The Prevalence of Non-Cardiac Chest Pain (NCCP) with Associated Anxiety using Emergency Department (ED) Data: A Northern Ireland Based Study.

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Background Literature

Chest pain is a common complaint which is frequently non-cardiac in origin. Research to date indicates that between 52% and 77% of patients who present to an ED with chest pain are discharged without clear medical diagnosis, and thereby may be referred to as incidences of unexplained chest pain (UCP), or non-cardiac chest pain (NCCP) (Christenson et al., 2004; Dunville, MacPherson, Griffith, Miles & Lewin, 2007; Stallone et al., 2014). A recent review of clinical care posited that the focus of care is more often on the exclusion of coronary disease and medical diagnosis, and not on the appropriate management of NCCP, despite the substantial prevalence rates (Chambers, Marks & Hunter, 2015). Consequently, patients with NCCP frequently endure chronic symptoms in addition to high levels of psychological distress (Chambers, Marks, Kinsley & Hunter 2013; Marks, Chambers, Russell, Bryan & Hunter, 2014).

Moreover, several studies have identified UCP and/or NCCP as a significant public health concern, linked with increased limitation of daily activities, work absenteeism, unemployment, disability, and repeated attendance at emergency departments, primary care, and acute medical services (Christoph et al., 2014; Eslick & Talley, 2004; Fagring et al., 2008; Jerlock et al., 2008).

Anxiety is said to have a key role in the neuro-behavioural processes associated with pain regulation, possibly contributing to UCP/NCCP. Some of the autonomic symptoms of anxiety are also features of NCCP, which may somewhat explain the findings of Smeijers et al. (2013), who detected higher levels of anxiety among individuals with NCCP compared with healthy individuals. This is also consistent with previous works which have indicated that the prevalence of panic disorder in NCCP is considerably higher than in the general population (Barlow, 2002; Huffman & Pollack, 2003). Furthermore, White et al. (2008) outlined a number of other psychological factors which are commonly comorbid with both panic disorder and NCCP, namely mood disorders, personality traits, and anxiety disorders other than panic.
Regarding respiratory symptoms being masked by anxiety, it is also useful to acknowledge that chest pain is not the only somatic symptom associated with anxiety. A number of studies have pointed to a link between panic disorder and a hypersensitivity to carbon dioxide (Papp et al., 2015), and between anxiety and reported respiratory sensations (Von Leupoldt, Chan, Bradley, Lang & Davenport, 2011). Pfortmueller et al. (2015) aimed to characterise patients with a primary presenting complaint of hyperventilation in the ED where a physical diagnosis was absent; a third of this identified population had previously experienced an episode of hyperventilation, and 50% had psychiatric comorbidity. Pfortmueller et al. (2015) have advocated the need for further studies investigating the prevalence of primary hyperventilation within acute medical services, given the lack of existing literature in this field.

Furthermore, anxiety and depression have been found to occur with similar prevalence rates among individuals with an actual cardiac disease diagnosis, and those identified as presenting with NCCP (Chambers et al., 2015). Importantly however, research indicates that these psychological difficulties are much less inclined to be resolved in NCCP (Chambers et al., 2014; Clare, Andiappan, MacNeil, Bunton & Jarrett, 2013; Robertson, Javed, Simani & Khunti, 2008), and are also associated with more health related cognitive distortions (Marks et al., 2014). More specifically, panic disorder is the psychological difficulty most prevalent among individuals with NCCP (Huffman & Pollack, 2003). As previously mentioned this is thought to be associated with the similarities between particular cardiovascular symptoms and the inclination of those with panic disorder to focus on the autonomic symptoms they perceive as dangerous (Barlow, 2002; Lessard et al., 2012). Despite reassurance by emergency physicians and cardiologists, more than 50% of patients presenting with NCCP continue to report chest discomfort and remain worried they have a serious health condition or have suffered myocardial infarction (Beek et al., 2013).

Foldes-Busques et al. (2010) also determined a high prevalence (44%) of panic-like anxiety in ED presentations, using valid psychometric tools including the State-Trait Anxiety Inventory (STAI) and the Anxiety Sensibility Index (ASI). However, this study also determined that physicians in the ED diagnosed just 7.4% of these panic cases. In addition to this, studies have also determined that even where panic and anxiety are identified in the emergency department, the appropriate interventions are seldom initiated within the scope of these services (Dammen, Bringager, Arnesen, Ekberg & Friis, 2006; Wulsin et al., 2002). Based on their findings, Foldes-Busques et al. (2010) have suggested that the need to increase understanding of unexplained chest pain in emergency departments is critical, and thus improved access to the appropriate psychological interventions could reduce attendance at health services and limit the social, physical, and occupational costs associated with anxiety and panic disorders.

Based on these recommendations, it is considered important to establish a true estimate of the prevalence of UCP or NCCP arriving in ED departments in Northern Ireland, as to date (to our knowledge) no such studies appear to have been carried out. The outcome of such a study would support the need (or not as the case may be) to provide additional psychological services for people who are repeatedly using hospital services for NCCP with associated anxiety or panic disorders.
Rationale and Aims

As indicated in the aforementioned studies, a priority for service improvement in NI, must be to assess the frequency of patients presenting to acute medical services (i.e. the ED), with UCP or NCCP with associated anxiety or panic, where a medical or cardiac diagnosis was not recorded.

Method

Design

The study adopted a cross sectional design, analysing (existing) data via the hospital patient data system (known as Symphony), for three year groups.

Data access

With the permission of service managers within Altnagelvin Area Hospital, Clinical Governance and the Service Improvement Department with the local Western Health and Social Care Trust, the data entries for all patients attending the ED in 2013/14, 2014/15, and 2015/16 was accessed by Trust administrative staff, who anonymised all entries and transferred the data onto an Excel spreadsheet. The data was prepared for secondary data analysis and given to the researchers at Ulster University. The purpose of the data search was to determine the overall prevalence of chest pain presentations within these ED attendances, and subsequently to determine the prevalence of anxiety or possible anxiety within these.

Data management procedures

The procedure had several stages, which are outlined below.

Stage one: The administrative staff within the local hospital in NI, carried out a search of the hospital’s patient database (i.e. Symphony), and extracted all patients who attended the ED across three year groups; 2013/2014 (n=59224); 2014/2015 (n=58123); 2015/2016 (n=63122). This data was compiled onto an Excel spreadsheet, with three columns (1, count of attendance – all, 2, presenting with and 3, diagnosis on discharge).

Stage two: This anonymised data was then examined manually by the research team, who systematically scrutinised the data in the following ways.

Firstly, one of the researchers searched for the following term (chest + pain) as the named presenting problem on arrival to the ED in the year 2013/2014. This yielded several ways in which this term was recorded (i.e. chest pain could be upper case, lower case, or with a prefix question mark etc). After completing this, it was noted that the staff had no standard term or coding system, which meant that chest pain as a presenting problem could be written in a range of ways. Although this indicated potential difficulties with regards to obtaining precise frequencies, researchers were able to determine precise search terms given the scrupulousness of this initial search.
This manual examination of the “presenting with” column terms indicated 272 ways in which chest pain presentations could be recorded on the database. A manual examination of the “diagnosis” column using the terms “chest” and “pain” indicated additional search terms. For example, when chest pain in the ‘diagnosis’ column was examined more closely, it revealed that chest pain terms such as “palpitations” or ‘heart problem” could also be recorded in the corresponding ‘presenting with’ column; this identified a further 130 ways in which chest pain was described as a presenting issue. Therefore in order to ensure important data was not missed, and the most accurate prevalence rates were captured, the systematic search of the database using the filter application on excel proceeded and indicated total presentations as indicated in the subsequent stages.

Stage three: For each of the years, the following criteria (search terms) were applied to the text filter facility on the “presenting with” column. The command filter term selected was contains and the search term was “chest” and contains “pain”. The three remaining command search terms were as follows: contains palpitation(s), contains “heart”, and contains “chest” and “tightness.” A frequency count was calculated for each year group. (see table one).

Stage four: In order to determine the prevalence of anxiety and UCP/ NCCP within these total chest pain presentations, data was systematically searched by applying text filters to both the “presenting with” and “diagnosis” columns simultaneously, for each of the three years. The search terms were paired and applied in the following eight ways: presenting with “chest” and “pain”/diagnosis of “chest pain” and “unknown cause.”, presenting with “chest” and “pain”/diagnosis of “anxiety” or “panic”, presenting with “palpitation(s)”/diagnosis of “chest pain” and “unknown cause”, presenting with “palpitations(s)”/diagnosis of “anxiety” or “panic”, presenting with “heart”/diagnosis of “chest pain” and “unknown cause”, presenting with “heart”/diagnosis of “anxiety” or “panic”, presenting with “chest” and “tightness”/diagnosis of “chest pain” and “unknown cause”, and presenting with “chest” and “tightness”/diagnosis of “anxiety” or “panic.”

Stage five: To ensure inter-rater reliability, a second researcher then followed the stages as outlined above, using the same search terms in the same ways. The frequencies were then recorded and compared to the first researcher. Exact matches were found, and we were therefore satisfied that the prevalence rates would be robust, accurate and reliable. This procedure was carried out for each of the three year groups.
Results

Table 1: Rates of chest pain presentations to ED by text filtered search terms.

<table>
<thead>
<tr>
<th>Search Term(s)</th>
<th>2013/14 (N=59244)</th>
<th>2014/15 (N=58123)</th>
<th>2015/16 (N=63122)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
</tr>
<tr>
<td>‘chest’ and ‘pain’</td>
<td>2161 (3.6)</td>
<td>2417 (4.2)</td>
<td>2908 (4.6)</td>
</tr>
<tr>
<td>‘palpitation’ or ‘palpitations’</td>
<td>81 (0.1)</td>
<td>84 (0.1)</td>
<td>88 (0.1)</td>
</tr>
<tr>
<td>‘heart’</td>
<td>115 (0.1)</td>
<td>131 (0.2)</td>
<td>192 (0.3)</td>
</tr>
<tr>
<td>‘chest’ and ‘tightness’</td>
<td>42 (0.1)</td>
<td>46 (0.1)</td>
<td>54 (0.1)</td>
</tr>
<tr>
<td>Total chest pain presentations</td>
<td><strong>2399 (4%)</strong></td>
<td><strong>2678 (4.6%)</strong></td>
<td><strong>3242 (5.1%)</strong></td>
</tr>
</tbody>
</table>
Table 2: Rates of chest pain of unknown cause, or anxiety/panic within each of the ‘presenting with’ search terms: chest and pain, palpitations (s) or heart, or chest tightness.

<table>
<thead>
<tr>
<th>Search term(s) 1 Presenting with..</th>
<th>Search term(s) 2 Diagnosis of..</th>
<th>2013/14 N= 2399</th>
<th>2014/15 N= 2678</th>
<th>2015/16 N= 3242</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘chest’ and ‘pain’</td>
<td>‘chest pain of unknown cause’</td>
<td>731 (30.5)</td>
<td>961 (35.8)</td>
<td>1193 (36.8)</td>
</tr>
<tr>
<td>‘chest’ and ‘pain’</td>
<td>‘anxiety’ or ‘panic’</td>
<td>51 (2.1)</td>
<td>41 (1.5)</td>
<td>45 (1.4)</td>
</tr>
<tr>
<td>‘palpitation(s)’</td>
<td>‘chest pain of unknown cause’</td>
<td>28 (1.2)</td>
<td>25 (0.9)</td>
<td>21 (0.6)</td>
</tr>
<tr>
<td>‘palpitation(s)’</td>
<td>‘anxiety’ or ‘panic’</td>
<td>5 (0.2)</td>
<td>7 (0.3)</td>
<td>12 (0.4)</td>
</tr>
<tr>
<td>‘heart’</td>
<td>‘chest pain of unknown cause’</td>
<td>42 (1.7)</td>
<td>43 (1.6)</td>
<td>58 (1.8)</td>
</tr>
<tr>
<td>‘heart’</td>
<td>‘anxiety’ or ‘panic’</td>
<td>10 (0.4)</td>
<td>4 (0.1)</td>
<td>7 (0.2)</td>
</tr>
<tr>
<td>‘chest’ and ‘tightness’</td>
<td>‘chest pain of unknown cause’</td>
<td>9 (0.3)</td>
<td>24 (0.9)</td>
<td>32 (0.9)</td>
</tr>
<tr>
<td>‘chest’ and ‘tightness’</td>
<td>‘anxiety’ or ‘panic’</td>
<td>4 (0.2)</td>
<td>1 (0.03)</td>
<td>2 (0.06)</td>
</tr>
</tbody>
</table>

Total chest pain presentations with unknown or anxiety outcome  880 (36.7)  1106 (41.3)  1370 (42.3)
### Table 3: Rates of chest pain presentations arriving in ED, with rates of chest pain of unknown cause or anxiety/panic attacks at discharge.

<table>
<thead>
<tr>
<th>Presentations and outcomes</th>
<th>2013/14 N=59,244</th>
<th>2014/15 N=58,123</th>
<th>2015/16 N=63,122</th>
<th>2013-2016 N=180,489</th>
</tr>
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<tbody>
<tr>
<td>N=(%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>presenting with ‘chest’ and ‘pain’</td>
<td>2399 (4.1)</td>
<td>2417 (4.2)</td>
<td>3242 (5.1)</td>
<td>8058 (4.5)</td>
</tr>
<tr>
<td>outcome of ‘anxiety’ or ‘panic’</td>
<td>70 (2.9)</td>
<td>53 (2.2)</td>
<td>66 (2)</td>
<td>189 (2.4)</td>
</tr>
<tr>
<td>outcome of ‘chest pain of unknown cause’</td>
<td>810 (33.7)</td>
<td>1053 (43.6)</td>
<td>1304 (40.2)</td>
<td>3167 (44.4)</td>
</tr>
</tbody>
</table>

### Percentage Prevalence rates of anxiety, panic or chest pain of unknown cause in patients arriving to the ED with chest pain from 2013 up to 2016.

In 2013/14, from a total of 59244 attendees, 2399 (4.05%) presented with a chest/cardiac complaint. 70 (2.92%) of these had an outcome of anxiety or panic, and 810 (33.76%) of these had a diagnosis indicating “chest pain of unknown cause.” In 2014/15, from a total of 58123 attendees, 2417 (4.16%), presented with a chest/cardiac complaint. 53 (2.19 %) of these had an outcome of anxiety or panic, and 1053 (43.57%) of these had a diagnosis indicating “chest pain of unknown cause.” In 2015/16, from a total of 63122 attendees, 3242 (5.14%), presented with a chest/cardiac complaint. 66 (2.04%) of these had an outcome of anxiety or panic, and 1304 (40.22%) of these had a diagnosis indicating “chest pain of unknown cause.”

For the purposes of the study, the overall prevalence rates between March 2013 and March 2016 for Altnaglevin Area Hospital A&E presentations can be summarised as follows: from a total of 180,489 attendees, 8058 (3.95%) presented with a chest/cardiac complaint. 189 (2.35%) of these had an outcome of anxiety or panic, and 3167 (44.37%) of these had a diagnosis indicating “chest pain of unknown cause.”
Discussion and implication of findings

The findings of the current study are consistent with those in the current literature (Stallone et al., 2014), given that a relatively small percentage of chest pain presentations to the ED between March 2013 and March 2016 were discharged with an outcome of anxiety or panic, and a substantial percentage (44.37%) of chest pain presentations to the ED were discharged with a recorded diagnosis indicating “unknown cause.” This is also commonly referred to as non-cardiac chest pain (NCCP) or unexplained chest pain (UCP).

Patients presenting with chest pain where heart disease has been ruled out, have a good prognosis medically, and the risk of future cardiac morbidity is the same as the general population (Cannon 2009). Although the prognosis may not be concerning in medical terms, it has been determined that NCCP patients do not function particularly well. Shah, Kataria and Tanna, (2015) evaluated and subsequently reported significant degrees of anxiety and depressive symptomatology among patients attending an outpatient service following their first episode of UCP. They found UCP was persistent, causing long term physical limitations and negatively impacting routine daily life. More specifically, they reported chest pain to be persistent in 50-70% of UCP patients, and determined loss of employment in 19-51% of the group, with functional loss reported in between 40 and 100%.

Furthermore, Schwarz, Prashad and Winchester, (2015) suggest that anxiety is extremely prevalent, and insufficiently recognised and managed within emergency care settings. A number of possible reasons have been suggested for this, including a lack of access to validated screening tools, and the hesitation of physicians to enquire, given that patients can be defensive about potential psychological causes (Hocaoglu, Gulec & Durmus, 2008). Foldes-Busques et al. (2010) also determined a high prevalence (44%) of panic-like anxiety in ED presentations and subsequently determined that physicians in the ED diagnosed just 7.4% of these panic cases. Based on the findings of the current study it may be tentatively suggested that anxiety may not have been picked up as it may not have been screened or assessed for after a cardiac diagnosis has been ruled out. Therefore, a future clinical and research recommendation could be to initiate a pilot study to screen for anxiety in all those who are given an outcome of ‘chest pain of unknown cause’ or be referred to an appropriate professional for a brief clinical assessment, with a view to treatment. Research has also suggested that even where panic and anxiety are recognised within the emergency care services, the appropriate interventions are seldom initiated here (Dammen et al., 2006; Wulsin et al., 2002).

Many patients with unexplained chest pain, never discover a known cause for their physical pain (Bozkurt Zincair et al., 2014). More specifically Bozkurt Zincair et al. (2014) found anxiety, somatic symptoms and the magnification of bodily sensations to be highly prevalent among NCCP patients, and concluded that they needlessly attended cardiology outpatient services.
It is also important to note that the data used to obtain prevalence rates in the current study was fully anonymised and indicated only counts of incidences, specifically with the corresponding recorded primary presenting problem, and the subsequent diagnosis. It was not possible therefore to determine if the same individual had attended services with the same or a similar presentation more than once. This is an acknowledged limitation of the current study but it can also be a future research recommendation to attempt to track repeat attenders who were discharged with NCCP or UCP.

This service improvement assessment has determined that there is a significant incidence of patients attending the ED with UCP/NCCP. Given the link between UCP/NCCP and clinical anxiety, it should subsequently be determined how to develop appropriate and timely psychological interventions.

Current reviews of clinical care have highlighted a failure to appropriately manage NCCP despite the substantial prevalence rates (Chambers et al., 2015). Studies to date have pointed to the efficacy of cognitive behavioural therapy (Spinhoven, Ven der Does, Van Dijk & Van Rood, 2010; Marchand et al., 2012). The efficacy of cognitive behavioural therapy as an intervention for NCCP has been evaluated in a number of randomised controlled trials (George, Abdallah, Maradey-Romero, Gerson & Fass, 2016). Mayou et al. (1997) compared CBT and standard clinical advice among NCCP patients and found major reductions in both the frequency and severity of symptoms in the CBT group, and only modest improvements within the control group.

Similarly Spinhoven et al. (2010) conducted an RCT with UCP patients and found that those who had completed a course of CBT had a significantly higher treatment response when compared with placebo and medication groups. Keefe et al. (2011) found that a low intensity CBT intervention, more specifically “coping skills” resulted in significant improvement relating to the catastrophizing of pain symptoms and anxiety when compared to a placebo group.

Recent research has also emphasised the success of brief cognitive behavioural therapy; Johson, Martinsen, Morken, Moum, and Dammen, (2013) found a three session CBT intervention to be effective for UCP patients in terms of illness perception. Beek et al. (2013) concluded that a brief cognitive behavioural intervention significantly reduced levels of anxiety and depression in patients with NCCP, with a diagnosis of panic and/or a depressive disorder based on HADS (Hospital anxiety and depression scale) scores. Based on these findings, Beek et al. (2013) recommended that individuals presenting with NCCP should be assessed for psychopathology, and a cognitive behavioural intervention offered in cases where psychological difficulties are detected. Lessard et al. (2012) found that cognitive behavioural interventions as brief as even a single session initiated within two weeks of an emergency attendance for the primary complaint of chest pain, seem to be effective for panic disorder. Furthermore, they have recommended that increased efforts should be employed to implement these interventions in the emergency department/primary care setting, considering the high prevalence of panic disorder there.
Several studies have now pointed to the fact that UCP patients frequently endure chronic symptoms and high levels of psychological distress (Chambers et al., 2013; Marks et al., 2014). Given the high percentage of patients in the current study who were discharged with an outcome of “chest pain of unknown cause”, future work is needed to assess the degree and prevalence of anxiety disorders among this group here in Northern Ireland. Furthermore, given the evidence base for the efficacy of CBT within this patient population, it may be posited that future research is also warranted to evaluate the effectiveness of a CBT intervention for those patients identified as having UCP and associated significant anxiety.

As highlighted previously, it is also important to acknowledge that chest pain is not the only somatic symptom associated with anxiety; several studies have reported on the association between anxiety and respiratory sensations such as shortness of breath (Papp et al., 2015; Pfortmüller et al., 2015). Moreover they have advocated the need for further research in this particular field, given the current lack of existing literature. It would be useful for future studies to assess anxiety and health anxiety symptomatology among UCP patients in order to obtain accurate knowledge regarding the prevalence of psychological distress among this patient population.

Governments are increasingly recognising the long term economic and social costs of high prevalence disorders including common mental health difficulties such as anxiety and panic disorder. Low intensity cognitive behavioural therapy is the most strongly evidenced in relation to common anxiety disorders, and moreover it has been shown to save money in the long term (London School of Economics 2012). It is still the case however, that we do not have the care pathways in place which apply the evidence in order to facilitate the provision of timely and appropriate interventions. As highlighted previously, NCCP has been identified as a significant public health concern given the associations determined between unemployment, disability, reduced function and repeated use of services (Christoph et al., 2014; Eslick & Talley 2004; Fagring et al., 2008; Jerlock et al., 2008).

Based on the recommendations of existing literature, this study has sought to establish a true estimate of the prevalence of UCP/NCCP cases within the ED here, given that to our knowledge, no such study has been carried out before. The findings support the need to further assess the prevalence of anxiety and anxiety related disorders among patients with UCP, and furthermore supports the need to offer and evaluate additional psychological services in relation to this substantial patient population.
### Key Recommendations

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<table>
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<tr>
<td>1</td>
<td>Implement a standardised system for recording presentations and outcomes on the patient database (e.g. drop down menu).</td>
</tr>
<tr>
<td>2</td>
<td>Identify rates of repeat attendance by individuals identified as NCCP.</td>
</tr>
<tr>
<td>3</td>
<td>Assess the actual prevalence of anxiety among those identified as NCCP.</td>
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<tr>
<td>4</td>
<td>Initiate a formal screening process based on the above after which a referral can be made to the relevant professional for brief assessment with a view to treatment.</td>
</tr>
<tr>
<td>5</td>
<td>Assess the relationship between anxiety and other common somatic symptoms presenting to ED, namely respiratory sensations such as shortness of breath.</td>
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<tr>
<td>6</td>
<td>Findings here support the need to offer and subsequently evaluate additional psychological services for NCCP patients. Research to date has highlighted the efficacy of brief/low intensity CBT and/or psycho-education interventions initiated in a timely way.</td>
</tr>
</tbody>
</table>

### References


Chambers, J. B., Marks, E. M., & Hunter, M. S. (2015). The head says yes but the heart says no: what is non-cardiac chest pain and how is it managed?. *Heart, heartjnl-2014.*


