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Adaptation and preliminary testing of the registered nursing forecasting (RN4CAST) nurse survey for use in the ambulatory chemotherapy setting

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Abstract

Purpose

This study aimed to adapt the Registered Nurse Forecast (RN4CAST) nurse survey making it appropriate to assess the working environments of ambulatory chemotherapy nurses, specifically focusing on care left undone.

Method

A two-phase approach was used. Firstly, cognitive interviews were conducted to adapt role specific sections of the RN4CAST nurses survey. The interviews were analysed to assess comprehension, retrieval, judgement and response processes to create the RN4CAST-chemotherapy assessment tool (CAT) survey. Secondly, a single centre feasibility study was undertaken to assess acceptability of the RN4CAST-CAT survey in an ambulatory chemotherapy setting. Results of the feasibility study were analysed using descriptive statistics and compared with routinely collected patient experience data.

Results

The cognitive interviews (n=6) resulted in important amendments to the RN4CAST-CAT. Response rate to the feasibility study was acceptable at 57% (n=12) and item completion rate was good (on average only 1 response missing per item). On average nurses looked after nine patients per shift, administered seven chemotherapy treatments and worked an hour and ten minutes over their contracted time. Main areas of care left undone were related to verbal communication with patients and assessing patient comorbidities and toxicities.

Conclusions

We were able to adapt the RN4CAST to make it suitable for use in the ambulatory chemotherapy setting. Our study offers preliminary evidence that the RN4CAST-CAT and methodology are feasible and acceptable within the ambulatory chemotherapy setting. Larger scale testing is now required and if validated the RN4CAST-CAT has the potential to provide useful insights into the impact of nursing workload on staff experience, patient care and outcomes on ambulatory chemotherapy settings.

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Adaptation and Preliminary Testing of the Registered Nursing Forecasting (RN4CAST) Nurse Survey for Use in the Ambulatory Chemotherapy Setting.

Introduction

Systemic anti-cancer therapy (or chemotherapy) is one of the most widely used cancer treatments and its usage has increased substantially in the last 20 years (NCAG, 2009) as rates of cancer incidence have increased (Ahmad, 2015). Most chemotherapy is delivered on a day case basis in ambulatory chemotherapy settings, which are largely nurse-led in the UK and Europe. Nurses in these settings are highly skilled in managing complex chemotherapy regimens in a timely fashion, despite high patient volumes and taxing psychological care responsibilities (Roe and Lennan, 2014). Whilst guidelines such as 'Safe staffing in adult inpatient wards' (NICE, 2014) exist to support the working environments of nurses in inpatient settings, specific tools to guide the organisation and workload management of nurses in ambulatory chemotherapy settings are lacking.

An analysis of routine data collected in the UK found higher rates of mortality in patients receiving first-line chemotherapy treatments than at any other stage of cancer treatment (NCEPOD, 2008). In the UK, both the National Confidential Enquiry into Patient Outcomes and Death (NCEPOD, 2008) and Public Health England's reports on this data (Wallington et al., 2016) suggested a variety of causes for this, including failures to undertake clinical assessments pre-treatment and prospectively record chemotherapy-induced symptoms in patient records resulting in delays in patients seeking timely medical support. These combination of factors suggest the need for further investigation into the ambulatory chemotherapy workforce, and that in particular understanding the role of missed care, will be necessary to improve mortality rates for this patient group.

Few studies have explored the work of chemotherapy nurses. Those that exist highlight increasing workload and rising patient numbers causing delays to scheduling (Wiseman et al., 2008). For example, Blay et al. (2002) calculated the hours worked by Full-Time Equivalent (FTE: a way of measuring hours of employment to make them comparable) chemotherapy nurses to be 7.2 hour per day as compared with 6.0 hours for radiotherapy clinicians, indicating chemotherapy nurses working at their maximum capacity. At the same time

chemotherapy nurses' workload is reported to be dominated by non-direct care activities, such as staff supervision, laboratory data interpretation and handling telephone queries (Blay et al., 2002, Souza et al., 2014).

The Registered Nurse Forecast (RN4CAST) study was conducted to predict future nursing requirements on acute medical and surgical inpatient wards by measuring the effect of variations in nursing environments, nurse-to-patient ratios, workload and the quality of the workplace, on patient and nurse outcomes (Aiken et al., 2013). The original study took place in 488 hospitals across 12 countries and showed that despite large differences in healthcare organisation and funding, the relationships between variables were consistent across healthcare systems. Specifically, increased burnout led to reduced patient safety (including missed care) and larger numbers of degree level nurses were associated with lower mortality rates and shorter lengths of hospital stay (Aiken et al., 2012, Aiken et al., 2013, Aiken et al., 2014).

The RN4CAST tool has the potential to provide valuable insights into the working environment and future workforce requirements for ambulatory chemotherapy nurses. The aims of this study, therefore, were to adapt the care specific components of the RN4CAST tool and make them relevant to the ambulatory chemotherapy setting. These care specific components assessed 1) the quality and safety of nursing care provided and 2) nursing care activities left undone. Furthermore, we sought to make a preliminary assessment of the feasibility and acceptability of the adapted RN4CAST tool within the ambulatory chemotherapy setting.

Methods

This study used a two-phase mixed-methods approach that comprised of: 1) the development of the adapted RN4CAST-chemotherapy ambulatory tool (CAT) following a focused literature review and cognitive interviews with chemotherapy nurses; 2) preliminary feasibility testing with nurses from an ambulatory chemotherapy setting in a London hospital to assess acceptability, data quality and generate preliminary estimates of outcomes in this setting.

Ethical Considerations

Ethical approval was granted for the study by the NHS Health and Research Authority (HRA 216410) and locally by the hospital R&D committee. Ethical approval was also granted by King's College London Research and Ethics Committee (LRU-16/17-4042). Permission was granted for use and adaptation of the RN4CAST tool from Linda Aiken on behalf of the leaders of the RN4CAST consortium.

Phase 1: RN4CAST adaptation

The original RN4CAST tool was made up of the five measures outlined in Table 1, three are generic (Section A) whilst two are role specific (Sections B & C) to general medical or surgical inpatient wards. The latter two measures were adapted for the RN4CAST-CAT.

Table 1: Original RN4CAST nurses measures

Measure name	Description of measure	Potential use in ambulatory cancer setting
(Section A) Practice environment and job satisfaction Practice Environment Scale of the Nursing Work Index (PES-NWI) (Lake ET. 2002)	32 items covering nurse Participation in hospital affairs (8 items); Quality of care (9 items); Nurse manager and support of nurses (4 items); Staffing adequacy (4 items); Nurse-doctor relations (7 items)	Generic questionnaire, suitable for use across nursing roles and settings
(Section A) Staffing levels and workload	8 items covering satisfaction with job, working environment and intention to leave job or nursing	Generic questionnaire, suitable for use across roles and settings
(Section A) Nurse Burnout Maslach Burnout Inventory Scale (MBI) (Maslach, 1996)	22 items, measures Emotional exhaustion (EE) (9 items), Personal accomplishment (PA) (8 items) Depersonalisation (DP) (5 items)	Validated and suitable for use across roles and settings
(Section B) Quality and Safety Adapted version of Hospital Survey on Patient Safety Culture (AHRQ, 2004)	5 items asking nurses to rate quality of care, one 7 item Likert scaled question on patient safety.	Generic questions suitable for use across roles and settings
Created by RN4CAST (Aiken, 2012)	One question detailing Occurring 13 incidents items	Role Specific- requires adaptation and development for use in ambulatory chemotherapy settings
(Section C) Activities done and left undone Created by RN4CAST (Aiken, 2012)	10 items on numbers of patients cared for and type of care provided. Non-direct care activities (9 items) and Care left undone (13 items)	Role specific- requires adaptation and development for use in ambulatory chemotherapy settings
In addition, the RN4CAST survey includes a demographic section with six generic questions about nursing demographics, the layout of these were adapted slightly so they are relevant to chemotherapy nurses		

Literature Review

A focused literature review was undertaken to explore available literature on the practice environment of ambulatory chemotherapy nurses in order to identify nursing activities relevant to this setting. Of 1809 identified papers, only four were included as relevant in the final synthesis, highlighting the lack of research on the ambulatory chemotherapy setting. Key activities and factors affecting work environment identified in the selected papers were used to create items relevant to 1) ambulatory chemotherapy nurse's workload and patient safety (Section B) and 2) the type of care activities that are undertaken in the ambulatory cancer setting that might be left undone (Section C). Table 2 shows the changes made to items in Sections B & C evidenced by either the papers included in the literature review or as advised by expert opinion of two Advanced Nurse Practitioners from chemotherapy settings.

Table 2: Explanation and evidence for changes made for the RN4CAST-CAT version 1

Original RN4CAST item	Revised RN4CAST-CAT item (either removed/ replaced with/ not changed or additional)	Lit review evidence/ Expert opinion
Section B: How often would each of the following incidents occur involving you or your patients? (Incidents Occurring)		
Patient wrong medication time or dose	Unchanged	Expert opinion
Pressure ulcer after admission	Prescription incomplete	Expert opinion
Patient falls with injury	Chemotherapy transfusion reaction	Expert opinion
Healthcare-associated infection:	Extravasation at cannula site	Expert opinion
Complaints from patients or families	Unchanged	Expert opinion
Verbal abuse towards nurses	Verbal abuse towards nurses	Expert opinion
Physical abuse towards nurses:	Removed	Expert opinion
Work related physical injury to nurses	Work related injury to nurses, needle stick or medication spill	Expert opinion
	Patient requires medical or Acute Oncology review	Expert opinion
	Walk-in or un-booked patients	Wiseman et al. 2005
Section B: About your most recent shift at this hospital		
Shift worked	Removed	Kamimura et al. 2012
Number hours contracted to work per shift	Number hours contracted to work per shift	Kamimura et al. 2012
Hours worked over contracted hours	Hours worked over contracted hours	Kamimura et al. 2012
Number patients directly responsible for?	Number chemotherapy administrations	Kamimura et al. 2012
	Comparison with usual workload	Kamimura et al. 2012
Number patients directly responsible for requiring a. assistance with ADLs b. hourly monitoring of treatments	Time spent on non-direct care activities	Wiseman et al. 2005 Blay et al. 2002
Describe caring role	Describe care provided	Alves de Souza et al. 2013
Total number patients on ward	Removed	Expert opinion
Number RNs providing direct patient care	Removed	Expert opinion
Number other nursing care staff providing care	Removed	Expert opinion
Section C: On your most recent shift, which of the following care activities were left undone because you lacked time to complete them?		
Adequate patient surveillance	Unchanged	Expert opinion
Skin care	Removed	Expert opinion
Oral hygiene	Assess chemotherapy toxicities with previous cycle	Expert opinion
Pain management	Patient pain medication/ management advice	Expert opinion
Comfort/talking to patients	Adequate time providing emotional support	Blay et al. 2002
Educating patients/families	Education on symptom management	Blay et al. 2002
Treatments & procedures	Assess patient managing comorbidities	Blay et al. 2002
Administer medications on time	Removed	Expert opinion
Preparing patients for discharge	Discharge planning/ arranged referrals/ transport	Blay et al. 2002
Adequately documenting nursing care	Unchanged	Blay et al. 2002
Develop or update care plans/ patient pathways	Update patients performance status	Expert opinion
Planning care	Removed	Expert opinion
Frequent changing of patient position	Removed	Expert opinion

Cognitive Interviewing

The RN4CAST-CAT contents were then evaluated using cognitive interviewing with ambulatory chemotherapy nurses. This method is used to try to understand peoples' thought processes when answering questions and helps to ensure survey tools are valid and reliable (Tourangeau et al., 2000). The four stages of cognitive interviewing are described in Figure 1.

Figure 1: Cognitive Theory (Tourangeau et al. 2002)

We aimed to recruit a purposive sample of 8-10 ambulatory chemotherapy nurses for cognitive interviewing (Coyne, 1997). London-based nurses employed to administer chemotherapy, who were not working at the site planned for the feasibility study, were eligible to participate. They were recruited both by advertising in the February 2017 newsletter of the UK Oncology Nurses Society (UKONS) and by using snowballing method, whereby senior UKONS members forwarded email invitations to eligible colleagues.

The cognitive interviews were audio recorded with participants providing prior written consent. Participants were asked to complete Sections B and C of RN4CAST-CAT. At the same time they were asked to describe their thought processes aloud, encouraged by the researcher asking probing questions such as ‘what does that word mean to you?’ and asking them to provide personal examples for clarity (Beatty and Willis, 2007; Blair and Presser, 1993). The audio recordings were listened to and issues, discussions and summaries of changes made were recorded using a tracking matrix (Online Appendix A) which was developed by the authors and based on Tourangeau’s method.

Data Analysis

Each item was analysed based on the four stages of cognitive interviewing (comprehension, retrieval, decision and response processes). Items for which recurrent issues were identified by interviewees were amended.

Results

The cognitive interviews were conducted in two iterative rounds and the survey content was amended following each round. Six nurses participated in the first round and two in the second. Two were recruited via the UKONS mail out and six by snowballing. All participants were female, on NHS Agenda for Change (AfC) pay scales 5-8 and had between 1-26 years' experience of working in oncology.

Figure 2: Content validity of cognitive process

Figure 2 summarises the overall number of issues identified during the interviews, the majority of which arose due to comprehension and response processes. Table 3 shows an example of a completed tracking matrix used to analyse one of the items from the Care Left Undone item. One issue was found for each of the comprehension, retrieval and decision processes and four for the response process in the first round. The changes made (summarised in table) improved the item resulting in fewer issues for round two. This method was repeated for all items in sections B and C and additional items were added to capture any areas which nurses suggested; such as '*Walk in or un-booked patients requiring assistance e.g. PICC lines, medication*' in the '*Incidents Occurring*' (Section B). Indications for no change were documented in the matrix which demonstrated all items were analysed with the same meaningfulness; the importance of this is emphasised by Willis et al. (2015).

Table 3: Cognitive Interviewing Matrix for Item 22a: Care left Undone

Question 22a. Adequate patient surveillance/ monitoring (n=4)				
Round one				
Comprehension process	Retrieval process	Decision process	Response process	Summary of changes made to item/ Corrected Q.
Yes (1) No (4)	Yes (1) No (3)	Yes (1) No (3)	Yes (4) No (0)	
'Site and rate check I think would be more important'	'How the chairs are laid out you're always keeping an eye'	'I would always tell my patients to contact me, don't think you can ever say never'	'Answered using descriptive words' 'I would say sometimes' 'I think it's probably better to have a scale' 'Balance between patient education of something going wrong, we may tend to rely on that'	Adequate patient and transfusion monitoring 7 point Likert scale added, from Never to A few times a day'
Round two Q22a: Adequate patient and transfusion monitoring (Never, a few times a year, once a month or less, a few times a month once a week, a few times a week, every day) (n2)				
Comprehension issue	Retrieval issue	Decision process	Response process	Summary of changes made to item (if necessary)
Yes (1) No (1)	Yes (0) No (2)	Yes (0) No (2)	Yes (0) No (2)	
'Again should be infusion here'				Adequate patient and infusion monitoring

Phase 2: Preliminary Testing of the RN4CAST-CAT

A small-scale feasibility study was conducted with ambulatory chemotherapy nurses in a central London hospital to assess the acceptability of the RN4CAST-CAT. Information collected will be used to inform a larger validation study.

Measures

Validated and reliable tools from the original RN4CAST study were used alongside the amended sections of the RN4CAST-CAT. These included the Practice Environment Scale of Nursing Work Index (PES-NWI) (Lake, 2002), RN4CAST Job Satisfaction Scale (Wanous et al., 1997) and Maslach Burnout Inventory (MBI) (Maslach et al., 1996). These measures assess work environment, job satisfaction and burnout in health service workers respectively and are generic, not role specific. This enabled comparison of the feasibility study findings with the RN4CAST study.

Method

The study was conducted in a London Cancer Centre. It was introduced to registered nurses working in the ambulatory care setting at staff meetings on two days in 2017 and information sheets were given out. All permanent members of nursing staff of any band were eligible to participate. On each of the data collection dates, all nurses were given the RN4CAST-CAT survey prior to their shift, replicating the methodology of the original RN4CAST study. Nurses submitted completed surveys anonymously via a collection box, the process of submission assumed nurses' consent to participate in the study. In addition, routinely collected information on patient reported experience was ascertained on the same two days using the Patient Reported Chemotherapy Indicators of Symptoms and Experience (PR-CISE) survey (Armes et al., 2014). This 22-item Likert scale measure was used to see if any comparisons could be drawn between findings from the nurses completing the RN4CAST-CAT and patient reported experiences.

Data analysis

As the aim of the study was to assess preliminary feasibility/acceptability and the sample was small only descriptive analysis of the data is presented. Response rates, participant's characteristics and the extent of missing data were used to assess feasibility of using the RN4CAST-CAT in a larger study. Data quality and estimates were assessed by describing the variability in estimates for each of the survey sub-scales (e.g. mean and standard deviation, median and interquartile range) for the RN4CAST-CAT and the generic measures included in the original RN4CAST study (MBI, PES-NWI) as well as the measure of patient experience (PR-CISE). In this paper, in the interests of brevity, we present results for amended sections of RN4CAST (B and C), MBI and PR-CISE (results for PES-NWI are available on request).

Results

Participant Characteristics

Of the 21 surveys distributed 12 were completed giving a response rate of 57%. Participants' characteristics are shown in Table 3. Overall the staff had a range of qualifications, AfC band and demographic characteristics.

Table 4: Pilot study participant characteristics

Participant Characteristics		
Gender	(n=12)	(%)
Male	0	0
Female	11	92
Missing	1	8
Qualification	(n=12)	(%)
Degree level	9	75
Non Degree	2	17
Missing	1	8
AFC Band	(n=12)	(%)
6	5	42
5	4	33
Missing	3	25
	Mean	SD
Age	29.7	6.8
Years in career	5.2	3.0
Years in specialty	3.1	1.3
Years on ACS	1.3	0.4
	Mean (SD)	(Median) (IQR)
Workload Items of nurses per day		
Contracted hours	8 (1.7)	8 (7.5, 9.8)
Hours worked over contracted hours	1.1 (0.7)	0.5 (0.4, 2.0)
No. of chemotherapy administrations	6.6 (2.6)	7.0 (6.0, 8.0)
No. provided supportive care for	2.3 (2.6)	1.0 (0.0, 0.0)
Walk-in's cared for	0.2 (0.6)	6.0 (4.5, 6.0)
Total cared for	8.5 (2.9)	8.0 (7.0, 9.0)

RN4CAST-CAT: workload

There was variability in the number of hours worked over contracted hours (Table 4). On average nurses worked an extra 30 minutes, but two nurses reported working two hours more and two worked no extra time. The median number of people cared for per nurse was eight whilst the median number of chemotherapy treatments administered was seven. There was little missing data.

RN4CAST-CAT: care left undone

Overall completion rates for this section were good, with little missing data (see Table 5).

Two areas of care left undone reported by just over half the respondents were 'checking patient's management of comorbidities' and 'exploring changes to performance status' with these happening a few times a month or more. Four items were reported as being left undone daily by at least one respondent: referrals to other services, adequate infusion monitoring and discussion with patients about specific toxicities. Two respondents reported adequate documentation being left undone daily.

Table 5:
Reported care left
undone

Item	Never	A few times year less	Once a month or less	A few times a month	Once a week	A few times week	Daily	Missing
Adequate patient and Infusion monitoring	6	0	1	1	1	1	1	1
Symptom management	5	1	2	2	0	1	0	1
Discussed specific toxicities	5	0	1	2	2	0	1	1
Educating patients on symptom management	6	0	1	2	2	0	0	1
Checked patient is managing comorbidities	2	1	1	6	0	1	0	1
Explored ECOG status changes	3	0	1	5	1	1	0	1
Referrals to other services	5	1	1	2	0	1	1	1
Adequately documented nursing care	7	0	1	0	0	1	2	1

Burnout

Overall completion rates of the Maslach Burnout scale were very good (12/12). Figure 3 below shows seven (60%) of the respondents reported a medium level of emotional exhaustion and a further four (33%) were categorised as high. Personal accomplishment during the shift was rated as medium or high by nearly all respondents. However, depersonalisation, which is described as nurses feeling de-humanised and having cynical attitudes towards patients in their care (Maslach et al., 1996), was considerable with 60% (7) scoring medium or high. Full subscale scores are available in online Appendix B.

Figure 3: MBI subscale total scores

Feasibility of simultaneously collecting patient experience data

Overall 32 patients completed the patient experience measure: PR-CISE, on the same two dates as the nurses' surveys (Table 6). Over the two-day period, not all patients answered 'Yes' to the question asking whether they would recommend the unit to their relatives with some leaving it blank and around a third would only recommended it to a certain extent. In general, patients reported they were made to feel welcome by nursing staff and treatments

were well explained. However, only 40% of patients each day reported that nurses asked them about their symptoms; 12% and 27% on each day, respectively, reported that they were not asked.

Table 6: PR-CISE data (n=32)

Key: Data collection Day 1: (n=17) Data collection Day 2: (n=15)	Day	Yes (%)	Yes, to some extent (%)	No (%)	Don't know/ remember (%)	Missing (%)
Upon arrival to the Unit today, were you made to feel welcome by the nursing staff?	1	17 (100)	0	0	0	0
	2	10 (67)	2 (13)	0	0	2 (20)
Before starting my first chemotherapy I was given a clear explanation by a nurse of what the treatment would involve	1	13 (75)	4 (24)	0	0	0
	2	12 (80)	0	0	0	2 (20)
I feel that the treatment was rushed and that the chemotherapy nurses do not have enough time	1	1 (6)	0	15 (88)	0	1 (5.9)
	2	1 (7)	2 (13)	8 (53)	0	4 (27)
Do the nurses who give you chemotherapy ask you about your symptoms?	1	7 (41)	5 (29)	2 (12)	0	3 (18)
	2	6 (40)	0	4 (27)	0	5 (33)
How likely are you to recommend our unit to friends and family if they needed similar care or treatment?	1	10 (59)	5 (29)	0	0	0
	2	7 (47)	5 (33)	0	0	3 (20)

Discussion

This two-phase study is the first, to our knowledge, to adapt the RN4CAST to the ambulatory chemotherapy setting and undertake preliminary feasibility testing within this setting.

Cognitive interviewing enabled us to make some important changes to the RN4CAST instrument and make it relevant for the ambulatory chemotherapy setting. This demonstrates the importance of adapting questionnaires to the context in which they will be used to ensure face validity and usability before measures are tested more widely. Most of the adaptations required were about ensuring appropriate response options were available to capture chemotherapy nurses' experience of their day-to-day work or to improve comprehension by improving clarity of the wording.

Feasibility of the RN4CAST-CAT

Our study suggests that the RN4CAST-CAT survey and its methodology are feasible and acceptable within the ambulatory chemotherapy setting. The response rate was 57% which is comparable to the nurse response rates from the original RN4CAST: Europe=62% (Aiken et al., 2013) and England=39% (Ball et al., 2012). However, the sample size was small and so

further testing is required to identify the barriers and facilitators to taking part through user-engagement with chemotherapy nurses before conducting a larger validation study.

Although the RN4CAST survey was not necessarily designed to measure activities at a ward level, overall it is reassuring that the results here suggest that the adapted tool was sensitive enough to measure the varying degrees of care left undone across the two-day study period. This is particularly important because under-reporting of care left undone or self-report bias has been discussed in other studies (Attree, 2007, Kalisch and Williams, 2009, Polit and Beck, 2010). In this study the care items with the highest rates of being left undone were those relating to verbal communication with patients; checking to see how patients were managing any comorbidities (e.g. stomas, diabetes or hypertension) at home; or the way they were able to carry out their activities of daily living with their current disease progression or symptom burden. The original RN4CAST findings are similar, with care items most frequently left undone being comforting patients (66%) and educating patients (52%) (Ausserhoff et al. 2014).

In this study the reporting of adequate patient and infusion monitoring being left undone is concerning from a care and risk management perspective, with five nurses reporting this happening more than once a month and three reported not doing this a few times a week. However, with regards to the acceptability of the RN4CAST-CAT, it is reassuring that nurses felt able to provide open and transparent answers in this small-scale testing. This finding reflects results from the inpatient acute settings in the UK RN4CAST, where a lack of sufficient patient monitoring has been posited as a key mechanism for the association between inadequate staffing levels and high mortality rates (Ball et al., 2013, Lankshear et al., 2005). This has been explored in more recent work on nurse staffing, missed vital signs and patient mortality in acute care (Griffiths et al., 2018).

Just over half the nurses (54%) reported not asking patients about specific toxicities before starting their chemotherapy treatments at least once a month or more and a similar number (40%) of patients also reported not being asked about toxicities in the PR-CISE patient experience survey. Routine monitoring of patient toxicities is an important part of the

chemotherapy nurse role (Blay et al. 2002) and so it will be important to explore this further in a multi-centre study.

Although levels of personal accomplishment for nurses were high, it is concerning that overall rates of emotional exhaustion and depersonalisation were equally high and these findings are similar to the high levels of emotional exhaustion and depersonalisation found in previous studies in oncology nurses in Helsinki (Kutluturkan et al., 2016), and the original UK RN4CAST study (Ball et al., 2012). Although these findings are not generalisable due to the preliminary nature and small sample size of this study, this warrants further exploration in larger multicentre studies.

Limitations

This was a preliminary study designed to lay the foundation for further research into this field. Further testing is needed to assess the validity and reliability of the RN4CAST-CAT. Further adaptations and cognitive interviews would need to be undertaken if it were to be used in a similar fashion to the original RN4CAST survey to ensure acceptability in different countries and translated for use in different healthcare contexts. Due to the small sample sizes in both phases caution should be exercised when interpreting the results. However, the cognitive interviews incorporated considerable topic depth and there was a noticeable reduction in issues found between rounds one and two which potentially signifies data saturation (Beatty, 2007).

For the PR-CISE tool there was some item missing data (ranging from 5-20%) which probably reflects that this tool is currently used and collects data as part of routine clinical practice with patient completing the measure around usual care and treatment activities on the ward. For any future research studies strategies to minimise the amount of missing data should be explored. However, it is reassuring that for the RN4CAST-CAT there was little missing data ($n=1$ per item), which perhaps offers preliminary evidence as to the acceptability of the tool items to the nurses completing it. Lessons learnt from the recruitment process and the response rate for the feasibility study could also be used to inform recruitment strategies and sample size for a larger pilot study.

Not all patients present on the ambulatory cancer setting were asked to complete the PR-CISE data on the days of data collection so it would not be appropriate to explore associations between these and the nurses survey since they may not be representative of the total population. However, as previously discussed the results found from the Care Left Undone section of the nurse's survey supported the results from the toxicities question of the PR-CISE data, suggesting the utility of this association should be explored in future studies.

Conclusions

We have successfully adapted RN4CAST so it is relevant for the ambulatory chemotherapy setting. In addition, we have provided preliminary evidence that RN4CAST-CAT is acceptable and feasible to use. Further larger scale pilot testing is now required to assess the RN4CAST-CAT validity, reliability and utility. If further validated, we believe the RN4CAST-CAT could increase our understanding of challenges facing the chemotherapy nursing workforce and facilitate exploration of potential links between staffing levels, nurse well-being, patient experience and outcomes.

References

- Ahmad, A. S., Ormiston-Smith, N. & Sasieni, P. D. 2015. Trends in the lifetime risk of developing cancer in Great Britain: comparison of risk for those born from 1930 to 1960. *Br J Cancer*, 112, 943-7.
- Aiken, L. H., Sermeus, W., Van Den Heede, K., Sloane, D. M., Busse, R., Mckee, M., Bruyneel, L., Rafferty, A. M., Griffiths, P., Moreno-Casbas, M. T., Tishelman, C., Scott, A., Brzostek, T., Kinnunen, J., Schwendimann, R., Heinen, M., Zikos, D., Sjetne, I. S., Smith, H. L. & Kutney-Lee, A. 2012. Patient safety, satisfaction, and quality of hospital care: cross sectional surveys of nurses and patients in 12 countries in Europe and the United States. *BMJ*, 344, e1717.
- Aiken, L. H., Sloane Dm Fau - Bruyneel, L., Bruyneel L Fau - Van Den Heede, K., Van Den Heede K Fau - Sermeus, W. & Sermeus, W. 2013. Nurses' reports of working conditions and hospital quality of care in 12 countries in Europe. *International Journal of Nursing Studies*.
- Aiken, L. H., Sloane, D. M., Bruyneel, L., Van den Heede, K., Griffiths, P., Busse, R., ... RN4CAST consortium. 2014. Nurse staffing and education and hospital mortality in nine European countries: a retrospective observational study. *Lancet London, England*, 383, 1824–1830. doi:10.1016/S0140-6736(13)62631-8
- Armes, J., Wagland, R., Finnegan-John, J., Richardson, A., Corner, J. & Griffiths, P. 2014. Development and testing of the patient-reported chemotherapy indicators of symptoms and experience: patient-reported outcome and process indicators sensitive to the quality of nursing care in ambulatory chemotherapy settings. *Cancer Nurs*, 37, E52-60.
- Ausserhofer, D., Zander, B., Busse, R., Schubert, M., De Geest, S., Rafferty A. M., Ball, J., Scott, A., ... 2014. Prevalence, patterns and predictors of nursing care left undone in European hospitals: results from the multicountry cross-sectional RN4CAST study *Quality and Safety in Health Care* 23, 126-135
- Attree, M. 2007. Factors influencing nurses' decisions to raise concerns about care quality. *Journal of Nursing Management*, 15, 392-402.
- Ball, J., Pike, G., Griffiths, P., Rafferty, A. & Murrells, T. 2012. National Nursing Research Unit RN4CAST Nurse Survey in England.
- Ball, J. E., Murrells T Fau - Rafferty, A. M., Rafferty Am Fau - Morrow, E., Morrow E Fau - Griffiths, P. & Griffiths, P. 2013. 'Care left undone' during nursing shifts: associations with workload and perceived quality of care.
- Beatty, P. C. & Willis, G. B. 2007. Research Synthesis: The Practice of Cognitive Interviewing. *Public Opinion Quarterly*, 71, 287-311.
- Blair, J. & Presser, S. 1993. Survey procedures for conducting cognitive interviews to pretest questionnaires: A review of theory and practice. . *Annual Meetings of the American Statistical Association*
- Blay, N., Cairns, J., Chisholm, J. & O'baugh, J. 2002. Research into the workload and roles of oncology nurses within an outpatient oncology unit. *European Journal of Oncology Nursing*, 6, 6-12.
- Coyne, I. T. 1997. Sampling in qualitative research. Purposeful and theoretical sampling; merging or clear boundaries? *Journal of Advanced Nursing*, 26, 623-630.
- Griffiths, P. Ball, J. Bloor, K. Böhning, D. Briggs, J. Dall'Ora, C. De Longh, A. Jones, J. Kovacs, C. Maruotti, A. Meredith, P. Prytherch, D. Recio Saucedo, A. Redfern, O. Schmidt, P.

- Sinden, N. Smith, G. 2018. Nurse staffing levels, missed vital signs and mortality in hospitals: retrospective longitudinal observational study. *Health Services and Delivery Research*, 6, 38
- Kalisch, B. J. & Williams, R. A. 2009. Development and psychometric testing of a tool to measure missed nursing care. *J Nurs Adm*, 39, 211-9.
- Kamimura, A. Schneider, K. Lee, C. S. Crawford, S. D. & Friese, C. R. 2012 Practice environments of nurses in ambulatory oncology settings: a thematic analysis. *Cancer Nursing*, 35 (1) 1-7
- Kutluturkan, S., Sozeri, E., Uysal, N. & Bay, F. 2016. *Resilience and burnout status among nurses working in oncology*.
- Lake, E. T. 2002. Development of the practice environment scale of the Nursing Work Index :'. *Res Nurs Health*, 25, 176-88.
- Lankshear, A. J., Sheldon Ta Fau - Maynard, A. & Maynard, A. 2005. Nurse staffing and healthcare outcomes: a systematic review of the international research evidence. *ANS Adv Nurs Sci*, 28, 163-74.
- Maslach, C., Jackson, S. E. & Leiter, M. 1996. Maslach Burnout Inventory: Manual. 3 ed. Palo Alto, CA: Consulting Psychologist Press.
- NCEPOD. Mort, D. L., M. Smith, N. Protopapa, K. Mason, M. . 2008. Systemic Anti-Cancer Therapy: For better or for worse? National Confidential Enquiry into Patient Outcome and Death. . Available: <https://www.ncepod.org.uk/2008sact.html>.
- NCAG 2009. Chemotherapy Services in England: Ensuring quality and safety. *In*: HEALTH, D. O. (ed.).
- NICE 2014. Safe staffing for nursing in adult inpatient wards *Safe Staffing Guidelines*.
- Polit, D. F. & Beck, C. T. 2010. *Essentials of Nursing research: Appraising evidence for nursing practice*, Philadelphia, Wolters Kluwer Health/ Lippincott Williams & Wilkins.
- Roe, H. & Lennan, E. 2014. Role of nurses in the assessment and management of chemotherapy- related side effects in cancer patients. *Annual review of nursing research*, 4, 103-115.
- Souza, C. a. D., Jericó, M. D. C. & Perroca, M. G. 2014. Measurement of nurses' workload in an oncology outpatient clinic. *Revista da Escola de Enfermagem da USP*, 48, 97-103.
- Torangeau, R., Rips, L. J. & Rasinski, K. 2000. The psychology of survey response. Cambridge, UK: Cambridge University Press.
- Wallington, M., Saxon, E. B., Bomb, M., Smittenaar, R., Wickenden, M., Mcphail, S., Rashbass, J., Chao, D., Dewar, J., Talbot, D., Peake, M., Perren, T., Wilson, C. & Dodwell, D. 2016. 30-day mortality after systemic anticancer treatment for breast and lung cancer in England: a population-based, observational study. *Lancet Oncol*, 17, 1203-16.
- Wanous, J. P., Reichers, A. E. & Hudy, M. J. 1997. Overall job satisfaction: How good are single-item measures? *Journal of Applied Psychology*, 82, 247-252.
- Willis, G.B., 2015. Analysis of the cognitive interview in questionnaire design. Oxford University Press.
- Wiseman, T., Verity, R., Ream, E. & Alderman, E. 2008. Exploring the work of nurses who administer chemotherapy. *European Journal of Oncology Nursing*, 3, 244-252.

Appendices

Appendix A: Exemplar Cognitive Interviewing Matrix

Phase One: Cognitive interviewing tracking matrix

Question 9h. Adequately documented nursing care

Round one

Comprehension issue	Retrieval issue	Decision process	Response process	Summary of changes made to item/ Corrected Q.
Yes/ No	Yes/ No	Yes/No	Yes/No	
Descriptive Quote	Descriptive Quote	Descriptive Quote	Descriptive Quote	

Appendix B: Full Burn out subscale findings

	Mean (SD) Min	Median (IQR) Max
Emotional Exhaustion Subscale (9 items)		
	25.3 (9.4)	21.5 (7)
EE subgroup totals		Low (0-16) 1 Medium (17-26) 7 High (27>) 4
Personal Accomplishment Subscale (8 items)		
	39.3 (5.4)	39 (9.5)
PA subgroup totals		Low 0-35 1 Medium 32-38 5 High 39> 6
Depersonalisation Subscale (5 items)		
DP subgroup totals	8.1 (4.8)	7.5 (9)
		Low 0-6 5 Medium 7-12 4 High 13> 3

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Highlights:

- The RN4CAST-CAT was adapted in this study using two rounds of cognitive interviewing with current ambulatory chemotherapy nurses, preliminary testing of the tool then took place to assess its acceptability.
- Results from preliminary testing of RN4CAST-CAT on one ambulatory chemotherapy unit showed it as feasible to use and acceptable to ambulatory chemotherapy nurses. Wider scale testing of this tool is now required.
- If validated this tool could prove useful for workforce planning to determine levels of safe staffing in the ambulatory chemotherapy setting

Conflict of Interest statement

Declarations of interest: none

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