Case series of a knowledge translation intervention to increase upper limb exercise in stroke rehabilitation

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Abstract

Background and purpose: Current approaches to upper limb rehabilitation are not sufficient to drive neural reorganisation and maximise recovery after stroke. To address this evidence-practice gap we developed a knowledge translation intervention using an established framework, the Behaviour Change Wheel. The intervention involves collaborative working with stroke therapy teams to change their professional practice, and increase therapy intensity by therapists prescribing supplementary self-directed arm exercise. The purposes of this case series are: (1) to provide an illustrative example of how a research-informed improvement process changed clinical practice and (2) to report on staff and patients' perceptions of the utility (i.e. the usefulness and usability) of the developed intervention.

Case descriptions: A participatory action research approach was used in three stroke rehabilitation units in the United Kingdom. All physiotherapists, occupational therapists, therapy assistants and therapy managers participated in the **knowledge translation** process. The intervention aimed to change four therapist level behaviours: (i) screening patients for suitability for supplementary self-directed arm exercise, (ii) provision of exercises, (iii) involving family/carers in assisting with exercises and (iv) monitoring and **progressing** exercises. **Data on changes in practice** were collected by therapy teams using a bespoke audit tool. Utility of the intervention was explored in qualitative interviews with patients and staff.

Outcomes: Components of the intervention were successfully embedded in two of the three stroke units. At these sites almost all admitted patients were screened for suitability for supplementary self-directed exercise. 77%, 70% and 88% of suitable patients across the three sites were provided exercises. Involving family/carers, and monitoring and **progressing** exercises, were not performed consistently.

Conclusions: This study is an example of how a rigorous research-informed knowledge translation process resulted in practice change. A screening process for suitability and provision of supplementary exercise was embedded in stroke rehabilitation units. Further research is needed to demonstrate that these changes can translate into increased intensity of upper limb exercise in acute stroke rehabilitation settings and affect patient outcomes.

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Background and purpose

It is widely accepted that a research-practice gap **exists** in physical therapy **with regards to intensity of rehabilitation**[1,2]. One potential explanation for this gap may be the way in which the research evidence is produced in the first instance. That is, while high intensity clinical trials have demonstrated the efficacy of stroke rehabilitation interventions they have involved highly selective patients, extra resources, highly trained specialised research clinicians, etc. **The effectiveness of these interventions in the usual care environment has been far less tested, but such studies are needed to ensure that the interventions still have the desired effects when delivered in today's health care settings involving existing personnel,** procedures and infrastructure [3]. Knowledge translation (KT) studies have been proposed as a means of addressing this **gap between evidence from interventions tested under 'research conditions' and the effectiveness of delivery in every-day clinical life.** KT is the exchange, synthesis, and ethically sound application of knowledge – within a complex system of interactions among researchers and users – to accelerate capture of the benefits of research[4]. KT embraces a constructivist approach to research utilisation recognising that knowledge is created by active and engaged users, often in a non-linear and emergent fashion[5].

Using a published framework, the Behaviour Change Wheel[6], we have developed an intervention to promote knowledge translation and address a research-practice gap in upper limb rehabilitation after stroke. Task-oriented training **involving hundreds of repetitions** is required to drive neural reorganisation and maximise recovery after stroke[7]. Observational studies, however, suggest that the dose of repetitions during current treatment for the upper limb falls significantly short. It has been reported that the average time spent in therapy sessions treating the upper limb is between 1 and 8 minutes[8] resulting in, on average, just 32 repetitions of task oriented movements per session[9]. Our intervention, called PRACTISE (Promoting Recovery of the Arm: Clinical Tools for Intensive Stroke Exercise), has been

designed to support therapy teams to change their professional practice and increase therapy intensity by supporting them to provide supplementary self-directed arm exercise for stroke patients during their in-patient rehabilitation. **The evidence underpinning the PRACTISE intervention is directly derived from the literature on the effectiveness of intensive repetitive task-specific training in stroke rehabilitation[10-12]. The content of the exercises are based on the Graded Repetitive Arm Supplementary Programme (GRASP), which has been shown to be effective in a multi-centre randomised controlled trial[12]. The issue of how to successfully implement GRASP in clinical practice remains unclear, with existing implementation known to have limited fidelity to the original GRASP[13].**

In this case series, we describe the process of implementing PRACTISE to (1) provide an illustrative example of how a research-informed improvement process changed clinical practice and (2) report on staff and patients' perceptions of its utility (i.e. the usefulness and usability).

Case Descriptions

Target settings

PRACTISE was implemented in three National Health Service (NHS) stroke rehabilitation units in the North West of England. Stroke units were identified through existing contacts between the research team and local stroke therapy teams. The characteristics of these sites are shown in Table 1.

<Insert Table 1 Characteristics of participating sites about here>

Development of PRACTISE

A detailed report on the development of **PRACTISE**, which was guided by the Behaviour Change Wheel[6] (BCW), has been published elsewhere[14] **and is summarised in Table 2. Target behaviours were identified and analysed to determine how behaviour change could be achieved using the COM-B model, the hub of the BCW[6]. COM-B is a simple model to understand behaviour based on capability to enact the behaviour, opportunity (the physical and social environment that enables the behaviour) and motivation.**

<Insert Table 2 Development of **PRACTISE** about here>

PRACTISE addresses four target behaviours for therapists; (i) identifying suitable patients for exercises by providing a screening tool, (ii) provision of supplementary self-directed exercises by providing instruction material for a comprehensive range of exercises, from which the therapists select a few that are most suitable for the patient, (iii) involving family/carers and (iv) monitoring and reviewing adherence to the exercises. PRACTISE consists of a paper-based toolkit and meetings between the research team and therapy team to ensure the toolkit is embedded into routine practice. By doing so it aims to **increase patients' physical opportunities to practise arm exercises, provide more efficient ways of therapists performing the behaviours needed to implement the exercises; and increase social opportunity by getting upper limb rehabilitation 'higher up on the agenda' through managerial support and team engagement[14].**

A full intervention description based on the Template for Intervention Description and Replication (TIDieR) checklist[15] endorsed by CONSORT, together with examples of the PRACTISE toolkit materials are provided in Appendix I. It includes a screening tool/ flow chart that therapists would use to categorise patients as 'red', 'amber' or 'green' based on their initial assessments. Patients categorised as 'red' either had no impairment or no active movement in their upper limb and were therefore not suitable

for exercises. Patients categorised as 'amber' had upper limb impairment and active movement but would require assistance or supervision with self-directed exercise due to cognition problems, or limited safety awareness for example. Patients categorised as 'green' were those who had upper limb impairment and active movement and would be able to safely complete self-directed exercises independently. The exercises included in PRACTISE were based on the GRASP programme [12] (Appendix I). In the GRASP programme patients are provided with a comprehensive manual to complete during self-directed exercise. However, during the development work for PRACTISE, we learned that therapists often selected exercises from the GRASP manuals for patients[13]. Thus, in PRACTISE we recommended that patients be provided five exercises. Therapists had autonomy to select the exercises that they felt were most suited to the patient based on their level of impairment and rehabilitation goals. PRACTISE also includes an audit tool to monitor the extent to which therapists performed the 'target behaviours' of the PRACTISE intervention, which form the basis of discussion at the meetings between therapists and researchers.

Outcome evaluation

The outcomes of interest were (i) change in therapists' behaviours and (ii) staff and patients' perceptions of the utility of the intervention. We collected outcome data using the audit tool, interviews with staff and patients, and field notes from site visits. The procedures for data collection and analysis are described below.

Audit tool

Performance of the target behaviours by therapy teams was recorded using an audit tool. Therapy teams completed the audit tool in a way that fitted with their routine practice **(e.g. by nominating an individual to take responsibility for completing the tool or completing**

the tool during weekly multidisciplinary team meetings). Anonymised copies were collected each month by the research team. Data for each of the target behaviours for each month were organised into a spreadsheet for each site and where possible, depending on the completeness of the data, totals and percentages were calculated (see Appendix I for worked example).

Interviews

Therapy team members' perceptions of the utility of **PRACTISE** were explored in semi-structured interviews. LC and NM conducted the face-to-face interviews throughout the study at monthly on-site meetings at a convenient time for the interviewees. **Where possible interviews were conducted in private offices, but due to space limitations, it was sometimes necessary to carry out interviews in quiet corners of public spaces, e.g. the hospital canteen. Team members provided written informed consent before participating and were only interviewed once over the course of the study.**

An interview guide, underpinned by Normalisation Process Theory (NPT)[16] was used. **Normalisation Process Theory (NPT) is a sociological theory that can be used to understand the implementation, embedding, and integration of innovation in healthcare settings. NPT is made up of four constructs each of which has four components:**

- **Coherence describes the sense-making processes that people go through when introduced to a new innovation**
- **Cognitive participation describes the process of committing to implementing the innovation**
- **Collective action describes how the work to implement the intervention gets done**
- **Reflexive monitoring describes the evaluation work that takes place.**

The emphasis of these components is on the dynamic and interactive processes that take place when attempting to embed a new innovation or practice.

Patients' perceptions of the utility of the arm exercises were also explored in semi-structured interviews. Patients were eligible for inclusion if they had been provided supplementary self-directed exercises **as part of the PRACTISE intervention** during their time in the stroke rehabilitation unit. LC and NM conducted the interviews in the stroke rehabilitation unit at a time and location preferred by the patient (e.g. bedside, private room). Patients that had been discharged after consenting to participate, but before it was possible to organise an appropriate time, were interviewed in their own home.

Audio recordings of all interviews were transcribed, anonymised and imported into NVivo 10 for content analysis. Transcripts were first read through several times for familiarisation before developing an initial coding frame reflective of the study objectives. Patient interviews were free coded. LC and NM coded the transcripts separately and made iterative changes to the coding frame as analysis evolved. Discrepancies in coding were discussed until agreement could be reached.

Field notes

Two of the authors (NM and LC) documented the following in field notes after each site visit: observations, the content of monthly meetings; ad hoc discussions with therapists; details of the number and frequency of meetings between the therapy and research teams and issues arising; additional contacts (e.g. email) between meetings and reasons for these; and informal discussions on the progress of the study by therapists and managers. These data were summarised at the end of data collection period to provide more detailed insight into the process of implementation, contextual factors influencing

implementation and therapy teams' perceptions of the utility of PRACTISE. They were converted into implementation timelines and reviewed by the coders in conjunction with the interview transcripts to triangulate the data and validate emergent findings from the interviews.

Comments by therapists on the audit tool were synthesised with the interview data and field notes to ensure all views on the utility of PRACTISE were captured. Emergent themes were discussed with study participants to ensure that the data had been accurately interpreted and to provide opportunity for clarification of preliminary findings.

Implementing PRACTISE

We used a phased approach to implementing PRACTISE, guided by adoption of the target behaviours and the principles of a participatory action research approach as described by Riel[17] (Figure 1). At an initial project set-up meeting between the research team (LC and NM) and therapy teams at each site (i.e. physiotherapists, occupational therapists, therapy assistants, therapy managers), we collaboratively identified how all admitted patients could be screened for suitability of self-directed upper limb exercise based on the resources, skills and processes in place at each site. Based on the outcomes of these meetings, the therapy teams would reorganise their work to embed the screening process into their every-day activity change and document this change using the audit tool.

The research and therapy teams then met monthly for six months to reflect on the extent to which it had be possible to implement the change, identifying any issues that had arisen or modifications that needed to be made to intervention components. Once the screening tool had been embedded into routine practice, we would progress to the next target behaviour (i.e.

provision of supplementary self-directed arm exercises in the form of PRACTISE packs) following the same reflexive cycle.

<Insert Figure 1 Study design here>

Significant differences emerged in the extent to which the therapy teams at each site were able to initiate and drive forward implementation at the outset. For example, at Sites A and C there was clear support from therapy leads in engaging with the research study and maximising efforts to implement the intervention. It was also evident at both sites that more senior therapists took responsibility for reminding the team about study tasks (e.g. completing the audit tool) until such a time as these activities were considered to be "embedded" in routine practice. However, at Site B a number of contextual factors emerged that negatively impacted on the team's capacity to implement change from the outset. The team was in the process of moving from a five day work week on the acute and rehabilitation units to a six day service that also followed patients up in community. Additionally, the therapy team lead, who had been instrumental in getting the study up and running at this site, resigned from, and left her post in the first month of the study. After this departure it emerged that despite positive perceptions of the value of the intervention, the team did not feel they had the basic organisational structures in place to fully engage in an implementation. Despite these challenges, we were able to continue with the phased implementation with the input of a senior therapist. The process of implementation across the three sites is summarised in Appendix II: Implementation timelines.

Outcomes

Implementation commenced at Sites A and B in October 2014. Site C acted as the development site for the intervention from December 2013 to June 2014. All members of the therapy teams participated in the improvement process across the three sites. A sample of 23

team members (8 physiotherapists, 11 occupational therapists and four therapy assistants) and 12 patients participated in interviews (Table 3). Patients were not recruited to participate in interviews at the development site, site C. Data from the audit tool were available for six months in Sites A and C, and for four months in Site B.

<Insert Table 3 Interview participants across sites about here>

Adherence to the intervention protocol

Almost all patients admitted onto the stroke rehabilitation unit of Sites A and C were screened for suitability for self-directed upper limb exercise (98% and 97% respectively). Due to an interruption in implementation at Site B with staffing changes, there were gaps in the audit tool records and it was therefore not possible to estimate the percentage of admissions screened, **and implementation only progressed as far as prescribing exercises**. There was marked variation in the proportion of patients categorised as red, amber or green across sites. Of the patients screened, 71% of patients were categorised as red in Site A, compared to 55% at Sites B and C. Of the **remaining** patients **categorised as amber or green,** 77%, 70% and 88% respectively were provided with additional self-directed exercises in the form of a PRACTISE pack. **Reasons for not prescribing exercises included patients deteriorating or being discharged.** At Site C both family involvement and reviewing of exercises were documented on the audit tool which showed that these behaviours were performed for over 80% of patients. Family involvement was low in Site A (13%) and can be explained in part due to restricted visiting times, and **an** emphasis placed on the role of therapy assistants in supporting patients with supplementary self-directed exercise. As a consequence of time spent working towards achieving family and carer involvement at Site A, we did not progress to our final target behaviour; reviewing the exercises.

Utility of the intervention

Staff views about the screening toolkit, providing exercises and using the audit tool were generally positive. Not surprisingly, participants' views on the utility related to their adherence to the intervention. Patients had mixed opinions about the usefulness and usability of the exercises and whether family should be involved with their exercises. They are summarised with exemplar quotes in Table 4 below.

<Insert Table 4 Summary of utility findings about here>

Discussion

Although resource intensive, it was feasible to promote knowledge translation by embedding components of PRACTISE into routine practice using a phased and reflexive implementation approach. This was in three hospital sites with different pathways and staffing levels. Therapists' perceived that screening patients for supplementary self-directed exercise and providing exercises were useful activities and these were performed consistently throughout the study. **However this took longer in Site B due to staffing and service issues. Providing exercises was not done one hundred percent of the time, though reasons for non-compliance were generally due to the realities of clinical environments and patients being discharged quickly.** Contextual factors and patients' personal wishes influenced the extent to which families or visitors were involved in the exercise programmes. Reviewing and progressing exercise programmes prior to discharge was not always prioritised by therapists in this study due to the short length of stay in the hospital and competing demands on their time.

Although most suitable patients were prescribed supplementary self-directed exercises, this gives no indication of adherence and it was evident that often regaining ability to walk was their primary concern. This is an important finding as stroke survivors, caregivers, and health professionals have listed identifying effective treatments for the upper limb as a research priority[18]. **However**, the stroke survivors and caregivers involved in these priority setting activities are typically at a later stage in their recovery when perhaps the limitations caused by their impaired upper limb are more pronounced. Future research should consider how, while respecting stroke survivors' priorities in the acute setting, we can maximise engagement in upper limb rehabilitation as potential for neurological recovery is greatest at this time.

'Involving others' has been identified as an effective way of overcoming practical problems in patient-led therapy[19]. For example, in this study it emerged that the ward environment often limited patients' opportunity to do their arm exercises because instructions and equipment were not always readily available. This issue may have been overcome by more active involvement of the wider multidisciplinary team. However, the optimum time to involve others in the improvement process is not clear (i.e. do some components of the knowledge translation intervention **need to be fully embedded before widening its scope**). In this study we endeavoured to involve family and carers in the self-directed exercise programme as this has been shown to improve outcomes for people after stroke[20,21]. However, resistance to this idea from the therapy teams and patients emerged. Family dynamics, the logistics of communicating exercises family and carers and the availability of therapy assistants who could fulfil this role were influencing factors.

Despite positive changes in therapy practice, it is unclear whether patients undertook the recommended dose of task practice, which is in the order of hundreds of repetitions per day[7]. A recently published randomised controlled investigating different models of

therapy provision (circuit class therapy and seven-day week individual therapy) found that although time in therapy increased, the time spent engaged in active task practice remained the same[22]. To achieve increased intensity of practice, closer attention needs to be paid to measures such as Patient Active Time[23] to reliably establish therapy intensity.

Limitations

The absence of baseline data for the behaviours of interest limits the conclusions that can be drawn about the extent of the change that occurred at each site. Therapy teams were responsible for data collection and there were some missing data at all sites. LC and NM facilitated implementation at each site and also conducted the interviews. Participants may have been inclined to provide favourable responses to the interviewers' questions and audit data **(i.e. a social desirability bias[24])** but it was stressed throughout that the purpose of the study was to learn about the process of implementing the intervention to encourage participants to be candid in relaying their experiences.

Conclusions

It was possible to use a knowledge translation approach to change the routine practices of therapy teams. A screening process for suitability and provision of supplementary exercise was embedded in stroke rehabilitation units. Further research is needed to demonstrate that these changes can translate into increased intensity of upper limb exercise in acute stroke rehabilitation settings and affect patient outcomes.

Ethical approval

The study was approved by the National Research Ethics Service (NRES), REC number 14/NW/1087, IRAS project ID: 157255.

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Tables

Table 1 Characteristics of participating sites

Site information	Site A	Site B	Site C
Organisation	General hospital	General hospital	General hospital
Number of stroke beds	23	24	24
Patients admitted from	Emergency department	Hyper-acute stroke ward	Hyper-acute stroke ward
Average length of stay	18.5 days	Missing	23
Weekday therapy input	**Target of 45 mins therapy per discipline per day**	**Target of 45 mins of each therapy per day**	**Target of 45 mins of each therapy per day**
Weekend therapy input	Reduced Saturday service (prioritise chest physiotherapy and new patients) **No service on Sundays**	Reduced Saturday service (prioritise chest physiotherapy and new patients) **No service on Sundays**	None routinely
Staffing (WTE, when full)	PT: 6.0 OT: 6.0 Assistants: 3.0	PT: 3.8 OT: 4.0 Assistants: 4.5	PT: 3.1 OT: 2.8 Assistants: 1.7

411 **Table 2 Development of PRACTISE**

Behaviour Change Wheel Phases
Phase 1: Understand who needs to do what, differently • Identify the evidence-practice gap • Specify the behaviour change needed to reduce the evidence-practice gap
Phase 2: Understand the behaviour change **that is needed to reduce the evidence-practice gap** • Use relevant theories, or frameworks to understand barriers and enablers
Phase 3: Identify the intervention components that could influence the barriers and enablers • Identify potential behaviour change techniques • Identify what is likely to be feasible, locally relevant, and acceptable • Combine the components identified above into an acceptable intervention that can be delivered
Phase 4: Identify how can the change be measured and understood • Identify mediators of change to investigate the proposed pathways of change • Select appropriate outcome measures • Determine feasibility of outcomes to be measured

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414 **Table 3 Interview participants across sites**

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Site	Total	PT	OT	Assistant	Patients
A	20	5	6	1	8
B	10	2	3	1	4
C	5	1	2	2	0

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417 **Table 4 Summary of utility findings for the intervention**

	Summary	Usability exemplar quote	Usefulness exemplar quote
Screening for suitability	Screening was deemed to be helpful and feasible, with the therapists perceiving the tool as a useful prompt. The implementation timelines demonstrated that implementation took different amounts of time and iterations at each of the three sites.	**Staff (site A):** *"when we have our group meetings every Thursday, we go through all the patients on the ward and we go through a tick list of whether they're red, amber or green"*	**Staff (site C):** *"…before we thought about it further down the line of the patient's journey whereas now we are screening them as soon as they arrive on the ward, and making sure that something is put in place for that person regardless of whether they are red, amber or green."*
Provision of PRACTISE exercise pack	Therapists found the PRACTISE **exercise** pack a quick and efficient way of **prescribing and delivering** exercises. Patients had mixed perceptions of the value of the exercises**.** Some struggled to see the relevance or felt their primary focus was walking. Patients' identified the ward environment as a barrier to using their exercise pack.	**Staff (site B):** *"I just think it's good, I like it because then you get a nice clear sheet for the patient to be doing, also it's nice for the family to then have something that's a bit more tangible that they can be doing"* **Patient:** *"I suppose what is getting in the way is ward life…you know you could be sitting here and told that dinner is coming but it might be an hour coming, so you could have done something, but then*	**Staff (site C):** *"I found that the more you sit at the bedside and get them to work through it, you see what they are able to do and you then have a better idea when you go back to pick out which exercises you think are appropriate."* **Patient:** *"I tend to leave them until after I've done everything else, because that way I feel that I'm not using my energy up on those when I might try and do some walking*

		people disappear and you don't want to press the buzzer just to drag somebody in to look through your cupboard and find paperwork and a bag of stuff."	*because obviously walking is more important than being able to use your hand."*
Involving family/carers	**Patients' perceptions varied greatly. Some were reluctant to burden their relatives, others appreciated their involvement.** **Therapists identified the logistics of catching family members, and family dynamics as factors influencing the extent to which they could involve families. They often involved assistants to supervise the exercises rather than family.**	**Staff (site C):** *"we don't see evening visitors that come in and we tend to catch one family member and then expect them to pass it on to the rest so it is difficult to catch them, but I suppose that's where using the volunteers and other people on the ward is useful."* **Patient: "***And I have a daughter and a grandson… but err, they're both working you see so they'll probably call in and see me tonight and tomorrow but they can't help me a lot"*	**Staff (site A):** *"I don't know how much the families take on actually and it's probably a little bit easier as well for us to just have the assistants go and do…because the assistants know what they're doing"* **Patient:** *"Again I've not been doing them every day with somebody watching, seeing my progress and that. You know I think that somebody should be doing it with you, it's better…it's alright me doing it myself but nobody watch me doesn't encourage me."*
Monitoring & progressing	Across all three sites returning to review and progress the prescribed exercises was a challenge. Quick turnaround of patients was the most prominent barrier identified	**Staff (site C):** *"Again, it is tricky isn't it? to keep the momentum going and I think because the length of stay for our patients generally, as they're coming up to review*	**Staff (site A):** *"I think sometimes it's about changing the exercises as well and that perhaps isn't happening as often as it should, I think patients are getting a*

	with a number of therapists suggesting that community stroke teams should be included in the process to ensure that the exercises are reviewed and progressed at a later time in the stroke pathway.	*date is generally when they're due to be discharged."*	*PRACTISE pack set up and then it's not getting reviewed at any point."*
Completing audit tool	Once there was a systematic way of including the audit tool in routine activities, it was deemed feasible to implement. However, **views on the value of the tool were mixed.** Some therapists valued being able to see **data** at a service level but the majority felt the tool was for collecting research data rather than a method to monitor performance.	**Staff (site A):** *"I think now it's embedded in practice and we've got it set up we more or less do it most times because it's just become part of what we do when we do our multidisciplinary team feedback, we do it [audit tool] as well"*	**Staff (site A):** *"Because I think otherwise there's a potential to forget it… going through the amber, red green thing I find useful."* **Staff (site A):** *"I think that without the form, I think we'd start of carrying on as we're doing it now but I think it would so it would start to fade, drift down."*

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Figures

Figure 1 Study design

See attached jpeg.

Appendices

Appendix I Intervention description and materials

See attached Word document.

Appendix II Implementation timelines

See attached pdf.