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Trajectories and predictors of state and trait anxiety in patients receiving chemotherapy for breast and colorectal cancer: Results from a longitudinal study

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ABSTRACT

Purpose: To examine the trajectories and predictors of state and trait anxiety in patients undergoing chemotherapy for breast or colorectal cancer.
Methods: Secondary analysis of data collected as part of a large multi-site longitudinal study. Patients with breast or colorectal cancer completed validated scales assessing their state and trait anxiety levels (State-Trait Anxiety Inventory) and symptom burden (Rotterdam Symptom Checklist) at the beginning of each chemotherapy cycle. Longitudinal mixed model analyses were performed to test changes of trait and state anxiety over time and the predictive value of symptom burden and patients' demographic (age, gender) and clinical characteristics (cancer type, stage, comorbidities, ECOG performance status).
Results: Data from 137 patients with breast (60%) or colorectal cancer (40%) were analysed. Linear time effects were found for both state ($\chi^2 = 46.3$ [df = 3]; $p < 0.001$) and trait anxiety ($\chi^2 = 17.708$ [df = 3]; $p = 0.001$), with anxiety levels being higher at baseline and gradually decreasing over the course of chemotherapy. Symptom burden ($\beta = 0.21$; SD = 0.06; $p = 0.001$) predicted state anxiety throughout treatment, but this effect disappeared when accounting for trait anxiety scores before the start of chemotherapy ($\beta = 0.85$; SD = 0.05; $p < 0.001$). Patients' baseline trait anxiety was the only significant predictor of anxiety throughout treatment.
Conclusions: Changes in the generally stable characteristic of trait anxiety indicate the profoundly life-altering nature of chemotherapy. The time point before the start of chemotherapy was identified as the most anxiety-provoking, calling for interventions to be delivered as early as possible in the treatment trajectory. Patients with high trait anxiety and symptom burden may benefit from additional support.

1. Introduction

Anxiety in patients with cancer is a topic of great importance: previous research shows that this particular emotion is not only extremely common in this patient group (Burgess et al., 2005; Lewis et al., 2014), but it also has far-reaching effects on symptom experiences during treatment (Lockefeer and Vries, 2013; Saevarsdottir et al., 2010; Whitford and Olver, 2012), treatment compliance (Greer et al., 2008), patient outcomes such as experienced side-effects (Van Esch et al., 2011), and even survivorship (García-Torres and Alós, 2014). A useful theoretical framework for researching anxiety throughout the course of cancer treatment is Spielberger's anxiety model (Spielberger, 1989; Spielberger et al., 1983), which differentiates between state and trait anxiety.

State anxiety represents a transitory emotional state as a reaction to a particular stressor, e.g. being diagnosed with cancer, and fluctuates over time. Trait anxiety, on the other hand, is a stable susceptibility or proneness to experience anxiety and is regarded as a vulnerability factor for adverse reactions to stress. This distinction has been empirically tested and is consistently supported by research with various populations, ranging from psychiatric,

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psychosomatic, and medical patient groups to the general population (Spielberger and Reheiser, 2009). Considering this model when investigating the experiences of patients with cancer can help discern the influence of patients' anxiety predisposition and anxiety as a reaction to a stressful life event.

In the cancer care context, high trait anxiety is often accompanied by poor health status as well as negative self-perceptions and expectations for the future (Van Esch et al., 2011). It can also act as a precursor for developing symptoms of depression and fatigue (Lockefeer and Vries, 2013). Of significance is that no study to date has investigated if trait anxiety remains stable when undergoing treatment for cancer, as predicted by Spielberger's theory (Spielberger, 1989; Spielberger et al., 1983).

Unlike trait anxiety, trajectories of state anxiety in patients with cancer have been explored in few longitudinal studies. Lewis et al. (2014) repeatedly assessed anxiety levels of 213 patients with non-metastatic breast cancer undergoing radiotherapy. Within this patient group, initially high anxiety rapidly declined with the start of treatment, suggesting habituation effects. In women scheduled to receive chemotherapy for breast cancer, the time point before the first treatment cycle was also identified as being the most anxiety-provoking (Jacobsen et al., 1993). Baseline trait anxiety levels and chemotherapy toxicity contributed significantly to higher levels of state anxiety during treatment. This research provides preliminary insight into the development of patients' state anxiety over time, but in qualification, it must be added that state anxiety in both studies was only measured with a single-item visual analogue scale instead of a validated state anxiety questionnaire based on Spielberger's conceptualization (Spielberger et al., 1983).

Burgess et al., 2005 stress the importance of providing psychological support for patients with cancer as anxiety stays elevated even after chemotherapy cessation/completion. This however requires a thorough understanding of underlying processes and pre-cursors of higher levels of anxiety. Further, untangling the influence of situational factors (e.g. diagnosis, treatment commencement, symptom burden) and underlying characteristics of a person (e.g. general anxiety predisposition, symptom experience), can help to identify critical time points and patient groups most in need for interventions.

The current analysis aimed to enhance our understanding of the trajectories and predictors of both state and trait anxiety in patients with cancer undergoing chemotherapy for breast or colorectal cancer, addressing the following research questions:

a) How do state and trait anxiety levels change over the course of treatment?
b) Do any demographic (age, gender) or clinical characteristics (cancer type, staging, comorbidity, performance status, symptom burden) predict initial levels and/or the trajectories of state and trait anxiety over the course of treatment?
c) Does baseline trait anxiety affect state anxiety over the course of treatment?

Testing those questions for the specified patient groups is particularly interesting due to a number of reasons. Firstly, breast and colorectal cancer are two of the most commonly diagnosed forms of cancer (Westlake and Cooper, 2008; Torre et al., 2015). Breast cancer is the most prevalent type of cancer in females, with an estimated incidence rate of 44,400 in the UK alone (Westlake and Cooper, 2008) and 1.7 million cases per year worldwide (Torre et al., 2015). Colorectal cancer is the third most common cancer in males and the second in females, with a yearly incidence rate of 36,200 in the UK (Westlake and Cooper, 2008) and 1.4 million worldwide (Torre et al., 2015).

Considering the experience of both patient groups is useful as previous longitudinal research predominantly focused on anxiety in female breast cancer patients (e.g. Burgess et al., 2005; Jacobsen et al., 1993; Lewis et al., 2014; Lim et al., 2011; Van Esch et al., 2011). On the one hand, this is reasonable as women typically report more anxiety problems (McLean and Anderson, 2009), but additionally accounting for male patients in this study allows testing of such gender effects. Beyond this, cancer experiences differ for different types of cancer and therefore it is advisable to research different patient groups (LeMasters et al., 2013). Finally, considering in particular patients undergoing chemotherapy for an exploration of trait and state anxiety suggested itself as this treatment causes higher anxiety levels than other treatment types (Lim et al., 2011), possibly due to its often distressing and potentially life threatening side effects (Du et al., 2008).

2. Methods

2.1. Participants and procedures

Data presented in this article derived from the first phase of a wide-scale, before-and-after intervention study that was conducted at four health boards across the UK. The overall aim of the study was to examine the feasibility and acceptability of the use of the Advanced Symptom Management System (ASyMS), a mobile phone-based, real-time, remote patient-monitoring system to assist with the assessment and management of chemotherapy-related toxicity (Kearney et al., 2009).

The 'Before Phase', which was the basis for the secondary data analysis reported in this article, focused on the baseline investigation of patients' experiences of chemotherapy before the introduction of the intervention. It involved the longitudinal assessment of patients receiving standard care, whereas the 'After Phase' collected the same self-reported data from a separate group of patients using the ASyMS system while undergoing chemotherapy. A publication with respect to the primary analysis is currently in preparation and results concerning the intervention are available from the authors. Research Governance and ethical approval were obtained for all parts of this research (East of Scotland Research Ethics Service: REC Reference No 10/S0501/55). Data was collected for this phase from August 2011 to July 2013.

Health care professionals at each site approached patients diagnosed with non-metastatic breast or colorectal cancer receiving adjuvant chemotherapy treatment aged 18 years or over. Written informed consent was obtained from all interested patients. Demographic and clinical information was collected for study participants, who also completed a battery of self-report questionnaires (see measures) at baseline and with each chemotherapy cycle in a repeated-measures format for a total six consecutive assessments.

2.2. Measures

Demographic and clinical characteristics data were assessed at baseline. Participants provided basic demographic information regarding their age and gender. The following clinical characteristics were obtained reviewing participants' medical case notes: cancer type and stage, type of treatment, chemotherapy cycle length, comorbidities and physical functioning (ECOG performance status).

Anxiety was assessed using the 40-item State-Trait Anxiety Inventory (STAI), a widely used measurement of state and trait anxiety (Spielberger, 1989; Spielberger et al., 1983). Each subscale consists of 20 items that are rated on a 4-point scale. The total score range for each subscale is 20–80, higher scores indicating higher anxiety. The STAI has been extensively researched in various