent content command hallucinations are more likely be classified as having homicidal ideation.

Consequently a third reason for admission was also used as an outcome measure for present violence. This was chosen in order to distinguish between the homicidal ideation that may have been recounted as part of a command hallucination in a clinical interview and a real threat to another person. This third variable is lethal weapon usage/threat. This was coded if the patient had actually threatened someone with a lethal weapon or used a gun or a knife against another person immediately preceding admission. The choice of this third variable should lessen the occurrence of bias from reverse causality as is possibly the case when using homicidal threat/ideation as an outcome measure.
2.7.3 Longitudinally measured violence

The MacArthur Violence Risk Assessment Study constructed reconciled reports of violent incidents from a variety of sources. These were subject self-reports, collateral informant reports, official arrest records, hospital admitting incident chart information and from checks of patient’s re-hospitalization records, where re-hospitalisation occurred. Subjects and collaterals were asked whether the subject had engaged in several categories of violent behaviour in the past 10 weeks. If a positive response was given, the subject or collateral was asked to list the number of times the behaviour occurred. Detailed information was obtained about each act, including the target and location.

These acts were then divided into two categories of seriousness. The first category was violence. This included battery that resulted in physical injury, sexual assaults, assaultative acts that involved the use of a weapon and threats made with a weapon in hand. The second category was other aggressive acts. This included battery that did not result in physical injury. Only violence was used as the outcome measure in this study as it represents the most severe form.

For all sources the type of violent act engaged in by the subject was categorised. Arrest reports and arrest charges for all participants were collected from official US records. All violent incidents were systematically reviewed, independently coded and
discussed by two trained coders whose tasks were threefold. First was a
determination as to whether incident reports met the inclusion criteria for the
reconciled variable. Second was to identify matching incident reports across multiple
sources. Third and most crucial was the matching of all incident reports and to select
the version of events that would be accepted in the reconciled variable.

2.8 Exposure measurement and classification

2.8.1 Measurement of auditory hallucinations

The Auditory Hallucinations Schedule (AHS) was used to collect information about
patient’s hallucinations. This measure was designed specifically for the study and
involved a series of structured questions collected at baseline and all follow up
interviews (see appendix 3 for the full list of questions, coding rules and further
information).

Participants were asked whether they had more than once had the experience of
hearing voices other people couldn’t hear? Participants who gave a positive response
to this question were then asked a number of questions related to their hallucinations.
For the purpose of this study responses from the following three questions were used:
(i) Have you more than once had the experience of hearing things or voices other
people couldn't hear? (ii) Do the voices tell you to do anything? (iii) What is the
highest level of violence the voices have told you to do? In determining the
participant groups for later analyses, patients with auditory hallucinations were firstly
identified if they gave a positive answer the question 1. Command hallucinators and command hallucinators of violent content were identified by positive responses to questions 1, 2 and 3.

One potential problem with the questions used within the auditory hallucination scale is that the questions do not determine whether the recipient considers the voice(s) as being either internal or external. Generally, within psychopathological classification voices what are perceived as external are considered to be true hallucinations whereas voices that are perceived as internal are considered as pseudo-hallucinations (Sims, 1995). The classification system used within the MacArthur Violence Risk Assessment Study and this PhD study has the potential to include participants with pseudo hallucinations as well as true hallucinations. As this study is a secondary analysis of an existing database it is not possible to determine further phenomenological characteristics of the participant's auditory hallucinations. Therefore an examination of the diagnoses of those with command hallucinations will be conducted in order to ensure that the primary diagnoses lie within the normal range of disorders within which command hallucinations occur.

2.8.2 Exposure classifications

The MacArthur Violence Risk Assessment Study coding rules used within the original data (see appendix 4 for coding rules and further information) presented an analytical challenge. The hierarchical coding of command hallucination content was
such that the highest level of violence was given precedence when recording. The coding rules were that commands with a content of violence to others took priority over commands with a content of violence to self. Consequently it is difficult to interpret the full range of command hallucination content that all participants experienced. For example a participant who experienced all three types of commands (e.g., violent-content command hallucinations, self-harming-content command hallucinations and benign command hallucinations) would be classified the same as a participant who had only ever experienced violent content command hallucinations. This therefore limits the available group comparisons that can be analysed when such hierarchical coding structures are used for the same variable.

In order to examine aim 1 cases were categorised as being violent-content command hallucinations, non-violent content command hallucinations comprising of benign and self-harming command hallucinations, non-command auditory hallucinations and non-hallucinators (Table 7).
Table 7: Exposure categorisations in order to examine Aim 1

<table>
<thead>
<tr>
<th>Group</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCCH group: Violent-content command hallucinations</td>
<td>Patients with a lifetime history of hearing violent-content command hallucinations as the highest level of violence directed by the command</td>
</tr>
<tr>
<td>NVCCH group: Non-violent content command hallucinations</td>
<td>Patients with a lifetime history of hearing non-violent (e.g. either benign or self-harming) command hallucination as the highest level of violence directed by the command</td>
</tr>
<tr>
<td>NCAH group: Auditory hallucinations without a history of command hallucinations</td>
<td>Patients with a lifetime history of auditory hallucinations but who denied ever having heard a command hallucination</td>
</tr>
<tr>
<td>NH group: Non-hallucinators (all remaining cases)</td>
<td>Patients who experienced an auditory hallucination and therefore have also not experienced a command hallucination. This group comprises of all remaining cases in the data base</td>
</tr>
</tbody>
</table>

In order to examine aim 2 cases were categorised as either command hallucinations per se (irrespective of content), non-command auditory hallucinations and non hallucinations (Table 8).

Table 8: Exposure categorisations in order to examine Aim 2

<table>
<thead>
<tr>
<th>Group</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH group: Command hallucinations</td>
<td>Patients with a lifetime history of hearing command hallucinations (irrespective of the content of the command hallucination)</td>
</tr>
<tr>
<td>NCAH group: Auditory hallucinations without a history of command hallucinations</td>
<td>Patients with a lifetime history of auditory hallucinations but who denied ever having heard a command hallucination</td>
</tr>
<tr>
<td>NH group: Non-hallucinators (all remaining cases)</td>
<td>Patients who experienced an auditory hallucination and therefore have also not experienced a command hallucination. This group comprises of all remaining cases in the data base</td>
</tr>
</tbody>
</table>
2.9 Potential confounding variables

Confounding occurs because of an association between exposure and an extraneous factor and the outcome under study (Gordis, 2000). To be a confounder, a factor must be associated to both the exposure and the outcome of interest (Gordis, 2000). The MacArthur Violence Risk Assessment Study collected a wide range of demographic, social, family, clinical and personality factors which could potentially confound any relationships between the sample group and the outcomes of interest.

The study designs within this PhD are cross-sectional and longitudinal. There are methodological considerations for each design when deciding potential confounders. For the cross sectional design potential confounding variables would ordinarily be those that are collected only at baseline. This was the case with all variables accept for psychopathy. For the longitudinal design potential confounders may include historical violence variables. But these historical variables may also lie on the causal pathway.

2.9.1. Historical violence as a potential confounding variable – a methodological consideration

An important consideration when considering confounders for longitudinal violence is the possibility that historical violence may be a potential confounder as well as an outcome. Where there are associations between violent content command hallucinations and any of the three historical violence variables further examination
as to whether historical violence is also associated with longitudinal violence will be performed. Where this occurs, consideration will be given as to whether historical violence should be considered as confounder or whether it lies on the causal pathway for longitudinal violence.

2.9.2 Psychopathy as a potential confounding variable – a methodological consideration

An important confounding variable of probable psychopathy as measured by the Psychopathy Checklist: Screening Version (PCL: SV) was not taken at the original baseline stage but at either follow-up 2 or follow-up 3. It is possible but unlikely that those who were not violent at the baseline stage of assessment but who were in the follow-up stage could possibly receive inflated scores on the PCL: SV. This means that the outcome of violence could cause the explanatory variable. This is called reverse causality.

This temporal difference in measurement causes slight problems. One option would be to drop probable psychopathy as a confound but this is a well-known risk factor for violence (Hemphill, Hare & Wong, 1998; Serin & Amos 1995). One study to date has assessed the PCL: SV’s ability to predict violence in civil patients (Douglas, 1999) and found that those who scored above the median in a sample of 193 civilly committed patients were 14 times more likely to be arrested for a violent crime than those who scored below the median. Consequently, it was decided to include
psychopathy as a potential confounding variable but to add this as the last variable in all statistical models. This then allows the model to be assessed without and with psychopathy in order to determine the effect that psychopathy has as a single variable on the total model. Cautious interpretations shall be employed where psychopathy alters the odds ratio and confidence intervals.

The PCL-SV was used to measure Psychopathy. The PCL: SV is a measure to screen for the possible presence of Psychopathy. The PCL: SV is a 12-item scale based (range 0-24) on a subset of PCL-R items that can be completed in civil and forensic settings. Eight of the twelve items in the PCL: SV have a strong parallel to their equivalent PCL-R items. Of the four PCL: SV items which differed from their equivalent PCL-R items, all four were found to be equal or superior to their equivalent PCL-R item in terms of discrimination (Cooke, et al., 1999). For the purposes of the secondary analyses cases were recoded into tertiles of approximate equal size within STATA.

2.9.3 Rationale and selection of potential confounding variables
In addition, to Psychopathy which has been discussed above, the potential confounding variables were selected from the baseline data. The potential confounding variables were categorised into five levels: (i) Socio-demographic variables, (ii) Historical variables; (iii) Current Mental Health variables – excluding delusions; (iv) The presence of any delusion and specifically persecutory delusions;
and (v) Psychopathy.

2.9.4 Socio-demographic variables

The following socio-demographic variables were identified:

Age, as violence has been found to be associated with being younger than 25 (Rachuba, Stanton & Howard, 1995; Orpinas, 1999; US Surgeon General, 1999; Snyder & Sickmund, 1995; Snyder & Sickmund, 1999; Centers For Disease Control, 1998). Due to the potential for confounding by age this variable was analysed as a continuous variable.

Gender, as violence has been found to be associated with being male (US Surgeon General, 1999; Reiss & Roth, 1993).

Ethnicity, as US studies have found positive associations between Afro-American ethnicity and violence when compared with white Americans (US Surgeon General, 1999; Snyder & Sickmund, 1995; Snyder & Sickmund, 1999; Klassen & O’Connor, 1994; Walsh et al., 2002). However these finding remain controversial (Hawkins, 1993, 1995, 1999) and further epidemiological study has been recommended (US Surgeon General, 1999). The original ethnicity codes in the MacArthur Violence Risk Assessment Study were white, black and Hispanic. Only 2% of the total sample were Hispanic so this variable was recoded as white or non-white.
Marital status, as being married potentially increases the chances of being a victim of violence to the spouse and children. Such violence invariably goes under-reported (National Victim Center and Crime Victims Research and Treatment Center, 1992). For the purposes of this secondary analysis the coding married/never married was used.

2.9.5 Historical variables

The following historical variables were identified:

Being beaten as a child under the age of 12 and being beaten as a teenager were selected. Being a victim of family violence has been found to be associated with later adult perpetrated violence (Fehon, Grilo & Lipschitz, 2001; Fitzpatrick, 1997; Malik, Sorenson & Aneshensel, 1997; Farrington, 1989). The specific questions asked within the Macarthur study as part of the family history questions are: (1) "Thinking about when you were a child (up to age 12) did your parents ever beat or hit you?" (2) "Thinking about when you were a teenager (over 12) did your parents ever beat or hit you?"

Living with a relative prior to admission was selected. One of the outcomes of interest is a past history of violence to a family member; therefore the very nature of living with a family member increases the probability of violently assaulting a family.
member. Living with a relative prior to admission was deemed appropriate when examining the association between the groups and historical violence. This is not appropriate for examining associations between the groups and longitudinal violence as it is likely to change if the victim of historical violence is a family member. In such cases it is less likely that a person will thereafter be discharged to the same place where they had previously been violent. For longitudinal violence the variable living with a relative after discharge was chosen as a potential confounder.

A history of alcohol abuse was selected. Historical alcohol abuse has been found to be associated with violence for those with and without mental illness (Soyka, 2000; Arseneault et al., 2000; Orpinas, 1999; Volavka, et al., 1997; Modestin, Berger & Ammann, 1996). Within the MacArthur study a Structured Interview for DSM-III-R was used to determine the presence of the following alcohol-related diagnoses: Alcohol dependence (current); Alcohol dependence (lifetime); Alcohol abuse (current); and Alcohol abuse (lifetime). The presence of a history of alcohol abuse was then coded according to a positive result for any of the above diagnoses.

A history of drug abuse was selected. Historical drug abuse has been found to be associated with violence for those with and without a mental illness (Soyka, 2000; Arseneault et al, 2000). Within the MacArthur study a Structured Interview for DSM-III-R was used to determine the presence of the following drug-related diagnoses: Psychoactive substance dependence (current); Psychoactive substance dependence
(lifetime); Psychoactive substance abuse (current) and Psychoactive substance abuse (lifetime). The presence of a history of drug abuse was then coded according to a positive result for any of the above diagnoses.

2.9.6 Current mental health variables (excluding delusions)

The following current mental health variables were identified:

Symptom severity. The Brief Psychiatric Rating Scale (BPRS) measured this. This was chosen as psychiatric symptomatology when examined both within the context of delusional beliefs (Taylor, 1985; Taylor 1998) and psychotic patients (McNiel & Binder, 1994; McNiel & Binder, 1995) has been found to be positively associated with violence. The BPRS was developed by Lukoff, Liberman and Nuechterlein (1986) and is a commonly used measure of the presence and severity of psychiatric symptoms. The BPRS consists of 18 symptom constructs which are rated in a 7-point scale of severity ranging from not present to extremely severe. Reliability of the BPRS has been reported for interrater item reliability (r=0.62-0.87) and overall interrater reliability of r=0.85. For the purposes of the secondary analyses cases were recoded into tertiles of approximate equal size within STATA.

Impulsivity was selected as it has been found to be an important determinant of violence (Rossi et al., 1986; Apter, Plutchik & van Praag, 1993; Segal et al., 1988). The Barratt Impulsivity Scale-11 (BIS-11) was used to measure impulsivity. The
published internal consistencies of total BIS-11 scores are within acceptable limits for use in applied studies across a range of samples (cronbach’s alpha 0.83) (Patton, Stanford, Barratt, 1995). For the purposes of the secondary analyses cases were recoded into tertiles of approximate equal size within STATA.

2.9.7 Delusions

Two delusion variables were selected. The first was whether there was a presence of any delusion at the time of admission and baseline interview. The second was whether there was a presence of persecutory delusions at the time of admission and baseline interview. Within the analyses delusions will be separated from other current mental health variables as it is a potential confounding variable of particular interest due to the consistent association found between delusions and violence (Taylor, 1998, Grassi, 2001) and persecutory delusions and violence (Taylor, 1998; Cheung, 1997).

The presence of delusions was ascertained through the administration of the Delusional Interview Schedule (DIS) (Robbins, et al., 1981). Interviewers asked a series of 17 questions and then determined whether any potential delusional beliefs were indeed delusional using DSM-III-R criteria or whether the beliefs were based upon some evidence such as drug dealers watching the subject. Categorical data was available for delusional jealousy, persecutory delusions, grandiose delusions, delusions of body mind control or influence on the subject, thought broadcasting or influencing by the subject, delusions of guilt, somatic delusions, religious delusions
and other delusions. These were then further categorised as to whether any delusion was present. In all cases an experienced psychiatrist (Paul S Appelbaum) reviewed all screening measures and patient’s verbatim responses to questions. Where any doubt existed as to the researcher ratings, the psychiatrist would then review audiotape recordings of the interview. The psychiatrist changed only one case for the entire sample from delusional to non-delusional.

2.10 Diagnoses as a non-confounding variable

As this thesis is primarily examining the relationship of symptoms of mental illness with violence diagnoses are not important. This is because the classification system used to determine the exposure groups will be representative of the correspondence of symptoms within diagnoses. The violent-content command hallucination exposure group will be at a greater chance of being diagnosed with a psychotic disorder than the non-auditory hallucination exposure group so adjusting for diagnoses is not appropriate. Nonetheless, the distribution of diagnoses across the groups is of interest. For example there may be differences between those people with violent-content command hallucinations and non-violent command hallucinations in relation to principle diagnosis. Therefore descriptive data on diagnoses will be presented and examined.

Diagnosis was determined according to DSM 111-R (APA, 1987) to confirm chart diagnosis using the DSM-III-R Checklist or to confirm a personality disorder using
the Structured Interview for DSM-III-R. All research interviewers received three days of intensive training in the use of this and other instruments. This included mock patient interviews supervised by an experienced psychiatrist within the study team. Checklist diagnoses corresponded to a chart diagnosis in 85.7% of the cases. Supplementary data were abstracted from patients' charts and a consultant psychiatrist at each site resolved discrepant diagnoses. Eighteen possible diagnoses were available for each case and these were collapsed as into: “Psychotic” (Schizophrenia, Brief reactive psychosis, Schizoaffective disorder, Schizoaffective disorder, Delusional disorder and Atypical psychosis); “Mood” (Depression, Dysthymia, Mania, Cyclothymia, and Bipolar); “Drug” (Psychoactive substance dependence, Psychoactive substance abuse, Drug dependence and Drug abuse); “Alcohol” (Alcohol dependence and Alcohol abuse); and “Personality” (Personality disorder).

2.11 Statistical analyses

For both hypotheses two levels of analyses were used. Firstly historical and present outcomes of violence were analysed according to the cross sectional design. Secondly future outcomes of violence were analysed according to the longitudinal design. SPSS Version 11 and STATA 8 were used to analyse the data.

2.11.1 Aim 1: Historical and Present violence

Firstly the participants were coded according to their exposure to violent-content command hallucinations, non-violent command hallucinations, auditory hallucinators
without command hallucinations and non-hallucinatory patients as previously
described in Table 8. In order to ensure that missing data does not have an effect on
the analyses missing data was recoded as a separate code for each variable. The
frequency distributions of all variables for the four groups were first examined and
Chi Square ($\chi^2$) test for independence was used to test for differences in proportions.
All statistical tests were considered significant at the $p<0.05$ level. Two-tailed $P$
values and 95% confidence intervals (CI) are presented where appropriate.

Logistic regression was employed to analyse the data. Logistic regression is perhaps
the most widely used method (Hailpern & Visintainer, 2003) for adjustment of
confounding in epidemiologic studies as the method can simultaneously adjust for
confounders measured on different scales. It also provides estimates that are clinically
interpretable and its estimates are valid in a variety of study designs with few
underlying assumptions. Logistic regression is a variation of ordinary regression and
is the most appropriate method of analysis when the observed outcomes are restricted
to two values. This usually represents the occurrence or non-occurrence of an
outcome event which is then coded as 1 or 0 respectively. Logistic regression
produces a formula that predicts the probability of the occurrence as a function of the
independent variables.

Logistic regression produces the odds ratios (O.R.) associated with each predictor
value. The odds of an event is defined as the probability of the outcome event
occurring divided by the probability of the event not occurring. The odds ratio for a predictor tells the relative amount by which the odds of the outcome increase. For example an O.R. greater than 1.0 denotes an increase in the odds of having the outcome and an OR less than 1 denotes a decrease in the odds of having the outcome. These odds ratios can be presented with 95% confidence intervals (95% C.I.). Confidence intervals for odds ratios are given in STATA and are computed by exponentiating the confidence limits for the logistic regression parameters.

All studies provide a sample estimate from a study. In this study it is the odds ratio. These estimates are subject to sampling error. Studies are primarily interested in the size of effect but it is also important to know how accurate the sample estimate is. Confidence intervals are based on an estimate of the size of the effect together with a measure of the uncertainty associated with the estimate of the size. A 95% confidence interval is constructed so that in 95% of cases it will contain the true value of the effect size. It is generally considered good epidemiological and statistical practice to summarise statistical results by confidence intervals rather than P-values although ideally both will be used. The rationale for this is that the P-value does not give an indication of the likely range of values of the effect size whereas the confidence interval does. Interpretation of odds ratios and confidence intervals is such that where the OR and the lower range of the C.I. are greater than one then an increase in the outcome has occurred. Where the OR and the upper range of the C.I. are less than one then a reduction in the outcome has occurred. Where the C.I. crosses one so that the
lower value is less than 1 and the upper value is greater than one then this is interpreted as a possible increase or decrease in the outcome. This is because the true value may lie either below 1 meaning a reduction in the outcome or above 1 meaning an increase in the outcome.

Logistic regression provides an unadjusted model which means that confounders have not been adjusted for. Thereafter, adjustments for potentially confounding variables are performed. This involves adding each identified potential confounder and examining the effect that this has on the original unadjusted odds ratio. This PhD study will provide descriptions where single variables have either large positive or negative effects of the OR. Five levels of a priori adjustment were determined and listed below:

1. Adjustment for socio-demographic variables of age, sex, marital status, and ethnicity.
2. Adjustment for socio-demographic and the historical variables of having been beaten as a child, having been beaten as a teenager, living with relative prior to admission, history of alcohol abuse and history of drug abuse.
3. Adjustment for socio-demographic, historical, and the current mental health variables of the severity of symptoms (BPRS) and impulsivity (BIS).
4. Adjustment for socio-demographic, historical, current mental health and the delusion variables of any delusions and persecutory delusions.
2.11.2 Aim 2: Historical and Present violence

Firstly the participants were coded according to their exposure to command hallucinations, auditory hallucinators without command hallucinations and non-hallucinatory patients as previously described in Table 9. The frequency distributions of all variables for the three groups were first examined and Chi Square (χ2) test for independence was used to test for differences in proportions. All statistical tests were considered significant at the p<0.05 level. Two sided P values and 95% confidence intervals (95% C.I.) are quoted where appropriate.

The analyses performed were as previously described for Aim 1 using logistic regression to calculate unadjusted Odds ratios and 95% Confidence Intervals for all outcomes. Thereafter adjustments for potentially confounding variables were performed. The exact five levels of adjustments used for Aim 1 were predetermined a priori.

2.11.3 Aim 1 and Aim 2: Longitudinal study of violence

For both aim 1 and aim 2 the previous coding of participant exposure was used.

As previously discussed the MacArthur data has already been examined for longitudinal associations between command hallucinations and violence. The data
was examined in two ways. Firstly whether there was any association between violent content hallucinations and any violence at either 20-weeks follow-up or at one year follow up using $\chi^2$. Secondly whether there was any association between command hallucinations irrespective of their content and any violence at either 20-weeks follow-up or at one year follow up again using $\chi^2$ (Monahan et al, 2001, p79).

With this analysis the authors reported that there was no association between command hallucinations irrespective of content and violence. They reported that participants with violent-content command hallucinations were significantly more violent in the first 20 weeks and over the entire year (20-weeks: $\chi^2 = 3.84$, df = 1, $p<.05$; 1-year: $\chi^2 = 10.23$, df = 1, $p<.001$). Caution must temper the interpretation of the results of this analysis due to the assumption that underlies the use of $\chi^2$ with this data as it does not make the best use of the available data as 5 follow-up time periods are available (10-week, 20-week, 30-week, 40-week and 50-week). Yet the authors only use the two time periods of 20-week and 50-week. Additionally such analyses assumes that there are no confounders and does not adjusted for the potential confound of time.

Ideally the first choice for the data would have been through survival analysis whereby analysis of time from discharge to violent incident for the exposure groups would be computed over the 5 follow-up periods. However, although the MacArthur Violent Risk data has discharge dates for all participants it does not have sufficient
details of the dates of longitudinal violence and over 70% of dates of first violent incident are missing from the database. Survival analysis is therefore not an appropriate analysis.

For this PhD study a random-effects repeated measures, logit model was used in STATA 8 using long format. Such a model is used for grouped or clustered data where observations within a group cannot be assumed to be mutually independent, as the case with the MacArthur data. This model is discussed in considerable detail by Conway (1990) and Pendergast et al. (1996). Participants were coded as either yes or no depending on whether a violent incident had occurred during the five follow-up periods. Such analysis does not assume that the exposure group’s observations of violence over time are mutually independent and therefore preliminary analyses of time trends were conducted to see if any interaction between time and groups was present. As no such interaction was observed, odds ratios were computed using xtlogit and i(id) was used to link together the records for each participant.

Thereafter odds ratios were again examined using the xtlogit command in stata. Adjusted odds ratios (OR) and 95% Confidence Intervals (95% C.I.) for longitudinal violence were then derived. These were then adjusted for potentially confounding variables and where appropriate descriptions are provided if single variables had either a large positive or negative effects on the OR. Due to the large number of adjusted variables the data will be presented using six levels of adjustment. The first
level of adjustment is time and the remaining 5 are those that were previously described for historical and present violence. The do-file of the stata commands used to conduct these analyses is appended (appendix 5).

### 2.12 Power calculation

The power of a statistical test is defined as the probability that a statistically significant test statistic will be obtained, given that the alternative hypothesis is true (Gail & Benichou, 1999). Estimations of the power for both aim 1 and aim 2 were calculated. As this study is a secondary data analysis the sample sizes are predetermined. The opportunity was available to preliminary examine the data for the basis of all power calculations. As the sample sizes were fixed, the base rate for the non-hallucinator group was determined. This then provides the % difference between the two groups which can be detected. All power calculations are based upon 80% power at the p<0.05 level of statistical significance to detect such differences. Power calculations were calculated using the “sampsi” command in Stata 8.

**Aim 1**

The prevalence of prior arrest for crimes against the person for the non-hallucinator group was 39%. The sample sizes were 728 for the non-hallucinator group and 105 for the violent content command hallucination group. This provides 80% power at the p<0.05 level of statistical significance to detect a difference of 20% and above between the two groups.

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The prevalence of self-reported history of violence to own family for the non-hallucinator group was 27%. The sample sizes were 728 for the non-hallucinator group and 105 for the violent content command hallucination group. This provides 80% power at the p<0.05 level of statistical significance to detect a difference of 19% and above between the two groups.

The prevalence of self-reported history of violence to others for the non-hallucinator group was 39%. The sample sizes were 728 for the non-hallucinator group and 105 for the violent content command hallucination group. This provides 80% power at the p<0.05 level of statistical significance to detect a difference of 20% and above between the two groups.

The prevalence of any aggression as a reason for admission for the non-hallucinatory group was 26%. The sample sizes were 728 for the non-hallucinator group and 105 for the violent content command hallucination group. This provides 80% power at the p<0.05 level of statistical significance to detect a difference of 19% and above between the two groups.

The prevalence of homicidal threat/ideation as reason for admission for the non-hallucinator group was 12%. The sample sizes were 728 for the non-hallucinator group and 105 for the violent content command hallucination group. This provides
80% power at the p<0.05 level of statistical significance to detect a difference of 16% and above between the two groups.

The prevalence of lethal weapon usage/threat for the non-hallucinator group was 5%. The sample sizes were 728 for the non-hallucinator group and 105 for the violent content command hallucination group. This provides 80% power at the p<0.05 level of statistical significance to detect a difference of 13% and above between the two groups.

The prevalence of violence over the total follow up period for the non-hallucinator group was 28%. The sample sizes were 728 for the non-hallucinator group and 105 for the violent content command hallucination group. This provides 80% power at the p<0.05 level of statistical significance to detect a difference of 19% between the two groups.

In summary the sample sizes are sufficient for 80% power at the p<0.05 level of statistical significance to detect differences of between 13% and 20% for the outcome measures.

Aim 2
The prevalence of prior arrest for crimes against the person for the non-hallucinator group was 39%. The sample sizes were 728 for the non-hallucinator group and 239
for the command hallucination group of any content. This provides 80% power at the p<0.05 level of statistical significance to detect a difference of 13% and above between the two groups.

The prevalence of self-reported history of violence to own family for the non-hallucinator group was 27%. The sample sizes were 728 for the non-hallucinator group and 239 for the command hallucination group of any content. This provides 80% power at the p<0.05 level of statistical significance to detect a difference of 13% and above between the two groups.

The prevalence of self-reported history of violence to others for the non-hallucinator group was 39%. The sample sizes were 728 for the non-hallucinator group and 239 for the command hallucination group of any content. This provides 80% power at the p<0.05 level of statistical significance to detect a difference of 13% and above between the two groups.

The prevalence of any aggression as a reason for admission for the non-hallucinator group was 26%. The sample sizes were 728 for the non-hallucinator group and 239 for the command hallucination group of any content. This provides 80% power at the p<0.05 level of statistical significance to detect a difference of 13% and above between the two groups.

85
The prevalence of homicidal threat/ideation as reason for admission for the non-hallucinator group was 12%. The sample sizes were 728 for the non-hallucinator group and 239 for the command hallucination group of any content. This provides 80% power at the p<0.05 level of statistical significance to detect a difference of 10% and above between the two groups.

The prevalence of lethal weapon usage/threat for the non-hallucinator group was 5%. The sample sizes were 728 for the non-hallucinator group and 239 for the command hallucination group of any content. This provides 80% power at the p<0.05 level of statistical significance to detect a difference of 8% and above between the two groups.

The prevalence of violence over the total follow up period for the non-hallucinator group was 28%. The sample sizes were 728 for the non-hallucinator group and 239 for the command hallucination group of any content. This provides 80% power at the p<0.05 level of statistical significance to detect a difference of 13% and above between the two groups.

In summary the sample sizes are sufficient for 80% power at the p<0.05 level of statistical significance to detect differences of between 8% and 13% for the outcome measures.
CHAPTER 3

RESULTS
RESULTS

This chapter will provide the results of all the statistical analyses undertaken to examine the associations between the exposure groups within both aim 1 and aim 2 and historical, current and longitudinally measured violence. A summary of the key finding is provided at the end of the chapter.

3.1 Exposure classifications

The total sample comprised of 1136 participants.

In order to examine aim 1 the participants were classified as either being a violent content command hallucinator (VCCH), a non violent-content command hallucinator (NVCCCH), a non-command auditory hallucinator (NCAH) and a non-hallucinator (NH).

In order to examine aim 2 cases were categorised as either being a command hallucinations per se, irrespective of the content of the commands (CH), a non-command auditory hallucinations (NCAH) or a non hallucinator (NH). Of the 1136 participants in the total sample 21% (239/1136) had experienced command hallucinations, 64% (729/1136) had never experienced an hallucination, 14% (158/1136) had had auditory hallucinations but that were not command hallucinations and 1% (10/1136) were unclassifiable. The unclassifiable cases included one
participant who refused to answer the salient question and there was missing data for
nine other cases. This is summarised in figure 1. Within the command hallucination
group, 44% (105/239) reported that the command hallucination had instructed
violence to others, 52% (125/239) reported that the command hallucination had never
instructed violence and 4% (9/239) were unclassifiable due to missing data or refusal.

**Figure 1: Overview of the numbers obtained following exposure classification**

<table>
<thead>
<tr>
<th>Total sample</th>
<th>(n=1136)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH (n=239)</td>
<td>NH (n=729)</td>
</tr>
<tr>
<td>VCCH (n=105)</td>
<td>NVCCH (n=125)</td>
</tr>
</tbody>
</table>

CH = command hallucinator, NH = non hallucinator, NCAH = non-command auditory hallucinator,
VCCH = violent-content command hallucinator, NVCCH = non-violent content command hallucinator

Table 9 shows that the violent content command hallucinations group are associated
with being of male gender, being non-white, having any delusion, having a
persecutory delusion, having a high BPRS score, having a high BIS score and having
a high PLC:SV score.
There were also differences between the exposure groups regarding the primary diagnosis, with psychosis or mood disorder accounting for the main diagnosis for those patients with violent command hallucinations (89%), non-violent content command hallucinations (87%) and non-command hallucinators (84%). A diagnosis of either psychosis or mood disorder accounted for less participants in the non-hallucination group (68%). This is unsurprising considering that command hallucinations/hallucinations are a principle symptom in psychosis and present in cases of severe depression.

Previously, the potential problem that the Auditory Hallucination Scale (AHS) may not distinguish between “pseudo” and “true” hallucinations was discussed in chapter 2. This was because the AHS does not assess whether the recipient construes the voice(s) as either internal, therefore considered a “pseudo” hallucination, or external, therefore considered a “true” hallucination. As it is not possible to determine whether the voice(s) were perceived as either internal or external within the secondary use of an existing database, examination of the principle diagnoses of the violent content command hallucination group was performed. This determines whether the diagnoses lie within the general range of diagnoses that are considered to be associated with command hallucinations. The results found that of the 105 participants with command hallucinations, 93 (89%) had a primary diagnosis of either a psychotic disorder or a mood disorder, nine (8%) had a primary diagnosis of either a drug or alcohol abuse (8%) and three (3%) had a personality disorder.
### Table 9: Baseline characteristics (number & %) of participants according to exposure classification

<table>
<thead>
<tr>
<th></th>
<th>VCCH (105)</th>
<th>NVCCCH (125)</th>
<th>NCAAH (157)</th>
<th>NH (728)</th>
<th>χ² (df)</th>
<th>p</th>
<th>Missing n (%)</th>
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<tr>
<td><strong>Age</strong></td>
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<tr>
<td>18-28 29-40</td>
<td>52 (50)</td>
<td>53 (50)</td>
<td>58 (37)</td>
<td>313 (43)</td>
<td>5.767 (3)</td>
<td>.123</td>
<td>0 (0%)</td>
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<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
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<tr>
<td>Male</td>
<td>68 (65)</td>
<td>62 (50)</td>
<td>87 (55)</td>
<td>436 (60)</td>
<td>6.971 (3)</td>
<td>.073</td>
<td>0 (0%)</td>
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<tr>
<td>Female</td>
<td>37 (35)</td>
<td>63 (50)</td>
<td>70 (45)</td>
<td>292 (40)</td>
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<tr>
<td><strong>Ever Married</strong></td>
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<tr>
<td>No</td>
<td>63 (60)</td>
<td>78 (63)</td>
<td>90 (57)</td>
<td>403 (55)</td>
<td>2.952 (3)</td>
<td>.399</td>
<td>1 (0.1%)</td>
</tr>
<tr>
<td>Yes</td>
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<td>46 (37)</td>
<td>67 (43)</td>
<td>325 (45)</td>
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<td><strong>Ethnicity</strong></td>
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<tr>
<td>White</td>
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<td>78 (62)</td>
<td>105 (67)</td>
<td>540 (74)</td>
<td>30.760 (3)</td>
<td>≤.001*</td>
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<tr>
<td>Non-white</td>
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<td>47 (38)</td>
<td>52 (33)</td>
<td>188 (26)</td>
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<tr>
<td><strong>Liv’ with rel’ prior to admit</strong></td>
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<tr>
<td>No</td>
<td>46 (60)</td>
<td>57 (61)</td>
<td>64 (50)</td>
<td>346 (54)</td>
<td>3.741 (3)</td>
<td>.291</td>
<td>290 (25.5%)</td>
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<tr>
<td>Yes</td>
<td>39 (40)</td>
<td>37 (39)</td>
<td>65 (50)</td>
<td>290 (45)</td>
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<tr>
<td><strong>Beaten as a child</strong></td>
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<td>No</td>
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<td>72 (58)</td>
<td>86 (55)</td>
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<tr>
<td>Yes</td>
<td>50 (48)</td>
<td>53 (42)</td>
<td>70 (45)</td>
<td>341 (47)</td>
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<tr>
<td><strong>Beaten as a teenager</strong></td>
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<tr>
<td>No</td>
<td>37 (36)</td>
<td>59 (47)</td>
<td>64 (41)</td>
<td>287 (39)</td>
<td>3.353 (3)</td>
<td>.340</td>
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<tr>
<td>Yes</td>
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<td>66 (53)</td>
<td>93 (59)</td>
<td>439 (61)</td>
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<td><strong>Principal diagnosis</strong></td>
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<td>Psychosis</td>
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<td>49 (39)</td>
<td>48 (31)</td>
<td>84 (11)</td>
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<td>.244</td>
<td>43 (3.8%)</td>
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<td>Mood</td>
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<td>58 (46)</td>
<td>79 (50)</td>
<td>417 (57)</td>
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<tr>
<td>Drug</td>
<td>8 (8)</td>
<td>9 (7)</td>
<td>15 (10)</td>
<td>122 (17)</td>
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<tr>
<td>Alcohol</td>
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<td>6 (5)</td>
<td>12 (8)</td>
<td>92 (13)</td>
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<td>Personality</td>
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<td>3 (2)</td>
<td>3 (2)</td>
<td>12 (3)</td>
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<tr>
<td><strong>H/O alcohol abuse</strong></td>
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<tr>
<td>No</td>
<td>72 (72)</td>
<td>72 (60)</td>
<td>90 (61)</td>
<td>442 (63)</td>
<td>4.166 (3)</td>
<td>.244</td>
<td>43 (3.8%)</td>
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<tr>
<td>Yes</td>
<td>28 (28)</td>
<td>48 (40)</td>
<td>57 (39)</td>
<td>263 (37)</td>
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<td><strong>H/O drug abuse</strong></td>
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<td>68 (57)</td>
<td>76 (52)</td>
<td>404 (58)</td>
<td>4.318 (3)</td>
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<td>52 (43)</td>
<td>71 (48)</td>
<td>301 (42)</td>
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<tr>
<td><strong>Any delusion</strong></td>
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<td>No</td>
<td>64 (61)</td>
<td>59 (47)</td>
<td>73 (47)</td>
<td>121 (17)</td>
<td>151.305 (3)</td>
<td>≤.001*</td>
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<tr>
<td>Yes</td>
<td>41 (39)</td>
<td>66 (43)</td>
<td>84 (53)</td>
<td>607 (83)</td>
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<td><strong>Persecutory delusion</strong></td>
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<td>No</td>
<td>58 (55)</td>
<td>42 (33)</td>
<td>56 (36)</td>
<td>92 (13)</td>
<td>130.618 (3)</td>
<td>≤.001*</td>
<td>0 (0%)</td>
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<tr>
<td>Yes</td>
<td>47 (45)</td>
<td>83 (67)</td>
<td>101 (54)</td>
<td>636 (87)</td>
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<td><strong>BPRS Score</strong></td>
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<tr>
<td>Low</td>
<td>14 (13)</td>
<td>31 (25)</td>
<td>44 (28)</td>
<td>339 (47)</td>
<td>124.019 (6)</td>
<td>≤.001*</td>
<td>6 (0.5%)</td>
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<tr>
<td>Moderate</td>
<td>23 (22)</td>
<td>32 (26)</td>
<td>51 (32)</td>
<td>223 (32)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>High</td>
<td>68 (65)</td>
<td>61 (49)</td>
<td>62 (40)</td>
<td>152 (21)</td>
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<tr>
<td><strong>BIS Score</strong></td>
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<tr>
<td>Low</td>
<td>17 (17)</td>
<td>32 (27)</td>
<td>47 (32)</td>
<td>282 (40)</td>
<td>33.621 (6)</td>
<td>≤.001*</td>
<td>46 (4%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>34 (33)</td>
<td>45 (38)</td>
<td>44 (30)</td>
<td>219 (31)</td>
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<td></td>
</tr>
<tr>
<td>High</td>
<td>51 (50)</td>
<td>41 (35)</td>
<td>57 (38)</td>
<td>202 (29)</td>
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<td><strong>PCL-SV</strong></td>
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</tr>
<tr>
<td>Low</td>
<td>13 (18)</td>
<td>40 (40)</td>
<td>51 (40)</td>
<td>186 (33)</td>
<td>17.406 (6)</td>
<td>.008*</td>
<td>265 (23.3%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>28 (38)</td>
<td>32 (32)</td>
<td>41 (33)</td>
<td>222 (40)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>32 (44)</td>
<td>28 (28)</td>
<td>34 (27)</td>
<td>150 (27)</td>
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</table>
3.2. Aim 1

Aim one examines the associations between violent content command hallucinations and violence. The hypothesis for aim 1 is:

"A higher proportion of patients with violent-content command hallucinations will have engaged in violence prior to admission, as a reason for admission and at follow up when compared with those patients who have: experienced non-violent content command hallucinations; non-command auditory hallucinations; and those who have never experienced auditory hallucinations. The proportion of violent content command hallucination patients who have engaged in violence will remain higher than the comparison groups even after adjustment for potential confounders".

3.2.1 Historical violence

3.2.1.1 Prior arrest for crimes against the person

The unadjusted OR for prior arrests for crimes against the person demonstrated that the VCCH group were not at increased risk of having been arrested for prior crimes against the person (Table 10).

At the first level of adjustment (socio-demographic variables), ethnicity had the greatest reduction on the OR for the VCCH group for a history of prior arrests against the person. Having adjusted for age, sex and marital status, the OR for the VCCH group had slightly increased to 0.99 (95% C.I., 0.56-1.77). However, adding ethnicity
at this level of adjustment the OR for prior arrests for crimes against the person for the VCCH group reduced to 0.77 (95% C.I., 0.42-1.40).

At the second level of adjustment (socio-demographic and historical variables), having been beaten as a child, having been beaten as a teenager, a history of drug abuse and a history of alcohol abuse had little effect on the OR (OR, 0.74; 95% C.I., 0.41-1.36). Following the third level of adjustment (socio-demographic, historical, and current mental health variables), neither symptom severity (BPRS) nor impulsivity (BIS) had little effect on the OR for the VCCH group (OR, 0.75; 95% C.I., 0.41-1.37). Following the fourth level of adjustment (socio-demographic, historical, current mental health and delusion variables), any delusion or persecutory delusions had little effect on the OR for the VCCH group (OR, 0.75; 95% C.I., 0.41-1.37). Finally, the fifth level of adjustment (socio-demographic, historical, current mental health, delusion and Psychopathy variables) again had little effect on the OR for the VCCH group (OR, 0.79; 95% C.I., 0.42-1.48).
### Table 10: Unadjusted odds ratios and adjusted odds ratios (with 95% C.I.) of participants prior arrests for crimes against the person (Aim1)

<table>
<thead>
<tr>
<th></th>
<th>N (%)</th>
<th>Odds Ratio (95% C.I.)</th>
<th>Adjusted Odds Ratio *1 (95% C.I.)</th>
<th>Adjusted Odds Ratio *2 (95% C.I.)</th>
<th>Adjusted Odds Ratio *3 (95% C.I.)</th>
<th>Adjusted Odds Ratio *4 (95% C.I.)</th>
<th>Adjusted Odds Ratio *5 (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCCH</td>
<td>105 (9)</td>
<td>0.95 (0.55-1.66)</td>
<td>0.77 (0.42-1.40)</td>
<td>0.74 (0.41-1.36)</td>
<td>0.75 (0.41-1.37)</td>
<td>0.78 (0.42-1.47)</td>
<td>0.79 (0.42-1.48)</td>
</tr>
<tr>
<td>NVCCH</td>
<td>125 (11)</td>
<td>0.93 (0.57-1.52)</td>
<td>0.87 (0.52-1.47)</td>
<td>0.87 (0.66-1.23)</td>
<td>0.89 (0.53-1.51)</td>
<td>0.90 (0.52-1.54)</td>
<td>0.90 (0.53-1.55)</td>
</tr>
<tr>
<td>NCAH</td>
<td>158 (14)</td>
<td>0.72 (0.45-1.17)</td>
<td>0.63 (0.38-1.05)</td>
<td>0.63 (0.38-1.05)</td>
<td>0.64 (0.38-1.06)</td>
<td>0.64 (0.38-1.09)</td>
<td>0.64 (0.38-1.08)</td>
</tr>
<tr>
<td>NH</td>
<td>729 (65)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>χ² (df)</td>
<td>1.86 (3)</td>
<td>97.43 (7)</td>
<td>99.02 (12)</td>
<td>104.72 (14)</td>
<td>106.03 (16)</td>
<td>106.98 (17)</td>
<td></td>
</tr>
<tr>
<td>p</td>
<td>0.0019</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
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</tr>
<tr>
<td>Number of obs</td>
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<td>1117</td>
<td>1117</td>
<td>1117</td>
<td>1117</td>
<td>1117</td>
<td></td>
</tr>
</tbody>
</table>

*1 Adjustment for socio-demographic variables (age, sex, marital status, and ethnicity)
*2 Adjustment for socio-demographic and historical variables (age, sex, marital status, ethnicity, having been beaten as a child, having been beaten as a teenager, living with relative prior to admission, history of alcohol abuse and history of drug abuse)
*3 Adjustment for socio-demographic, historical, and current mental health variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS) and impulsivity (BIS))
*4 Adjustment for socio-demographic, historical, current mental health and delusion variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions)
*5 Adjustment for socio-demographic, historical, current mental health, delusion and Psychopathy variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions, and Psychopathy (PCL: SV))

#### 3.2.1.2. Self-reported historical violence to others

The unadjusted OR for self-reported historical violence to others found that the VCCH group were over twice the risk of having been violent to others when compared with all other groups (Table 11). At the first level of adjustment (socio-demographic variables), the OR for the VCCH group decreased to 1.83 (95% C.I., 1.20-3.78). Adjusting for gender and ethnicity had the greatest lowering effect. At the second level of adjustment (socio-demographic and historical variables), the OR for
the VCCH group again decreased to 1.53. The greatest lowering effects were observed after adjusting for having been beaten as a child and for a history of drug abuse. Little effect on the OR was noted after the third level of adjustment (socio-demographic, historical, and current mental health variables) and adjustment for symptom severity (BPRS) and impulsivity (BIS) resulted in an OR for the VCCH group of 1.55 (95% C.I., 0.85-2.84). However, following the fourth level of adjustment (socio-demographic, historical, current mental health and delusion variables), any delusion or persecutory delusions reduced the OR further to 1.34 (95% C.I., 0.71-2.53). Finally, the fifth level of adjustment (socio-demographic, historical, current mental health, delusion and Psychopathy variables) had little effect on the OR for the VCCH group (OR, 1.30; 95% C.I., 0.69-2.47).
Table 11: Unadjusted odds ratios and adjusted odds ratios (with 95% C.I.) of participants reporting historical violence to others (Aim 1)

<table>
<thead>
<tr>
<th></th>
<th>N (%)</th>
<th>Odds Ratio (95% C.I.)</th>
<th>Adjusted Odds Ratio *1 (95% C.I.)</th>
<th>Adjusted Odds Ratio *2 (95% C.I.)</th>
<th>Adjusted Odds Ratio *3 (95% C.I.)</th>
<th>Adjusted Odds Ratio *4 (95% C.I.)</th>
<th>Adjusted Odds Ratio *5 (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCCH</td>
<td>105</td>
<td>2.41 (1.37-4.24)</td>
<td>1.83 (1.02-3.29)</td>
<td>1.53 (0.84-2.79)</td>
<td>1.55 (0.85-2.84)</td>
<td>1.34 (0.71-2.53)</td>
<td>1.30 (0.69-2.47)</td>
</tr>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>NVCCH</td>
<td>125</td>
<td>1.15 (0.73-1.80)</td>
<td>1.20 (0.75-1.92)</td>
<td>1.14 (0.70-1.85)</td>
<td>1.16 (0.72-1.88)</td>
<td>1.05 (0.64-1.74)</td>
<td>1.10 (0.67-1.82)</td>
</tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCAH</td>
<td>158</td>
<td>0.90 (0.59-1.38)</td>
<td>0.92 (0.59-1.44)</td>
<td>0.86 (0.55-1.35)</td>
<td>0.87 (0.55-1.37)</td>
<td>0.81 (0.51-1.29)</td>
<td>0.86 (0.53-1.37)</td>
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<tr>
<td>NH</td>
<td>729</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
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</tr>
<tr>
<td>χ² (df)</td>
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<td>10.51 (3)</td>
<td>62.26 (7)</td>
<td>88.85 (12)</td>
<td>91.53 (14)</td>
<td>93.85 (16)</td>
<td>101.62 (17)</td>
</tr>
<tr>
<td>p</td>
<td></td>
<td>0.0147</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
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<td>0.0001</td>
</tr>
<tr>
<td>Number of obs</td>
<td></td>
<td>1117</td>
<td>1117</td>
<td>1117</td>
<td>1117</td>
<td>1117</td>
<td>1117</td>
</tr>
</tbody>
</table>

*1 Adjustment for socio-demographic variables (age, sex, marital status, and ethnicity).
*2 Adjustment for socio-demographic and historical variables (age, sex, marital status, ethnicity, having been beaten as a child, having been beaten as a teenager, living with relative prior to admission, history of alcohol abuse and history of drug abuse).
*3 Adjustment for socio-demographic, historical, and current mental health variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS) and impulsivity (BIS)).
*4 Adjustment for socio-demographic, historical, current mental health and delusion variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions).
*5 Adjustment for socio-demographic, historical, current mental health, delusion and Psychopathy variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions, and Psychopathy (PCL: SV)).

3.2.1.3. Self-reported historical violence to the family

The unadjusted OR for self reported violence to the family found that the VCCH group were over twice the risk of having been violent to others when compared with all other groups (Table 12). At the first level of adjustment (socio-demographic variables), having adjusted for age, gender and marital status the OR for the VCCH group decreased slightly to 2.50 (95% C.I., 1.36-4.62). However ethnicity reduced the OR to 2.09 (95% C.I., 1.12-3.91). Little effect was observed after adjustment for socio-demographic, historical, and current mental health variables. Adjustment for
delusions and persecutory delusions had a further lowering effect on the OR, whereas adjustment for Psychopathy had little effect.

Table 12: Unadjusted odds ratios and adjusted odds ratios (with 95% CI) of participants reporting historical violence to family (Aim I)

<table>
<thead>
<tr>
<th></th>
<th>n (%)</th>
<th>Odds Ratio *(95% C.I.)</th>
<th>Adjusted Odds Ratio <em>(1)</em> *(95% C.I.)</th>
<th>Adjusted Odds Ratio <em>(2)</em> *(95% C.I.)</th>
<th>Adjusted Odds Ratio <em>(3)</em> *(95% C.I.)</th>
<th>Adjusted Odds Ratio <em>(4)</em> *(95% C.I.)</th>
<th>Adjusted Odds Ratio <em>(5)</em> *(95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCCH</td>
<td>105</td>
<td>2.69 <em>(1.47-4.91)</em></td>
<td>2.09 <em>(1.12-3.91)</em></td>
<td>2.10 <em>(1.11-3.96)</em></td>
<td>2.15 <em>(1.12-4.12)</em></td>
<td>1.87 <em>(0.95-3.68)</em></td>
<td>1.90 <em>(0.96-3.78)</em></td>
</tr>
<tr>
<td>NVCCH</td>
<td>125</td>
<td>1.06 <em>(0.62-1.80)</em></td>
<td>1.09 <em>(0.62-1.90)</em></td>
<td>1.10 <em>(0.63-1.94)</em></td>
<td>1.13 <em>(0.64-1.99)</em></td>
<td>1.02 <em>(0.57-1.83)</em></td>
<td>1.04 <em>(0.58-1.88)</em></td>
</tr>
<tr>
<td>NCAH</td>
<td>158</td>
<td>0.91 <em>(0.54-1.52)</em></td>
<td>0.96 <em>(0.56-1.64)</em></td>
<td>0.94 <em>(0.55-1.62)</em></td>
<td>0.97 <em>(0.56-1.67)</em></td>
<td>0.90 <em>(0.51-1.57)</em></td>
<td>0.97 <em>(0.55-1.71)</em></td>
</tr>
<tr>
<td>NH</td>
<td>729</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>X2</td>
<td>10.74 <em>(3)</em></td>
<td>47.79 <em>(7)</em></td>
<td>52.31 <em>(12)</em></td>
<td>54.52 <em>(14)</em></td>
<td>57.42 <em>(16)</em></td>
<td>69.94 <em>(17)</em></td>
<td></td>
</tr>
<tr>
<td>p&lt;</td>
<td>0.0132</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td></td>
</tr>
<tr>
<td>Number of obs</td>
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<td>1117</td>
<td>1117</td>
<td>1117</td>
<td>1117</td>
<td>1117</td>
<td></td>
</tr>
</tbody>
</table>

*1 Adjustment for socio-demographic variables (age, sex, marital status, and ethnicity).
*2 Adjustment for socio-demographic and historical variables (age, sex, marital status, ethnicity, having been beaten as a child, having been beaten as a teenager, living with relative prior to admission, history of alcohol abuse and history of drug abuse).
*3 Adjustment for socio-demographic, historical, and current mental health variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), and impulsivity (BIS)).
*4 Adjustment for socio-demographic, historical, current mental health and delusion variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions).
*5 Adjustment for socio-demographic, historical, current mental health, delusion and Psychopathy variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions, and Psychopathy (PCL: SV)).

3.2.1.4 Summary of associations between violent-content command hallucinations and historical violence (aim I)

After adjustment, there was no clear association found for either prior arrest for crime against the person or self-reported violence to others when considering the odds ratios
and 95% confidence intervals. However, a near association was found for violence against the family where, following adjustment, violent-content command hallucinations were associated with nearly twice the risk of violence to family members when compared with non-hallucinators (OR, 1.90). However, the confidence interval crosses "1" (95% C.I. 0.96-3.78), suggesting that there is a slight possibility that the true value of the OR may be less than one.

3.2.2 Current violence

3.2.2.1 Any aggression as reason for admission

The unadjusted OR for any aggression as reason for admission found that the VCCH group were over twice the risk of being admitted due to any aggression when compared with all other groups (Table 13). Little effect was observed on the OR for the VCCH group after the first level of adjustment (socio-demographic variables), second level of adjustment (socio-demographic and historical variables) and third level of adjustment (socio-demographic, historical, and current mental health variables). Adjustment at the fourth level (socio-demographic, historical, current mental health variables and delusions) found that adjustment for any delusion reduced the OR for the VCCH group from 2.52 to 2.01 (95% C.I., 1.27-3.18). Adjustment for persecutory delusions had little effect on the OR. The final level of adjustment (Psychopathy) again had little effect. The total adjusted OR was 2.04 (95% C.I., 1.29-3.23), showing that the VCCH group are more than twice as likely to be admitted due to any aggression when compared with all other groups.
**Table 13: Unadjusted odds ratios and adjusted odds ratios (with 95% C.I.) of participants reason for admission as being any aggression (Aim 1)**

<table>
<thead>
<tr>
<th></th>
<th>N (%)</th>
<th>Odds Ratio (95% C.I.)</th>
<th>Adjusted Odds Ratio *1 (95% C.I.)</th>
<th>Adjusted Odds Ratio *2 (95% C.I.)</th>
<th>Adjusted Odds Ratio *3 (95% C.I.)</th>
<th>Adjusted Odds Ratio *4 (95% C.I.)</th>
<th>Adjusted Odds Ratio *5 (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCCH</td>
<td>105(9 )</td>
<td>2.56 (1.68-3.88)</td>
<td>2.46 (1.61-3.78)</td>
<td>2.52 (1.63-3.89)</td>
<td>2.52 (1.63-3.89)</td>
<td>2.05 (1.29-3.25)</td>
<td>2.04 (1.29-3.23)</td>
</tr>
<tr>
<td>NVCC</td>
<td>125(11)</td>
<td>0.98 (0.63-1.51)</td>
<td>1.05 (0.67-1.64)</td>
<td>1.05 (0.67-1.64)</td>
<td>1.06 (0.68-1.65)</td>
<td>0.89 (0.56-1.41)</td>
<td>0.90 (0.57-1.42)</td>
</tr>
<tr>
<td>NCAH</td>
<td>158(14)</td>
<td>1.02 (0.69-1.50)</td>
<td>1.05 (0.71-1.56)</td>
<td>1.04 (0.70-1.55)</td>
<td>1.04 (0.70-1.55)</td>
<td>0.90 (0.59-1.35)</td>
<td>0.90 (0.60-1.36)</td>
</tr>
<tr>
<td>NH</td>
<td>729(65)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td></td>
<td>19.67 (3)</td>
<td>39.05 (7)</td>
<td>41.11 (12)</td>
<td>41.74 (14)</td>
<td>53.13 (16)</td>
<td>53.76 (17)</td>
</tr>
<tr>
<td>p*</td>
<td></td>
<td>0.0002</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Number of obs I

|          | 1117  | 1117  | 1117  | 1117  | 1117  | 1117  |

*1 Adjustment for socio-demographic variables (age, sex, marital status, and ethnicity).
*2 Adjustment for socio-demographic and historical variables (age, sex, marital status, ethnicity, having been beaten as a child, having been beaten as a teenager, living with relative prior to admission, history of alcohol abuse and history of drug abuse).
*3 Adjustment for socio-demographic, historical, and current mental health variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), and impulsivity (BIS)).
*4 Adjustment for socio-demographic, historical, current mental health and delusion variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions).
*5 Adjustment for socio-demographic, historical, current mental health, delusion and Psychopathy variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions, and Psychopathy (PCL: SV)).

### 3.2.2.2. Homicidal threat/ideation as reason for admission

The unadjusted OR found that the VCCH group were nearly four times the risk of their reason for admission being due to homicidal threat/ideation when compared to all other groups (Table 14). Little effect was observed on the OR for the VCCH group after the first level of adjustment (socio-demographic variables). The second level of adjustment (socio-demographic and historical variables) raised the OR for the VCCH group with the adjustments for having been beaten as a teenager accounting for the greatest increase. The third level of adjustment (socio-
demographic, historical, and current mental health variables) had little effect.

Adjustment at the fourth level (socio-demographic, historical, current mental health variables and delusions) found that adjustment for any delusion reduced the OR for the VCCH group from 4.94 (95% C.I., 3.06-7.94) to 4.58 (95% C.I., 2.76-7.59).

However, adjustment for persecutory delusions had little additional effect. The final level of adjustment (Psychopathy) again had little effect. The total adjusted OR was 4.58 (95% C.I. 2.75-7.63), showing that the VCCH group are four times as likely to be admitted due to homicidal threat/ideation when compared with all other groups.

Table 14: Unadjusted odds ratios and adjusted odds ratios (with 95% C.I.) of participants reason for admission as being homicidal threat/ideation (Aim1)

<table>
<thead>
<tr>
<th></th>
<th>N (%</th>
<th>Odds Ratio (95% C.I.)</th>
<th>Adjusted Odds Ratio</th>
<th>Adjusted Odds Ratio</th>
<th>Adjusted Odds Ratio</th>
<th>Adjusted Odds Ratio</th>
<th>Adjusted Odds Ratio</th>
<th>Adjusted Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>*1 (95% C.I.)</td>
<td>*2 (95% C.I.)</td>
<td>*3 (95% C.I.)</td>
<td>*4 (95% C.I.)</td>
<td>*5 (95% C.I.)</td>
<td></td>
</tr>
<tr>
<td>VCCH</td>
<td>105</td>
<td>4.78 (3.04-7.51)</td>
<td>4.45 (2.28-7.07)</td>
<td>4.91 (3.02-7.90)</td>
<td>4.94 (3.06-7.95)</td>
<td>4.58 (2.75-7.62)</td>
<td>4.58 (2.75-7.63)</td>
<td></td>
</tr>
<tr>
<td>WCCH</td>
<td>125</td>
<td>1.19 (0.68-2.07)</td>
<td>1.21 (0.69-2.14)</td>
<td>1.25 (0.71-2.21)</td>
<td>1.25 (0.71-2.21)</td>
<td>1.19 (0.66-2.13)</td>
<td>1.19 (0.66-2.13)</td>
<td></td>
</tr>
<tr>
<td>NCAH</td>
<td>158</td>
<td>1.21 (0.73-1.99)</td>
<td>1.21 (0.73-2.02)</td>
<td>1.23 (0.74-2.05)</td>
<td>1.17 (0.69-1.98)</td>
<td>1.17 (0.69-1.98)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NH</td>
<td>729</td>
<td>1.00 (0.66-1.55)</td>
<td>1.00 (0.66-1.55)</td>
<td>1.00 (0.66-1.55)</td>
<td>1.00 (0.66-1.55)</td>
<td>1.00 (0.66-1.55)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

χ² (df) = 42.37 (3) 52.12 (7) 62.06 (12) 62.46 (14) 63.19 (16) 63.20 (17)

*p < 0.0001 0.0001 0.0001 0.0001 0.0001 0.0001

Number of obs = 1117 1117 1117 1117 1117 1117

*1 Adjustment for socio-demographic variables (age, sex, marital status, and ethnicity).
*2 Adjustment for socio-demographic and historical variables (age, sex, marital status, ethnicity, having been beaten as a child, having been beaten as a teenager, living with relative prior to admission, history of alcohol abuse and history of drug abuse).
*3 Adjustment for socio-demographic, historical, and current mental health variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severety of symptoms (BPRS) and impulsivity (BIS)).
*4 Adjustment for socio-demographic, historical, current mental health and delusion variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions).
*5 Adjustment for socio-demographic, historical, current mental health, delusion and Psychopathy variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions, and Psychopathy (PCL-SV)).
3.2.2.3. *Lethal Weapon usage or threat as reason for admission*

The unadjusted OR found that the VCCH group were nearly three times the odds of their reason for admission being due to lethal weapon usage or threat when compared to all other groups (Table 15). Little effect was observed on the OR after the first level of adjustment (socio-demographic variables), the second level of adjustment (socio-demographic and historical variables), or the third level of adjustment (socio-demographic, historical, and current mental health variables). Adjusting for any delusion found that the OR increased slightly from 4.28 (95% C.I., 2.24-8.17) to 4.70 (95% C.I., 2.31-9.55). Further adjustment at this level for persecutory delusions had little effect. The final level of adjustment (Psychopathy) again had little effect. The total adjusted OR was 4.85 (95% C.I. 2.37-9.91), showing that the VCCH group were over twice the risk of being admitted due to lethal weapon usage/threat than the NVCCH group and nearly five times the risk when compared with the NCAH and NH groups.
Table 15: Unadjusted odds ratios and adjusted odds ratios (with 95% CI) of participants reason for admission as being lethal weapon usage/threat (Aim1)

<table>
<thead>
<tr>
<th></th>
<th>n (%)</th>
<th>Odds Ratio (95% C.I.)</th>
<th>Adjusted Odds Ratio *1 (95% C.I.)</th>
<th>Adjusted Odds Ratio *2 (95% C.I.)</th>
<th>Adjusted Odds Ratio *3 (95% C.I.)</th>
<th>Adjusted Odds Ratio *4 (95% C.I.)</th>
<th>Adjusted Odds Ratio *5 (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCCH</td>
<td>105 (9)</td>
<td>4.23 (2.29-7.81)</td>
<td>3.94 (2.10-7.40)</td>
<td>4.26 (2.24-8.13)</td>
<td>4.28 (2.24-8.17)</td>
<td>4.79 (2.35-9.78)</td>
<td>4.85 (2.37-9.91)</td>
</tr>
<tr>
<td>NVCCH</td>
<td>125 (11)</td>
<td>1.58 (0.74-3.39)</td>
<td>1.67 (0.77-3.60)</td>
<td>1.65 (0.76-3.58)</td>
<td>1.68 (0.77-3.65)</td>
<td>1.76 (0.79-3.89)</td>
<td>1.70 (0.77-3.79)</td>
</tr>
<tr>
<td>NCAH</td>
<td>158 (14)</td>
<td>0.81 (0.33-1.95)</td>
<td>0.82 (0.34-1.99)</td>
<td>0.85 (0.34-2.07)</td>
<td>0.86 (0.35-2.10)</td>
<td>0.90 (0.36-2.24)</td>
<td>0.88 (0.35-2.12)</td>
</tr>
<tr>
<td>NH</td>
<td>729 (65)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>(\chi^2) (df)</td>
<td></td>
<td>20.18 (3)</td>
<td>24.78 (7)</td>
<td>31.25 (12)</td>
<td>32.96 (14)</td>
<td>33.62 (16)</td>
<td>35.49 (17)</td>
</tr>
<tr>
<td>p &lt; 0.0002</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of obs</td>
<td></td>
<td>1117</td>
<td>1117</td>
<td>1117</td>
<td>1117</td>
<td>1117</td>
<td>1117</td>
</tr>
</tbody>
</table>

*1 Adjustment for socio-demographic variables (age, sex, marital status, and ethnicity).
*2 Adjustment for socio-demographic and historical variables (age, sex, marital status, ethnicity, having been beaten as a child, having been beaten as a teenager, living with relative prior to admission, history of alcohol abuse and history of drug abuse).
*3 Adjustment for socio-demographic, historical, and current mental health variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS) and impulsivity (BIS)).
*4 Adjustment for socio-demographic, historical, current mental health and delusion variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions).
*5 Adjustment for socio-demographic, historical, current mental health, delusion and Psychopathy variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions, and Psychopathy (PCL-SV)).

3.2.2.4 Summary of associations between violent-content command hallucinations and current violence (Aim1)

After adjustment for potential confounders association were found for all three outcome measures. These were any aggression as reason for admission, homicidal threat/ideation as reason for admission and lethal weapon usage or threat as reason for admission.
Violent-content command hallucinations were associated with over four and half times the risk of being admitted due to homicidal threat/ideation (OR 4.85; 95% C.I. 2.37-9.91). Again, such an association was not found for either non-violent content command hallucinators or non-command auditory hallucinators. Violent-content command hallucinations were associated with nearly five times the risk of being admitted due to lethal weapon usage/threat (OR 4.85; 95% C.I. 2.37-9.91). An association was found for non-violent content command hallucinators for the risk of being admitted due to lethal weapon usage/threat (OR 1.70). However, the 95% C.I. (0.77-3.79) does not rule out the possibility that the true value lies below one and that an association may not be present. No association was found for non-command auditory hallucinators and the risk of being admitted due to lethal weapon usage/threat.

### 3.2.3 Longitudinally measured violence

There were no statistically significant differences between all the groups for losses to follow-up for either the first, second, third or fourth follow-up and follow-up rates were achieved for approximately 70% of participants. There was a statistically significant difference between all the groups for losses to follow-up at the fifth follow-up as 80% of the NVCCH group were followed up compared with between 63%-67% for the other groups ($\chi^2=11.58$, $df=3$, $p<0.01$). As discussed in the methods section the differences between those followed up and those lost to follow up have previously been examined by the original MacArthur research team and the effect that
these differences have will be considered in the later discussion. As previously reported, only one historical violence variable (previous violence to a family member) was associated with the exposure groups, where the OR for the violent content command hallucination group was 1.90 (95% C.I., 0.96-3.78) suggesting that it may be considered as a potential confounder. For this to be a confounder it must be associated with the exposure groups and with longitudinally measured violence.

The $\chi^2$ test for independence found that previous violence to a family member was associated with the exposure groups ($\chi^2=11.78$, $df$, 3; $p=0.008$). Additionally, the $\chi^2$ test for independence found that previous violence to a family member was also associated with 4 out of the 5 follow-up outcomes of longitudinal violence (FU1. $\chi^2=32.44$, $df$, 2; $p<0.001$; FU2. $\chi^2=11.70$, $df$, 2; $p<0.005$; FU3. $\chi^2=8.56$, $df$, 2; $p<0.05$; FU4 $\chi^2=17.86$, $df$, 2; $p<0.001$; FU5. $\chi^2=4.03$, $df$, 2; $p>0.1$).

This therefore suggests that previous violence to a family member should be possibly considered as a confounder for longitudinally measured violence. This assumes that previous violence to a family member causes the command hallucinations, which is an unlikely but possible explanation. A more likely explanation is that command hallucinations caused the previous violence to a family member. Therefore previous violence to a family member should not be considered a confound but a potential factor on the causal pathway for longitudinally measured violence. As the data on previous violence to a family member is dependent on patient self reporting, it is not
possible to determine whether the command hallucinations occurred before the previous violence to a family member or vice versa. Therefore although it is unlikely that previous violence to a family member causes the command hallucination, such an assumption will be considered and analysed in order that the most cautious levels of analyses and interpretation can be fully considered.

The following analyses will therefore be presented. Firstly the OR will be determined for unadjusted and time adjusted longitudinal violence. Thereafter the OR will be additionally adjusted for the predetermined potential confounders, without adjusting for previous historical violence. Finally the OR will be additionally adjusted for historical violence.

3.2.3.1 Fully adjusted odds ratios (95% C.I.) of longitudinal measured violence without adjustment for historical violence (Aim 1)

As shown in Table 16, the VCCH group had a greater percentage of longitudinal episodes of violent incidents compared to the other three groups (39% compared to 26%, 28% and 28%).

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of violent incidents (denominator is the number of person follow-ups)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCCH</td>
<td>136/351 (39%)</td>
</tr>
<tr>
<td>NVCCH</td>
<td>129/493 (26%)</td>
</tr>
<tr>
<td>NCAH</td>
<td>157/561 (28%)</td>
</tr>
<tr>
<td>NH</td>
<td>703/2513 (28%)</td>
</tr>
</tbody>
</table>

Table 16: Descriptive results of the proportion of violent incidents per number of person follow-ups for the four exposure groups (Aim 1)
The first level of analyses examined whether there was any interaction between exposure groups and time. No interaction was observed (p>0.1) so the planned random-effects repeated measures, logit model is appropriate.

Table 17 shows that after adjusting for time effects the OR for longitudinal violence was 1.94 (95% C.I., 1.22-3.99). At the second level of adjustment (socio-demographic variables) the OR for the VCCH group decreased to 1.62 (95% C.I., 1.02-2.58). Within these adjustments the OR remained constant at 1.91 after adjusting for age, sex and marital status but decreased to 1.62 (95% C.I., 1.02-2.58) after adjusting for ethnicity. Little effect was observed at the third level of adjustment (socio-demographic and historical variables) when the OR for the VCCH group slightly increased to 1.72 (95% C.I., 1.07-2.77). The effects of each variable were as follows: the OR after adjusting for having been beaten as a child was 1.68 (95% C.I., 1.06-2.66), the OR after adjusting for having been beaten as a teenager was 1.64 (95% C.I., 1.03-2.61), the OR after adjusting for having been discharged to a relative was 1.76 (95% C.I., 1.09-2.87), the OR after adjusting for a history of alcohol abuse was 1.68 (95% C.I., 1.04-2.71) and the OR after adjusting for a history of drug abuse was 1.72 (95% C.I., 1.07-2.77). Little effect was noted after the fourth level of adjustment (socio-demographic, historical, and current mental health variables). The OR after adjustment for symptom severity (BPRS) was 1.77 (95% C.I., 1.08-2.91) and was 1.68 (95% C.I., 1.02-2.75) after adjustment for impulsivity (BIS). The fifth level of adjustment (socio-demographic, historical, current mental health and
delusion variables) slightly increased the OR to 1.83 (95% C.I., 1.10-3.05).

Adjustment for psychopathy had no effect on the overall model and the OR remained at 1.83 (95% C.I., 1.11-3.01).

Table 17: Adjusted odds ratios (with 95% C.I.) of longitudinally measured violence (Aim 1)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adjusted Odds Ratio *1 (95% C.I.)</th>
<th>Adjusted Odds Ratio *2 (95% C.I.)</th>
<th>Adjusted Odds Ratio *3 (95% C.I.)</th>
<th>Adjusted Odds Ratio *4 (95% C.I.)</th>
<th>Adjusted Odds Ratio *5 (95% C.I.)</th>
<th>Adjusted Odds Ratio *6 (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCCH</td>
<td>1.94 (1.22-3.99)</td>
<td>1.62 (1.02-2.58)</td>
<td>1.72 (1.07-2.77)</td>
<td>1.68 (1.02-2.75)</td>
<td>1.83 (1.10-3.05)</td>
<td>1.83 (1.11-3.01)</td>
</tr>
<tr>
<td>NVCCH</td>
<td>0.91 (0.60-1.38)</td>
<td>0.91 (0.60-1.39)</td>
<td>0.97 (0.63-1.49)</td>
<td>0.93 (0.60-1.44)</td>
<td>0.97 (0.62-1.51)</td>
<td>1.04 (0.67-1.60)</td>
</tr>
<tr>
<td>NCAH</td>
<td>0.97 (0.66-1.44)</td>
<td>0.97 (0.66-1.43)</td>
<td>1.06 (0.72-1.56)</td>
<td>1.06 (0.71-1.58)</td>
<td>1.12 (0.75-1.79)</td>
<td>1.29 (0.87-1.92)</td>
</tr>
<tr>
<td>NH</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Wald-χ²</td>
<td>108.59 (7)</td>
<td>132.80 (11)</td>
<td>158.27 (16)</td>
<td>159.26 (18)</td>
<td>160.97 (20)</td>
<td>200.65 (21)</td>
</tr>
<tr>
<td>p</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

*1 Adjustment for time (5 follow-ups). No interaction of time observed (χ² = 0.15).
*2 Adjustment for socio-demographic variables (age, sex, marital status, and ethnicity).
*3 Adjustment for socio-demographic and historical variables (age, sex, marital status, ethnicity, having been beaten as a child, having been beaten as a teenager, living with relative after discharge, history of alcohol abuse and history of drug abuse).
*4 Adjustment for socio-demographic, historical, and current mental health variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative after discharge, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS) and impulsivity (BIS)).
*5 Adjustment for socio-demographic, historical, current mental health and delusion variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative after discharge, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions).
*6 Adjustment for socio-demographic, historical, current mental health, delusion and Psychopathy variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative after discharge history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions, and Psychopathy (PCL: SV)).
3.2.3.2 **Fully adjusted odds ratios (95% C.I.) of longitudinal measured violence including adjustment for historical violence (Aim 1)**

Only one of the three historical violence outcomes was associated with violent content command hallucinations and longitudinally measured violence. This was a previous history of violence to a family member. Although it is unclear whether this association is due to this variable truly being a confounder or whether it is associated with longitudinal violence as it lies on the causal pathway. A cautious approach will be adopted. This involves further adjusting for previous violence to a family member in order to examine the effect that this has on the OR and 95% C.I. for violent content command hallucinations and longitudinal violence.

Following adjustment for a history of violence to a family member the OR for the violent content command hallucination group remained constant at 1.80 and the C.I., was 1.09-2.98. This means that a positive association was found for violent content command hallucinations and longitudinally measured violence even after adjustment for a self reported history of violence to a family member.

3.2.3.3 **Summary of associations between violent-content command hallucinations and longitudinal violence (Aim 1)**

As can be seen in table 16 violent-content command hallucinations have a greater percentage of violent incidents across follow-ups when compared with the three other groups. Table 17 found that after adjustment for time and all potential confounders
except for a previous history of violence to a family member that the violent-content command hallucination group were nearly twice the risk of being violent over the five follow-up periods when compared to the non-hallucinator group. Additionally, the lowest score for the C.I., never crossed “1” throughout all levels of adjustment, suggesting that with 95% confidence, the true value lies above one.

Although it is highly unlikely that a history of violence to a family member is a confounder, a cautious approach was taken and adjustment for this variable was made. This did not significantly alter the OR or the 95% confidence intervals and a positive association was found. This means that there is a positive association between violent content command hallucinations and longitudinally measured violence and that even with the most cautious of analyses, whereby past violence to a family member was included as a potential confounder, this effect was still present.

As it is highly unlikely that a history of violence to a family member is a confounder. The results presented in the remaining sections of this PhD when reviewing longitudinally measured violence will refer to those obtained from the fully adjusted odds ratios (95% C.I.) of longitudinal measured violence without adjustment for historical violence. The rationale for examining a history of previous familial violence was to ensure that the even though this is a highly unlikely confounder that the possibility of a loss of effect should be considered. As adjustment for this variable did not alter the observed positive association then this variable will be discarded.
3.3. Aim 2

The hypothesis for aim 2 is:

"The proportion of patients who will have engaged in violence prior to admission, as a reason for admission and at follow up will be reduced, after adjustment for potential confounders when compared with the results obtained for those with violent-content command hallucinations as found from aim 1".

3.3.1. Historical violence

3.3.1.1. Prior arrest for crimes against the person

The unadjusted OR for prior arrests for crimes against the person found that the CH group were not at increased risk of having been arrested for prior crimes against the person (Table 18). Following adjustment for all variables the OR remained constant throughout.
Table 18: Unadjusted odds ratios and adjusted odds ratios (with 95% C.I.) of participants prior arrests for crimes against the person (Aim 2)

<table>
<thead>
<tr>
<th></th>
<th>n (%)</th>
<th>Odds Ratio (95% C.I.)</th>
<th>Adjusted Odds Ratio*1 (95% C.I.)</th>
<th>Adjusted Odds Ratio*2 (95% C.I.)</th>
<th>Adjusted Odds Ratio*3 (95% C.I.)</th>
<th>Adjusted Odds Ratio*4 (95% C.I.)</th>
<th>Adjusted Odds Ratio*5 (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH</td>
<td>239 (22)</td>
<td>0.95 (0.64-1.40)</td>
<td>0.84 (0.55-1.27)</td>
<td>0.83 (0.54-1.26)</td>
<td>0.84 (0.55-1.28)</td>
<td>0.87 (0.56-1.36)</td>
<td>0.88 (0.56-1.37)</td>
</tr>
<tr>
<td>NCAH</td>
<td>158 (14)</td>
<td>0.72 (0.45-1.17)</td>
<td>0.63 (0.38-1.05)</td>
<td>0.63 (0.38-1.04)</td>
<td>0.64 (0.38-1.06)</td>
<td>0.64 (0.38-1.09)</td>
<td>0.64 (0.38-1.08)</td>
</tr>
<tr>
<td>NH</td>
<td>729 (64)</td>
<td>1.00 (1.00)</td>
<td>1.00 (1.00)</td>
<td>1.00 (1.00)</td>
<td>1.00 (1.00)</td>
<td>1.00 (1.00)</td>
<td>1.00 (1.00)</td>
</tr>
</tbody>
</table>

\( \chi^2 \) (df)  

|        | 1.85 (2) | 98.21 (6) | 100.57 (11) | 104.25 (13) | 105.79 (15) | 106.76 (16) |

\( p \leq 0.0019 \)  

Number of obs | 1126 | 1126 | 1126 | 1126 | 1126 | 1126 |

*1 Adjustment for socio-demographic variables (age, sex, marital status, and ethnicity).
*2 Adjustment for socio-demographic and historical variables (age, sex, marital status, ethnicity, having been beaten as a child, having been beaten as a teenager, living with relative prior to admission, history of alcohol abuse and history of drug abuse).
*3 Adjustment for socio-demographic, historical, and current mental health variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), and impulsivity (BIS)).
*4 Adjustment for socio-demographic, historical, current mental health and delusion variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions).
*5 Adjustment for socio-demographic, historical, current mental health, delusion and Psychopathy variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions, and Psychopathy (PCL: SV)).

3.3.1.2 Self-reported historical violence to others

The unadjusted OR of 1.50 for self reported historical violence to others found that the CH group were one and half times more likely to have been violent to others when compared with all other groups (Table 19). At the first level of adjustment (socio-demographic variables) the OR for the CH group decreased to 1.39 (95% C.I., 0.95-2.03). Adjusting for ethnicity was the main reason for this lowering effect. All additional adjustments had a slight lowering effect on the OR for the CH group. The total adjusted OR shows that the CH group is not associated with historical violence.
to others (O.R., 1.14; 95% C.I., 0.75-1.74).

Table 9: Unadjusted odds ratios and adjusted odds ratios (with 95% CI) of participants reporting historical violence to others (Aim 2)

<table>
<thead>
<tr>
<th></th>
<th>Odds Ratio (95% C.I.)</th>
<th>Adjusted Odds Ratio *1 (95% C.I.)</th>
<th>Adjusted Odds Ratio *2 (95% C.I.)</th>
<th>Adjusted Odds Ratio *3 (95% C.I.)</th>
<th>Adjusted Odds Ratio *4 (95% C.I.)</th>
<th>Adjusted Odds Ratio *5 (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH</td>
<td>239 (22)</td>
<td>1.50 (1.04-2.15)</td>
<td>1.39 (0.95-2.03)</td>
<td>1.26 (0.86-1.86)</td>
<td>1.14 (0.75-1.73)</td>
<td>1.14 (0.75-1.74)</td>
</tr>
<tr>
<td>NCAH</td>
<td>158 (14)</td>
<td>0.90 (0.59-1.38)</td>
<td>0.92 (0.59-1.44)</td>
<td>0.86 (0.55-1.35)</td>
<td>0.81 (0.51-1.29)</td>
<td>0.81 (0.51-1.29)</td>
</tr>
<tr>
<td>NH</td>
<td>729 (64)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

X² (df) 5.64 (2)  64.72 (7)  86.10 (11)  90.55 (13)  93.85 (15)  98.00 (15)

P< .05 0.0001  0.0001  0.0001  0.0001  0.0001

Number of obs 1126  1126  1126  1126  1126

*1 Adjustment for socio-demographic variables (age, sex, marital status, and ethnicity).
*2 Adjustment for socio-demographic and historical variables (age, sex, marital status, ethnicity, having been beaten as a child, having been beaten as a teenager, living with relative prior to admission, history of alcohol abuse and history of drug abuse).
*3 Adjustment for socio-demographic, historical, and current mental health variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS) and impulsivity (BIS)).
*4 Adjustment for socio-demographic, historical, current mental health and delusion variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions).
*5 Adjustment for socio-demographic, historical, current mental health, delusion and Psychopathy variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions, and Psychopathy (PCL: SV)).

3.3.1.3. Self-reported historical violence to the family

The unadjusted OR for self-reported historical violence against the family found that the CH group had a slightly greater risk (OR, 1.59; 95% C.I., 1.06-2.40) than the other groups for violence against a family member (see table 20). However, the total adjusted OR shows that the CH group is not associated with historical violence to the family (O.R., 1.36; 95% C.I., 0.83-2.20).
Table 20: Unadjusted odds ratios and adjusted odds ratios (with 95% C.I.) of participants reporting historical violence to family (Aim 2)

<table>
<thead>
<tr>
<th></th>
<th>N (%)</th>
<th>Odds Ratio (95% C.I.)</th>
<th>Adjusted Odds Ratio *1 (95% C.I.)</th>
<th>Adjusted Odds Ratio *2 (95% C.I.)</th>
<th>Adjusted Odds Ratio *3 (95% C.I.)</th>
<th>Adjusted Odds Ratio *4 (95% C.I.)</th>
<th>Adjusted Odds Ratio *5 (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH</td>
<td>239 (22)</td>
<td>1.59 (1.06-2.40)</td>
<td>1.49 (0.97-2.29)</td>
<td>1.50 (0.97-2.32)</td>
<td>1.53 (0.98-2.37)</td>
<td>1.34 (0.84-2.15)</td>
<td>1.36 (0.83-2.20)</td>
</tr>
<tr>
<td>NCAH</td>
<td>158 (14)</td>
<td>0.91 (0.54-1.52)</td>
<td>0.96 (0.56-1.64)</td>
<td>0.94 (0.55-1.62)</td>
<td>0.97 (0.56-1.67)</td>
<td>0.90 (0.51-1.57)</td>
<td>0.97 (0.55-1.71)</td>
</tr>
<tr>
<td>NH</td>
<td>729 (64)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>(\chi^2)</td>
<td>5.46 (2)</td>
<td>46.40 (6)</td>
<td>51.12 (11)</td>
<td>52.58 (13)</td>
<td>55.76 (15)</td>
<td>67.05 (16)</td>
<td></td>
</tr>
<tr>
<td>(p)</td>
<td>0.0651</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td></td>
</tr>
<tr>
<td>Number of obs</td>
<td>1126</td>
<td>1126</td>
<td>1126</td>
<td>1126</td>
<td>1126</td>
<td>1126</td>
<td></td>
</tr>
</tbody>
</table>

*1 Adjustment for socio-demographic variables (age, sex, marital status, and ethnicity).
*2 Adjustment for socio-demographic and historical variables (age, sex, marital status, ethnicity, having been beaten as a child, having been beaten as a teenager, living with relative prior to admission, history of alcohol abuse and history of drug abuse).
*3 Adjustment for socio-demographic, historical, and current mental health variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), and impulsivity (BIS)).
*4 Adjustment for socio-demographic, historical, current mental health and delusion variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions).
*5 Adjustment for socio-demographic, historical, current mental health, delusion and Psychopathy variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions, and Psychopathy (PCL: SV)).

3.3.1.4 Summary of associations between any command hallucination and historical violence (aim 2)

No association was found for the CH group and any of three historical outcomes.

When comparing the results from the previous analyses conducted under aim 1, there was a strong suggestion of an association between the VCCH group and one historical violent which a history of violence to a family member. As hypothesised the association was not as strong when using a sample comprising of all command
hallucinations, irrespective of their content. This is presented in Table 21.

<table>
<thead>
<tr>
<th>Prior arrest for crimes against the person</th>
<th>Violence to others</th>
<th>Violence to family</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCCH</td>
<td>0.79 (0.42-1.48)</td>
<td>1.30 (0.69-2.47)</td>
</tr>
<tr>
<td>CH</td>
<td>0.88 (0.56-1.37)</td>
<td>1.14 (0.75-1.74)</td>
</tr>
</tbody>
</table>

3.3.2. Current violence

3.3.2.1. Any aggression as reason for admission

The unadjusted OR for any aggression as the reason for admission found that the CH group had a slightly greater risk than the other groups (Table 22). However, the total adjusted OR shows that the CH group are not associated with being admitted due to any aggression (O.R., 1.37; 95% C.I., 0.97-1.94).
Table 22: Unadjusted odds ratios and adjusted odds ratios (with 95% C.I.) of participants reason for admission as being any aggression (Aim 2)

<table>
<thead>
<tr>
<th></th>
<th>N (%)</th>
<th>Odds Ratio (95% C.I.)</th>
<th>Adjusted Odds Ratio 1 (95% C.I.)</th>
<th>Adjusted Odds Ratio 2 (95% C.I.)</th>
<th>Adjusted Odds Ratio 3 (95% C.I.)</th>
<th>Adjusted Odds Ratio 4 (95% C.I.)</th>
<th>Adjusted Odds Ratio 5 (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH</td>
<td>239 (22)</td>
<td>1.62 (1.19-2.21)</td>
<td>1.66 (1.20-2.28)</td>
<td>1.66 (1.20-2.30)</td>
<td>1.67 (1.21-2.31)</td>
<td>1.37 (0.97-1.94)</td>
<td>1.37 (0.97-1.94)</td>
</tr>
<tr>
<td>NCAH</td>
<td>158 (14)</td>
<td>1.02 (0.69-1.50)</td>
<td>1.05 (0.71-1.56)</td>
<td>1.05 (0.71-1.56)</td>
<td>1.05 (0.71-1.56)</td>
<td>0.90 (0.59-1.35)</td>
<td>0.90 (0.59-1.36)</td>
</tr>
<tr>
<td>NH</td>
<td>729 (64)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Odds Ratio (95% C.I.)</th>
<th>Adjusted Odds Ratio 1 (95% C.I.)</th>
<th>Adjusted Odds Ratio 2 (95% C.I.)</th>
<th>Adjusted Odds Ratio 3 (95% C.I.)</th>
<th>Adjusted Odds Ratio 4 (95% C.I.)</th>
<th>Adjusted Odds Ratio 5 (95% C.I.)</th>
</tr>
</thead>
</table>

| χ² (df) | 9.36 (3) | 33.69 (6) | 35.36 (11) | 35.92 (13) | 47.89 (15) | 48.82 (16) |
| p     | 0.0093 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| Number of obs | 1126 | 1126 | 1126 | 1126 | 1126 | 1126 |

1. Adjustment for socio-demographic variables (age, sex, marital status, and ethnicity).
2. Adjustment for socio-demographic and historical variables (age, sex, marital status, ethnicity, having been beaten as a child, having been beaten as a teenager, living with relative prior to admission, history of alcohol abuse and history of drug abuse).
3. Adjustment for socio-demographic, historical, and current mental health variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS)).
4. Adjustment for socio-demographic, historical, current mental health and delusion variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions).
5. Adjustment for socio-demographic, historical, current mental health, delusion and Psychopathy variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions, and Psychopathy (PCL, SV)).

3.3.2.2. Homicidal threat/ideation as reason for admission

The unadjusted OR for homicidal threat/ideation as reason for admission found that the CH group was at twice the risk when compared with all other groups (Table 23).

After adjustment this risk remained relatively stable and the total adjusted OR shows that the CH group are twice as likely to be admitted due to homicidal threat/ideation than the other groups (O.R., 2.41; 95% C.I., 1.60-3.64).
Table 23: Unadjusted odds ratios and adjusted odds ratios (with 95% C.I.) of participants reason for admission as being homicidal threat/ideation (Aim 2)

<table>
<thead>
<tr>
<th>Group</th>
<th>N (%)</th>
<th>Odds Ratio (95% C.I.)</th>
<th>Adjusted Odds Ratio *1 (95% C.I.)</th>
<th>Adjusted Odds Ratio *2 (95% C.I.)</th>
<th>Adjusted Odds Ratio *3 (95% C.I.)</th>
<th>Adjusted Odds Ratio *4 (95% C.I.)</th>
<th>Adjusted Odds Ratio *5 (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH</td>
<td>239 (22)</td>
<td>2.57 (1.78-3.72)</td>
<td>2.51 (1.72-3.66)</td>
<td>2.64 (1.80-3.87)</td>
<td>2.65 (1.80-3.88)</td>
<td>2.41 (1.60-3.64)</td>
<td>2.41 (1.60-3.64)</td>
</tr>
<tr>
<td>NCAH</td>
<td>158 (14)</td>
<td>1.21 (0.73-2.00)</td>
<td>1.22 (0.73-2.04)</td>
<td>1.22 (0.73-2.04)</td>
<td>1.23 (0.74-2.05)</td>
<td>1.15 (0.68-1.95)</td>
<td>1.15 (0.68-1.95)</td>
</tr>
<tr>
<td>NH</td>
<td>729 (64)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>χ² (df)</th>
<th>p≤</th>
<th>Number of obs</th>
</tr>
</thead>
<tbody>
<tr>
<td>24.39 (2)</td>
<td>0.0001</td>
<td>1126</td>
</tr>
<tr>
<td>39.03 (6)</td>
<td>0.0001</td>
<td>1126</td>
</tr>
<tr>
<td>47.53 (11)</td>
<td>0.0001</td>
<td>1126</td>
</tr>
<tr>
<td>47.85 (13)</td>
<td>0.0001</td>
<td>1126</td>
</tr>
<tr>
<td>49.54 (15)</td>
<td>0.0001</td>
<td>1126</td>
</tr>
<tr>
<td>49.56 (16)</td>
<td>0.0001</td>
<td>1126</td>
</tr>
</tbody>
</table>

*1 Adjustment for socio-demographic variables (age, sex, marital status, and ethnicity).
*2 Adjustment for socio-demographic and historical variables (age, sex, marital status, ethnicity, being beaten as a child, having been beaten as a teenager, living with relative prior to admission, history of alcohol abuse and history of drug abuse).
*3 Adjustment for socio-demographic, historical, and current mental health variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS)).
*4 Adjustment for socio-demographic, historical, current mental health and delusion variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions).
*5 Adjustment for socio-demographic, historical, current mental health, delusion and Psychopathy variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions, and Psychopathy (PCL: SV)).

### 3.3.2.3. Lethal Weapon usage or threat as reason for admission

The unadjusted OR for lethal weapon usage/threat as reason for admission found that the CH group were at twice the risk when compared with all other groups (Table 24).

After adjustment this risk remained relatively stable and the total adjusted OR shows that the CH group are over twice as likely to be admitted due to lethal weapon usage/threat than the other groups (O.R., 2.77; 95% C.I., 1.53-5.01).
Table 24: Unadjusted odds ratios and adjusted odds ratios (with 95% C.I.) of participants reason for admission as being lethal weapon usage/threat (Aim 2)

<table>
<thead>
<tr>
<th></th>
<th>N (%)</th>
<th>Odds Ratio (95% C.I.)</th>
<th>Adjusted Odds Ratio *1 (95% C.I.)</th>
<th>Adjusted Odds Ratio *2 (95% C.I.)</th>
<th>Adjusted Odds Ratio *3 (95% C.I.)</th>
<th>Adjusted Odds Ratio *4 (95% C.I.)</th>
<th>Adjusted Odds Ratio *5 (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH</td>
<td>239 (22)</td>
<td>2.60 (1.53-4.41)</td>
<td>2.57 (1.53-4.41)</td>
<td>2.62 (1.52-4.53)</td>
<td>2.66 (1.54-4.60)</td>
<td>2.79 (1.54-5.03)</td>
<td>2.77 (1.53-5.01)</td>
</tr>
<tr>
<td>NCAH</td>
<td>158 (14)</td>
<td>0.81 (0.33-1.95)</td>
<td>0.81 (0.33-1.95)</td>
<td>0.85 (0.35-2.06)</td>
<td>0.86 (0.35-2.09)</td>
<td>0.88 (0.36-2.19)</td>
<td>0.86 (0.34-2.14)</td>
</tr>
<tr>
<td>NH</td>
<td>729 (64)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

X2 (df) 13.61 (3) 19.32 (6) 25.18 (11) 27.10 (13) 27.34 (15) 29.20 (15) p< 0.001 0.0037 0.0086 0.0120 0.0261 0.0226

Number of obs 1126 1126 1126 1126 1126 1126

*1 Adjustment for socio-demographic variables (age, sex, marital status, and ethnicity).
*2 Adjustment for socio-demographic and historical variables (age, sex, marital status, ethnicity, having been beaten as a child, having been beaten as a teenager, living with relative prior to admission, history of alcohol abuse and history of drug abuse).
*3 Adjustment for socio-demographic, historical, and current mental health variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS) and impulsivity (BIS)).
*4 Adjustment for socio-demographic, historical, current mental health and delusion variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions).
*5 Adjustment for socio-demographic, historical, current mental health, delusion and Psychopathy variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative prior to admission, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions, and Psychopathy (PCL: SP)).

3.3.3.4. Summary of associations between any command hallucinations and current violence (Aim 2)

After adjustment of the three outcomes, associations were found for command hallucinations irrespective of content for two of the three outcome measures. These were homicidal threat/ideation as reason for admission and lethal weapon usage or threat as reason for admission. The OR for any aggression as the reason for admission was 1.37. The 95% C.I. crosses one and there is only a slight possibility that the true value of the OR is greater than one.
Table 25 presents the results of the same analyses for the violent-content command hallucination group and the command hallucination group. As hypothesised the odds ratios are reduced and have nearly halved for all three current violence variables for the CH group.

Table 25: Adjusted odds and 95% C.I. of current violence variables for the VCCH group and the CH group (Aim 2)

<table>
<thead>
<tr>
<th></th>
<th>Any aggression</th>
<th>Homicidal threat/ideation</th>
<th>Lethal weapon usage/threat</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VCCH</strong></td>
<td>2.04 (1.29-3.23)</td>
<td>4.58 (2.75-7.63)</td>
<td>4.85 (2.37-9.91)</td>
</tr>
<tr>
<td><strong>CH</strong></td>
<td>1.37 (0.97-1.94)</td>
<td>2.41 (1.60-3.64)</td>
<td>2.77 (1.53-5.01)</td>
</tr>
</tbody>
</table>

### 3.3.3 Longitudinal violence

There were no statistically significant differences between all the groups for losses to follow-up at any follow-up period. As discussed in the methods section the differences between those followed up and those lost to follow up have previously been examined by the original MacArthur research team and the effect that these differences will have will be considered in the later discussion.

Unlike the analysis undertaken to examine Aim 1 where an association was found between the exposure groups and historical violence, there was no such association with the three exposure groups for Aim 2. This means that it is not necessary to adjust for historical violence when examining the associations between command...
3.3.3.1 Overview of time adjusted and fully adjusted random-effects repeat measure logit model (Aim 2)

Table 26 presents descriptive data and the OR (with 95% C.I.) for both the time adjusted and fully adjusted models for aim 2. As shown, the three groups are closely matched regarding the percentage of violent incidents. Model 1 adjusts for the five follow-up times periods and the OR for the CH group is 1.23 (95% C.I., 0.88-1.71). The fully adjusted model shows little change and results in an OR of 1.28 (95% C.I., 0.89-1.84) for the CH group.

Table 26: Descriptive, time adjusted and fully adjusted odds ratios (95% C.I.) of longitudinally measured violence (Aim 2)

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of violent incidents (denominator is the number of “person follow-ups”)</th>
<th>Model 1: Odds Ratio, adjusted for time (95% C.I.)</th>
<th>Model 2: Odds Ratio adjusted for time and potential confounders (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH</td>
<td>265/856 (31%)</td>
<td>1.23 (0.88-1.71)</td>
<td>1.28 (0.89-1.84)</td>
</tr>
<tr>
<td>NCAH</td>
<td>157/561 (28%)</td>
<td>0.97 (0.66-1.44)</td>
<td>1.28 (0.86-1.91)</td>
</tr>
<tr>
<td>NH</td>
<td>703/2513 (28%)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

No significant $\chi^2$ interaction was observed between groups and time ($p=0.58$).

3.3.3.2 Fully adjusted odds ratios (95% C.I.) of longitudinal violence (Aim 2)

Table 27 shows that there was no interaction between the exposure groups and time ($p>0.5$) after adjusting for time effects. After adjustment for time the OR for the CH group for longitudinal violence was 1.23 (95% C.I., 0.88-1.71). Thereafter, the OR
remained relatively constant throughout all levels of adjustment for potential confounders and was 1.28 (95% C.I., 0.89-1.84)

Table 27: Adjusted odds ratios (95% C.I.) of longitudinally measured violence (Aim 2)

<table>
<thead>
<tr>
<th></th>
<th>Adjusted Odds Ratio *1 (95% C.I.)</th>
<th>Adjusted Odds Ratio *2 (95% C.I.)</th>
<th>Adjusted Odds Ratio *3 (95% C.I.)</th>
<th>Adjusted Odds Ratio *4 (95% C.I.)</th>
<th>Adjusted Odds Ratio *5 (95% C.I.)</th>
<th>Adjusted Odds Ratio *6 (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH</td>
<td>1.23 (0.88-1.71)</td>
<td>1.14 (0.82-1.59)</td>
<td>1.19 (0.85-1.68)</td>
<td>1.16 (0.81-1.66)</td>
<td>1.23 (0.85-1.78)</td>
<td>1.28 (0.89-1.84)</td>
</tr>
<tr>
<td>NCAH</td>
<td>0.97 (0.66-1.44)</td>
<td>0.97 (0.66-1.43)</td>
<td>1.06 (0.71-1.56)</td>
<td>1.05 (0.70-1.57)</td>
<td>1.11 (0.74-1.67)</td>
<td>1.28 (0.86-1.91)</td>
</tr>
<tr>
<td>NH</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Wald-χ² (df)</td>
<td>102.66 (7)</td>
<td>129.01 (10)</td>
<td>153.71 (15)</td>
<td>154.90 (17)</td>
<td>156.51 (19)</td>
<td>198.05 (20)</td>
</tr>
<tr>
<td>p&lt;=</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
<tr>
<td>Number of obs</td>
<td>3930</td>
<td>3925</td>
<td>3559</td>
<td>3416</td>
<td>3416</td>
<td>3243</td>
</tr>
<tr>
<td>Ave 'nu' of participants obs</td>
<td>4.2</td>
<td>4.2</td>
<td>4.3</td>
<td>4.3</td>
<td>4.3</td>
<td>4.4</td>
</tr>
</tbody>
</table>

*1 Adjustment for time (5 follow-ups). No interaction of time observed (p=0.58).
*2 Adjustment for socio-demographic variables (age, sex, marital status, and ethnicity).
*3 Adjustment for socio-demographic and historical variables (age, sex, marital status, ethnicity, having been beaten as a child, having been beaten as a teenager, living with relative after discharge, history of alcohol abuse and history of drug abuse).
*4 Adjustment for socio-demographic, historical, and current mental health variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative after discharge, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS) and impulsivity (BIS)).
*5 Adjustment for socio-demographic, historical, current mental health and delusion variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative after discharge, history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions).
*6 Adjustment for socio-demographic, historical, current mental health, delusion and Psychopathy variables (age, sex, marital status, ethnicity, beaten as a child, beaten as a teenager, living with relative after discharge history of alcohol abuse, history of drug abuse, severity of symptoms (BPRS), impulsivity (BIS), any delusions, persecutory delusions, and Psychopathy (PCL-SV)).
3.3.3.3 Summary of associations between any command hallucinations and longitudinal violence (aim 2)

As shown in Table 26 and Table 27 command hallucinations irrespective of content have no greater percentage of violent incidents across follow-ups when compared with the two other groups. Adjustment for time and for all potential confounders found that the OR and C.I. remained stable throughout with only slight changes.

Table 28 presents the results of the same analyses for the violent-content command hallucination group and the command hallucination group. As hypothesised the odds ratios are reduced by approximately 30% for longitudinally measured violence.

Table 28: Adjusted odds and 95% C.I. of longitudinally measured violence for the VCCH group and the CH group (Aim 2)

<table>
<thead>
<tr>
<th></th>
<th>Adjusted for time only</th>
<th>Adjusted for time and all potential confounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCCH</td>
<td>1.94 (1.22-3.99)</td>
<td>1.83 (1.11-3.01)</td>
</tr>
<tr>
<td>CH</td>
<td>1.23 (0.88-1.71)</td>
<td>1.28 (0.89-1.84)</td>
</tr>
</tbody>
</table>

3.4 Overall summary of results

The results for both aim 1 and aim 2 are presented in Table 29. The overall results support the hypothesis for aim 1. That is that the proportion of violent content command hallucination patients who have engaged in violence has remained higher than the comparison groups even after adjustment for potential confounders. This was evident for the strongest of the designs which was longitudinally measured violence.
This positive association was found for all three current violence outcomes as measured by the reason for admission. The associations were less obvious for historical violence with only one of the three historical outcomes found to have a positive association with the violent content command hallucination group.

The results also support the hypothesis for aim 2. That is that the proportion of those patients exposed to all command hallucinations (irrespective of the content) will have engaged in reduced levels of violence.
Table 29: Comparisons between the OR (with 95% C.I.'s) for the VCCH group and the CH group on all outcome measures

<table>
<thead>
<tr>
<th></th>
<th>VCCH</th>
<th>CH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Historical violent outcomes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Prior arrests for crimes against the person</td>
<td>0.79 (0.42-1.48)</td>
<td>0.88 (0.56-1.37)</td>
</tr>
<tr>
<td>(2) Historical violence to others</td>
<td>1.30 (0.69-2.47)</td>
<td>1.14 (0.75-1.74)</td>
</tr>
<tr>
<td>(3) Historical violence to family</td>
<td>1.90 (0.96-3.78)</td>
<td>1.36 (0.83-2.20)</td>
</tr>
<tr>
<td><strong>Current violent outcomes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Any aggression as reason for admission</td>
<td>2.04 (1.29-3.23)</td>
<td>1.37 (0.97-1.94)</td>
</tr>
<tr>
<td>(2) Homicidal threat/ideation as reason for admission</td>
<td>4.58 (2.75-7.63)</td>
<td>2.41 (1.60-3.64)</td>
</tr>
<tr>
<td>(3) Lethal Weapon usage or threat as reason for admission</td>
<td>4.85 (2.37-9.91)</td>
<td>2.77 (1.53-5.01)</td>
</tr>
<tr>
<td><strong>Longitudinally measured violence</strong></td>
<td>1.83 (1.11-3.01)</td>
<td>1.28 (0.89-1.84)</td>
</tr>
</tbody>
</table>
CHAPTER 4

DISCUSSION
DISCUSSION

This chapter will provide a detailed discussion of the studies undertaken in this PhD. Firstly the discussion will consider a number of issues that have the potential to lead to spurious associations being found. This includes the study designs, chance due to errors in hypothesis testing, chance due to errors in the estimation of associations, selection bias, information bias, reverse causality and confounding.

Separate discussions and conclusions for aims one and two will then be presented. This is followed by a discussion of the contribution that the studies undertaken in this PhD offer the research community. Finally the overall conclusions and implications of the findings are discussed.

4.1 Strengths and limitations

This study examined violence outcomes at three periods of time. These were historical, present and future and incorporated two study designs. A cross sectional survey design was used to examine the cross sectional data and a cohort study was used to examine longitudinal data. These designs have their own respective strengths and weaknesses.
4.1.1 Cross-sectional design used to examine historical and current outcomes

A cross-sectional design is where the exposures and disease or outcome are determined simultaneously for each participant (Gordis, 2000). A cross-sectional design does not allow for certainty in the direction of the relationship between the exposure and the outcome (Gordis, 2000). This is because the measurement of the outcome, which in this design was violence, is only being made once. This means that the direction of the relationship cannot be determined. This study found positive associations between violent content command hallucinations and one of the three historical violence variables and three of the three current violence variables. This cross-sectional design cannot confirm whether hearing violent-content command hallucinations causes these violent outcomes or whether the violent outcomes cause violent-content command hallucinations. Although the latter is unlikely it may be possible. This could occur where patients attempt to excuse their historical or current violent behaviour by stating that the command hallucination caused it when it did not. This is known as reverse causality.

In order to address the issue of reverse causality a longitudinal study is required to offer interpretable evidence for the probable direction of these associations and to cast doubt on the possibility of reverse causality (Gordis, 2000). A cross-sectional design is a useful method for suggesting exposure and outcome causality. This can then be further tested using a different design. As the longitudinal design found a positive association for aim one and aim two then this corroborates the findings from
the cross sectional design and suggests that the direction of the association is exposure causes outcome. Therefore based upon the evidence obtained from the longitudinal design and clinical experience it is highly unlikely that the positive associations found in the cross sectional survey were a result of reverse causality.

4.1.2 Longitudinal design to examine follow-up outcomes

Cohort studies constitute a central epidemiological approach to the study of relationships between personal characteristics or exposures and the occurrence of a health related event or outcome (Gail & Benichou, 1999). Cohort studies allow for a wide range of health events to be studied in relation to exposures and that prospective ascertainment of exposure data is of higher quality than retrospectively collected data (Gordis, 2000). For this study it allowed the individuals to be followed up over time making it possible to measure a new episode of violence prospectively and therefore determine the direction of any associations. In addition it offers support for any positive associations found in the earlier cross sectional design. The MacArthur Violence Risk Assessment Study followed people up at approximately 10-week intervals over one year. The main limitation of cohort studies is in minimising and managing the problem of losses to follow-up (Gordis, 2000). This will be discussed under the later section examining selection biases.
4.2 Chance

4.2.1 Hypothesis testing

Statistical inferences about populations are based upon hypothesis testing and the exclusion of associations appearing by chance. Hypothesis testing generally involves a probability of less than 5% that the result could have occurred by chance to reject the null hypothesis (Gordis, 2000). This study had predetermined hypotheses. This reduces the number of statistical analyses that were conducted and therefore a type-I error is less likely (Gordis, 2000). Hypothesis testing relies on sufficient sample sizes in order to have enough statistical power to detect important differences between groups. As previously shown there was sufficient statistical power in this study to detect statistically significant differences between groups from between 13% and above and 20% and above for aim 1 and from between 8% and above and 13% and above for aim 2. Post hoc analyses examined whether there was sufficient power for the outcomes of both aims. This found that for both aims, there was insufficient power to detect significant differences for the outcome of prior arrests for crimes against the person. Both aims only had a 1% difference in arrests rates. Yet the confidence intervals allow us to make cautious interpretations. Chance is unlikely to provide an explanation for the associations found in this study because of the highly significant p-values. For example, the majority of the significant p-values for the adjusted odds ratio models in this study were estimated at $p<0.00001$. In summary it is highly unlikely that spurious positive findings occurred due to errors in hypothesis testing.
4.2.2 Estimation of associations

The study's primary method of analysis used odds ratios to estimate the magnitude of the associations between the exposures and outcomes. Ninety-five percent confidence intervals were used and presented to illustrate the precision of the estimate. Only those associations that had both lower and upper limits greater than one were construed as evidence of a positive association. This means that with 95% confidence the true odds are greater than one. It is therefore highly unlikely that the positive association found in this study were due to incorrect estimation of associations.

4.3 Bias

Bias is defined as any systematic error that results in inaccurate estimation of the effect of an exposure on an outcome (Gail & Benichou, 1999) and results from the way the study was carried out. Biases can generally be classified as either selection bias or information bias.

4.3.1 Selection bias

Selection bias refers to a distortion in the estimate of effect resulting from either the manner in which the participants were selected for a given study and/or selective losses from the study population prior to data analysis (Gail & Benichou, 1999). The common attribute of all aspects of selection bias is that the effect estimated from the available study population is meaningfully different from that which would have been obtained had all the participants theoretically eligible to participate been included in
the analysis (Gordis, 2000). Attempts to minimise selection bias should ideally occur within the study design (Gail & Benichou, 1999) and not at the analysis stage. One of the most important ways this is achieved is through the careful selection of the exposure group of interest and comparison groups (Gordis, 2000). Ideally more than one comparison group should be used, as was the case in this study, as it allows for greater interpretation of the results (Gail & Benichou, 1999).

No selection bias due to selection procedures occurred in the MacArthur Violence Risk Assessment Study as participants were randomly selected to be approached to enter the study. Some differences were observed between participants and non-participants. When recruiting participants the original team examined the representativeness of the sample comparing responders with non-responders and found that demographic and clinical comparisons of those who agreed and refused to participate in the study showed that participants were significantly associated with being in the age group 18-24 as opposed to the age group 25-40 ($p<0.05$), less likely to have a chart diagnosis of schizophrenia ($p<0.001$) and more likely to have a chart diagnosis of alcohol/drug abuse ($p<0.001$) than the non-participants. There were no further significant differences between those who did and did not agree to participate. These differences are not a result of selection bias and relate to the generalisability of the findings. These differences between the groups are such that they could both increase the effects as participants were more likely to be young and decrease the effects as schizophrenia is associated with violence (Walsh et al, 2002a).
In relation to bias resulting from selective losses from the study population prior to data analysis, it is important that efforts are taken to minimise the effect that this can have at the design stage as opposed to the analytical stage (Gordis, 2000). Efforts to minimise losses should involve good follow-up procedures. The MacArthur Violence Risk Assessment Study recontacted participants in the community who were then interviewed five times over one year from the date of discharge. Availability for follow-up interview varied over time. There were no differences in the procedures used for follow-up with the exposure groups in this study. Relatively high rates of at least one follow-up were achieved for participants (84%, n=951/1136), with 72% (818/1136) being followed up on at least three occasions and 50% (564/1136) participants having all five follow-ups.

When examining the five follow-ups for both aim one and aim two it was apparent that there was only one episode where there were differences between the groups at follow-up. This occurred for aim one where it was found that the non-violent content command hallucination group had an 80% follow-up whereas the other groups all had follow-up rates of between 63%-67%. This difference is very unlikely to have affected the results as the numbers lost to follow-up across the other four follow-ups did not significantly differ. Additionally four exposure groups were predetermined to allow for meaningful comparisons across all groups. A difference in one of these groups at one time period does not reduce the ability to interpret the results. In summary, bias as a result from selective losses to follow-up are highly unlikely in this
4.3.2 Information bias

Information bias refers to a distortion in the effect estimation that occurs when measurement of either the exposure or the disease is systematically inaccurate (Gail & Benichou, 1999). The main form of information bias is that of misclassification bias (Gordis, 2000). Misclassification bias is a measurement error resulting from the misclassification of exposure and/or outcome status of study participants (Gordis, 2000). Such misclassification can be due to imprecise measurement of the exposure or the outcome, mistaken or missed diagnoses, inaccuracies in self-reported information or any other factor which causes a subject to be placed in the wrong cell in a 2X2 table (Gordis, 2000). The main strategy for addressing the potential for misclassification is to ensure that all study participants are subject to the same standardized diagnostic procedures and the same follow-up procedures. To this extent study participants and study personnel responsible for data collection should both be blind as to the main hypothesis under investigation.

The MacArthur research team were careful to ensure that all participants were subjected to exactly the same standardised procedures. Further additional checks also took place both at the central data collection center and by reviews of diagnoses and symptoms by trained psychiatrists to ensure protocol adherence for diagnostic detection. For example, in all cases an experienced psychiatrist reviewed all screening
measures and patient's verbatim responses to questions. Where any doubt existed about the rating, the psychiatrist reviewed audiotape recordings of the interview. The psychiatrist changed only one case from delusional to non-delusional. When the completed forms were sent to a central data collection center, all forms were carefully reviewed for completion and accuracy according to the coding rules. Additionally all field researchers had been instructed to record any areas where the participant's response did not fit easily into the assigned coding variables. All researchers had a codebook which was created for all instruments and data entry programmes. Where coding was ambiguous the decisions were made at the quality control centre and not in the field in order that there were no variations across the three sites.

Furthermore, the MacArthur research team did not have any priori hypothesis about their sample. This means that the researchers collecting the data were highly unlikely to have influenced either exposure or outcome measurement in favour of one group of patients over another and were effectively blinded to the hypotheses contained with this PhD study.

One potential problem of misclassification results from the use of the Auditory Hallucination Schedule which was designed for this study (see appendix 3). Participants were asked whether they had more than once had the experience of hearing voices other people couldn't hear. Participants who gave a positive response to this question were then asked a number of questions related to their hallucinations.
For the purpose of this study responses from the following three questions were used:

(i) Have you more than once had the experience of hearing things or voices other people couldn't hear? (ii) Do the voices tell you to do anything? (iii) What is the highest level of violence the voices have told you to do? In determining the participant groups for later analyses, patients with auditory hallucinations were firstly identified if they gave a positive answer the question one. Command hallucinators and command hallucinators of violent content were identified by positive responses to questions one, two and three.

One potential problem with the questions used within the auditory hallucination scale is that the questions do not determine whether the recipient considers the voice(s) as being either internal or external. Generally, within psychopathological classification voices that are perceived as external are considered to be true hallucinations whereas voices that are perceived as internal are considered as pseudo-hallucinations (Sims, 1995). The classification system used within the MacArthur Violence Risk Assessment Study and this PhD study had the potential to include participants with pseudo hallucinations as well as true hallucinations. As this study was a secondary analysis of an existing database it was not possible to determine further phenomenological characteristics of the participant's auditory hallucinations. Therefore an examination of the diagnoses of those with command hallucinations was conducted in order to ensure that the primary diagnoses lie within the normal range of disorders within which command hallucinations occur. The results found that of the
105 patients with command hallucinations, 89% (93/105) had a primary diagnosis of either a psychotic disorder or a mood disorder, 8% had a primary diagnosis of either a drug or alcohol abuse (9/105) and 3% (3/105) had a personality disorder. Command hallucinations commonly occur within psychosis and mood disorders (Sims, 1995) and this study found that the vast majority of patients fell in these categories and could be considered as true hallucinations. Additionally, command hallucinations can occur in disorders of alcohol and drug use as well as in personality disorder (Sims, 1995). It is difficult to determine whether the command hallucinations for these patients were true hallucinations and experienced inside the head or pseudo hallucinations experienced outside the head. Nonetheless irrespective of this problem this study is reflective of the symptoms reported by patients in everyday clinical practice. It is not uncommon for patients with alcohol disorders, drug disorders or borderline personality disorders to report command hallucinations. This study therefore includes a sample that has a greater generalisability to everyday clinical practice as it considers the associations of command hallucinations and violence irrespective of diagnosis. This pragmatic approach is desirable when making clinical decisions about the potential for violence that a person with command hallucinations may have irrespective of the diagnosis or where the diagnosis is uncertain.

The outcome classifications were such that all participants were again subject to the same procedure irrespective of their exposure classification. The weakest classification was that used for historical violence as this relies on memory and
accurate self-report. Self-report is potentially weak as participants may under-report historical violence due to social desirability or to influence some aspect of their admission. This may occur when patients fear that perceptions about risk could lead to greater restrictions or a greater length of admission. Of the three temporal outcomes used within this study, historical violence had the weakest association. It is difficult to interpret whether this is a true reflection of the association or whether it is due to the unreliable measure of self-report. As this is the weakest design it should be afforded less weight when considering the evidence for associations between command hallucinations and violence.

Current violence was fairly robust as the outcomes for current violence were ascertained through examination of case-note data. This overcomes the problem of biased self-reporting or recall errors. The procedure for follow-up data collection of violence data was the most robust method used not just within this study but also for all studies of psychiatric violence research as it incorporated a wide range of potential information sources and should be afforded the greatest weight of all the outcomes studied.

The aforementioned procedures and system checks within the MacArthur data were such to make the chance of information bias a possibility for historical violent outcome, possible but unlikely for current violence outcomes and highly unlikely for longitudinally measured violent outcomes. These slight limitations should be
considered in light of the alternative studies that have been conducted on command hallucinations and violence that had an array of information biases within their designs. Therefore the designs used within this study and the information collected were of such rigour that greater weight should be given to the results within this study when compared with the available evidence base. In summary the results found in this study are highly unlikely to be due to information bias.

4.4 Reverse causality

Reverse causality occurs where the disease can lead to the exposure and is an inherent design difficulty with cross sectional and case control studies as neither study design identifies whether the outcome or the exposure occurred first (Gordis, 2000). In order to address the potential for reverse causality longitudinal studies are necessary as they identify the exposures and then over time, examine whether the outcome occurs (Gordis, 2000). This study examined the associations between violent content command hallucination/command hallucinations, irrespective of the content and past violence, current violence and follow-up violence. The first two outcomes were determined using cross sectional data and therefore it is possible that reverse causality may have occurred, in so far as historical violence and current violence caused the command hallucination. This could occur if a participant was attempting to excuse their violent behaviour on a symptom in order to reduce the likelihood of prosecution.

In order to address the issue of reverse causality, a longitudinal study is required to
offer interpretable evidence as to the probable direction of these associations (Gordis, 2000). As the longitudinal design found a positive association for aim one and aim two then this corroborates the findings from the cross sectional design and suggests that the direction of the association is that the exposure leads to the outcome. In summary it is highly unlikely that reverse causality occurred within the cross sectional design and cannot occur with longitudinal designs.

4.5 Confounding

All observational studies are susceptible to confounding. Confounding occurs when the effect of the exposure of interest is mixed up with that of one or more extraneous variables (Gordis, 2000). It can occur even in the perfect study as it is something that is already present in the population. Confounding can inadvertently result in an observed exposure-disease relationship being attributed exclusively to the exposure of interest when in reality the relationship is due either wholly or in part to the effect of another variable or variables (Gail & Benichou, 1999). In observational aetiological research the main approach for addressing confounding is through mathematical modeling procedures (Gordis, 2000). This is commonly through the use of logistic regression models to determine whether the estimated measure of effect changes meaningfully when confounders are added to the model (Gordis, 2000). This study predetermined a large number of potential confounders based upon known factors that are associated with an increase in violence. Additionally it adjusted for a wide range of potential confounders. This reduces the likelihood that confounding
has occurred and in turn reduces the likelihood that spurious associations have occurred.

However, it is always possible that other confounders may be present. It is possible that additional confounding may be occurring, as it is not always possible to adjust for confounders that are not known or not measured. One likely candidate for such a third factor or mediating factor is “beliefs about voices”. Three studies have examined the relationship between possible mediating factors and compliance with command hallucinations. Junginger (1990) examined 44 inpatients and outpatients and found that patients with command hallucinations were more likely to comply if they also had hallucination-related delusions the patient could identify. Junginger (1995) tested these factors in a subsequent study of 93 inpatients and found that voice familiarity and a decreased level of dangerousness of commanded acts increased compliance. Interestingly, this subsequent study found that hallucination-related delusions did not influence compliance with command hallucinations.

Beck-Sander, Birchwood & Chadwick (1997) explored factors influencing compliance with command hallucinations in 35 patients who collectively had 42 command hallucinations for longer than one year. Five of the patients were being detained in a Regional Secure Unit and the rest were being cared for as either inpatients or outpatients in District Services. This study found that voices perceived as benevolent (positive) were correlated with compliance to innocuous (non-dangerous to others or self) and
severe (major illegal) commands but not with self-harm commands. However a malevolent (negative) belief about the voice was not correlated with compliance. Patients who reported self-control over their voice had low levels of compliance for innocuous, severe and self-harm commands. Additionally, participants were more likely to comply with self-harm commands than with commands to hurt others. However, no statistical analysis of this relationship was reported. The authors acknowledged that due to sampling biases (all patients were in a non-acute phase of their illness and settled in a rehabilitation system) that caution is needed when generalizing from their study. Consequently, it is possible that further confounding may be occurring. It was not possible to assess whether confounding at this level has influenced the results found within this study, as the MacArthur study did not collect such data.

4.6 Aim 1: Discussion

The first aim of this PhD thesis was to compare historical, present and longitudinal violence between four exposure groups: (i) those having experienced violence to others command hallucinations; (ii) those having experienced non-violence to others command hallucinations; (iii) those having experienced non-command auditory hallucinations; and (iv) those having never experienced auditory hallucinations.

The first aim was successfully carried out with comparisons being made between the exposure groups for historical, current and longitudinally measured violence. It is highly unlikely that the results obtained in this study are a consequence of chance,
bias, reverse causality or confounding. This means that a greater confidence about causality can be determined (Gordis, 2000).

The results supported the hypothesis that the proportion of violent content command hallucination patients who have engaged in violence will remain higher than the comparison groups even after adjustment for potential confounders. This was evident for the strongest of the designs, which was longitudinally measured violence. This occurred with even the most cautious of adjustments which was the adjustment for a previous history of violence to a family member. Even though it was highly unlikely that this was a confounder. It was also found for all three current violence outcomes as measured by the reason for admission. The associations were less obvious for historical violence with only one of the three historical outcomes found to have a positive association with the violent content command hallucination group.

The magnitude of the association for follow-up violence was nearly double when compared with the reference group which consisted of non auditory hallucination patients. (OR, 1.83; 95% CI, 1.11-3.01). Furthermore the magnitude of the OR for violence as a reason for admission was very high. The OR for any aggression as a reason for admission when compared to non auditory hallucinators was 2.04 (1.29-3.23). While the OR for homicidal threat/ideation as reason for admission was 4.58 (95% CI, 2.75-7.63). The OR for lethal weapon usage or threat as reason for admission was 4.85 (95% CI, 2.37-9.91). These latter results mean that violent
content command hallucinators are twice as likely to be admitted due to a reason of aggression and four times more likely to be admitted due to homicidal threat or lethal weapon usage/threat. This result may offer some insight into why psychiatrists and clinical team members have continued to consider command hallucinators as being a high risk for violence (Rogers et al, 2002).

The finding that violent content command hallucinations are positively associated with longitudinally measured and current violence is in line with recent research findings (McNiel et al, 2000) where the samples were selected based upon the presence of violent content command hallucinations. As McNiel et al (2000) did not report confidence intervals it is difficult to determine the agreement across studies and whether the strength of these associations are similar. This provides greater weight to the findings of this study being causal as it is line with other findings.

It is difficult to definitively conclude why no associations were found for two of the three historical violent outcomes. These outcomes were self reported history of violence to others and a prior history of arrests for crimes against the person. This does not mean that no association exists as the confidence intervals cross one for both outcomes and there may or may not be an association with violent content command hallucinations and these two outcome variables.
It is highly likely that historical violence, current violence and future violence lie on the same causal pathway. Therefore one would expect the positive associations found for both current violence and future violence to be evident for historical violence. However this was not the case for two out of the three outcomes. This leads to the need to review the evidence from a methodological perspective. As current violence and longitudinally measured violence were examined with the strongest designs and measurements, greater weight should be given to these results than those found for historical violence.

This raises the question about whether the lack of association for historical violence has been somehow obscured. It is again important to consider that the confidence intervals cross one meaning that an association may or may not exist.

A number of factors may have obscured a positive association. This is a possibility for a number of reasons in relation to self-reported violence to others. Firstly it is dependent on the recall of the participant which may be biased due to the problem of social desirability or for fear of a more restrictive management regime had the participant given a positive response. Secondly there is no way of corroborating this account unlike current violence where observed behaviours were used and longitudinal violence where multiple methods of detecting violence occurred. Yet this does not explain why a positive association was evident for a history of violence to a family member as the same problems apply. Therefore one would expect that had
recall bias been an issue for violence to others then it should also be a problem for violence to a family member. Alternatively it is possible that participants were less prone to recall bias when answering questions about familial violence. The reason for this is that many participants may have expected to receive visits from family members who in turn would discuss the participant's case with the clinical team members. Additionally, participants may have been influenced by information about the study design. It was explained to participants that collaterals would be approached after discharge to determine whether violence has occurred. In addition, the collateral would most likely be the person who best knew the participant. Consequently participants may have been less likely to minimise or under-report familial violence as they may have feared that such under-reporting would have been detected.

These difficulties in interpreting the results of self reported historical violence further the case for not using single self-reported measures of historical violence in violent outcome studies.

The lack of association between violent command hallucinations and prior arrests is possibly due to a number of known factors that can occur when a person with an obvious mental disorder comes into contact with the police (Walsh et al, 2002a). This is because the proportion of violent acts that lead to arrest and prosecution vary as a function of the intensity and quality of policing, behaviour of the suspect, the availability of diversion to the mental health system and the severity of offence. It is
known that most violent individuals are not convicted (Elliott et al, 1986). Persons with a mental disorder tend to be diverted to the mental health care system at various stages from apprehension to conviction. This view has some support from the results of the analyses conducted in this study. Even though the fully adjusted OR for violence to others was elevated at 1.30 (95% C.I., 0.69-2.47) and the OR for violence to the family was 1.90 (95% C.I., 0.96-3.78), the OR for prior arrests for crimes against the person suggests that violent content command hallucinators are at a decreased risk of such an outcome (OR, 0.79; 95% C.I., 0.42-1.48). Therefore even though the OR suggests higher rates of historical violence arrest is less likely. As such this supports the notion that the lack of a positive association for prior arrests for crimes against the person may be being obscured by unknown factors related to arrest rates.

The use of multiple combined measures for violence as used in this study for longitudinally measured violence has highlighted the limitations of the majority of previous studies that relied on a single source. Steadman et al (1998) have previously analysed the detection rates of violence from the MacArthur Violence Risk Assessment data. The one year follow up period prevalence for the total sample for violence was 4.5% using age arrest and rehospitalisation records alone; 23.7% after adding patient self-reported acts that had not been in agency records; and 27.5% after adding collateral informant-reported acts that had not been in either agency records or patient self-reports. Therefore the final prevalence was six times greater than it would
have been if estimated from agency records alone. Although Steadman et al (1998) examined the effects of different sources on detection longitudinally, it is probable that the same problems apply to historically measured police arrests.

4.7 Aim 2: Discussion

The second aim of this PhD thesis was to compare historical, present and longitudinal violence between three exposure groups: (i) those having experienced command hallucinations irrespective of content; (ii) those having experienced non-command, auditory hallucinations and (iii) those having never experienced auditory hallucinations.

The second aim was successfully carried out with comparisons being made between the exposure groups for historical, current and longitudinally measured violence. It is highly unlikely that the results obtained in this study are a consequence of chance, bias, reverse causality or confounding. This means that a greater confidence about causality can be determined (Gordis, 2000).

The results supported the hypothesis that the proportion of those patients exposed to all command hallucinations (irrespective of the content), will have engaged in reduced levels of violence prior to admission, as a reason for admission and at follow up, after adjustment for potential confounders when compared with the results obtained for those with violent-content command hallucinations as found from aim
In the violent content command hallucination group, a positive association was either strongly suggested or found for five out of the seven violent outcomes. These were historical violence to a family member, any aggression as reason for admission, homicidal threat/ideation as reason for admission, lethal weapon usage or threat as reason for admission and longitudinally measured violence. The same was not found when examining command hallucinations irrespective of their content (see table 29). Command hallucinations were associated with only two out of the seven violent outcomes. These were for homicidal threat/ideation as reason for admission and lethal weapon usage or threat as reason for admission. These associations would probably not be evident if the command hallucination group excluded those with violent content command hallucinations as it is probable that the very high OR observed for violent content command hallucinations are influencing the OR for command hallucinators irrespective of their content. As hypothesised the magnitude of the association for all positively associated violent outcomes for the violent content command hallucination group was diminished when examining the same outcomes for the command hallucination group.

This is in accordance with the arguments presented in the introduction chapter. Specifically that the reason why all the pre-2000 studies did not find any association with command hallucinations and violence was because they did not control for the
content of command hallucinations. This makes clinical and common sense as there is no possible theoretical reason to assume that patients with non violent command hallucinations should be more violent than other patients. For example there is no reason to expect that patients who have command hallucinations instructing them to conduct everyday behaviours such as “make the tea” or “wash your face” should be violent. For these reasons it is somewhat surprising that the pre 2000 studies did not consider the importance of the content of the command hallucination when examining associations with violence.

Finally the finding that command hallucinations of any content are less likely to have a positive association with violence when compared to violent content command hallucinators is in line with previous research findings. The same finding was found in the preliminary exploratory study undertaken prior to the studies reported in this PhD (Rogers et al, 2002). Rogers et al (2002) also tested the possibility that the association between command hallucinations and violence and self-harm was obscured when comparing those with any command hallucination and those with self-harming content or violent content command hallucinations.

Using the same principle of analyses undertaken in this study, Rogers et al (2002) mimicked the effects of ignoring the content of command hallucinations on the magnitude of observed associations between hallucinations and both violent and self-harm behaviour in an inpatient forensic sample. Negative Binomial Regression was
used to analyze incident rate ratios for self-harm and violence. This resulted in a
decreased self-harm incident rate ratio from 8.32, p=0.001 (C.I. 2.35-29.51) for
patients with self-harm command hallucinations to 5.36, p=0.013 (C.I. 1.42-20.24) for
the command hallucination group where the content was uncontrolled. Additionally,
a reduced violent incident rate ratio was also observed; from 1.39, p=ns (C.I. 0.53-
3.66) for patients with violent command hallucinations to 0.48, p=ns (C.I. 0.18-1.32)
for the command hallucination group. This provides greater weight to the findings of
this study being causal as it is line with these reported findings.

Table 29: Comparisons between the OR (with 95% C.I. ‘s) for the VCCH group
and the CH group on all outcome measures

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<tr>
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<th>VCCH</th>
<th>CH</th>
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<tr>
<td><strong>Historical violent</strong></td>
<td></td>
<td></td>
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<tr>
<td>outcomes</td>
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<tr>
<td>(1) Prior arrests for</td>
<td>0.79 (0.42-1.48)</td>
<td>0.88 (0.56-1.37)</td>
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<tr>
<td>crimes against the</td>
<td></td>
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<tr>
<td>person</td>
<td>1.30 (0.69-2.47)</td>
<td>1.14 (0.75-1.74)</td>
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<td>(2) Historical violence</td>
<td></td>
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<tr>
<td>to others</td>
<td>1.90 (0.96-3.78)</td>
<td>1.36 (0.83-2.20)</td>
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<tr>
<td>(3) Historical violence</td>
<td></td>
<td></td>
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<tr>
<td>to family</td>
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<tr>
<td><strong>Current violent</strong></td>
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<tr>
<td>outcomes</td>
<td></td>
<td></td>
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<tr>
<td>(4) Any aggression as</td>
<td>2.04 (1.29-3.23)</td>
<td>1.37 (0.97-1.94)</td>
</tr>
<tr>
<td>reason for admission</td>
<td></td>
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<tr>
<td>(5) Homicidal threat/</td>
<td>4.58 (2.75-7.63)</td>
<td>2.41 (1.60-3.64)</td>
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<tr>
<td>ideation as reason for</td>
<td></td>
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<tr>
<td>admission</td>
<td>4.85 (2.37-9.91)</td>
<td>2.77 (1.53-5.01)</td>
</tr>
<tr>
<td>(6) Lethal Weapon usage</td>
<td></td>
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<tr>
<td>or threat as reason for</td>
<td></td>
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</tr>
<tr>
<td>admission</td>
<td>1.83 (1.11-3.01)</td>
<td>1.28 (0.89-1.84)</td>
</tr>
<tr>
<td><strong>Longitudinally measured</strong></td>
<td></td>
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<tr>
<td>violence</td>
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</table>

VCCH= Violent content command hallucinations
CH= command hallucination group of any content
4.8 Aim 1: Conclusions

Violent content command hallucinations are associated with longitudinally measured violence, violence as a reason for admission and a previous history of familial violence. It is highly unlikely that the results obtained in this study are a consequence of chance, bias, reverse causality or confounding. This means that a greater confidence about causality can be determined. Additionally the findings are in line with previous research that found similar results (McNiel et al, 2000). This therefore strengthens the case for a causal relationship between violent content command hallucinations and violence.

The reason why violent content command hallucinations are not associated with prior arrests for crimes against the person or a history of violence to others is uncertain. It is likely that the patient under reporting and the availability of reliable methods for ascertaining historical violence may influence this.

4.9 Aim 2: Conclusions

Studies that do not control for the content of command hallucinations reduce the likelihood that a positive association will be found between violent content command hallucinations and violence. It is highly unlikely that the results obtained in this study are a consequence of chance, bias, reverse causality or confounding. Additionally the findings are in line with previous research that found similar results (Rogers et al, 2002). This therefore strengthens the case for a lack of causal relationship between
command hallucinations of any content and violence.

4.10 Contributions to the research knowledge base

This study has critically examined the literature and noted that all previous studies that have examined the associations between command hallucinations and violence were flawed in their methodologies or in their statistical analytical procedures. Pre 2000 studies were characterised by small sample sizes, singular measures of violence, predominantly based upon inpatient violence and statistically poor. For example it was rare for studies to examine and if necessary, make adjustments for differences in inpatient admission length. Post 2000 studies have improved our understanding of command hallucinations in so far as they suggest that the content of the command hallucination is an important consideration. However these post 2000 studies have not addressed confounding or have used inappropriate statistical analyses.

This study has as far as is possible, addressed the problems identified in all previous studies of the associations between command hallucinations and violence. The use of secondary analysis of the MacArthur Violence Risk Assessment enabled such questions to be addressed. Alternative methodologies available during the course of this PhD study would not have allowed the research questions to be answered. This is because it would have not been possible to conduct a longitudinal study with the necessary number of participants and sufficient power for the statistical analyses that are required.

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In addition this study was designed in such a way to attempt to investigate whether earlier studies may have not found a positive association due to not controlling for the content of command hallucinations. This involved repeating the analytical procedures conducted in aim 1 to determine if the magnitude of positive associations either reduced or diminished. This approach of studying two aims in the one PhD thesis has assisted the research community to not only better understand the associations between command hallucinations and violence but also to make evidence based interpretations about earlier studies.

4.11 Suggestions for future research

Future research into the associations between command hallucinations and violence should take into the account the content of the command hallucinations in the sample. This applies to self-harming content command hallucinations and self-harming behaviours.

Further longitudinal study into command hallucinations is indicated in order to examine whether these findings are replicable. Ideally such study should take precise measurements of the phenomenology of the command hallucinations as well as their content. This ensures that we can be more certain about the indicated causality found in this study.
4.12 Clinical implications

Research into command hallucinations and violence was clinically important as a large degree of uncertainty existed about the nature of this relationship. Much of this clinical uncertainty resulted from the fact that previous studies have supported all possible three hypothesised associations: null, negative and positive. Prior to this study it was difficult to know why all three possible associations were found. This study has indicated that the previous studies that did not control for the content of command hallucinations may have not found positive associations with violence as a result of the sample. This study suggests that less weight should be given to those studies where the content of the command hallucination was uncontrolled when making clinical decisions about risk.

In the course of this PhD study, it was commonplace for clinicians and academics alike to dismiss command hallucinations as a risk indicator while citing one of the pre-2000 studies that found no such associations. Consequently clinical decision making about psychiatric risk factors for violence has potentially been misinformed by the earlier research studies. This study indicates that clinicians should carefully consider the role that command hallucinations have on the risk of future violence when making decisions about the discharge and management of such patients. This is especially the case for violent content command hallucinations. It is possible that self-harming content command hallucinations also have an association with self-harming behaviour in such patients.
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US Department of Health


Appendix 1


Working with clients in forensic settings

Paul Rogers

&

Joe Curran
LEARNING OBJECTIVES

After reading this chapter and doing the activities at the end of it you should be able to:

1. Describe the complexities of relevant aspects of Forensic clinical work.
2. Discuss the main problems amenable to a cognitive behavioural approach, with a specific focus on Posttraumatic stress disorder and command hallucinations.
3. Understand the relationships between clients’ problems and risk.
4. Examine the appropriateness of the cognitive behavioural intervention in relation to the client’s context.
5. Explore the need for collaboration between client and mental health worker.
6. Discuss the need for supervision and support for mental health workers in forensic environments.
Introduction

It is only in the last 10 years that we have seen the implementation of cognitive behavioural approaches within Forensic Services worldwide. At present, a number of Medium Secure Units in Britain employ Cognitive Behavioural Therapists and all three English Special Hospitals (Broadmoor, Rampton and Ashworth Hospitals) have at one time employed one. Yet, complacency about such integration should be avoided since, across the world, forensic settings continue to be an area where cognitive behavioural interventions are the exception rather than the rule (Kitchiner 1999, Kitchiner 2000, Newell and Gournay 1994).

Forensic Settings

Forensic settings in Britain are defined as any area where a person may come into contact with the criminal justice system. This includes: High security, Medium Security and Low Security Hospitals; Police Stations, Courts, Prisons, Probation Hostels, etc. For the purpose of this chapter a focus on in-patients secure settings is provided. Secure hospital environments are required to balance the concepts of risk (e.g. violence to staff), security and containment with care, treatment and intervention. The culture and leadership within such organizations often determines how well this balance is maintained. For example, where the organizational culture places a greater emphasis on security, therapy can be seen as secondary and bureaucratic “red tape”, including excessive checking and lack of support can thwart
attempts to use psychotherapeutic interventions for the clinician. Alternatively, where the organizational culture does place a greater emphasis on therapy and intervention, such interventions are frequently requested and held in high esteem (see chapters 3 and 15 for related discussions). However, for the moment it is sufficient to assert that there will be times where culture can impact on therapy provision. For this reason, implementing cognitive behavioural approaches in such organizations takes time, patience, good communication and an awareness of cultural factors which may influence whether an intervention is likely to be successful or not.

Forensic Clients and their Problems

Unfortunately, it is impossible to describe “common problem areas” with any certainty. This is because clients are detained in forensic units against their will, due to their having offended or their propensity for potential offending, and by the fact that they will have a mental health problem. As such, whole spectrums of mental health problems are present.

Very little has been written about cognitive behavioural interventions in forensic settings in the international literature. Rogers (1997a) reported an audit of a cognitive behavioural service at the Caswell Clinic, Medium Secure Unit in South Wales over a two-year period. This service offered assessment, and treatment to inpatients and outpatients, as well as advising other services and agencies on a range of clinical
management issues. In the two-year audit, this two and a half day clinical service received a total of seventy-six referrals for assessment and treatment from Consultant Psychiatrists. Rogers has also reported on a number of single cases when providing this service (Rogers 1997a, Rogers 1997b, Sullivan and Rogers 1997, Rogers, Gray, Williams, & Kitchiner, 2000).

Invariably, when working in such environments there are two factors, which require consideration: the mental health problem and the actual or potential offending behaviour. These provide the following potential scenarios for therapy input:

- Intervention for offending only (e.g. sexual offending)
- Intervention for disorder only (e.g. delusions or false beliefs)
- Intervention for both (e.g. false belief driven violence)

Predominantly cognitive behavioural approaches in such settings are geared towards the last option, where it is considered that either the offending behaviour harms the person’s mental health or the person’s mental health has an association with their offending. Yet, it is sometimes possible that the intervention will only be required for a mental health problem where the disorder has been considered by the Court and the Psychiatrist as having no relationship with the person’s offending. An example of such a case is where a person is imprisoned for an offence at a time when there is no evidence of the person suffering from mental disorder. Whilst imprisoned the person then goes on to develop a mental health disorder warranting treatment (e.g.
Specific Cognitive Behavioural Skills Required

An understanding and working experience of a wide range of cognitive behavioural interventions is required. It is possible that one week a referred client may suffer a specific phobia while the next week a referred client may have Posttraumatic stress disorder (PTSD) after killing a family member while suffering from delusional beliefs. Furthermore, experience in formal methods and procedures of risk assessment are desirable. Although, on the whole, many clients will be referred for a clinical problem, it is important that the therapist is aware of formal, standardised measures of risk and their administration, for example the HCR-20* (Webster et al. 1995), a broad-band, violence risk assessment tool which identifies potential risk indicators for previous, current, and future risk (e.g., previous violence, early maladjustment, Insight into mental health problems).

Additionally, an ability to communicate effectively is essential as forensic services depend upon communication as a means of assessing and managing risks. At first, the need to communicate important points of the assessment and/or treatment sessions may seem tedious and can at times feel “intrusive”. However, when working with forensic clients,
It is important that all members of the clinical team are given information about clients, as it is often the case that no one member of the team will have a “full picture” of a client across the full week and 24 hours a day.

Mental health workers should also have an ability to remain objective, logical, and evidence based. Sometimes, a client may challenge the own beliefs and values of mental health workers through the very nature of their offence (e.g. perpetrators of sexual assault/abuse). Because of this, it is important that workers are able to access clinical supervision and support, and are able and willing to utilise such resources (see chapter three).

An additional necessary skill, which develops over time, is the ability to formulate a given risk (e.g., risk of violence, self-harm, sexual offending, absconding) and clinical problems for the same client. This ability develops through practice, discussion with clients and seeking feedback about working formulations, but also with clinical team members and sometimes with family members. When working with such clients it is important that case formulations, which consider risk and clinical problems, cannot and should not be dependent solely on talking with the client, and will require an understanding and conceptualisation of the client, their history and their known risk from secondary and primary sources.

As stressed in chapter two, by far the most important skill is collaboration – a concept
fundamental to the cognitive behavioural approach. Generally, in adult outpatient settings, it’s meaning is applied to clients who recognise they have a problem, and who have some motivation to change. This may not always be the case in forensic settings where, some clients will not discuss their main problems or are ambivalent about therapeutic interventions. Sometimes this can be as a result of the disorder, and the consequent experiences of the client (e.g. false beliefs). Equally, this may also be an effect of previous experiences of intervention experienced by the client as unhelpful. Indeed, the client’s experience of previous interventions is a crucial area of assessment. In occasional cases, some clients may have disclosed things within therapy, which are then communicated to the clinical team resulting in a subsequent change of risk status. For example, a patient who informs a mental health worker that they are having violent thoughts about certain people may find their observation levels increased, or even moved to a more secure ward. However, despite the above problems, collaboration is paramount within forensic settings and requires the mental health worker to “work with, as opposed to work against people” (Rogers & Vidgen 2000).

Finally, it is important to work on the client’s main problems. Sometimes clinical teams will refer clients for problems, which the client doesn’t agree with. For example, one client was referred for a needle phobia as he refused his injections of anti-psychotic medication. On assessment, however, it wasn’t the needle the client was afraid of but the side effects of the medication. In such cases, it is helpful to re-
formulate the problem. In this case, it was formulated as a lack of agreement between the client and his clinical team about what is and isn’t appropriate care and intervention. Additionally, and understandably, some clients may test out the mental health worker’s ability. This can be done by firstly offering the worker a real but rather minor problem and dependent on the outcome, the client may or may not then disclose a greater problem, while each step of the way assessing the worker’s ability to cope and assist them. This has obvious implications for the need for good quality clinical supervision, discussed at greater length in chapters 2 and 3.

Clinical Examples

Posttraumatic stress disorder (PTSD)

PTSD arises from events involving actual or threatened death or serious injury, or a threat to the physical integrity of self or others (American Psychiatric Association, 1994), during which the sufferer felt intense fear, helplessness, or horror. Meichenbaum (1994) has suggested a classification system for trauma (See box 2).

<table>
<thead>
<tr>
<th>Box 2: Classification system for trauma (Meichenbaum, 1994)</th>
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<tbody>
<tr>
<td>Natural Disasters (Floods, Storms, Earthquakes and tremors, Avalanches)</td>
</tr>
<tr>
<td>Accidental Disasters (Plane, Train, Car, Coach)</td>
</tr>
<tr>
<td>Man-made Disasters (Bombings, Rape, Assaults, Robbery)</td>
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</table>

Following the traumatic event, the person then develops three clusters of symptoms: re-experiencing (e.g. where they have nightmares or where unwanted thoughts keep coming to mind); increased arousal (e.g., panic and anxiety, increased “jumpiness”),
and avoidance of things, which remind them of their trauma. These symptoms must be present one-month after the traumatic event. It is estimated that between 1% and 1.3% of the general population have PTSD (Davidson et al. 1991 and Helzer 1987). However, it is increasingly being recognised that PTSD is also a problem for many patients in forensic settings.

Freyne and O'Connor (1992) reported on six prisoners who observed a cellmate's death in prison. Three developed full PTSD and the other three developed some PTSD symptoms. In a separate case they report how one prisoner developed PTSD after an assault by other prisoners leading to his attempted suicide. They go on to advise that due to the high risk of suicidal thoughts and PTSD in this study that all prisoners should be screened for PTSD after witnessing attempted suicide. Due to the constraints of the chapter we cannot report on all aspects of PTSD work within forensic settings.

Huckle (1995) reported on 22 male rape survivors who had been referred to a Forensic Psychiatric Service over a six-month period (representing 12.5% of male referrals): Of these 22 subjects, 9 (41%) had a diagnosis of PTSD. Thus, rape-induced PTSD accounted for approximately 6% of all male referrals. Rogers (1997b) reported on the psychological consequences of male rape in a single case where the client had unwanted and intrusive memories coming to mind, seven times a day, lasting up to
one hour, when he felt he was being raped again.

Another interesting area where PTSD is being recognised is as a consequence to the traumatic effect of killing. To date, this has primarily focused on combat veterans or police officers with little research pertaining to mentally disordered offenders. Kruppa, Hickey & Hubbard (1995) studied the prevalence of PTSD in a sample of 44 inpatients diagnosed as psychopathic that were detained in a British High Security Hospital. Seven (16%) met criteria for a lifetime diagnosis of PTSD related to their index offence.

Hambridge (1990) described three cases of grief in perpetrators of homicide. One case of a 28-year-old man, who had strangled his wife fulfilled DSM-III diagnostic criteria for PTSD. If, as is suggested, PTSD can develop after the killing of another person, then what are the treatment implications? Rogers, Gray, Kitchiner and Williams (2000) reported on the case of a woman who developed PTSD consequential to killing her employer with a knife. The patient had 16 cognitive behavioural sessions and improved on all measures of PTSD and depression symptomatology at 30-month follow up.

Case presentation: ‘Michael’

Michael was a 16-year-old male who was arrested for attempted murder. He had no previous convictions and no history of mental illness. His assessing Psychiatrist
concluded and reported to the court that the assault was “driven” by the client’s Posttraumatic stress disorder. Michael lived in an inner-city area, which had significant drug problems. Two weeks earlier, three known drug dealers had attacked his mother in her home. Michael awoke in the middle of the night on hearing the front door being “kicked in”. He ran downstairs and witnessed his mother being attacked. He was then chased by one of the men carrying a blood-filled syringe upstairs where he jumped out of the bedroom window and ran for help. His mother sustained minor physical injuries and the two men were later arrested.

Unfortunately, when news broke of their arrest in the local community, a gang of youths aged between 15-19 began verbally abusing the family and sitting outside their home 24 hours a day. The police were repeatedly called but although they youths would move on, they would return 5 minutes later. One day, the youths began to kick down the door; Michael recounted having a flashback (where a person has thoughts about an event which cause them to feel anxiety similar to the first time that they experienced it in real life) to the previous attack on his mother and reported being 100% convinced that he had gone back in time. As he ran downstairs he picked up a metal bar and repeatedly attacked the gang of youths causing significant head injuries to one of them. The judge accepted a defence of diminished responsibility following medical testimony and he was released on bail with a condition of outpatient cognitive behavioural help.
On assessment, he was an intelligent, engaging but shy, muscular young man. Michael was highly motivated to engage in treatment. He had many goals in life which his problems were stopping him achieve and he was very mature for his years. He had been housebound for 5 months since his arrest and the family had continued to be abused. He reported, and the police confirmed, that three months earlier, Michael had been followed home following an evening at the gym and attacked by three youths with knives. He was convinced that they would have stabbed him had they caught him, and knew them all by name – two having previously been his friends. Due to conflict between Michael, his family and known drug dealers in the area, the local police had arranged for a steel door to replace the front door and an emergency alarm was placed in the house direct to the police station. Michael had also heard through a cousin that there was a “notice” out for him to be “cut up” as by now he had been involved in the prosecution of two local drug dealers and had put three people in hospital.

As a consequence, he rarely slept, keeping vigil from his bedroom at night. He had a range of makeshift weapons next to every window and door in the house and never left the house alone. The only respite he received was when his Uncle came in his van twice a week and took him to the countryside 20-40 miles away where he would exercise by riding his bike for 4 hours.

An explicit definition of the problem was collaboratively developed and agreed with
the Michael:

"Panic and flashbacks when reminded of the attack on my mum, causing me to avoid leaving the house, frequently checking the doors and windows, leading to low mood, lack of independence and anger"

Case formulation: “Michael”

A three systems model of formulations was used (Hawton et al. 2002) (first described in chapter two) and is presented in Box 3.

<table>
<thead>
<tr>
<th>Box 3: Michael’s 3 system formulation</th>
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<tr>
<td><strong>TRIGGER</strong></td>
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<tr>
<td>Trauma related events, including going out alone, loud noises, seeing the people who attacked him</td>
</tr>
<tr>
<td><strong>THOUGHTS</strong></td>
</tr>
<tr>
<td>I'm not safe</td>
</tr>
<tr>
<td>I’m going to be attacked</td>
</tr>
<tr>
<td><strong>BEHAVIOUR</strong></td>
</tr>
<tr>
<td>Avoiding going out</td>
</tr>
<tr>
<td>carrying weapons ‘just in case’</td>
</tr>
<tr>
<td>constantly checking over shoulder and windows of his home</td>
</tr>
<tr>
<td><strong>PHYSICAL SENSATIONS</strong></td>
</tr>
<tr>
<td>anxiety, panic, sweating, heart pounding, breathing faster</td>
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Although Michael clearly met DSM-IV diagnostic criteria (APA, 1994) for PTSD, his case was extremely complicated. His assessing psychiatrist had informed the court
that, with cognitive behavioural help, he would have a 60%+ chance of recovery and therefore such treatment was required by the court. The 60% rating was based upon research findings as to how many people’s posttraumatic difficulties improve with treatment (Marks, 1997). However, although there was an expectancy that he should be treated, how does the mental health worker complete treatment in such circumstances where the client could be killed if he left the house? In addition, if the “safety” weapons were removed and the house was attacked again what could this mean for the patient and his family?

The formulation in such a case is difficult as it proved impossible to determine which experiences were associated with PTSD (e.g., hyper-vigilance where the person regularly looks/checks for signs of danger, increased startle response, avoidance of going out and intrusive thoughts of the attack) and which were “normal” responses to the levels of threat that he and his family were being subjected to? To put it plainly, were these experiences due to the past (the trauma), or the present (the threat to self and family)? Furthermore, and as worrying, was what would happen to Michael if he were exposed to a circumstance which resulted in him having to defend himself and attack another person? Thus, the issue of his risk to other people could not be ignored.

Consequently, following open and honest discussion between Michael and his therapist, it was jointly decided that cognitive behavioural work could only take place
once he (and his family) were removed from the situation. Only then could the true extent of his PTSD be assessed. This was a major task as relocation of families in such circumstances can be a difficult event to organise. Nonetheless, following a number of multi-agency meetings taking 4 months, it was achieved. These meetings involved the probation service, the local psychiatric service, the forensic psychiatric service, social services and the housing department and was usually attended by Assistant Chief constables and Service Directors. It was agreed that, in the best interests of the family and the local community, the family would be relocated and their address be kept secret. Michael often became frustrated at the lack of progress over this time, but at the same time, reported that he was very pleased with his therapist as he could actively see what (and how) the therapist was doing to actively resolve his difficulties. This assisted the collaborative “team-work” which would be later required for therapy. Whilst this was being arranged, the role of the therapist was to offer support, problem solving of potential eventualities, (e.g. what to do if the house was attacked) and working with the family about ensuring their safety. Interestingly, the effect of moving the family significantly reduced Michael’s symptoms and he subjectively reported that these symptoms had at least improved by 50%.

Case re-assessment: “Michael”

On re-assessment, Michael still had a number of difficulties: getting off to sleep; nightmares about the attack on his mother and the attack on himself; as well as
nightmares about the attack that he made. Although he was now leaving the house regularly, he was still hyper-vigilant when out and would “jump” if he heard people running behind him, fast cars, people shouting, or similar loud noises. He became panicky whenever he saw a group of youths and was constantly scanning his environment. He only when out during daylight hours, and only if he had a knife with him. He continued to have flashbacks throughout the day involving images of his mother being attacked.

**Case treatment: “Michael”**

Michael took part in 12 sessions of exposure to real life, day to day situations which triggered off his fear, including leaving his house. However, the priority at this stage was to stop him carrying weapons. This was achieved through problem solving what to do if he were attacked, and he decided to join a self-defence class at a local college, which he attended twice weekly. Within 6 weeks he was confidently leaving the house without a weapon and stated he no longer felt the need. At the same time imaginal exposure to both traumas (his mother being attacked and his attack on the youths) was facilitated with a very good reduction in anxiety, nightmares and intrusive thoughts. Imaginal exposure involves assisting the client to recount their memories of the trauma, which at the same time is audiotaped. This includes recounting what the client was thinking at the time as well as a factual account. Clients then listen to the audiotape daily, which causes short-term distress, but with repeated exposure over time this distress greatly reduces (Falsetti, 1997).
After successful engagement with the exposure method, the next stage of the intervention was designed to reduce his hyper-vigilance. An audiotape was made which had intermittent noises on it. These included shouting, loud noises, crashing windows, banging doors, fast cars and footsteps. Michael was encouraged to listen to this on his way to college and back every day and "resist" the urge to look back and scan his environment. He soon got used to this and gradually over 3 weeks his checking behaviours stopped. Evaluation showed that he no longer met DSM-IV criteria for PTSD and his scores on the psychological questionnaires all supported this. Michael was discharged from treatment and followed up at 1 month, 3 month and 6 month intervals where these improvements continued.

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<tr>
<th>“Michael’s” case: Issue for discussion/consideration (1)</th>
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<td>This case demonstrates one of the core assessment criteria for CBT suitability that can never be overlooked in Forensic settings: specifically, the effects that an intervention will have and the potential consequences of such effects. Or put simply, “What could go wrong if this situation was changed?” Had Michael have been encouraged to go out without any means of protecting himself, then he could have been attacked again. However, the assessment suggested that there could be significant potential negative effects of intervening by asking Michael to begin leaving the house. Therefore, it is important that any intervention is carefully considered before it is implemented.</td>
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</table>
A similar example of when to consider withholding treatment is in the case of victims of crime who suffer PTSD but who have yet to attend and give account to a court. In such cases, untreated, a victim’s method of account and emotional reaction would undoubtedly influence a jury and judge’s decision-making. However, treatment may influence a client’s method of account and emotional reaction by reducing distress. This could, inadvertently, lead the court into believing that the impact on the victim was less severe than pre-treatment. This may not have any influence at all on the decision making of the court, however it needs to be considered by the therapist. For this reason, the English Department of Health, the Crown Prosecution Service and the Home Office recently (2001) issued practice guidance on the Provision of Therapy for vulnerable or intimidated Adult Witnesses Prior to a Criminal Trial as part of the Home Office led Action for Justice Programme. This report highlights the problems of providing psychotherapy for PTSD pre-trial and offers pragmatic and useful guidance on the most appropriate method of achieving this.

Command hallucinations

The recent emergence of CBT interventions for serious mental illness offers many opportunities within forensic environments. One such area is that of command hallucinations. Hellerstein et al (1987, 219) defined command hallucinations as auditory hallucinations which:

“Order particular acts, often violent or destructive ones...(and)... instruct a patient to act in a certain manner - ranging from making a gesture or grimace to committing suicidal or homicidal acts”.

There are a known high proportion of people with command hallucinations in forensic environments. Rogers et al. (1990) found that 38% of all patients in a secure hospital had command hallucinations. As discussed earlier, the experience of
command hallucinations is an obvious concern of forensic settings where the person is being “told” to commit violent acts.

However, despite a strong historical belief within psychiatry that command hallucinations increase a person’s risk (Bleuler 1930, Schneider 1959), it has only been recent that the true risks of command hallucinations have been quantified (Rogers et al. 2002). Specifically, an examination of the research literature shows that:

- There is no relationship between unspecified content command hallucinations (e.g., non-dangerous content commands, “make a cup of tea”) and risk.

- There is evidence for a relationship between violent content command hallucinations (e.g., “hit him, hit him”) and violence for patients during the 3-month period preceding admission when they are presumably more able to act freely and therefore behave violently.

- There is a relationship between self-harm command hallucinations (e.g., “cut yourself”) and self-harm behaviours in in-patient settings.

Thus, and importantly, command hallucination content appears to be a specific factor in determining risk. However, this alone is not sufficient in understanding the risk as
not all clients do what command hallucinations tell them to do. At present, it is
unknown exactly what features predict which patients will do what the commands tell
them and which will not. Nonetheless, when a person does comply with command
hallucinations, the risks are enormous. Numerous case reports have described people
following a dangerous command: sexual offending (Pam and Rivera, 1995); violence
to others (Good 1997); self amputation of a limb (Hall et al. 1981); self amputation
of the penis (Hall et al. 1981); swallowing objects (Karp et al. 1991); self mutilation
of the eyes (Field & Waldfogel 1995); self inflicted lacerations (Rowan and Malone,
1997); and suicide (Zisook et al. 1995).

Case presentation: ‘James’

James was a 37-year-old man detained in secure hospital. His early family history was
characterised by numerous violent attacks by his natural father. His natural father had
received treatment for alcoholism and there was a suggestion of his pathological
jealousy as James reported that he remembered him frequently putting a tape recorder
under mother’s bed to see if she was being unfaithful while he was out. His parents
divorced when he was 9 and his mother remarried when he was 10. He described a
relatively stable family environment thereafter. He first came into contact with the
police at the age of 14 for minor stealing offences. His first conviction was when aged
25, when James and five other people robbed a 93 year old lady. During the robbery she
received a broken arm, black eye, and was tied to the bed, they stole £500 worth of
goods from her. James was the “look out” during this offence and maintained that he

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did not know the others would be violent.

James received a 2-year prison sentence while the others received between 5 and 8 years. At the time there was a public outcry, as the victim later died in hospital from cardiac failure and a stroke. Consequently, other prisoners had “targeted” the group for punishment beatings. James asked and was granted “rule 43” (self-imposed isolation in prison). It was at this time that James first began hearing a single male voice telling him that he should kill himself. Thereafter, for the following 12 years James had a significant history of psychiatric contact (including numerous in-patient admissions) due to the voice telling him to self-harm and attempt suicide, which he had complied or had tried to comply with on many occasions. During this time, James occasionally reported that the voice told him to hurt others, which he sometimes did. He wasn’t sure why he sometimes did and other times did not do what the voice said.

James was admitted to the secure hospital after he had stabbed his stepfather three times with a knife while his stepfather was asleep. After the attack, James immediately reported the attack to the police and ambulance services and reported that the voice “told him to do it”. At the time of his offence James was heavily abusing alcohol, which he said, quietened the voice. Additionally, he was abusing amphetamine and heroin on a daily basis. On assessment, he was very motivated to obtain help and was very remorseful for his actions. He reported hearing a voice from a number of objects (TV, stereo, fan, from the taps and in objective space) calling him abusive names and telling
him to: "hit", "attack", or "kill". On average, he reported that they occur twice a day and lasted for 1 hour. The volume varied from whisper to shouting. However, on the day of the attack it had been continuous all day and shouting.

Although the voice never identified itself by name, James had a 100% conviction that the voice belonged to the 93-year-old lady's son and that the purpose was to torment him for his part in the robbery and that it would not stop until he killed himself. James supported this belief by reporting that the voice started after she died. The voice was very patient, had not left him alone since the offence, and frequently told James to kill himself. James believed the voice was extremely powerful ("it must be powerful to communicate to me in the way it does"), and that it could predict the future. He suggested that the voice was as powerful as the devil but not as powerful as God. James believed the voice to be malevolent and evil.

James reported that the only way he was able to stop or "turn off" the voice was through drinking great amounts of alcohol and/or taking illicit drugs. He reported that some commands were obeyed all the time (i.e., "drink tea, eat food, smoke, go to the toilet, have a bath, listen to the radio, watch TV"). James said that the voice regularly told to kill himself and attack others, but he was usually able to resist these commands. However, on the day of the offence the voice told him his stepfather was the devil, that he should kill his stepfather and he (James) would be free of his torment (the torment being the voice). James believed this to mean that if he killed
his stepfather the voice would leave him alone. On assessment, measurement consisted of the following:

- Problem & Target measurement (see chapter 2).

- Strength of Belief Ratings (S.o.B) (Chadwick & Birchwood, 1994). This is a self-report measure of percentage conviction in identified beliefs. Items are rated by the client on a 0 - 100% point scale.

Case formulation: “James”

James’ risk was clearly attributable to his illness and his command hallucinations were significant in determining risk. He was detained by the court under section 37/41 (enforced hospital treatment order with Home Office restrictions) of the English and Wales Mental Health Act (1983). Successful treatment of his command hallucinations would be likely to reduce his risk status. Alternatively, should this not be possible, then intervention to reduce his compliance with the command hallucinations would be warranted. Additionally, his use of disinhibiting substances (i.e., alcohol and illegal drugs) needed to be addressed.

In understanding James’ command hallucinations, it is important to remember that they began after he was found guilty of aiding the robbery of the old lady’s home. Being “targeted” within prison perpetuated this guilt. Chadwick, Birchwood and
Trower (1996) have developed a very useful clinical aid when working with such cases: that of persecution or punishment or "Poor Me/Bad Me". Persecution beliefs ("poor me") occur when a person believes that the voices are undeserved, unwarranted and therefore the person assumes a victim position which ordinarily means that they do not engage with the voices. Punishment beliefs ("bad me") however, are perceived as deserved, where the person believes they are bad, have done bad things, and consequently are more likely to engage with the voice.

James felt very guilty about the offence and felt that he deserved to be punished. This was compounded by the fact that the victim later died and although the perpetrators could not be charged with directly causing her death, the belief of everyone in the local community, including the press and James, was that the attack and robbery indirectly contributed to her cardiac failure and stroke.

<table>
<thead>
<tr>
<th>&quot;James's&quot; case: Issue for discussion/consideration (1)</th>
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<tbody>
<tr>
<td>How would James's beliefs about the power of the voice be challenged?</td>
</tr>
<tr>
<td>How could James's guilt contribute to the power that he gives the voice?</td>
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</table>

As such, it was James' beliefs about the voices (origin, intent, deservedness), which in turn, gave it a power base. It was this power base, therefore, which determined compliance and contributed to his risk, guilt, alcohol and drug taking. If for example, James felt the voice was less powerful, then he would be better able to disengage
from the voice (See box 4).

<table>
<thead>
<tr>
<th>Box 4: James’s 3 system formulation</th>
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<tbody>
<tr>
<td>TRIGGER</td>
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<tr>
<td>Hearing the voice telling him to “hurt himself”</td>
</tr>
</tbody>
</table>

1. THOUGHTS ABOUT SELF
   - I’m a bad person
   - I’m being punished
   - I deserve to be punished
   - It was all my fault
   - I shouldn’t have helped

2. THOUGHTS ABOUT VOICE
   - It’s the old lady’s son
   - It’s very powerful
   - I’m scared of not doing what is says
   - I can’t “turn it off”
   - It “controls” me

BEHAVIOUR
- Do what the voice says as much as possible
- Listen to the voice
- Try and drown it out with alcohol or drugs

PHYSICAL SENSATIONS/EMOTION
- 1. Guilt and low mood due to thoughts about self
- 2. Anxiety and panic due to thoughts about voice

Cognitive behavioural intervention: James

The cognitive behavioural intervention used to help James consisted of firstly developing a collaborative relationship, followed by helping James to self-monitor his voice, challenge his beliefs about the voice and engage in behavioural experiments. His
beliefs about the power of the voice were the focus of therapy. The following beliefs were identified (original strength of belief (SoB) in parenthesis):

**“James’s” beliefs on assessment**

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<tbody>
<tr>
<td>1. The voice is so powerful it can communicate to everyone (S.o.B: 95%).</td>
<td></td>
</tr>
<tr>
<td>2. The voice belongs to the lady’s son (S.o.B: 100%).</td>
<td></td>
</tr>
<tr>
<td>3. The voice controls everything that I do (S.o.B: 100%).</td>
<td></td>
</tr>
<tr>
<td>4. The voice is so powerful because I cannot control it (S.o.B: 100%).</td>
<td></td>
</tr>
</tbody>
</table>

The fourth belief was the first examined. Specifically through teaching coping strategy enhancement (CSE) (Tarrier et al., 1998). CSE is a technique, which helps people to learn strategies for coping with voices by using distraction (e.g. loud music, physical activity). This involves firstly trying to make the voice happen. James was very reluctant to try and bring on the voice, as he had never previously been able to “turn it off”. This was the first and only time that the therapeutic alliance was challenged. James was being asked to do something, which he feared, and place significant trust in his therapist. However, with encouragement and support he agreed to try. The main strategy used to bring on the voice was by asking James to think of the robbery of the old lady and her death (thereby inducing guilt). Within seconds, James’ voice began and he recounted what it said in session: “Evil”; “Weak”; “Her”; “Kill you”; “Run bastard”; “Kill them”; “Kill”; “Die”; “Kill, Die”.

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James was asked to try and stop the voice, but didn’t know how to. He became frightened and said that the voice was “very strong”. James was asked what he would ordinarily do if his voice was this bad and he replied, “get drunk and drown them out”. He was encouraged to try out a range of different coping strategies. He found the most useful were listening to loud music on his headphones, engaging in conversation about things he found interesting (e.g. horse racing) and going to the gym. This behavioural experiment was agreed as daily homework, and after two weeks he reported that he was able to turn the voices on and off at will. This had a dramatic effect on his belief that he could not control the voice. Furthermore, it had a strong effect on the relationship and alliance as James had placed his trust in the therapist despite his fears (see chapter two). This allowed both parties to cement a stronger relationship, which would only serve to benefit later work.

The results of the first experiment encouraged James to fully engage with the therapeutic aims and he noticeably became more confident in discussing the voice, its meaning and possible experiments. Another behavioural experiment was then set up to test out the first belief that the voice was heard by others. James had rarely discussed his voice and had always assumed that other people could also hear it. The experiment consisted of James randomly picking 12 members of nursing staff and asking them whether the voice communicated to them. He also asked friends and family when they visited. As all people said they didn’t, James’ belief changed to 0%. This experiment had a significant effect on James’ belief and he started to independently question the
power of the voice and how he viewed it.

Thereafter, the second belief (the meaning about the voice and why it was punishing him) was examined by discussing his own guilt about the offence, which he rated as 100% and reported: “If I had stopped them going in then it wouldn’t have happened”. He stated that he had tried to dissuade the men from going into the house. With hindsight he felt he should have tried to physically stop them. He also stated he shouldn’t have taken the money and he could have phoned the police afterwards.

This belief was examined by asking James to reconsider his options at the time and not with hindsight and also to apportion percentage responsibility to all involved. After 3 sessions James’ belief in his 100% responsibility reduced to 20%. He reported that he was frightened of the men who attacked the lady and it wasn't his idea. He disclosed that he had previously managed to dissuade those involved on one previous occasion from the act. Further, he reported that he thought the house was empty, had no idea what they did and didn’t accept any of the goods they stole. A record was made of these responses and James was encouraged to keep this record and to take it out whenever, the voice started and whenever he felt strong guilt about his actions. As time went by, James reported that the punishing content of the voices was changing and that they were less likely to command him to self-harm or try and kill himself. Consequently, his belief about the origin of the voice changed. He still thought that it could be from the old lady’s son but was less certain and rated his belief as 40%.
The third belief, that the voice controlled everything that James did, was challenged during one session after he automatically and innocently scratched his arm. He was asked why he did this, and he said that his arm was itchy. This was used to then generate doubt that the voice controlled all actions all the time. A behavioural experiment was set up whereby James recorded whether everyday tasks over two weeks were completed because he wanted to do them or because the voice told him and made him. These tasks included walking, smoking, talking, going to the toilet and other day-to-day activities.

At the next session James had recorded that, in the vast majority of cases, the tasks had been self-generated and that after he thought about the task the voice would then tell him to do it. On the occasions where the voice told him to do something and he hadn't thought about this beforehand, he reported that he only did the task if he wanted to. Thereafter, James was asked to record all tasks that the voice made him do, against his will, over a one-week period. The result was none. James' Strength of Belief ratings significantly improved with no endorsements of previously held beliefs.

Following this, James received general psycho-education about “psychosis” and how other people report similar experiences. Kingdon et al. (1994) and Kingdon and Turkington (1991) showed how cognitive techniques can help clients construe false beliefs in non-psychotic terms, by examining their beliefs in a collaborative non-
confrontational manner, and offering alternative explanations. James found the information he had been given to read about psychosis very helpful, and became confident that his experiences were a "psychological disorder" made worse by guilt as opposed to him being persecuted by malevolent forces. The client's clinical team corroborated these improvements. James' voice, whilst still present, no longer held the same fear as previously. At then end of treatment he described feeling more in control and able to turn them on and off at will. He was then discharged.

Case considerations: “James”

Previous clinical treatment outcomes for people with command hallucinations have excluded patients who had acted on commands to seriously injure themselves or others. This single case offers further support for the Cognitive Behavioural interventions first proposed by Chadwick and Birchwood (1994a) and suggests that such an intervention may be of benefit even with those clients who have a history of doing what the commands tell them, even when they are severe commands. The important component in helping James was to try and identify why the client followed the commands (in this case due to beliefs about "power") and then to gradually test out these beliefs.

The current available risk literature strongly suggests that analysis of risk should be confined to 'static' factors such as a person's history of offending, and on the whole this has benefits for understanding the relative risk that a person poses. However, such models of risk do not allow for individual identification of factors, which either
inhibit or increase risk. Therefore, a more detailed analysis through the identification and appraisal of other factors is required, including cognitive factors. This position was also proposed by Beck-Sander and Clarke (1998) who suggested that dynamic as well as static assessments of risk are required when assessing risk in psychosis.

If beliefs about voices effect compliance with cognitive behavioural interventions, then undoubtedly this presents many possible opportunities. In relation to command hallucinations, risk assessment could be improved through the identification of those clients who are at risk of complying and those who are not. This allows services to be able to better determine which clients are in need of the scant resources available to forensic services. Furthermore, and as equally important, by identifying those likely to comply we will also be able to more accurately determine which clients are safe to be discharged back into the community. The ability to identify which cognitions effect compliance leads to the possibility of cognitive behavioural interventions being employed in an attempt to alter such cognitions.

<table>
<thead>
<tr>
<th>James’s case: Issue for discussion/consideration (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>What are the limitations in applying these techniques to other clients?</td>
</tr>
<tr>
<td>What are the possible advantages of such approaches?</td>
</tr>
</tbody>
</table>
Conclusion

The cognitive behavioural approach has a great deal to offer forensic mental health, to services, clients and nurses. This chapter has only provided a brief overview of what the approach can offer forensic service environments and vice versa. Invariably, these environments challenge all and the overarching concept of risk assessment and risk management is never too far away from clinical decision-making.

The cases described in this chapter are interesting from theoretical and clinical viewpoints, however, it is impossible to discuss and describe the minute levels of clinical and risk formulations that occur on a session-by-session basis. All too often, these formulations do not "jump out" immediately, but evolve over time. Usually, it is the case, that a partial formulation has been developed which is then constantly tested out gradually. If we examine the case of James, it was possible that the formulation (that his experiences were a current normal reaction to day to day events) was incorrect. However, had that been the case, and his PTSD not have changed with geographical movement, then this in itself would have been a significant factor in determining a new, revised formulation. Consequently, it is important that mental health workers do not present their formulations as "absolutes"; they are merely educated guesses, which require face validity and logical, empirical testing. As such, the need for a collaborative relationship is very important, where both parties attempt (where possible) to understand the problems together and achieve solutions and
understanding “together”.

It is possible and indeed probable, that a different mental health worker may well have formulated the two cases described in this chapter differently, and it is possible that different formulations would have had positive outcomes. Case formulation does not necessarily therefore have an evidence base, which may be the way forward for future research (Tarrier and Calam 2002). However, at present the clinician can use it as an essential aide to assessment and intervention.

The English National Service Framework for Mental Health has emphasised the need to prioritise the provision of cognitive behavioural interventions as the central evidence based, non-pharmacological intervention for mental health problems (Department of Health, 1999). Forensic service managers and clinicians internationally could well benefit from taking notice of the therapeutic opportunities that the cognitive behavioural approach offers them.
**SUMMARY**

- The cognitive behavioural approach and forensic mental health are two relatively new specialisms, which can work well together.
- Delivering the cognitive behavioural approach in such settings requires a breadth of skills and knowledge as well as a good understanding of risk assessment.
- Interventions will be required in a range of settings, with a range of complexities and require adaptation on behalf of the mental health worker.
- Collaboration is a significant requirement and, when the mental health worker and client work in partnership, excellent results can be achieved.
- Clinical supervision and peer support are essential when working with forensic clients.

<table>
<thead>
<tr>
<th>Further reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written by respected authors who have been actively working in this area to establish both principles of theory and practice. The text gives very good descriptions of how to make a cognitive assessment of both hallucinations and delusions, which measures to use and, the latest methods of intervention. This book formed the basis for the second case study in this chapter.</td>
</tr>
<tr>
<td>An excellent book which combines both the application of cognitive therapy with meaningful case studies. Both the views of the client and therapist are provided as they slowly build collaborative relationships. The text underpins therapy in all Forensic settings where collaboration is the key.</td>
</tr>
<tr>
<td>This comprehensive book from the leading authorities on psychological trauma provides “best practice guidelines for the treatment of PTSD”. It was developed under the auspices of the PTSD Treatment Guidelines Task Force of the International Society for Traumatic Stress Studies. The book is a well-used reference book and source of advice and greatly assisted in the treatment provided for the first case in this chapter.</td>
</tr>
</tbody>
</table>
References:


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CONTENT OF COMMAND HALLUCINATIONS CAN PREDICT SELF-HARM BUT NOT VIOLENCE IN A MEDIUM SECURE UNIT

Published in the Journal of Forensic Psychiatry 13(2): 251-262.

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Acknowledgements: The authors would like to thank Dr Morven Leese, Senior Lecturer in Biostatistics, Institute of Psychiatry.
ABSTRACT

Background: To date, evidence has supported negative relationships, a null relationship and a positive relationship between command hallucinations and violence or self-harm.

Aim: This study was designed to determine the relationship between command hallucinations with violent or self-harm content and incidents of violence and self-harm in forensic inpatients.

Method: Patients with (n=56) and without (n=54) a lifetime history of command hallucinations resident in a medium secure hospital were identified through clinical/legal records over 51 months. Measures included: staff observed violence and self-harm; presence and content of command hallucinations; paranoid delusions; previous violent convictions; length of stay; gender; history of alcohol or illicit drug abuse. Statistical analyses used negative binomial regression.

Results: Violent command hallucinations and inpatient violence were unrelated. Self-harming command hallucinations and an absence of paranoid delusions were positively associated with self-harm.

Conclusions: Content of command hallucinations can predict inpatient self-harm but not inpatient violence. The processes that determine compliance with command hallucinations remain unclear.
INTRODUCTION

Over the past 20 years, reviews examining the association between psychosis and violence have tended to conclude that mental disorder has a small or weak association with violence and crime when compared to criminal history factors (Monahan and Steadman, 1983; Bonta et al, 1998). However, such reviews have been limited by sampling and other methodological problems. Junginger (1996) questioned the validity of continuing research that examines broad categories of disorder and proposed that analysis of individual psychotic symptoms might be more informative. Buchanan (1997) supported this position, and pointed out that studies of risk using diagnosis alone have limited designs and that individual elements of phenomenology should be examined. These elements include persecutory beliefs, passivity phenomena and command hallucinations.

Research into the association between psychotic symptoms and violence has resulted in positive findings for an association between delusions and violence (e.g., Taylor, 1998; Smith & Taylor 1999). However, despite a strong historical assumption that command hallucinations elevate risk (e.g., Bleuler, 1930; Schneider, 1959) such an association has not been found unequivocally for command hallucinations (Rudnick, 1999). Hellerstein et al, (1987) defined command hallucinations as auditory hallucinations that:
"Order particular acts, often violent or destructive ones...(and)... instruct a patient to act in a certain manner - ranging from making a gesture or grimace to committing suicidal or homicidal acts"

In attempting to identify factors that predict individual compliance with command hallucinations, the American Psychological Association (A.P.A.; 1986) reviewed the professional literature on compliance with command hallucinations for the U.S. Supreme Court. The A.P.A. concluded that there was clearly an insufficient quantitative body of knowledge to allow adequate appraisal of compliance with command hallucinations. Further, the A.P.A. cautioned that the "prediction of compliance with command hallucinations in individual cases could not be made with confidence".

LITERATURE REVIEW

Numerous case reports suggest a positive relationship between command hallucinations and the risk of: sexual offending (Pam & Rivera, 1995); violence to others (Good, 1997); self amputation of a limb (Hall et al., 1981); self amputation of the penis (Hall et al., 1981); swallowing objects (Karp et al., 1991); self mutilation of the eyes (Field & Waldfogel, 1995); self inflicted lacerations (Rowan & Malone, 1997); and suicide (Zisook et al., 1995).

However, Rudnick's (1999) systematic review into the relationship between command hallucinations and violence/self-harm concluded that no
relationship existed. Rudnick’s review (MEDLINE, 1966-1997; PSYCHLIT, 1974-1997) identified 41 articles, which examined command hallucinations and risk, 11 of which were controlled. However, only 7 were concerned with violence/self-harm. Four exclusively examined violence to others, whilst 3 examined both violence and self-harm. Six found a null relationship between command hallucinations and violence/self-harm and one reported a negative (inverse) relation (Thompson et al, 1992). However, interestingly, Zisook (1995) reported that during their study two patients out of 20 (10%) with self-harming command hallucinations committed suicide while inpatients. Methodological disparities between these reviewed controlled studies made meta-analysis untenable. Rudnick concluded that all of the controlled studies were methodologically weak; therefore, the conclusions that can be drawn from them must be tentative. Since Rudnick’s review there has been one further controlled study (McNiel et al., 2000). This study tested the relationship between command hallucinations and violence to others in a three-month period preceding admission to a mental health unit. Contrary to all previous studies they found a significant positive relationship between command hallucinations and violence.

Interpreting the evidence

The current state of our understanding of the relationship between command hallucinations and risk is problematic. Clinicians routinely evaluate the risk
posed by patients to themselves and others. The presence or absence of command hallucinations along with other psychotic symptoms inevitably form part of such risk assessments. Yet, available evidence supports null, negative and positive relationships between command hallucinations and risk. It is therefore important to understand why these studies have reached different conclusions. The controlled studies have significant methodological flaws that cannot be fully examined here. However the following problems were observed: (1) Standardised definitions of command hallucinations are absent. (2) The definition and measurement of violence and self-harm were for the majority of studies, not specified or were ambiguous (e.g. one study included violence to people and property (Cheung et al., 1987). (3) Confounding is a consistent theme across all studies. Indeed, Rudnick (1999) in his review concluded, "confounding was mostly blatantly present or undetermined". Rudnick identified the following major confounders in four of the seven studies reviewed: time in hospital; gender; age; and chronicity of illness. (4) Little attention has been paid to the content of the command that patients reported hearing. Apart from McNiel et al. (2000), all studies have contained a command hallucination group that was either unspecified regarding the content of command hallucinations or consisted of a "mixed" group that included both benign (non-violent) command hallucinations (e.g. "make a cup of tea") and violent or self-harming command hallucinations. Interestingly, the only study to control for the content of command hallucinations in their sample (McNiel, et al., 2000) is the only study that
reported a positive relationship between the command hallucination and the outcome (violence). This suggests that the content of command hallucinations may well predict the outcome rather than the mere presence/absence of command hallucinations per se.

The current study was designed to test two hypotheses: (1) That content specific command hallucinations (either of violent content or self harming content) predict violent or self-harm behaviour. (2) That any association found between content-specific command hallucinations and violence or self-harm disappears if all command hallucinators are grouped together regardless of content.

METHOD

Sample

Data relating to all patients resident in a medium secure unit (Caswell Clinic, South Wales) over a 51-month period (1995-1999) were extracted from clinical and legal records. Patients were categorized as experiencing lifetime histories of command hallucinations or lifetime histories of paranoid delusions if the Psychiatrist reported either symptom in a court report, pre-admission assessment report or in the patient’s first case conference. Command hallucinations were defined using the definition provided by Hellerstein et al, (1987): Auditory hallucinations that order particular acts,
often violent or destructive ones..(and)... instruct a patient to act in a certain
manner - ranging from making a gesture or grimace to committing suicidal or
homicidal acts.

Lifetime histories of drug and alcohol abuse were classified if the Psychiatrist
reported either symptom in a court report, pre-admission assessment report
or in the patient’s first case conference. Diagnoses were derived from the
Psychiatrist's clinical records on admission. Previous violent convictions were
obtained from the UK National Offender’s Index (maintained by the Home
Office). Patients were excluded when: records were not available and when
the Psychiatrist did not specify content of auditory hallucinations. The
hospital’s untoward incident forms provided a description of untoward events
with corroborating witness statements. Violence was defined as: assault on
another person where physical contact occurred; verbal threats of impending
violence resulting in the need for staff intervention. Self-harm was defined
as: successful or failed suicide attempt; successful or threatened self-injury
requiring staff intervention.

Statistics
STATA 5 (Stata Corp, 1997) was used to analyse the data. Negative
Binomial Regression was used to analyse violent and self-harm incident
rates over the study period. Negative Binomial Regression is an appropriate
model when incident frequencies are characterized by over dispersion, as was the case with incident rates in this sample. Statistical tests were two-tailed.

RESULTS

Demographic and clinical characteristics

The demographic and clinical characteristics of the sample are presented in table 1. One hundred and thirty five patients were resident in the medium secure unit during the study period. Twenty-five patients were excluded for the following reasons: their clinical records were not available (n=9); content of auditory hallucinations not specified by the Psychiatrist (n=10); the patient refused to discuss their symptoms (n=6). The sample consisted of 56 (51%) non-command hallucinators (i.e. patients who did not have a lifetime history of command hallucinations) and 54 (49%) command hallucinators.
Table 1. Demographic and clinical characteristics of command hallucinators and non-command hallucinators

<table>
<thead>
<tr>
<th></th>
<th>Command Hallucinators (n=54)</th>
<th>Non Command Hallucinators (n=56)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Violent commands</td>
<td>34</td>
<td>0</td>
</tr>
<tr>
<td>Self-harm commands</td>
<td>37</td>
<td>0</td>
</tr>
<tr>
<td>Gender: Male</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td>Female</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Median age on admission</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>Previous violent convictions</td>
<td>26</td>
<td>25</td>
</tr>
<tr>
<td>Violent index</td>
<td>33</td>
<td>38</td>
</tr>
<tr>
<td>Drug history</td>
<td>30</td>
<td>27</td>
</tr>
<tr>
<td>Alcohol history</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>History of paranoid delusions</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>Length of stay (days)</td>
<td>390</td>
<td>332</td>
</tr>
</tbody>
</table>

For this first analysis, patients were assigned to one of two groups on the basis of presence or absence of command hallucinations. Table 1 demonstrates that there were no major differences between the two groups with respect to gender, age, previous violent convictions, drug history, alcohol history and paranoia. Command hallucinators diagnoses on admission were: schizophrenia (44); mood disorder (7) and borderline personality disorder (3). The comparison group's diagnoses were: schizophrenia (36), mood disorder (9), borderline personality disorder (5), anti-social personality disorder (2) and "other" (4). The mean length of stay was longer for command hallucinators (389.91 days) than non-command hallucinators (332.27 days).
difference was not statistically significant (t=0.93, p=0.03). However, to ensure that length of stay did not contaminate the results, this was included as an exposure factor in subsequent regression analyses. Seventeen patients had both violent and self-harm commands.

**All incidents**

During the study period there were a total of 223 incidents (25 command hallucinators accounted for 174 (78%) incidents; 19 non-command hallucinators accounted for 49 (22%) incidents). Sixty-one incidents were neither violent nor self-harm and related to: (1) security breaches (e.g. absconding); (2) damage to property; and (3) refusal of medication. Sixty-two violent incidents occurred (18 command hallucinators accounted for 46 (74%) violent incidents; 10 non-command hallucinators accounted for 16 (26%) violent incidents). One hundred self-harm incidents occurred (16 command hallucinators accounted for 81 (81%) self-harm incidents; 4 non-command hallucinators accounted for 19 (19%) self-harm incidents).

**Violent and self-harm commands and violent and self-harm incidents**

Negative Binomial Regression was used to analyse the data. The dependent variables were rate of self-harm and violent incidents. Independent variables were presence of violent-content command hallucinations, presence of self-harm-content command hallucinations; female gender, presence of paranoid...
delusions, previous violent convictions; lifetime history of drug abuse; and lifetime history of alcohol abuse. The heterogeneity of diagnoses precluded inclusion of diagnosis as a factor in the Negative Binomial Regression.

Negative binomial regression revealed that violent command hallucinations, gender, paranoid delusions, previous violent sentence and a history of drug or alcohol abuse were not significantly associated with violent incident rates after controlling for bed-days (Table 2). Self-harm command hallucinations, however, were significant predictors of self-harming behaviour with an incident rate ratio of 8.32, \( p=0.001 \) (C.I. 2.35-29.51). Additionally, an absence of paranoid delusions were significant predictors of self-harm behaviour with an incident rate ratio of 0.202 \( p=0.049 \) (C.I. 0.04-0.99) (see Table 2). The finding that self-harm-content command hallucinations predicts self harm behaviour as an inpatient led us to revisit the findings of Zisook (1995), whereby two patients with self-harming command hallucinations out of 10 committed suicide while inpatients. No patients in our study were successful in committing suicide during their in-patient stay. However, we conducted a 3 month, post discharge, follow-up of all patients in both groups and found that that two of the 37 (5.4\%) patients in this study who had self-harm command hallucinations committed suicide within 3 months of leaving the unit (1 while in prison and 1 while in Special Hospital). No patients from the comparison group committed suicide.
Table 2. Incident rate ratios (IRR), 95% confidence intervals (CI) and (P) significance levels

<table>
<thead>
<tr>
<th>Violent commands</th>
<th>IRR</th>
<th>CI</th>
<th>P</th>
<th>Self-harm commands</th>
<th>IRR</th>
<th>CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.393</td>
<td>0.530-3.661</td>
<td>0.501</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female Gender</td>
<td>1.728</td>
<td>0.426-7.012</td>
<td>0.444</td>
<td></td>
<td>2.881</td>
<td>0.605-13.713</td>
<td>0.184</td>
</tr>
<tr>
<td>Paranoid delusions</td>
<td>0.601</td>
<td>0.214-1.689</td>
<td>0.334</td>
<td></td>
<td>0.202</td>
<td>0.041-0.992</td>
<td>0.049*</td>
</tr>
<tr>
<td>Violent conviction</td>
<td>2.542</td>
<td>0.770-8.392</td>
<td>0.126</td>
<td></td>
<td>1.536</td>
<td>0.417-5.659</td>
<td>0.519</td>
</tr>
<tr>
<td>Drug abuse</td>
<td>1.005</td>
<td>0.329-3.072</td>
<td>0.993</td>
<td></td>
<td>1.163</td>
<td>0.322-4.205</td>
<td>0.818</td>
</tr>
<tr>
<td>Alcohol abuse</td>
<td>1.768</td>
<td>0.620-5.042</td>
<td>0.286</td>
<td></td>
<td>1.691</td>
<td>0.454-6.299</td>
<td>0.434</td>
</tr>
</tbody>
</table>

(*) denotes an inverse relationship

Uncontrolled content of command hallucinations and violent and self-harm incidents

In order to test our suggestion that an association between command hallucination content and behavioural outcomes may have been obscured in previous studies (i.e. where the nature of the commands in the command hallucination group were not fully specified) we conducted a second analysis. This analysis mimicked the effects of ignoring the content of command hallucinations on the magnitude of observed associations between
hallucinations and both violent and self-harm behaviour. As in previous studies, patients were re-assigned to group membership on the basis of the presence or absence of command hallucinations without regard for the content of command hallucinations. This new command hallucination group consisted of: 17 patients who had both self-harm and violent command hallucinations; 20 patients who had only self-harm command hallucinations; and 17 patients who had only violent command hallucinations.

Negative Binomial Regression was again used to analyze incident rate ratios for self-harm and violence. This resulted in a decreased self-harm incident rate ratio from 8.32, p=0.001 (C.I. 2.35-29.51) for patients with self-harm command hallucinations to 5.36, p=0.013 (C.I. 1.42-20.24) for the command hallucination group. Additionally, a reduced violent incident rate ratio was also observed; from 1.39, p=ns (C.I. 0.53-3.66) for patients with violent command hallucinations to 0.48, p=ns (C.I. 0.18-1.32) for the command hallucination group.

DISCUSSION

The high prevalence of command hallucinations found in this study is similar to the findings of Rogers et al (1990) who found that 51% of hallucinators and 38% of all patients in a forensic population had command hallucinations. Additionally, Rogers (1986) found that 43% of patients referred for forensic
assessment reported command hallucinations. Zisook et al (1995) found that the prevalence of command hallucinations in outpatients with schizophrenia was 43% for all patients and 50% for patients with auditory hallucinations.

This study controlled for the content of command hallucinations and found that self-harming command hallucinations and an absence of paranoid delusions predict in-patient self-harm. However, we failed to replicate the findings of McNiel et al., (2000); that violent command hallucinations predict violence within an inpatient medium secure setting. This may be due to: (1) The natural limitations of retrospective study where case note data was used to measure command hallucinations; (2) Differences between the two study environments regarding how those environments are managed or controlled; (3) Differences between the two study environments in terms of the type, dose and exposure of medication and therapy interventions.

McNiel et al. (2000) examined violence in a three-month period prior to hospitalization where histories of command hallucinations were established through structured interview, while we studied violence in an in-patient medium secure unit using case-note data as the means of determining histories of command hallucinations. Consequently, methodological differences, an effect of environment/treatment cannot be ruled out (e.g. those with violent command hallucinations on admission were successfully managed and treated with medication). Medium secure units will undoubtedly
assertively treat and manage psychotic and violent behaviour due to the
dangerousness of this forensic population. Therefore, it is possible that the
secure environment, medication and observation regimes of the medium
secure unit reduced the overall levels of violence for both groups during the
study period. Indeed assumptions about associations between command
hallucinations and risk may have meant that command hallucinators were
treated differently and their freedom/ability to act violently may have been
more restricted than the non-command hallucination group. The slight
differences found in this study regarding diagnoses between those with a
lifetime history of command hallucinations and those without also cannot be
ruled out as a possible confound. However, the heterogeneity of diagnoses
found in this sample is similar to that found within the McNiel et al. (2000)
sample and therefore it is unlikely that diagnosis is acting as a confound.

This study is unable to ascertain whether individuals were still experiencing
command hallucinations at the time of the violent or self-harm episode. As
such, we cannot assume that command hallucinations were the drive behind
self-harm or violent acts. Nonetheless, we found a positive association
between a lifetime history of self-harm command hallucinations and in-patient
self-harm, despite environmental and treatment confounds. This finding
warrants further study. Furthermore, three month follow-up of the outcomes
of patients with self-harm command hallucinations found that two of the 37
(5.4%) patients in this study who had self-harm command hallucinations
committed suicide within 3 months of leaving the unit. No patients from the comparison group committed suicide. Zisook (1995) reported a similar finding: two patients out of 20 (10%) with self-harming command hallucinations committed suicide while inpatients. This would suggest that research into the long-term follow-up of patients with self-harm command hallucinations and suicide is warranted.

Additionally, our suggestion that an association between command hallucination content and behavioural outcomes may have been obscured in previous studies was supported. When we repeated the analysis but did not control for content of command hallucinations we observed that the self-harm incident rate ratio fell from 8.32 to 5.36 and that the violent incident rate ratio fell from 1.39 to 0.48. These findings are supportive of our interpretation of the existing research evidence; that it is the content and form of auditory hallucinations, which predicts risk and not merely presence. We suggest therefore that previous studies, which have not controlled for content, have failed to take into account a crucial risk factor.

This allows us to interpret the existing evidence more clearly. If we examine the literature, what we can now say is: (1) There is no association between command hallucinations and violence or self-harm per se. (2) There is evidence for an association between violent content command hallucinations and violence for patients during the 3-month period preceding admission.
when they are presumably more able to act freely and therefore behave violently. (3) There is no association between violent command hallucinations and in-patient violence in a medium secure unit where they will be receiving "aggressive" medication and management. (4) There is an association between self-harm command hallucinations and self-harm behaviours in a medium secure unit.

Should, through further replication, the content of command hallucinations predict content-specific behaviour, then this has significant and immediate implications for current clinical practice regarding risk assessment and risk management of patients with violent or self-harm command hallucinations. In the course of our research we have observed that clinicians and academics alike dismiss command hallucinations as a risk indicator while citing one of the studies reviewed by Rudnick (1999). However, we urge caution with such practice until further controlled research has been conducted that examines systematically (and prospectively) the risk predictiveness of content-specific command hallucinations in different environments. This is a small retrospective study in an inpatient setting where medication effects and diagnoses were uncontrolled. However, this study reports the largest sample of known violent and self-harm command hallucinators so far. A study into the role of mediating factors in compliance with command hallucinations is needed.
REFERENCES


StataCorp (1997) *Stata Statistical Software. Release 5.0.* College Station, TX: Stata Corporation.


Appendix 3

AUDITORY HALLUCINATIONS SCHEDULE

AHS1  1 Have you more than once had the experience of hearing things or voices other people couldn't hear? 0 = No [END], 1 = Yes, 7 = Refused, 8 = NA / Instrument not done, 9 = Don't know.

AHS2  1 Do you have this experience only when you are high on (street) drugs or alcohol? 0 = No, 1 = Yes, 7 = Refused, 8 = NA, 9 = Don't know, What did you hear? (Check all that apply) 0 = No, not checked.

AHS3.1  1 Sound/Noises 1 = Yes, checked
AHS3.2  1 One voice 7 = Refused
AHS3.3  1 Multiple voices 8 = NA, 9 = Don't know
How long have you been hearing things? CODE # OF YEARS, MONTHS &/ OR WEEKS

AHS4YY  2 Years 97 = Refused
AHS4MM  2 Months 98 = NA, 99 = Don't know
AHS4WW  1 Weeks 7 = Refused, 8 = NA, 9 = Don't know
AHS4.1  1 In the last two months? 0 = No
AHS4.2  1 In the last day? 1 = Yes, 7 = Refused, 8 = NA, 9 = Don't know
What do the voices say?

AHS5.1  1 Talk about you / to you in a negative way (Check all that apply)
AHS5.2  1 Talk about you / to you in a neutral way 0 = No, not checked
AHS5.3  1 Talk about you / to you in a positive way 1 = Yes, checked, 7 = Refused, 8 = NA, 9 = Don't know

AHS6  1 Do you do anything to stop the voices? 0 = No (skip to AHS8), 1 = Yes, 7 = Refused
8 = NA, 9 = Don't know, AHS7  1 What do you do? 1 = Mental, 2 = Behavioral, 3 = Both, 7 = Refused, 8 = NA, 9 = Don't know.

AHS8  1 Do the voices tell you to do anything? 0 = No [END], 1 = Yes, 7 = Refused, 8 = NA, 9 = Don't know.

AHS9  1 Check highest level of violence 0 = No violence, 1 = Level 1, 2 = Level 2, 3 = Violent but don't know level, 4 = Suicide or self harm, 7 = Refused, 8 = NA, 9 = Don't know if violent.
AHS10 1 Do you feel you have to obey? 0 = No, 1 = Yes, 7 = Refused, 8 = NA, 9 = Don't know.

AHS11 1 Have you ever done what the voices tell you to do? 0 = Never, 1 = Once, 2 = More than once (2-5 times), 3 = More than 5 times, 7 = Refused, 8 = NA, 9 = Don't know.

AHS12 1 When was the last time that happened? 1 = Last week, 2 = In the last two months, 3 = Before the last two months, 7 = Refused, 8 = NA, 9 = Don't know.

AHS13 1 Check highest level of violence 0 = No violence, 1 = Level 1, 2 = Level 2, 3 = Violent but don't know level, 4 = Suicide or self harm, 7 = Refused, 8 = NA, 9 = Don't know if violent.

AHS14 1 Do you believe you will obey the voices 1 = Yes, sometime in the future? 2 = No, 7 = Refused, 8 = NA, 9 = Unsure.
Appendix 4

MacArthur Violence Risk Assessment Study Violent Incident Coding Rules

I. INCLUSION CRITERIA
If the subject reported a violent incident(s) that did not match with a collateral report (and the subject was deemed ‘accurate’ by project interviewers), his or version of events was accepted. The collateral’s version of violent events was accepted if the collateral was (1) present during the incident; or (2) the victim of the incident; or (3) heard about the incident from either the subject or victim. Regardless of whether the collateral’s version matched with a subject version. If either the subject or collateral was deemed unreliable by the interviewer, we did not include their version of violent events. By unreliable, we refer to cases for which the interviewer rated the reporting of violence as extremely untruthful in the direction of over reporting violence.

We always incorporated official reports of violence into the reconciled variable (e.g., rap sheet, re-hospitalization data, and admitting incident chart information) whether or not they matched with other sources.

II. IDENTIFY MATCHING INCIDENT REPORTS
Incidents reported by different sources were considered to match if they were recorded as occurring within two weeks of each other and seemed to depict the same violent event (e.g., based on the reported location, victim, and injury level). When no descriptive data were available, we relied solely on the incident date.

III. SELECT APPROPRIATE VERSION FROM INCIDENT MATCHES
If both the subject and collateral were judged by the interviewer as credible, we accepted the collateral’s version of events (over the subject’s) if the collateral was (1) present during the incident; or (2) the victim of the incident; or (3) heard about the incident from either the subject or victim. This implies that we accepted the subject’s version of a matching incident (rather than the collateral’s) only if the collateral had heard about the incident third-hand (i.e., from some other person not involved in the incident). There were no special rules for collaterals who were mental health Professionals.

If the subject reported violence (regardless of the interviewer’s assessment of truthfulness) and the collateral was judged as accurately reporting that no violence occurred, we accepted the subject’s report because we assumed that the collateral could not have full knowledge of the subject’s behavior. We thus interpreted a collateral’s report of no violence to mean that, regardless
of frequency of contact, the collateral could not remain completely aware of all of the subject’s violent behavior. If the collateral was judged by the interviewer as over-reporting violence and the subject was judged as accurately reporting that no violence occurred, we accepted the subject’s version.
Appendix 5

Stata 8 do-file for the random-effects, repeated measure, logit model

The following "do-file" is presented in the interests of replication. This allows the reader to rerun the repeated measures, logit model analyses with the original MacArthur data.

***** Renaming and dropping variables *****
rename studyid id
rename ethn2 ethnicity
rename q5_5_1 beatchild
rename q5_6_1 beatteen
rename aI_1_1c1 relative
rename od15_1 alcohol
rename od15_2 drugs
rename de100_1 delusions
rename de102_1 persecutory
rename aim1 _4groups
rename aim2 _3groups
order id _4groups _3groups viofu1-bistert pcltert

***** Recoding missing data as . *****
qui mvdecode viofu viofu2 viofu3 viofu4 viofu5, mv(9)
qui mvdecode evermarr, mv(9)
qui mvdecode beatchild beatteen relative alcohol drugs, mv(9)
qui mvdecode bprstert bistert pcltert, mv(9)

***** Reshaping into LONG format *****
reshape long viofu, i(id) j(time)

***** descriptive statistics *****
tab viofu _4groups, col
tab viofu _3groups, col

***** repeated measures analysis (random effects) *****
*(a) 4-group classification (non-hallucinators as reference group)
*(i) unadjusted
xi: xtlogit viofu i._4groups*i.time, i(id) nolog or
est store A
xi: xtlogit viofu i._4groups i.time, i(id) nolog or
lrtest A, stats
testparm _I_4groups_1- _I_4groups_3
*(ii) fully adjusted
xi: xtlogit viofu i._4groups*i.time agecont-
persecutory, i(id) nolog or
est store B
\texttt{xii: xtlogit viofu i.\_4groups i.time agecont-persecutory, i(id) nolog or}
\texttt{lrtest B, stats}
\texttt{testparm \_I\_4groups\_1 - \_I\_4groups\_3}
* (b) 3-group classification (non-hallucinators as reference group)
* (i) unadjusted
\texttt{xii: xtlogit viofu i.\_3groups\*i.time, i(id) nolog or}
\texttt{est store C}
\texttt{xii: xtlogit viofu i.\_3groups i.time, i(id) nolog or}
\texttt{lrtest C, stats}
\texttt{testparm \_I\_3groups\_1 - \_I\_3groups\_2}
* (ii) fully adjusted
\texttt{xii: xtlogit viofu i.\_3groups\*i.time agecont-persecutory, i(id) nolog or}
\texttt{est store D}
\texttt{xii: xtlogit viofu i.\_3groups i.time agecont-persecutory, i(id) nolog or}
\texttt{lrtest D, stats}
\texttt{testparm \_I\_3groups\_1 - \_I\_3groups\_2}