CONCORSO PUBBLICO PER TITOLI ED ESAMI A N.4 POSTI DI C.P.S. FISIOTERAPISTA CAT.D DA ASSEGNARE ALLE AZIENDE DEL S.S.R. DEL F.V.G.

Bando prot n.7994 del 26/02/2021

VERBALE N.1

omissis

La commissione in considerazione del numero degli iscritti alla procedura, prende atto che si rende necessario:

- convocare gli stessi in due distinte fasce d'orario, pertanto definisce il calendario prova scritta:

Giorno	Sede	Orario
28/07/2021	Udine e Gorizia Fiere spa – Torreano di Martignacco (UD)	Ore 09.00
28/07/2021	Udine e Gorizia Fiere spa – Torreano di Martignacco (UD)	Ore 14.00

- predisporre n. 4 prove destinate al sorteggio.

Viene stabilita l'articolazione delle prove come segue:

5 domande a risposta aperta	Criteri di valutazione: – parola corretta inserita nel testo secondo sequenza logica. – Punteggio assegnabile: 2,1,0.	Motivazioni: – Punti 0: manca la risposta, molto insufficiente; – Punti 1: risposta parziale, attinente ma incompleta; – Punti 2: risposta attinente e completa.	Totale punti 10
20 domande a risposta multipla	Criteri di valutazione: – risposta corretta - punti 1 – ogni altro caso – punti 0 Ogni domanda prevede 4 alternative di cui 1 sola corretta.		Totale punti 20

In relazione alla prova orale la commissione stabilisce che la stessa si svolgerà in presenza ma saranno valutate le richieste dei candidati interessati al colloquio a distanza se opportunamente motivate.

omissis

RANCATI JACOPO MATTEO | CAPONE FRANCESCA | ZORZETTO ELENA | PICCINI ROMILDA

CONCORSO PUBBLICO PER TITOLI ED ESAMI A N.4 POSTI DI C.P.S. FISIOTERAPISTA CAT.D DA ASSEGNARE ALLE AZIENDE DEL S.S.R. DEL F.V.G.

Bando prot n.7994 del 26/02/2021

VERBALE N.2

Omissis

La commissione pertanto:

- procede all'elaborazione delle domande delle 4 prove scritte destinate al sorteggio, articolate in 5 domande a risposta aperta e 20 domande a risposta multipla;
- stabilisce che i candidati avranno a disposizione 2 righe per le 5 domande a risposta aperta, mentre per le 20 domande a risposta multipla avranno 4 alternative di cui una corretta;
- conferma altresì la valutazione di cui al verbale 1;
- definisce altresì il format del foglio "prova scritta domande" e il format del foglio "prova scritta risposta", entrambi in modello A4;
- decide che non saranno assegnati ulteriori fogli oltre a quelli sopra indicati;
- decide che il tempo previsto per lo svolgimento della prova è pari a quaranta (40') minuti;
- decide che le istruzioni operative della prova scritta, per i candidati, verranno pubblicate sul sito di ARCS alla pagina dedicata al concorso.

La commissione riceve informazioni in merito alla presenza di candidati che hanno la necessità di tempi aggiuntivi, per predisporre le prove in modo accessibile anche per gli stessi.

In ciascuna delle buste "prova scritta" numerate da 1 a 4 viene inserito, un foglio "prova scritta domande" in formato A3 destinato al candidato con tale esigenza.

Omissis

RANCATI JACOPO MATTEO	CAPONE FRANCESCA	ZORZETTO ELENA	PICCINI ROMILDA

PROVA SCRITTA1- DOMANDE 28/07/2021

DOMANDE A RISPOSTA APERTA

1	Quali sono i tre parametri sui quali si basa la scala di Glasgow (Glasgow-Coma Scale GCS).
2	Quale nervo è comunemente interessato nel caso si osservi un deficit di dorsiflessione del piede (cd "piede cadente")?
3	Indicare il nome dei quattro muscoli che compongono la cuffia dei rotatori della spalla.
4	Bradicinesia, tremore al riposo, freezing sono i sintomi più comuni di quale patologia?
5	Un soggetto che non parla, che non sa ripetere, leggere e scrivere, ma è in grado di comprendere è affetto da:

DOMANDE A RISPOSTA MULTIPLA

N^	DOMANDE	RISPOSTA A	RISPOSTA B	RISPOSTA C	RISPOSTA D
1	Per impostare il piano di trattamento riabilitativo di un paziente con lesione midollare cosa si deve valutare?	La presenza di limitazioni articolari e di retrazioni muscolo-tendinee	La motilità non volontaria sotto-lesionale	Le capacità funzionali	Tutte le precedenti
2	Per International Classification of Functioning si intende:	La classificazione statistica internazionale delle malattie e dei problemi sanitari correlati	La classificazione internazionale del funzionamento, della disabilità e della salute	La classificazione statistica ed internazionale della disabilità, della salute e della malattia	La classificazione statistica internazionale del funzionamento, della disabilità e dei problemi sanitari correlati
3	Rispetto ad ortesi, protesi, tutori, il fisioterapista può:	Collaudarli	Prescriverli	Proporli	Prenotarli
4	Secondo quanto indicato nelle linee guida del Ministro della Sanità per le attività di Riabilitazione (30 maggio 1998, n.124), il progetto riabilitativo è:	L'insieme dei programmi svolti da ciascun professionista a beneficio della persona malata	Un patto sottoscritto con l'utente in cui vengono stabiliti gli obiettivi terapeutici e le principali strategie al riguardo	L'insieme di proposizioni, elaborate dall'équipe riabilitativa, coordinata dal medico responsabile	La documentazione clinica di ogni persona affetta da patologie invalidanti, dalla raccolta dei dati anamnestici fino alla lettera di dimissione
5	E' necessario effettuare il bendaggio del moncone nei primi mesi dopo l'amputazione per:	Ridurre il rischio di infezione	Evitare la sensazione dell'arto fantasma	Dare la forma al moncone	Nessuna delle precedenti
6	Quale fra le seguenti caratteristiche è tipica dell'atteggiamento scoliotico?	Evolutività	Presenza di gibbo alla manovra di bending	Rotazione dei corpi vertebrali	Paramorfismo della colonna vertebrale sotto carico
7	Quali fra i seguenti segni non è tipico del paziente con lesione cerebellare?	Atassia	Dismetria	Tremore a riposo	Fenomeno del rimbalzo

8	Quale fra le seguenti affermazioni riguardo alla paralisi cerebrale infantile (PCI) è falsa?	La paralisi cerebrale infantile può essere imputata a cause prenatali, perinatali e post-natali	La paralisi cerebrale infantile provoca un danno permanente alla motricità	L'encefalopatia ipossico-ischemica è una fra le principali cause di paralisi cerebrale infantile	La paralisi cerebrale infantile ha connotazione degenerativo-progressiva
9	Il linfonodo sentinella è:	Il primo linfonodo ad essere raggiunto dalla metastasi	E' il linfonodo successivo a quello colpito dalla metastasi	E' il linfonodo sottoposto a biopsia	Nessuna delle precedenti
10	L'assetto anomalo della scapola chiamato "scapola alata" indica un deficit nell'azione di quale muscolo?	Romboide	Gran dentato	Gran dorsale	Gran pettorale
11	La riabilitazione respiratoria è indicata:	In caso di allettamento	Per pazienti che hanno subito interventi chirurgici al torace	In caso di riduzione della capacità respiratoria	Tutte le precedenti
12	La protesi inversa di spalla.	E' così definita perché convessità e concavità si scambiano	E' indicata nei pazienti più giovani	Non è indicata nelle rotture massive della cuffia dei rotatori	Indicata nel caso di frattura di Colles
13	La principale causa di morte per Sclerosi Laterale Amiotrofica è:	Insufficienza respiratoria	Broncopolmonite	Demenza	Nessuna delle precedenti
14	La scala di Borg viene utilizzata per valutare il livello di:	Percezione dell'ansia	Percezione del dolore	Percezione della fatica	Nessuna delle precedenti
15	Nella sindrome da conflitto sub-acromiale il dolore e l'impotenza funzionale sono causati:	Dal conflitto tra tessuti molli sub-acromiali	Dallo schiacciamento del muscolo sovra spinoso	Dall'instabilità dell'articolazione gleno-omerale	Tutte le precedenti
16	L'utilizzo di ortesi in fase precoce nel paziente con esiti di ustione ha l'obiettivo primario di:	Contrastare la rigidità articolare	Contrastare la retrazione cicatriziale	Correggere la postura	Proteggere la regione ustionata
17	La paralisi periferica del VII nervo cranico interessa:	La parte inferiore dell'emifaccia contro laterale alla lesione	L'emifaccia omolaterale alla lesione	L'emifaccia contro laterale alla lesione	La parte superiore dell'emifaccia contro laterale alla lesione
18	In quale contesto normativo vengono definiti i concetti di titolarità ed autonomia professionale per gli operatori delle professioni sanitarie della riabilitazione?	Legge N.833/1978	Legge N.42/1999	Legge N.251/2000	Legge N.502/1992
19	Quale tra le seguenti affermazioni sulla carrozzina elettrica è falsa.	E' indicata per assistiti che trascorrono gran parte della giornata in ambienti prevalentemente interni	Può essere associata l'opzione della verticalizzazione della seduta	Il comando di guida solo a joystick	Può avere sei ruote
20	Quale delle seguenti combinazioni di movimenti è propria della sinergia estensoria dell'arto inferiore?	Abduzione ed extra rotazione dell'anca	Flessione dell'anca e flessione del ginocchio	Estensione dell'anca ed inversione della caviglia	Estensione del ginocchio e flessione dorsale della caviglia

PROVA SCRITTA 1 RISPOSTE

28/07/2021

A fine prova inserire nella busta grande, pena esclusione:

-la busta piccola contenente la scheda anagrafica del candidato debitamente compilata;

-il presente foglio “prova scritta risposte”;

Rendere separatamente il foglio “prova scritta domande” che sarà consegnato dopo il sorteggio.

DOMANDA 1
OCULARE, VERBALE E MOTORIA

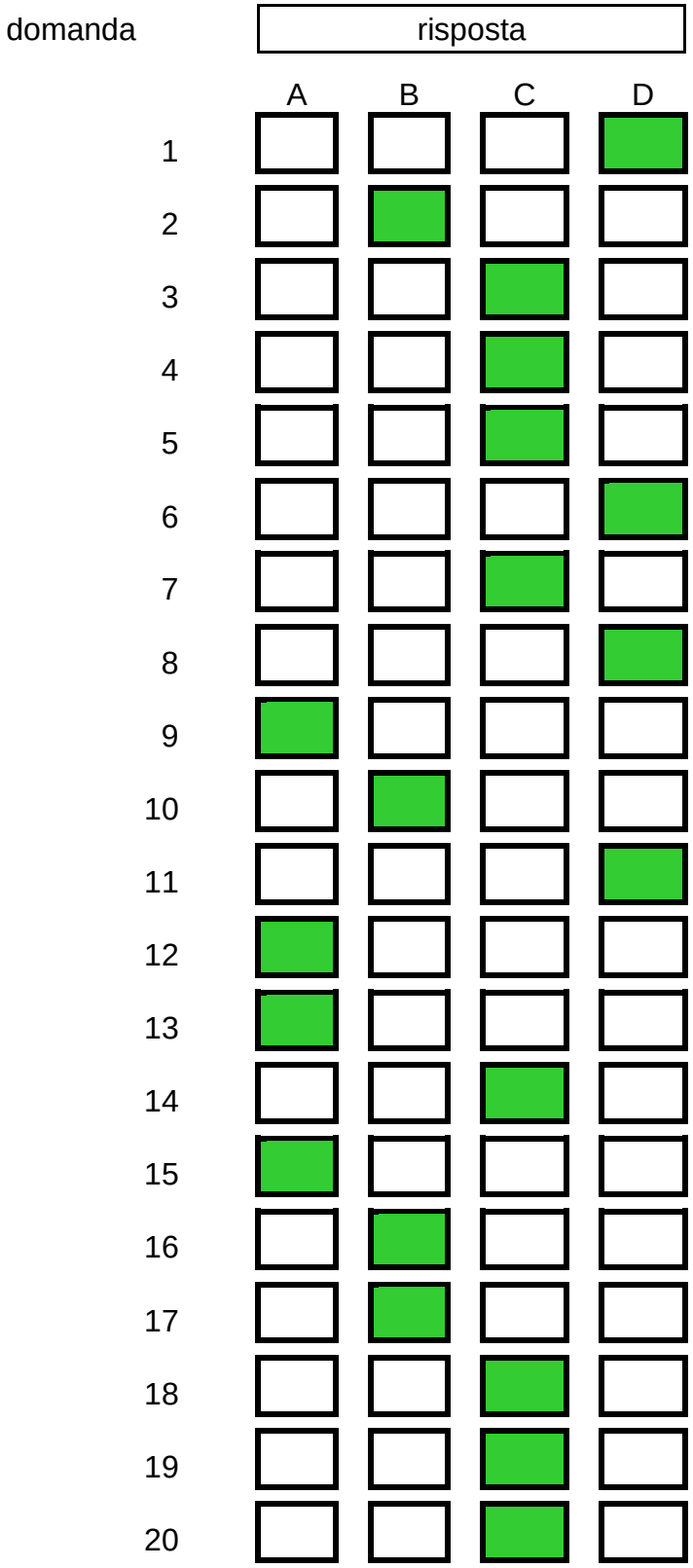
DOMANDA 2
SCIATICO POPLITEO ESTERNO OPPURE PERONIERO COMUNE

DOMANDA 3
SOTTOSCAPOLARE, SOVRASPINATO, SOTTOSPINATO (INFRASPINATO), PICCOLO
ROTONDO

DOMANDA 4
MORBO DI PARKINSON

DOMANDA 5
AFASIA DI BROCA

CORRETTORE PROVA SCRITTA 1



ARCS
Azienda Regionale di Coordinamento per la Salute

CONCORSO N.4 POSTI DI C.P.S. FISIOTERAPISTA CAT.D
BANDO PROT.N. 7994 del 26/02/2021

PROVA SCRITTA 2 - DOMANDE 28/07/2021

DOMANDE A RISPOSTA APERTA

1	Quale test viene prevalentemente utilizzato per valutare i seguenti movimenti nel paziente in esiti di stroke: girarsi sul lato malato, girarsi sul lato sano, passaggio da supino a seduto ed equilibrio da seduto (sul bordo del letto).
2	A seguito di una lussazione acuta anteriore di spalla o in alcune fratture dell'estremità prossimale di omero può lesionarsi il nervo ascellare o circonflesso. Quale muscolo può risultare interessato da tale lesione?
3	Indicare il nome dei quattro capi del muscolo quadricipite femorale.
4	Dolore che migliora con l'esercizio ma non a riposo, dolore e rigidità che peggiorano al mattino ma non durante la notte, presenza di infiammazione delle articolazioni sacro-iliache, alterazioni del rachide denominate "a canna di bambù": sono tutti elementi che caratterizzano quale patologia?
5	Un soggetto che ignora il lato leso, non lo riconosce o afferma che non gli appartiene è affetto da:

DOMANDE A RISPOSTA MULTIPLA

N^	DOMANDE	RISPOSTA A	RISPOSTA B	RISPOSTA C	RISPOSTA D
1	Da quale radice inizia la cauda equina?	L1	L5	S1	S3
2	Una scala di valutazione delle condizioni cliniche di una persona anziana che viene definita come "totalmente dipendente – parzialmente dipendente – autosufficiente" è una scala:	Di tipo ordinale	Di tipo nominale	Ad intervalli	Che valuta l'indipendenza di un soggetto nelle ADL
3	L'art.18 del DPCM del 12 Gennaio 2017 identifica i destinatari delle prestazioni di Assistenza Protesica:	Le persone con invalidità civile, di guerra e per servizio	I minori di 18 anni che necessitano di un intervento di prevenzione, cura e riabilitazione di un'invalidità grave e permanente	Le persone in attesa di accertamento dell'invalidità per le quali il medico specialista prescrittore attesti la necessità di urgenza di un ausilio	Tutte le precedenti
4	Il campo di attività e responsabilità delle professioni sanitarie sancite dalla legge n.42/1999 è definito?	Dagli ordinamenti didattici dei corsi di formazione di base e post base	Dai profili professionali e dagli ordinamenti didattici dei corsi di formazione	Dai codici deontologici	Dal profilo professionale, dagli ordinamenti didattici dei corsi di formazione di base e post base e dai codici deontologici
5	Per quanto tempo è consigliato effettuare il bendaggio del moncone di coscia?	Per i primi giorni dopo l'amputazione	Per i primi mesi dopo l'amputazione	Fino ad 1 anno dall'amputazione	Per tutta la vita
6	Nei casi di scoliosi particolarmente gravi (angolo di Cobb maggiore di 45°), qual è l'intervento rieducativo essenziale e prioritario?	La fisioterapia respiratoria	La rieducazione posturale	Il rinforzo muscolare	La mobilizzazione
7	Che cosa indica esattamente il termine bradicinesia?	Assenza di movimento	Lentezza di movimento	Mancanza di coordinazione	Incapacità di programmazione motoria

8	Quale fra le seguenti forme di paralisi cerebrale infantile (PCI) si caratterizza tipicamente per una notevole riduzione del tono posturale?	La diplegia	La tetraparesi spastica	L'emiplegia	L'atetosi
9	Indicare l'affermazione corretta.	La tecnica del linfonodo sentinella viene eseguita solo se la lesione mammaria è risultata benigna	Il linfonodo sentinella è il primo linfonodo della catena loco-regionale drenante nel quale si devono ricercare eventuali cellule neoplastiche provenienti dal sito tumorale	Il linfonodo sentinella di una neoplasia mammaria è localizzato a livello inguinale	Nessuna delle precedenti
10	Il diaframma è innervato dal nervo:	Frenico	Vago	Accessorio	Trigemino
11	Gli obiettivi della fisioterapia respiratoria post operatoria sono:	Facilitare la clearance muco-ciliare	Migliorare gli scambi gassosi	Migliorare il rapporto ventilazione/perfusione	Tutte le precedenti
12	La lesione del nervo femorale è una possibile complicanza di:	Intervento di endoprotesi d'anca	Intervento di ernia a livello L4-L5	Displasia congenita dell'anca	Frattura di femore
13	Nella forma di Sclerosi Multipla remittente-recidivante:	La progressione della malattia è a plateau	I periodi tra le recidive sono caratterizzati da progressione continua	Gli episodi acuti di peggioramento (poussées) si alternano a periodi di recupero quasi completo	Nessuna delle precedenti
14	Quale tra i seguenti test è utilizzato per la valutazione della tolleranza all'esercizio in un paziente con Bronco-Pneumopatia Cronico Ostruttiva (BPCO).	6 minutes-walking test (6 MWT)	Stand up and go test	10 meter-walking test (10 MWT)	Scala Tinetti
15	In fase acuta l'algodistrofia o Morbo di Sudeck si manifesta con:	Dolore, edema, alterazione vasomotoria, rigidità articolare	Dolore, edema, deficit di forza	Dolore, edema, alterazioni della sensibilità	Dolore, edema, deficit di forza, alterazioni della sensibilità
16	Un paziente che presenta dolore alla compressione digitale del polpaccio, può presentare:	Tromboflebite in atto	Vene Varicose	Una zona con alterata sensibilità dolorifica	Cisti tendinea
17	La valutazione del XII nervo cranico (ipoglosso) si esegue chiedendo al paziente di:	Sorridere	Far uscire la lingua dalla bocca, osservando l'eventuale deviazione da un lato	Guardare il più lontano possibile senza muovere la testa	Seguire con gli occhi i movimenti orizzontali e verticali del dito dell'esaminatore senza muovere la testa
18	La Legge 10 agosto 2000 n.251 all'art.2 sancisce che gli operatori delle professioni sanitarie dell'area della riabilitazione svolgono con titolarità ed autonomia professionale attività dirette:	Alla prevenzione, alla cura e alla riabilitazione	Alla cura e alla riabilitazione	A procedure di valutazione funzionale	Alla prevenzione, alla cura, alla riabilitazione e alle procedure di valutazione funzionale
19	Quali tra i seguenti dispositivi non è presente tra gli ausili per il trasferimento:	Asse per il trasferimento	Disco girevole	Telo ad alto scorrimento	Deambulatore con 4 puntali rigido
20	Nell'andatura cosiddetta "steppage":	Il paziente appoggia a terra il piede prima con l'avampiede e successivamente con il calcagno	Il paziente extraruota e abduce a ginocchio esteso	Il paziente esegue una triplice flessione ogni volta che esegue il passo anteriore con l'arto leso	Il piede è bloccato in flessione dorsale

PROVA SCRITTA 2 RISPOSTE 28/07/2021

A fine prova inserire nella busta grande, pena esclusione:

-la busta piccola contenente la scheda anagrafica del candidato debitamente compilata;

-il presente foglio “prova scritta risposte”;

Rendere separatamente il foglio “prova scritta domande” che sarà consegnato dopo il sorteggio.

DOMANDA 1
TRUNK CONTROL TEST

DOMANDA 2
DELTOIDE

DOMANDA 3
RETTO FEMORALE, VASTO MEDIALE, VASTO LATERALE, VASTO INTERMEDIO

DOMANDA 4
SPONDILITE ANCHILOSANTE

DOMANDA 5
EMISOMATOAGNOSIA

CORRETTORE PROVA SCRITTA 2

domanda	risposta			
	A	B	C	D
1	■			
2	■			
3				■
4				■
5		■		
6	■			
7		■		
8				■
9		■		
10	■			
11				■
12	■			
13			■	
14	■			
15	■			
16	■			
17		■		
18				■
19				■
20	■			

PROVA SCRITTA 3- DOMANDE 28/07/2021

DOMANDE A RISPOSTA APERTA

1	Quali sono le due aree valutate nella scala Tinetti.
2	Tutti i muscoli del gruppo posteriore del braccio (il tricipite brachiale e l'anconeo) e dei gruppi posteriore e laterale dell'avambraccio, gli estensori del polso e delle mani, sono innervati da:
3	Indicare il nome dei muscoli facenti parte della loggia posteriore della coscia.
4	Fatica, disturbi visivi, disturbi della sensibilità, demielinizzazione sono gli elementi che caratterizzano quale patologia?
5	Un soggetto con eloquio fluente, ma privo di significato è affetto da:

DOMANDE A RISPOSTA MULTIPLA

N^	DOMANDE	RISPOSTA A	RISPOSTA B	RISPOSTA C	RISPOSTA D
1	Quale fra i seguenti muscoli non conserva attività motoria in un paziente che presenti una lesione completa a livello C7?	Deltoide	Bicipite	Tricipite	Gran pettorale
2	Il Barthel Index è un test che valuta:	Il grado di autonomia nelle patologie del sistema extrapiramidale i cui risultati si misurano con un punteggio che va da 0 a 20	Il danno dopo sindrome da allettamento i cui risultati si misurano con un punteggio che va da 0 a 50	Le limitazioni funzionali dopo neuro-lesioni periferiche i cui risultati si misurano con un punteggio che va da 0 a 80	Le attività quotidiane dopo ictus cerebrale i cui risultati si misurano con un punteggio che va da 0 a 100
3	Nell'elenco 2B del Nomenclatore Tariffario degli ausili, sono inclusi:	Gli ausili tecnologici di fabbricazione continua o di serie, pronti per l'uso, che non richiedono l'applicazione da parte del professionista sanitario abilitato	Gli ausili tecnologici di fabbricazione continua o di serie, che devono essere applicati dal professionista sanitario abilitato	Le protesi e le ortesi costruite o allestite su misura da un professionista abilitato all'esercizio della specifica professione sanitaria	Nessuna delle precedenti
4	Il Ministro della Sanità ha riconosciuto il profilo professionale del fisioterapista nel:	1990	1992	1994	2001
5	Quali sono gli obiettivi del trattamento riabilitativo dell'amputato di arto inferiore?	Preparazione del moncone alla protesizzazione	Prevenire limitazioni articolari e retrazioni muscolo-tendinee	Educare il paziente alla corretta igiene del moncone	Tutte le precedenti
6	A quale età il bambino comincia a orientare il capo in direzione di un suono?	Attorno al sesto mese	Attorno al terzo mese	Attorno al primo mese	Sin dalla nascita
7	L'atassia è un segno caratteristico delle lesioni a carico:	Del cervelletto	Delle regioni frontali	Delle vie piramidali	Delle aree del linguaggio

8	Un bambino affetto da paralisi cerebrale infantile può presentare:	Ipotonia, distonia, spasticità, rigidità	Distonia, rigidità	Ipertonia, spasticità	Ipotonia, distonia, spasticità
9	Secondo le Linee Guida Nazionali (Pnlg) esistono prove di efficacia che dimostrano che per ottenere una diminuzione dell'edema è necessario un intervento che preveda l'utilizzo di:	Linfodrenaggio, bendaggio, guaina per arto superiore	Linfodrenaggio	Bendaggio, chinesiterapia	Nessuna delle alternative proposte è corretta
10	Quando gli abduttori d'anca sono paralizzati o ipostenici:	Non è più possibile l'avanzamento simmetrico degli arti inferiori durante il cammino	La stabilità del bacino sul piano frontale in appoggio monopodalico è impossibile	Intervengono significative difficoltà nella salita delle scale	Subentra un atteggiamento di antiversione del bacino con frequente iperlordosi lombare
11	Il diaframma è innervato dal nervo:	Frenico	Vago	Accessorio	Trigemino
12	Quale fra le seguenti posizioni è da sconsigliare al paziente, operato con via d'accesso postero-laterale, perché favorente la lussazione della protesi d'anca?	Abduzione, flessione, intrarotazione	Abduzione, flessione, extrarotazione	Adduzione, flessione, intrarotazione	Adduzione, estensione, extrarotazione
13	Nella Sclerosi Laterale Amiotrofica (SLA), le prime alterazioni motorie che si rilevano a carico della muscolatura è/sono:	Le fascicolazioni	La tetania	La paralisi flaccida	Le clonie
14	In quale delle seguenti fasi non si ha contrazione dei muscoli espiratori?	Durante lo sforzo	Durante l'espirazione forzata	Durante l'espirazione normale	Durante la tosse
15	L'atrofia di Sudeck è più frequente dopo la frattura:	Del calcagno	Del piatto tibiale	Della scapola	Nessuna delle precedenti
16	Quali sono le complicanze nei pazienti gravemente ustionati?	Sepsi	Shock ipovolemico	Broncopolmoniti	Tutte le precedenti
17	La sindrome di Guillain-Barré è una polineuropatia di origine:	Infiammatoria autoimmune	Dismetabolica	Ereditaria secondo le leggi di Mendel	Alcolica
18	Nel codice deontologico il titolo IX parla di:	Rapporti Professionali	Disposizione finale	Rapporti con i colleghi	Rapporti con le persone assistite
19	Quale affermazione riguardanti gli ausili per il sollevamento è corretta:	Dispositivi concepiti per faciliate il compito del caregiver che comportano il sollevamento e/o il trasferimento della persona disabile	Possono essere mobili	Possono essere fissi a soffitto	Tutte le precedenti
20	Quando il paziente ignora il lato leso, non lo riconosce o afferma che non gli appartiene, ci si trova di fronte ad un problema di:	Agnosia	Nosoagnosia	Emisomatoagnosia	Prosopoagnosia

PROVA SCRITTA 3 RISPOSTE

28/07/2021

A fine prova inserire nella busta grande, pena esclusione:

-la busta piccola contenente la scheda anagrafica del candidato debitamente compilata;

-il presente foglio “prova scritta risposte”;

Rendere separatamente il foglio “prova scritta domande” che sarà consegnato dopo il sorteggio.

DOMANDA 1
EQUILIBRIO ED ANDATURA

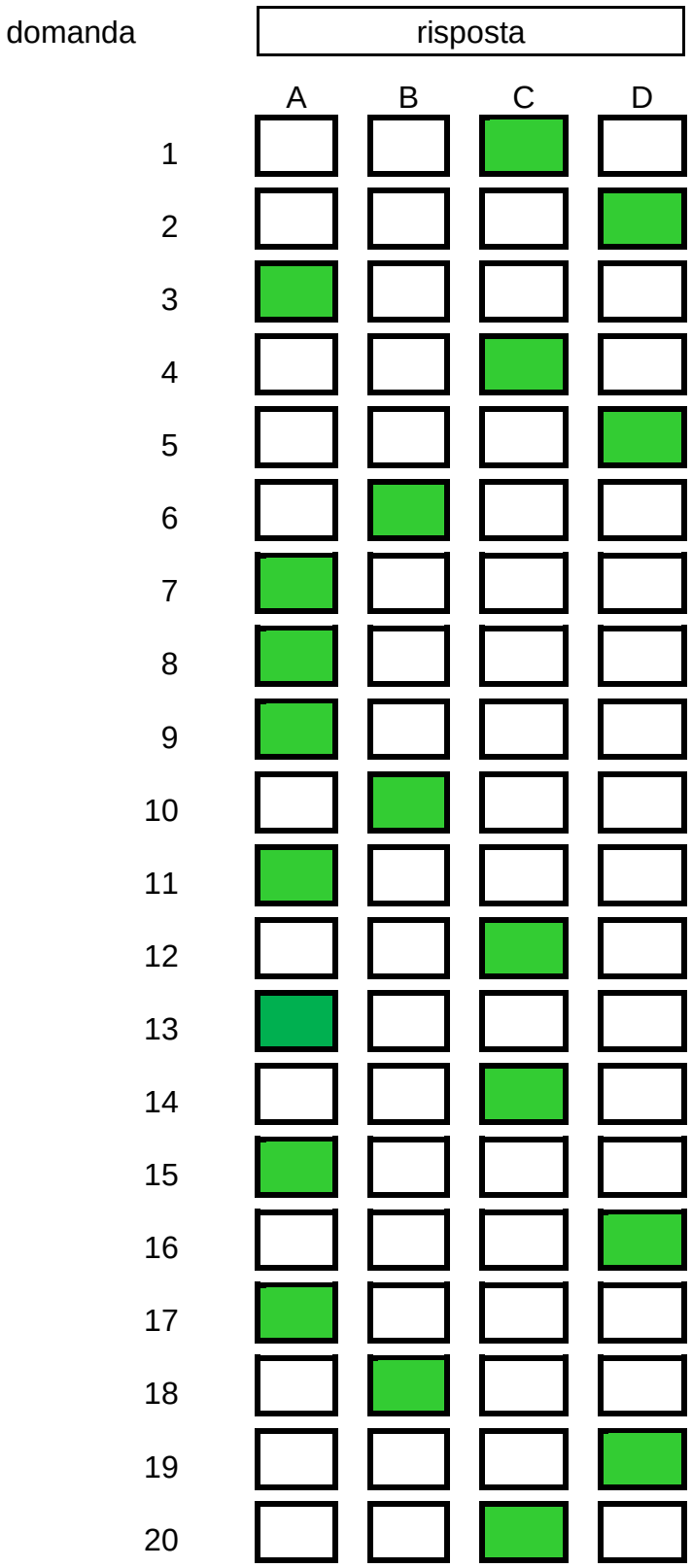
DOMANDA 2
NERVO RADIALE

DOMANDA 3
BICIPITE FEMORALE, SEMIMEMBRANOSO, SEMITENDINOSO

DOMANDA 4
SCLEROSI MULTIPLA

DOMANDA 5
AFASIA DI WERNICKE

CORRETTORE PROVA SCRITTA 3



PROVA SCRITTA 4 - DOMANDE 28/07/2021

DOMANDE A RISPOSTA APERTA

1	Misura di outcome standardizzata normalmente impiegata per quantificare soggettivamente l'intensità del dolore percepito.
2	Quale muscolo occorre testare nel caso si osservi il fenomeno della "scapola alata" in presenza di un sospetto di sofferenza del Nervo Toracico Lungo?
3	Indicare il nome dei muscoli della parete addominale.
4	Enfisema, dispnea invalidante, torace a botte, astenia: sono elementi che caratterizzano quale patologia?
5	Un soggetto che conosce e ricorda il movimento programmato, ma è incapace di eseguirlo sotto comando verbale è affetto da:

DOMANDE A RISPOSTA MULTIPLA

N^	DOMANDE	RISPOSTA A	RISPOSTA B	RISPOSTA C	RISPOSTA D
1	Qual è tra i seguenti l'unico obiettivo terapeutico verosimilmente raggiungibile nel trattamento di rieducazione respiratoria in un paziente con lesione completa a livello C5-C6?	Il rinforzo del diaframma	Il rinforzo dei muscoli intercostali	Il rinforzo dei muscoli dentato posteriore superiore ed inferiore	Il rinforzo dei muscoli pettorali
2	La scala di Glasgow viene utilizzata per misurare:	Il rischio di caduta accidentale nei pazienti anziani	Il rischio di insorgenza di una lesione da pressione	Lo stato di salute di un neonato alla nascita	Lo stato di coscienza
3	Quale tra le seguenti affermazioni è falsa:	Gli ausili antidecubito e gli ausili per la cura personale fanno parte dell'elenco 2B	Le protesi di arto superiore ed arto inferiore fanno parte dell'elenco 2A	Le ortesi spinali e le ortesi per gli arti superiori ed inferiori fanno parte dell'elenco 1	Gli ausili per la casa (es. letto, montascale) fanno parte dell'elenco 2B
4	L'obbligo della formazione permanente (ECM) per il mantenimento dell'adeguatezza professionale è stato introdotto con il decreto:	Legislativo n. 502/1992	Ministeriale n. 70/1997	Legislativo n. 229/1999	Ministeriale n. 741/ 1994
5	Nel realizzare l'invasatura di una protesi per amputazione di gamba quali sono i punti anatomici che vanno messi in scarico per evitare ulcerazioni?	La spina tibiale, la testa del perone e l'apice del moncone	Il tendine rotuleo	Il poplite e i malleoli	Il polpaccio
6	Quali delle seguenti competenze non è propria di un bambino di 3 mesi?	Il sorridere	L'attività manipolatoria	L'emissione di suoni	La capacità di seguire uno stimolo visivo con lo sguardo e con il capo
7	Il "cammino parkinsoniano" si caratterizza per:	Riduzione della lunghezza del passo	Aumento della cedenza	Aumento della lunghezza del passo	Rallentamento del movimento volontario
8	Le cause di Paralisi Cerebrale Infantile (PCI) possono essere:	Prenatali e postnatali	Perinatali	Perinatali e postnatali	Sia a che b

9	Nel linfedema secondario, dopo una terapia di linfodrenaggio manuale, è importante:	L'utilizzo di una guaina compressiva su misura a maglia piatta	Non è necessario fare altro se non aspettare il ciclo successivo di linfodrenaggio	Tenere il più possibile l'arto in scarico per un mese	L'utilizzo di una guaina a trama circolare
10	L'esercizio isocinetico è caratterizzato da:	Resistenza variabile	Velocità angolare costante	Resistenza costante	Scarsa riproducibilità degli esercizi
11	Lo spirometro incentivante viene utilizzato per:	Valutare la saturazione di ossigeno	Ventilare in situazioni di emergenza o urgenza	Umidificare e fluidificare le secrezioni bronchiali	Migliorare la capacità respiratoria nei pazienti sottoposti ad intervento chirurgico
12	La causa più frequente di lesione del nervo radiale è:	Frattura diafisi omerale	Frattura epifisi omerale	Frattura di polso	Nessuna delle precedenti
13	In età giovanile, la Sclerosi Multipla si manifesta con:	Parestesie agli arti superiori	Neurite ottica retro-bulbare	Deficit di forza agli arti inferiori	Deficit di forza agli arti superiori
14	Quali tra i seguenti muscoli sono inspiratori accessori?	Intercostali esterni	Sterno Cleido Occipito Mastoideo e Scaleni	Intercostali Interni	Diaframma e retto dell'addome
15	Un paziente con diagnosi di distorsione di II grado dell'articolazione tibio-tarsica presenta:	Stiramento del legamento senza instabilità articolare	Stiramento del legamento, importante tumefazione, limitazione articolare ed instabilità	Parziale rottura del legamento con moderata tumefazione, dolorabilità e lieve instabilità	Nessuna delle precedenti
16	Un giovane ha riportato una frattura comminuta della gamba dopo un trauma ad alta energia in moto. Ricoverato con trazione transcalcaneare il giovane accusa forte dolore che non regredisce con la somministrazione ripetuta di analgesici. Si può sospettare:	Una tromboflebite	Una contusione profonda	Una sindrome compartimentale	Tutte le precedenti
17	La sindrome di Guillain-Barrè:	Esordisce con paralisi muscolare discendente	Esordisce con paralisi muscolare ascendente	Esordisce con monoparesi	Tutte le precedenti
18	La legge n. 104 del 5 febbraio del 1992 è:	La legge quadro per l'assistenza, l'integrazione sociale ed i diritti delle persone diversamente abili	La legge sulla privacy delle persone con handicap fisico e sensoriale	La legge che disciplina la materia delle barriere architettoniche	La legge che istituisce le Aziende Sanitarie Locali
19	Quale tipo di materasso antidecubito è indicato per persone ad altissimo rischio o con lesioni già certificate?	Materasso ventilato in espanso composito	Materasso di fibra cava siliconata	Materasso a bassa pressione di contatto a cessione d'aria (alta prevenzione)	Materasso di fibra cava siliconata ad inserti asportabili
20	Quali sono le più frequenti alterazioni posturali osservabili nella stazione seduta dell'emiplegico?	Il carico è per lo più mantenuto sull'emibacino e la coscia sani	Il carico è per lo più mantenuto sull'emibacino e la coscia	Rotazione interna e adduzione dell'arto inferiore plegico	L'arto inferiore plegico è flesso, il tronco è ruotato

PROVA SCRITTA 4 RISPOSTE

28/07/2021

A fine prova inserire nella busta grande, pena esclusione:

-la busta piccola contenente la scheda anagrafica del candidato debitamente compilata;

-il presente foglio “prova scritta risposte”;

Rendere separatamente il foglio “prova scritta domande” che sarà consegnato dopo il sorteggio.

DOMANDA 1
VISUAL ANALOGIC SCALE O NUMERIC RATING SCALE

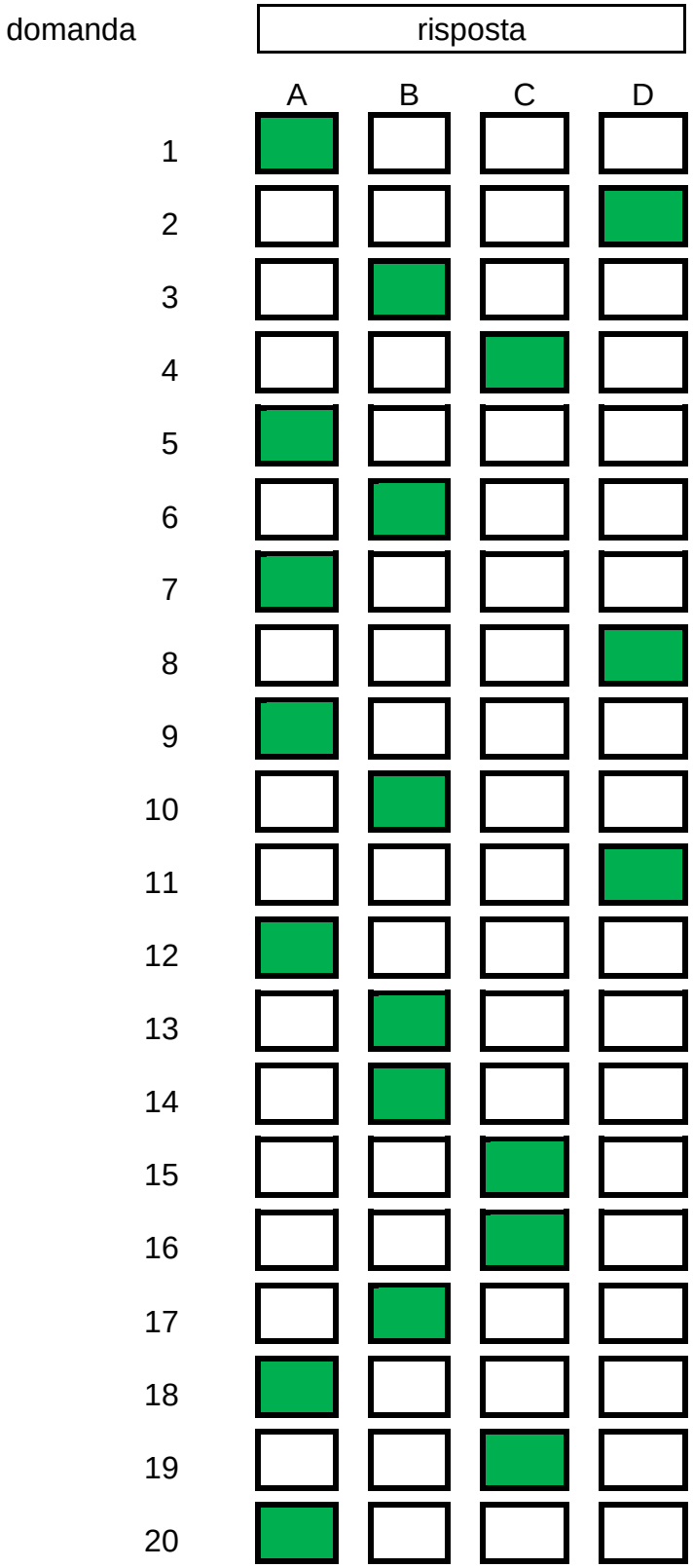
DOMANDA 2
DENTATO ANTERIORE

DOMANDA 3
TRAVERSO DELL’ADDOME, OBLIQUO INTERNO, OBLIQUO ESTERNO E RETTO

DOMANDA 4
BPCO

DOMANDA 5
APRASSIA IDEOMOTORIA

CORRETTORE PROVA SCRITTA 4



CONCORSO PUBBLICO PER TITOLI ED ESAMI A N.4 POSTI DI C.P.S. FISIOTERAPISTA CAT.D DA ASSEGNARE ALLE AZIENDE DEL S.S.R. DEL F.V.G.

Bando prot n.7994 del 26/02/2021

VERBALE N.3

Omissis

La commissione pertanto:

- elabora la versione definitiva della "prova scritta domande" e le racchiude nelle buste "prova scritta" - contrassegnate dai numeri 1, 2, 3, 4 – originale per il sorteggio più 529 copie di cui una in formato A3 – **ALLEGATI 1**-;
- elabora la versione definitiva del foglio "prova scritta risposte" e racchiude nella busta "prova scritta risposte" le 529 copie destinate ai candidati – **ALLEGATO 2**;
- gli originali del foglio "prova scritta domande" e il foglio "prova scritta risposte", vengono firmati dal Presidente prima dell'inserimento nelle relative buste;
- elabora la versione definitiva dei correttori per ogni prova – **ALLEGATO 3** -.

Le buste contenenti le prove vengono chiuse ermeticamente in 4 buste chiuse, numerate 1, 2, 3 e 4, timbrate e siglate sui lembi di chiusura dai membri della commissione.

Il sorteggio sarà effettuato con estrazione a sorte di 1 pallina su 4, poste all'interno di in un contenitore coprente, a cura di un candidato volontario – numerate 1, 2, 3, 4 -.

Omissis

La commissione:

- correggerà in forma anonima gli elaborati scritti e, una volta terminato, provvederà all'abbinamento con il nominativo del candidato;
- dà altresì atto che l'esito delle prove sarà pubblicato sul sito ARCS identificando i candidati a mezzo ID, ovvero codice univoco riportato a piè di pagina della domanda di adesione al concorso di ciascun concorrente.

Omissis

RANCATI JACOPO MATTEO | CAPONE FRANCESCA | ZORZETTO ELENA | PICCINI ROMILDA

CONCORSO PUBBLICO PER TITOLI ED ESAMI A N.4 POSTI DI C.P.S. FISIOTERAPISTA CAT.D DA ASSEGNARE ALLE AZIENDE DEL S.S.R. DEL F.V.G.

Bando prot n.7994 del 26/02/2021

VERBALE N.5

Omissis

La commissione al completo:

- si accerta dell'integrità dei due plichi contenenti le prove svolte al mattino e al pomeriggio,
- decide di completare la valutazione delle prove in data odierna,
- stabilisce che le prove orali si svolgeranno nelle giornate del 04 – 05 – 06 – 07 ottobre 2021,
- decide, al fine di ottimizzare i tempi, di procedere alla valutazione dei soli titoli relativi ai candidati che superano la prova scritta.

Omissis

S'intendono riportate le motivazioni ai punteggi così come definite nel verbale 1.

Omissis

L'esito sarà pubblicato entro il giorno 09/08/2021 sul sito dell'ARCS nella pagina dedicata al concorso.

Sempre in tale data verrà inoltre pubblicato il calendario delle prove orali, che stabilisce l'ordine di accesso all'aula d'esame di ciascun candidato.

Omissis

RANCATI JACOPO MATTEO	CAPONE FRANCESCA	ZORZETTO ELENA	PICCINI ROMILDA

CONCORSO PUBBLICO PER TITOLI ED ESAMI A N.4 POSTI DI C.P.S. FISIOTERAPISTA CAT.D DA ASSEGNARE ALLE AZIENDE DEL S.S.R. DEL F.V.G.

Bando prot n.7994 del 26/02/2021

VERBALE N.7

Omissis

La commissione prende atto che sul sito aziendale dell'ARCS, nella pagina dedicata al concorso, è stato pubblicato:

- in data 09/08/2021 l'esito della prova scritta e il calendario della prova orale di cui all'**ALLEGATO 1**,
- le raccomandazioni inerenti la prevenzione alla diffusione del covid-19 in relazione alla prova orale.

Omissis

La commissione, in relazione alla prova orale, decide:

- ai sensi dell'art. 16 e 43 si procederà all'accertamento delle conoscenze delle apparecchiature informatiche e della lingua inglese così come previsto dal bando,
- all'unanimità suddivide nel seguente metodo il punteggio previsto per la prova orale:

a) colloquio	19.5/19.5
b) accertamento elementi d'informatica	0.25/0.25
c) verifica conoscenza, almeno a livello iniziale, di una lingua straniera	0.25/0.25

La commissione inoltre:

- definisce la strutturazione della prova orale,
- dà atto che sarà accertata l'identità personale,
- stabilisce che la prova orale tenderà prioritariamente alla verifica delle conoscenze informatiche, della preparazione professionale ed infine della lingua inglese,
- dispone che per la prova di inglese i candidati dovranno leggere la sezione di articoli scientifici predisposti dalla commissione,
- prende atto che la prova si svolgerà a porte aperte e nel rispetto delle norme anti covid-19,
- ogni domanda avrà lo stesso peso in modo che l'impegno risulti equivalente,
- stabilisce che ciascun candidato procederà all'estrazione di uno solo dei biglietti progressivamente numerati e corrispondenti le domande che sono definite in data odierna ma che per riservatezza saranno riportati nel verbale del 04.10.2021.

L'attribuzione dei punteggi per la prova avverrà in base ai seguenti criteri:

PROFESSIONALE	
Da 8 a 9/19.5	GRAVEMENTE INSUFFICIENTE: non conoscenza/non risponde.
Da 10 a 11/19.5	MOLTO INSUFFICIENTE: trattazione molto scarsa, linguaggio tecnico inappropriato.
Da 12 a 13/19.5	INSUFFICIENTE: trattazione argomento molto limitata, linguaggio tecnico limitato.
Da 14 a 14.5/19.5	SUFFICIENTE: pertinenza al tema, qualche imprecisione, linguaggio abbastanza appropriato.
Da 15 a 15.5/19.5	PIU' CHE SUFFICIENTE: pertinenza al tema e esposizione abbastanza coerente, linguaggio abbastanza appropriato.
Da 16 a 17.5/19.5	DISCRETA: pertinenza al tema, trattazione completa, linguaggio abbastanza appropriato.

RANCATI JACOPO MATTEO — CAPONE FRANCESCA — ZORZETTO ELENA — PICCINI ROMILDA

Da 18 a 18.5/19.5	BUONA: trattazione completa ed esaustiva, esposizione coerente, linguaggio appropriato.
19/19.5	OTTIMA: trattazione completa ed esaustiva, esposizione coerente, linguaggio tecnico appropriato e capacità di centrare l'argomento.
INFORMATICA	
0/0.25	ERRATA
0.25/0.25	CORRETTA
INGLESE	
0/0.25	ERRATA
0.25/0.25	CORRETTA

Omissis

CONCORSO PUBBLICO PER TITOLI ED ESAMI A N.4 POSTI DI C.P.S. FISIOTERAPISTA CAT.D DA ASSEGNARE ALLE AZIENDE DEL S.S.R. DEL F.V.G.

Bando prot n.7994 del 26/02/2021

VERBALE N.8

Omissis

La commissione ha predisposto n. 198 domande di informatica e professionali, **ALLEGATO 1,** mentre per la prova di inglese ha disposto la lettura di una sezione di n. 08 articoli scientifici che verranno scelti dalla commissione nelle sessioni del mattino e pomeriggio di ogni giorno, **ALLEGATO 2.**

Omissis

RANCATI JACOPO MATTEO | CAPONE FRANCESCA | ZORZETTO ELENA | PICCINI ROMILDA

nr dom	**domanda tecnica**	**domanda informatica**
1	Con il decreto ministeriale 741/94 cosa viene individuato	A cosa serve il "cestino"
2	Cos'è un Percorso Diagnostico-Terapeutico-Assistenziale (PDTA)	A cosa serve la funzione "anteprima di stampa" in word
3	Cosa si intende per Educazione Continua in Medicina (ECM)	a cosa serve la funzione filtro in un foglio di calcolo elettronico
4	Ruolo del fisioterapista nell'equipe multiprofessionale	A cosa serve un programma antivirus
5	Ambiti di intervento del fisioterapista	A cosa serve una periferica di archiviazione di massa
6	Ruolo del fisioterapista in setting ospedalieri	Che cosa si intende con powerpoint
7	Ruolo del fisioterapista nelle degenze riabilitative	Che cos'è Android?
8	Ruolo del fisioterapista nel setting ambulatoriale	Che cos'è lo zip
9	Ruolo del fisioterapista nel setting domiciliare	Come deve esser composta una password per garantire la massima sicurezza
10	Ruolo del fisioterapista nei luoghi di lavoro	Come si chiama la procedura che esegue copie di sicurezza dei dati conservati in un hard disk
11	Cosa intendiamo per caregiver	Cosa accomuna un cd rom ed una chiavetta USB
12	Qual è il ruolo del caregiver in un percorso riabilitativo	Cosa identifica la username
13	Cosa si intende per educazione terapeutica	Cosa indica il messaggio loading
14	Qual è il ruolo del fisioterapista nella gestione delle cronicità	cosa indica la sigla "WWW"
15	Gestione del dolore nel percorso riabilitativo	Cosa indica l'estensione di un file
16	Il ruolo del paziente nella definizione degli obiettivi riabilitativi	Cosa occorre per collegare un pc ad internet
17	Rischi connessi alla movimentazione manuale dei carichi	Cosa serve il programma winzip
18	Quali rischi connessi all'attività lavorativa, oltre a quello della movimentazione manuale dei carichi	Cosa serve il simbolo".xls"
19	Il ruolo del fisioterapista nella tenuta documentale	Cosa serve il tasco "Block-num" sulla tastiera
20	Cosa si intende per compliance di un paziente	Cosa serve il toner in una stampante
21	Alzata terapeutica: aspetti assistenziali ed aspetti riabilitativi	Cosa serve la funzione "piè di pagina" in word
22	Quale condotta deve tenere il fisioterapista, durante il trattamento riabilitativo, nei confronti di un paziente cosciente che manifesta segni/sintomi da crisi ipotensiva	Cosa serve la funzione intestazione di word
23	Quale il ruolo del fisioterapista in ambito di prevenzione	Cosa serve un "firewall"?
24	Cosa sono le ADL	In base alle normative vigenti in materia di protezione dei dati personali, la password di accesso a procedure informatiche, dopo la prima assegnazione deve essere modificata e ...
25	Cosa sono le IADL	Cosa serve un programma di backup
26	Cosa si intende per pratica clinico-riabilitativa basata su prove di efficacia	Che cos'è il "trojan horse"
27	Cosa si intende per DPI in ambito sanitario	Cosa si intende con banner
28	Il ruolo del fisioterapista nel modello del self-management	Cosa si intende con fax server
29	Cosa si intende per problem solving scientifico in ambito sanitario	Cosa si intende con file
30	Differenza tra segni e sintomi nella valutazione funzionale	Cosa si intende con hardware
31	Cosa si intende per persona fragile	cosa si intende con il simbolo ".xls"
32	Cosa si intende per paziente complesso in ambito riabilitativo	Cosa si intende con il termine "informatica"
33	Cosa si intende per bisogno semplice e bisogno complesso in ambito riabilitativo	cosa si intende con pixel
34	Opportunità di telemedicina in riabilitazione	Cosa si intende con powepoint
35	Paziente esperto: ruolo educativo del fisioterapista	Cosa si intende con scanner
36	Cosa si intende per perdita della funzione	Cosa si intende con server
37	Qual è la differenza tra frattura traumatica e frattura patologica e quali implicazioni sulle strategie riabilitative	Cosa si intende con software
38	Quali sono le più frequenti complicanze legate alla frattura	Cosa si intende con virus informatico
39	Indicazioni e controindicazioni della crioterapia	cosa si intende per "bug" di un software
40	Cosa si intende per atteggiamento antalgico	Cosa si intende per "Cookies"
41	Cosa si intende per capacità funzionali	Cosa si intende per "E-learning"?
42	Cosa si intende per postura	Cosa si intende per "form"
43	Esercizi in catena cinetica aperta e chiusa	Cosa si intende per "malware"
44	Pianificazione degli esercizi terapeutici di gruppo	Cosa si intende per "motore di ricerca"
45	Esercizio terapeutico di gruppo: ambiti di applicazione possibili	Cosa si intende per "PDF"
46	Modalità di esecuzione di una sessione di esercizi terapeutici di gruppo	Cosa si intende per "provider"
47	Riabilitazione in acqua: quali possibili ambiti di applicazione	Cosa si intende per "record"
48	L'acqua come strumento terapeutico in idrochinesiterapia	Cosa si intende per "spam"?
49	Piani instabili: ambiti di applicazione	Cosa si intende per "WLAN"?
50	Misure di outcome in ambito neurologico	Cosa si intende per browser
51	Misure di outcome nella fisioterapia respiratoria	cosa si intende per disco fisso
52	Misure di outcome nella valutazione del cammino	Cosa si intende per download
53	Che cosa si intende con squilibrio muscolare	Cosa si intende per firma digitale
54	Che cosa si intende per controllo neuro-motorio	Cosa si intende per formato MP3?
55	Possibili cause di dolore di spalla nell'adulto	Cosa si intende per formattazione
56	Utilizzo di esercizi contro resistenza elastica: indicazioni terapeutiche	Cosa si intende per posta elettronica certificata
57	Quali sono gli effetti dell'immobilità sul corpo	Cosa si intende per rete wireless
58	quali sono gli effetti dell'esercizio fisico sul corpo	Cosa significa formattare un disco
59	BPCO: valutazione funzionale	Cosa significa il simbolo ∑ nel foglio elettronico di excel
60	BPCO: misure di outcome	cosa significa la funzione help in office
61	BPCO: approccio riabilitativo	Cosa significa la sigla WWW
62	BPCO: educazione terapeutica	Cos'è "internet explorer"
63	BPCO: obiettivi riabilitativi	Cos'è "Mozilla"

64	Pazienti in esiti recenti di chirurgia toracica: valutazione funzionale	Cos'è acrobat reader
65	Pazienti in esiti recenti di chirurgia toracica: misure di outcome	Cos'è google
66	Pazienti in esiti recenti di chirurgia toracica: approccio riabilitativo in fase acuta	cos'è il collegamento ipertestuale
67	Pazienti in esiti recenti di chirurgia toracica: indicazioni a domicilio	Cos'è il modem
68	Pazienti in esiti recenti di chirurgia toracica: educazione terapeutica	Cos'è il mouse pad
69	Fibrosi cistica: valutazione funzionale	Cos'è il programma LINUX
70	Fibrosi cistica: tecniche di disostruzione	Cos'è la "mailing list"?
71	Fibrosi cistica: educazione terapeutica	Cos'è la barra degli strumenti
72	Fibrosi cistica: obiettivi riabilitativi	Cos'è l'HTTP
73	Scompenso cardiaco: chronic care model	Cos'è l'icona di un file
74	Scompenso cardiaco: misure di outcome	cos'è l'interlinea in word
75	Scompenso cardiaco: educazione terapeutica	cos'è microsoft outlook
76	Riabilitazione cardiologica: ruolo del fisioterapista	Cos'è Microsoft Word
77	Riabilitazione cardiologica: misure di outcome	Cos'è mozilla
78	Riabilitazione cardiologica: educazione terapeutica	Cos'è un archivio compresso
79	Riabilitazione cardiologica: controindicazioni all'esercizio	Cos'è un driver
80	Riabilitazione cardiologica: programma riabilitativo	cos'è un elenco puntato in word
81	Frattura testa-omerale trattamento conservativo: valutazione funzionale	cos'è un foglio elettronico
82	Frattura testa-omerale trattamento conservativo: misure di outcome e obiettivi riabilitativi	Cos'è un indirizzo "IP"
83	Frattura testa-omerale trattamento conservativo: programma riabilitativo	cos'è un link
84	Esiti di intervento di sutura della cuffia dei rotatori: valutazione funzionale	Cos'è un mouse
85	Esiti di intervento di sutura della cuffia dei rotatori: obiettivi e misure di outcome nel primo mese post intervento	Cos'è un notebook
86	Esiti di intervento di sutura della cuffia dei rotatori: programma riabilitativo nel primo mese post intervento	Cos'è un operazione di login
87	Esiti di intervento di sutura della cuffia dei rotatori: obiettivi e misure di outcome nel secondo mese post intervento	Cos'è un pixel
88	Esiti di intervento di sutura della cuffia dei rotatori: programma riabilitativo nel secondo mese post intervento	Cos'è un programma open-source
89	Frozen shoulder: valutazione funzionale	Cos'è una homepage
90	Frozen shoulder: obiettivi riabilitativi e misure di outcome	Cos'è una penna USB
91	Frozen shoulder: programma riabilitativo	Cos'è una periferica
92	Esiti di frattura bi-malleolare trattata chirurgicamente: valutazione fuzionale	Cos'è una rete "intranet"
93	Esiti di frattura bi-malleolare trattata chirurgicamente: programma riabilitativo	Cos'è un'operazione di login
94	Esiti di frattura bi-malleolare trattata chirurgicamente: obiettivi riabilitativi ed outcome	Cos'è Windows
95	Esiti di frattura bi-malleolare trattata chirurgicamente: progressione terapeutica nella rieducazione al cammino	Dal punto di vista della sicurezza informatica, a cosa servono username e password
96	Frattura del piatto tibiale trattato chirurgicamente: valutazione funzionale	Dove risiede fisicamente la memoria RAM
97	Frattura del piatto tibiale trattato chirurgicamente: obiettivi riabilitativi ed outcome	Il simbolo @ a cosa serve
98	Frattura del piatto tibiale trattato chirurgicamente: programma riabilitativo	In internet cosa significa la sigla "URL"
99	Frattura del piatto tibiale trattato chirurgicamente: progressione terapeutica nella rieducazione al cammino	Nel programma Word, cosa indica il simbolo con il dischetto
100	Protesi totale di ginocchio: educazione terapeutica pre-chirurgica	Qual è la differenza tra hardware e software
101	Protesi totale di ginocchio: valutazione funzionale	Qual è la differenza tra memoria RAM e memoria ROM
102	Protesi totale di ginocchio: obiettivi riabilitativi e misure di outcome	Quale applicativo informatico viene utilizzato comunemente per la stesura di testi
103	Protesi totale di ginocchio: programma riabilitativo	Quale differenza c'è tra il comando "salva" e "salva con nome"
104	Protesi totale di anca: valutazione funzionale	Quale operazione aumenta il rischio di infettare il computer con un virus
105	Protesi totale di anca: progressione terapeutica nella rieducazione al cammino	Quale sistema occorre per la lettura ottica di testi, immagini e fotografie
106	Protesi totale di anca: programma riabilitativo	Quali sono i principali software per la navigazione internet
107	Protesi totale di anca: obiettivi riabilitativi e misure di outcome	Quali sono le principali funzionalità di un foglio di calcolo
108	Protesi totale di anca: educazione terapeutica pre-chirurgica	Quali sono scopo ed utilità di una cartella condivisa in rete
109	Paziente con esiti di frattura di femore trattata chirurgicamente: valutazione funzionale	Su internet cosa sono le FAQ
110	Paziente con esiti di frattura di femore trattata chirurgicamente: obiettivi riabilitativi e misure di outcome	Un file eliminato dove può esser ritrovato
111	Paziente con esiti di frattura di femore trattata chirurgicamente: progressione terapeutica nella rieducazione al cammino	Da cosa è composto un indirizzo di posta elettronica?
112	Paziente con esiti di frattura di femore trattata chirurgicamente: programma riabilitativo	Quali sono le periferiche di input in un computer
113	Paziente con esiti di frattura di femore trattata chirurgicamente: ruolo del care giver nel percorso riabilitativo	Quali sono le periferiche di output di un computer

114	Paziente con esiti di frattura di femore trattata chirurgicamente: valutazione ambientale funzionale al rientro a domicilio	Per inviare un messaggio di posta elettronica si deve conoscere...
115	Ruolo collaborativo del fisioterapista nella prevenzione delle lesioni da pressione	Quale software risulterebbe adeguato per presentare al pubblico i risultati di un'indagine statistica?
116	Quali ausili si utilizzano per la prevenzione delle lesioni da pressione	I tasti col simbolo delle freccette a cosa servono?
117	Ruolo del fisioterapista nella prevenzione della sindrome ipocinetica	A cosa serve il tasto Invio (o Enter o Return)?
118	Ruolo del fisioterapista nel percorso di "disallettamento"	Cosa si indica con il termine "directory" o cartella
119	Quali sono le complicanze del paziente nella sindrome ipocinetica	Cosa sono le icone?
120	Grave cerebro-lesione acquisita: scopi dell'allineamento posturale	Per aprire un documento generato da Word come procedo?
121	Grave cerebro-lesione acquisita: valutazione funzionale nell'immediato post-acuto	Come procedo per spostare un'icona da una cartella a un'altra?
122	Grave cerebro-lesione acquisita: obiettivi riabilitativi durante la degenza nell'immediato post-acuto	Quando si riceve un messaggio di posta elettronica con un allegato, è buona abitudine..
123	Grave cerebro-lesione acquisita: quali le manifestazioni cliniche correlate alle funzioni corticali superiori	Per quali motivi è utile aggiornare i programmi?
124	Grave cerebro-lesione acquisita: valutazione ambientale funzionale al rientro a domicilio	In un messaggio di posta elettronica, il campo CCN cosa indica?
125	Persona con esiti di recenti di ictus emisferico sinistro: valutazione funzionale	Normalmente un parola che appare sottolineata in una pagina web cos'è?
126	Persona con esiti recenti di ictus emisferico sinistro: quali le manifestazioni cliniche correlate alle funzioni corticali superiori	Quando viene inviato un messaggio di posta elettronica certificata (PEC) con allegato un documento, i sistemi di gestione della PEC certificano
127	Persona con esiti di recenti di ictus emisferico sinistro: programma riabilitativo	I principali vantaggi di una rete informatica sono..
128	Persona con esiti di recenti di ictus emisferico sinistro: progressione terapeutica nella rieducazione al cammino	Che cos'è la crittografia
129	Persona con esiti di recenti di ictus emisferico sinistro: obiettivi riabilitativi e misure di outcome	Quando un computer è completamente bloccato e non risponde ai comandi di mouse e tastiera, è necessario spegnerlo. Qual è la procedura corretta?
130	Persona con esiti di recenti di ictus emisferico sinistro: ruolo del care giver nel percorso riabilitativo	Una penna ottica è un dispositivo atto a ..
131	Persona con esiti di recenti di ictus emisferico sinistro: valutazione ambientale funzionale al rientro a domicilio	Una Pen Drive può essere utilizzata quante volte per memorizzare dati?
132	Come organizzare una stanza di degenza del paziente eminattento	Per poter avere copia dei dati da poter ripristinare in caso di rottura dell'HardDisk, che operazione è opportuno fare periodicamente?
133	Persona con sindrome della spinta: obiettivi riabilitativi e proposte terapeutiche	Qual è la durata massima di una password secondo la vigente normativa?
134	Persona con disturbo aprassico: obiettivi riabilitativi e proposte terapeutiche	Che cosa si intende per Wi-Fi?
135	Persona con neglet (eminattenziaone spaziale): obiettivi riabilitativi e proposte terapeutiche	A cosa serve la combinazione di tasti Ctrl+V?
136	Quali difficoltà e rischi nella gestione della persona con anosognosia	Dove si possono memorizzare permanentemente cartelle e file?
137	Persona affetta da SLA (sclerosi Laterale Amiotrofica): elementi di valutazione funzionale	Cosa si intende con il termine database?
138	Persona affetta da SLA (sclerosi Laterale Amiotrofica): obiettivi riabilitativi e misure di outcome	A cosa si riferisce il termine desktop?
139	Persona affetta da SLA (sclerosi Laterale Amiotrofica): ruolo del fisioterapista nella progressione della malattia	Che tipo di computer è il laptop?
140	Persona affetta da SLA (sclerosi Laterale Amiotrofica): ruolo del fisioterapista nell'equipe multiprofessionale	Un programma può essere installato su qualsiasi computer?
141	Persona affetta da SLA (sclerosi Laterale Amiotrofica): ruolo del fisioterapista nel coinvolgimento/educazione del caregiver	Per lanciare un programma che cosa è necessario fare?
142	Persona affetta da SLA: valutazione ambientale domiciliare	Cos'è la RAM?
143	Persona affetta da Sclerosi Multipla: elementi di valutazione funzionale	Che operazione compio per spostare una finestra?
144	Persona affetta da Sclerosi Multipla: obiettivi riabilitativi e misure di outcome	Per salvare le modifiche ad un documento esistente?
145	Persona affetta da Sclerosi Multipla: ruolo del fisioterapista nella progressione della malattia	Con quale oggetto viene selezionato il testo?
146	Persona affetta da Sclerosi Multipla: ruolo del fisioterapista nell'equipe multiprofessionale	Cosa significa mettere un testo in grassetto?
147	Persona affetta da Sclerosi Multipla: ruolo del fisioterapista nel coinvolgimento/educazione del caregiver	Quali comandi devo usare per copiare del testo?
148	Persona affeta da Sclerosi Multipla: valutazione ambientale domiciliare	Quali comandi devo usare per spostare del testo?
149	Persona affetta da morbo di Parkinson: elementi di valutazione funzionale	Come viene identificata una cella in Excel?
150	Persona affetta da morbo di Parkinson: obiettivi riabilitativi e misure di outcome	Quale tipo di dati puoi inserire in una singola cella di excel?
151	Persona affetta da morbo di Parkinson: ruolo del fisioterapista nella progressione della malattia	Qual è l'utilizzo dello Screen saver?

152	Persona affetta da morbo di Parkinson: ruolo del fisioterapista nell'equipe multiprofessionale	Che differenza c'è tra un monitor da 17 pollici e uno da 14 pollici?
153	Persona affetta da morbo di Parkinson: ruolo del fisioterapista nel coinvolgimento/educazione del care giver	Come viene definita la stampante su cui viene mandato direttamente in stampa un documento?
154	Persona affetta da morbo di Parkinson: valutazione ambientale domiciliare	Quanto tempo passa prima che Windows attivi lo Screen Saver?
155	Fenomeno con freezing nella persona affetta da morbo di Parkinson: strategie terapeutiche da proporre	Il nome di un file di Windows, può contenere degli spazi?
156	Persona affetta da distrofia muscolare di Duchenne: ruolo del fisioterapista nella progressione della malattia	Comprimere un file significa:
157	Persona affetta da distrofia muscolare di Duchenne: ruolo del fisioterapista nell'equipe multiprofessionale	Le parole che Word considera scorrette sono sottolineate in colore:
158	Paralisi Cerebrale Infantile: ruolo del fisioterapista nella valutazione delle ortesi	É di norma possibile stampare su una stampante diversa da quella fisicamente connessa al proprio PC?
159	Paralisi Cerebrale Infantile: obiettivi riabilitativi nei primi tre anni di vita	Come si misurano le dimensioni di un monitor?
160	Paralisi Cerebrale Infantile: obiettivi riabilitativi dal 4° anno di vita	Che cos'è la posta elettronica certificata PEC?
161	Paralisi Cerebrale Infantile: quali le manifestazioni cliniche correlate alle funzioni corticali superiori	Cosa si intende quando si parla di programmi o applicativi classificati come foglio di calcolo?
162	Paralisi Cerebrale Infantile: scopo del trattamento riabilitativo nei luoghi di vita	Che estensione hanno i file in word?
163	Paralisi Cerebrale Infantile: ruolo del fisioterapista nell'accordo terapeutico con la famiglia	In un programma di elaborazione testi eseguendo la sequenza taglia incolla
164	Paralisi Cerebrale Infantile: ruolo del fisioterapista nell'inserimento scolastico	In base alle normative vigenti in materia di protezione dei dati personali, gli operatori informatici classificati come "amministratori di sistema" cosa possono fare?
165	Infante affetto da spina bifida: scopo del trattamento riabilitativo nei luoghi di vita	Che cosa caratterizza, essenzialmente un foglio di calcolo?
166	Fanciullo affetto da spina bifida: interventi riabilitativi finalizzati all'impostazione del cammino	Fonti luminose e disposizione del monitor
167	Persona affetta da paraplegia: obiettivi riabilitativi nell'immediato post-acuto	Lavorando a videoterminale è consigliato
168	Persona affetta da paraplegia: obiettivi riabilitativi a medio termine funzionali alla deospedalizzazione	Alla riaccensione del pc dopo un black-out elettrico da che punto è possibile riprendere il lavoro precedentemente iniziato?
169	Persona affetta da paraplegia: valutazione ambientale funzionale al rientro a domicilio	Cosa significa l'acronimo PEC?
170	Persona affetta da paraplegia: scopo del trattamento riabilitativo nei luoghi di vita	Windows e Linux sono?
171	Persona affetta da tetraplegia: obiettivi riabilitativi nell'immediato post-acuto	A cosa servono le unità disco?
172	Persona affetta da tetraplegia: obiettivi riabilitativi a medio termine funzionali alla deospedalizzazione	È possibile aprire un programma dal desktop?
173	Persona affetta da tetraplegia: scopo del trattamento riabilitativo nei luoghi di vita	Si possono aprire più finestre nel desktop?
174	Persona affetta da paraplegia: valutazione ambientale funzionale al rientro a domicilio	Una cartella cosa può contenere?
175	Chronic Lower Back pain: ambiti di valutazione	Come viene eliminato un file?
176	Chronic Lower Back pain: contenuti del programma di riabilitazione	Quale termine viene usato per indicare il salvataggio di un file da un server Internet, nel disco fisso del tuo computer?
177	Ruolo del fisioterapista nella prevenzione secondaria rivolta all'adulto affetto da mal di schiena cronico	È possibile creare file direttamente sul desktop?
178	Persona con atassia cerebellare: obiettivi riabilitativi e proposte terapeutiche	Come apro un documento esistente?
179	Persona con atassia cerebellare: valutazione ambientale domiciliare	Per cancellare i dati su una cella, seleziono la cella e ....
180	Nel paziente con demenza senile ad eziologia vascolare, quali sono le prime alterazioni dell'attività motoria	A cosa serve l'asterisco "*" in Excel?
181	Ruolo del fisioterapista nella prevenzione delle cadute nelle persone anziane	In Windows cosa indica il termine "cartella"?
182	Ruolo del fisioterapista nel contesto delle cure palliative: obiettivi riabilitativi di un paziente ricoverato in hospice	Per ridimensionare contemporaneamente una finestra in altezza e larghezza si agisce con il mouse dove?
183	Ruolo del fisioterapista nel contesto delle cure palliative: obiettivi riabilitativi di un paziente che desidera rientrare a domicilio	Ogni indirizzo email deve avere una password di accesso?
184	Ruolo del fisioterapista nel contesto delle cure palliative: obiettivi riabilitativi di un paziente seguito a domicilio	A cosa serve il simbolo slash "/" in Excel?
185	Paziente operata di mastectomia bilaterale: quali gli obiettivi riabilitativi nella prima settimana dall'intervento	L'esecuzione del comando Taglia può essere operata dalla combinazione di quali tasti sulla tastiera?
186	Paziente operata di mastectomia bilaterale: quali gli obiettivi riabilitativi in ambito ambulatoriale	Excel, all'interno di una formula in quale posizione deve essere inserito il segno dell'uguale =?
187	prevenzione/gestione del linfedema nella persona mastectomizzata	Normalmente su una penna USB, che tipo di files possiamo copiare?
188	Quali gli obiettivi riabilitativi nel paziente oncologico con manifestazioni di fatigue	Di norma, in Windows, la pressione del tasto destro del mouse provoca:
189	Piede torto congenito: obiettivi e programma riabilitativo	L'indirizzo web: http:\\www.simone.it è corretto?
190	Ruolo del fisioterapista nel paziente con amputazione di arto inferiore nelle giornate successive all'intevento chirurguco (prima settimana)	In un messaggio di posta elettronica, il campo CC cosa indica?

191	Ruolo del fisioterapista nel paziente con amputazione di arto inferiore nella fase pre-protesica	Descriva la funzione "inoltra" su un gestore di posta elettronica
192	Ruolo del fisioterapista nel paziente con amputazione di arto inferiore nella rieducazione al cammino con protesi	Quale canale può essere utilizzato per l'attività di phishing?
193	Paziente con amputazione di arto inferiore: scopi del trattamento	In uno schermo, i pixel misurano..
194	Paziente con amputazione di arto inferiore: valutazione ambientale domiciliare	In un programma di elaborazione testi, per “testo giustificato” cosa si intende
195	Quali sono gli ausili maggiormente utilizzati per la deambulazione	Qual è il programma di Microsoft che gestisce le e-mail
196	Quali sono i più frequenti ausili utilizzati per la movimentazione dei pazienti non autosufficienti	Qual è la definizione di Tablet?
197	Differenza tra carrozzina ad autospinta sulle ruote posteriori pieghevole e carrozzina ad autospinta sulle ruote posteriori leggera	Excel è un applicazione di permette di:
198	Indicazioni all'utilizzo del tavolo inclinabile per statica	Si possono denominare due file con lo stesso nome?

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Which type of exercise therapy is effective after hip arthroplasty? A systematic review of randomized controlled trials

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***Background*. Early multidisciplinary rehabilitation can improve the recovery after total hip arthroplasty (THA). However, optimal exercise therapy has not been defined.**

We aimed to answer the question: "Which type and/or timing of exercise therapy is effective following THA?"

***Design*. Systematic review.**

***Methods*. We searched four databases: MEDLINE, PEDro, Cochrane Library, and Cinahl since January 2008 till December 2012. Literature before 2008 was not searched for, because it was previously analyzed by two systematic reviews. Eligible criteria for studies were: Randomized Controlled Trials (RCTs); English language; interventions on type and/or timing of physical exercise initiating after THA; outcome measures including at least one among impairment, activity, participation, quality of life, or length of stay in hospital.**

***Results*. Eleven papers on nine RCTs were identified. Trial quality was mixed. PEDro scores ranged from four to eight. Exercise therapy varied greatly in type and timing. Each of the nine RCTs addressed a specific issue and overall the results were sparse. In the early postoperative phase favorable outcomes were due to ergometer cycling and maximal strength training. Inconclusive results were reported for aquatic exercises, bed exercises without external resistance or without its progressive increase according to the overload principle, and timing. In the late postoperative phase (> 8 weeks postoperatively) advantages were due to weight-bearing exercises.**

***Conclusion*. Insufficient evidence exists to build up a detailed evidence-based exercise protocol after THA. Sparse results from few RCTs support specific exercise types which should be added to the usual mobility training in THA patients.**

KEY WORDS: Arthroplasty - Hip - Physical exercise - Prosthesis - Rehabilitation.

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The prevalence of hip osteoarthritis (OA) varies greatly depending on both the populations studied and the diagnostic criteria adopted. It has been estimated that 3% to 6% of the adult Europeans and Americans of European descent are affected by a symptomatic form of the disease, whereas the prevalence is generally lower in non-European people and obviously higher when the disease is diagnosed at imaging findings in the preclinical phase.[1-4] In the next years, the absolute number of patients with hip OA is expected to increase further as suggested by incidence studies, given the longer life expectancies, and the rising of elderly people.[5]

Total hip arthroplasty (THA), which is the treatment of choice for the end-stage joint disease,[6, 7] is among the most widely performed procedures in orthopedic practice in a lot of countries.[8-12] The increasing number of patients with hip OA together with the change of thresholds for surgery [13, 14] and the growing volume of revisions [9-12] has led to the continuing raise in the number of THAs.[9-12, 15] A further increase in THAs is predicted by around

175% between 2005 and 2030,[16] although relevant disparities exist in patients' use of hip replacement depending on geographic area, socio-economic status, gender, and race.[14]

Outcome studies after THA consistently showed an overall satisfaction by both patients and physicians [17-19] with pain relief, and substantial improvement in function and quality of life.[20-23] However, a wealth of observational studies indicate the persistence of impairment and functional limitations both at short- and long-term follow-up.[24-34] Rehabilitation after THA is expected to optimize outcomes. Consequently, people with THA largely attend rehabilitation services.[15, 34, 35] In 2008 one systematic Cochrane review showed that early multidisciplinary rehabilitation can actually improve outcomes at the level of both activity and participation following THA.[36] As a consequence, early multidisciplinary rehabilitation is a milestone to optimize THA outcome. Although exercise therapy is a crucial component of the rehabilitation strategy, detailed protocols including exercise type, initiation time of the intervention, duration of each session and of the overall intervention, time interval between sessions, and specific equipment required, strictly based on the hierarchy of evidence, have not been agreed upon, and the available protocols are largely experience-based.[37-43]

A preliminary step to build up evidence-based, widely shared, protocols is the systematic review of the literature. In 2009, two systematic reviews on the effectiveness of exercise therapy after THA were published.[44, 45] Our objective was to update our previous systematic review,[44] examining the new randomized controlled trials (RCTs) published since 2008 which assessed at least one among impairment, activity, participation, health-related quality of life, or length of stay in hospital as outcome measure. We aimed to answer the question: "Which type and/or timing of exercise therapy is effective following THA?"

Materials and methods

Eligibility criteria

Studies were eligible for review if they met the following criteria: 1) they were RCTs; 2) language was English; 3) interventions regarded type and/or timing of physical exercise defined as physical activity that is planned, structured, and repetitive for the purpose of conditioning any part of the body; 4) interventions began after THA. All the patients underwent THA, or data from the subgroup with THA were analyzed separately; 5) outcome measures included at least one among impairment, activity, participation, health-related quality of life, or length of stay in hospital.

Given the low number of studies, we did not select them on the basis of their methodological quality, although we judged each study using the Physiotherapy Evidence Database (PEDro) scale. This is a reliable scale developed to rate the quality of randomized controlled trials (RCTs) evaluating physical therapist interventions.[46, 47] The PEDro score is determined by counting the number of checklist criteria that are satisfied in the trial report. Overall, PEDro score derives from 10 criteria (out of the 11 criteria of the checklist).

Search strategy for identification of studies

Firstly, we conducted a MEDLINE search by using the following key words: "hip, arthroplasty, rehabilitation". Further searches were performed by substituting either "prosthesis" or "replacement" for "arthroplasty" and "exercise" for "rehabilitation". Secondly, we searched three further databases: PEDro, Cochrane Library, and Cinahl. The literature was searched since January 2008 till December 2012. Literature before 2008 was not systematically evaluated, because it was previously analyzed by two systematic reviews.[44, 45] All potentially eligible studies were evaluated for inclusion independently by two reviewers, without prior consideration of the results. Conflicts on eligibility were resolved by discussion. Finally, we hand-searched the references of all the studies included in this review and their "related articles" (by using Pubmed).

Data items of included studies

For each of the included studies we evaluated the following items: sample size, exclusion criteria, mean age of the participants, interventions, setting, allocation concealment, blinding, type and timing of the exercise regimen in intervention and control groups, duration of follow-up, outcome measures, dropouts, and overall PEDro score. Limitations of the studies as both pointed out by the authors and highlighted

by two independent reviewers were recorded, with special consideration for potential sources of bias.

We maintained our previous distinction between early studies (performed within eight weeks since THA) and later studies.[44]

Results

Interventions performed in the early postoperative phase (operation interval <8 weeks)

The PRISMA flow of information through the different phases of the review [48] is summarized in Figure 1. Seventeen papers were excluded after full-text examination.[49-65] A total of 11 articles [66-72, 74-77] reporting on nine RCTs fulfilled our inclusion criteria. Table I summarizes the main features of each study. The results of each of the nine studies are summarized below.

Liebs *et al.* showed that the addition of ergometer cycling for at least three weeks to a conventional exercise program induced a significant increase in function assessed by the Western Ontario and McMaster Universities (WOMAC) index score versus the control group at both three and 24 months.[66] Notably, the significant differences in the functional score exceeded the absolute minimal clinically important improvement threshold by a factor of 2. Also, the Lequesne hip score was significantly better in the cycling group at the 24-month follow-up. The percentage of "very satisfied" patients was significantly higher in the cycling group at three, 12, and 24 months. The physical component of the SF-36 questionnaire on quality of life showed a significantly better score in the cycling group at six and 24 months. No adverse events were reported and the number of hospital readmissions was the same (five) in the two groups at the three-month follow-up. The authors concluded that ergometer cycling after total hip arthroplasty is an effective means of achieving significant and clinically important improvement in patients' early and late health-related quality of life and satisfaction.

Husby *et al.* assessed maximal strength training for hip abduction and leg press plus conventional physiotherapy versus conventional physiotherapy only.[67] The intervention began one week postoperatively and lasted for 4 weeks. The authors found a significant between-group difference in muscle strength and rate of force development (a measure of the ability to develop muscle strength rapidly) five

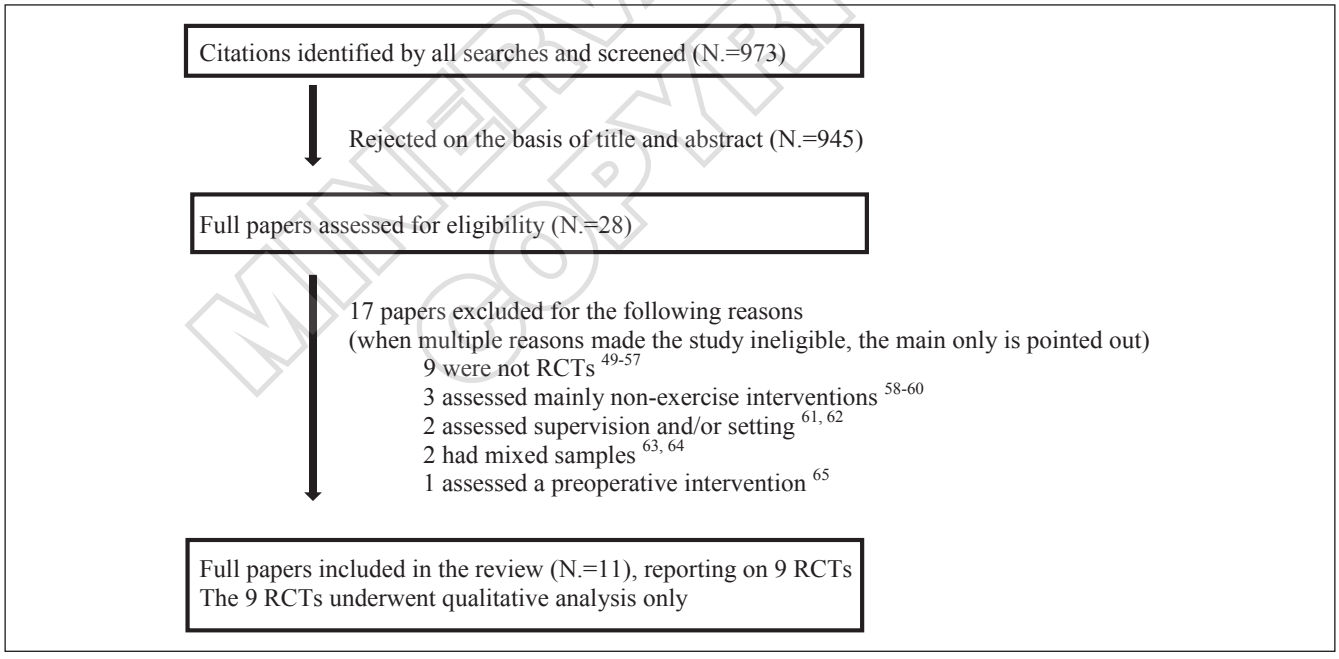

Figure 1.—Flow diagram to summarize the stages of the systematic review.

TABLE I.—*Main characteristics of the nine RCTs included in the review.*

Study	Randomized participants	Intervention
Liebs *et al.*[66]	203 patients with unilateral THA from five centers. Excluded: history of septic arthritis, fractures, intraoperative complications, revision surgery, rheumatoid arthritis, amputations, malignancy, inability to complete questionnaires. Mean age: 67.2 ± 8.5 and 67.2 ± 10.3 years, respectively in the 2 groups.	Randomization to 2 groups (with allocation concealment). Both participated daily in a standard program which included range-of-motion activities, exercises to improve muscle strength, venous return, balance, coordination, and gait, and instruction in activities of daily living. The intervention group had an additional treatment: they performed cycling by an ergometer after the second post-operative week, 3 times a week for at least 3 weeks. The ergometer resistance was set to a minimum (for example 30 W).
Husby *et al.*[67, 68]	24 patients with unilateral THA from one center. Excluded: hip damage not due to osteoarthritis, age > 70 years, ASA score different from 1, muscular or skeletal diseases, heart or lung diseases, diabetes mellitus. Mean age: 58 ± 5 and 56 ± 8 years respectively in the 2 groups.	Randomization to 2 groups (without allocation concealment). Both groups exercised for 1 hour daily for 5 days a week, for 4 weeks. They performed sling exercises with low resistance (>12-15 repetitions) or no resistance and aquatic exercises. They attended educational classes twice a week. The intervention group had an additional treatment: 5 training bouts a week, for 4 weeks, from 1 week postoperatively. Each session consisted of 10-minute warm-up followed by 4 series of 5RM of leg press and hip abduction involving the operated leg only. The series were separated by rest periods of 2 minutes.
Mikkelsen *et al.*[69]	46 patients with unilateral THA from one center. Excluded: discharged to rehabilitation units, not able to complete questionnaires. Mean age: 67.7 ± 7 and 66.8 ± 8 years respectively in the 2 groups	Cluster randomization to 2 groups (with allocation concealment). Clusters corresponded to groups of 2-4 patients who were instructed in the exercises in 3 supervised sessions during their stay in hospital. After discharge, all the participants were recommended to perform one set of 10 repetitions of the exercises twice a day at home, and supplement the training with bicycling and walking. The exercises for the intervention group (but not for the controls) included external rubber-band resistance and step exercises with progression after 4 weeks.
Smith *et al.*[70, 71]	60 patients with unilateral THA from one center. Excluded: not able to understand written and spoken English, inability to undertake assessment and treatment procedures, an inability to mobilize independently with or without walking aids, patients required to be non-weight bearing after surgery, complex primary THAs requiring bone grafting and/or acetabulum screw fixation. Mean age: 66.2±11.3 and 68.1±10.5, respectively, in the two groups.	Randomization to 2 groups (without allocation concealment). Both received daily a standard mobility program since the first postoperative day. The program included sitting on the edge of the bed, and attempting to stand and walk using the appropriate walking aid, step and stair practice. In addition the intervention group received bed exercises, including active hip flexion, active ankle dorsi- and plantar-flexion, static quadriceps and static gluteal exercises performed bilaterally whilst supine. Patients were advised to perform each exercise 10 times, five times daily, and to continue their exercises for as long as they wished once discharged.
Giaquinto *et al.*[72]	Around 70 patients with unilateral THA from one center (the number of participants was inconsistently reported). Excluded: concomitant acute illness, cognitive impairment, inability to complete questionnaires, no compliance, not speaking Italian language. Mean age: 70.6 ± 8.4 and 70.1 ± 8.5, respectively in the 2 groups.	Randomization to 2 groups (without allocation concealment) within the 10th postoperative day. Both groups were treated 6 times a week for 3 weeks. Each session lasted 40 minutes (plus 20 minutes of warm-up). Intervention group: hydrotherapy in a special non-swimming pool. Control group: land-based physiotherapy.
Rahmann *et al.*[74]	27 patients with unilateral THA from one center (included together with 27 patients with total knee arthroplasty. The results were shown separately for the two groups at the 14-day follow-up). Excluded: living outside the metropolitan area, neurologic disorders, other major musculoskeletal problems, cognitive dysfunction, revision surgery, requesting aquatic therapy, medically unstable. Mean age was not available separately for the patients with THA (it was 70.4 ± 9.2 years, 69.4 ± 6.5 years, and 69.0 ± 8.9 years, respectively in the 3 groups from the whole sample).	Randomization to 3 groups (with allocation concealment). All 3 received a standard land-based exercise program daily during the first 3 days postoperatively and throughout the intervention phase (from day 4 to day 14 postoperatively). From day 4 after surgery each group received an additional treatment daily: aquatic physiotherapy (to maximize strength and function), water exercise (generic exercises), or land-based physiotherapy.

Follow-up	Blinding	Outcome	Dropouts	PEDro score
24 months	None	Primary: WOMAC index. Secondary: leg specific stiffness and pain, both measured by the WOMAC index; quality of life (physical component of the SF-36); Lequesne-Hip-Score, and a question on patient satisfaction.	at 3, 6, 12, and 24 months they were 13, 0, 4, and 11 respectively in the intervention group (7, 2, 0, and 7 in the control group). Three patients from the intervention group who were not available at the 3-month follow-up were available again at 6 months and afterward.	7/10
12 months	None	1RM leg press strength, 1RM abduction strength, rate of force development (10% to 90% of peak force obtained from the maximum slope of the force-time curve), work efficiency measured during walking on a treadmill at a 40W workload, gait patterns, quality of life by SF-36, and hip function by the Merle D'Aubigné and Postel scoring system.	At 5 weeks, 6 months and 12 months there were no dropouts in the intervention group and 0, 0, and 2 dropouts respectively in the control group.	5/10
12 weeks	Assessors	Primary: maximal gait speed by a 10-m walk test. Secondary: isometric hip abductor muscle strength by a hand-held dynamometer in the supine position, one-legged stance, health-related quality of life by the EQ-5D questionnaire, patient satisfaction, WOMAC index, self-reported activity level measured by PAS.	At 4 and 12 weeks they were 2 and 0, respectively in the intervention group (0 and 0 in the control group)	7/10
12 months	Assessors	Primary: ILOA scale and SF-12 questionnaire. Secondary: determining if patients received postoperative physiotherapy, duration of hospital admission, and whether patients experienced complications possibly related to exercise and mobility.	At 3 days, 6 weeks, and 12 months they were 0 in the intervention group (0, 0, and 1 respectively in the control group).	7/10
6 months	Assessors	Sub-scores of the WOMAC index (self-assessed function, stiffness, and pain).	Inconsistently reported (may be 6 overall), not separately indicated for each of the two groups and for each of the timing of follow-up assessment.	4/10*
14 days (data at longer follow-up were not separately shown for THA patients)	Assessors	Primary: WOMAC index, Hip abductor isometric strength by using a handheld dynamometer, walking speed by a 10-m test. Secondary: quadriceps and hamstrings isometric strength by using a handheld dynamometer, Timed up-and-go test, 2 subscales of the Arthritis Self-Efficacy scale, Patient-Specific Functional Scale, hospital length of stay, need for additional physiotherapy interventions.	None	7/10

TABLE I.—*Continues from previous page.*

Study	Randomized participants	Intervention
Liebs *et al.*[75]	280 patients with unilateral THA from 4 centers. Excluded: history of septic arthritis, fractures, intraoperative complications, revision surgery, rheumatoid arthritis, amputations, malignancy, inability to complete questionnaires. Mean age: 66.7 ± 10.3 and 69.1 ± 9.8 respectively in the 2 groups.	Randomization to 2 groups (with allocation concealment). Both received aquatic therapy (30 minutes, 3 times a week, up to the 5th postoperative week): pool exercises aimed at training of proprioception, coordination, and strengthening. Both received standard physiotherapy daily. "Early" group began aquatic on the 6th postoperative day, "late" group on the 14th.
Stockton *et al.*[76]	57 patients with unilateral THA from one center. Excluded: inability to perform the assessment procedures, inability to mobilize preoperatively as a result of musculoskeletal or neurologic problems, preference for hydrotherapy. Mean age: 68.2 ± 10.6 and 68.3 ± 9.3 years respectively in the 2 groups.	Randomization to 2 groups (with allocation concealment). Both received once daily physiotherapy which included mobilization, exercises, and transfer practice since the first postoperative day. The exercises were initially performed in the supine position and involved active movements at ankle, knee, and hip plus isometric contractions. Standing exercises and gait reeducation were gradually added. Education regarding precautions and the safe use of stairs were part of the pre-discharge preparation. In addition, the intervention group received one more physiotherapy treatment each day focusing on bed transfers and mobility.
Heiberg *et al.*[77]	68 patients with unilateral THA from 2 centers. Excluded: diagnosis other than hip osteoarthritis, living more than 30km far from the hospital, concomitant osteoarthritis at either knee or contralateral hip with walking restriction, neurologic disease, dementia, heart disease, drug abuse, inadequate ability to read and understand Norwegian. Mean age: 65 years (95% CI 63-68) and 66 years (95% CI 63-69), respectively in the two groups.	Randomization to 2 groups (with allocation concealment). The intervention group participated in 12 sessions, which were held twice a week, since 3 months post-surgery. Each session lasted for 70 minutes. The participants exercised in small groups (2-8 patients each). The exercise program was aimed at training neuromuscular functioning by doing several repetitions of different ambulatory tasks and activities (sit to stand, lunges, single-leg stance, standing on foam-balance pad, step up/step down, stair climbing, obstacle course, throwing ball, walking, stretching). The control group did not attend any supervised program; it was encouraged to continue with the exercises learnt after surgery.

*PEDro score calculated by the authors of this review differed from the one available at PEDro site; ASA: American Society of Anesthesiologists ILOA: Iowa Level of Assistance; PAS: Physical Activity Scale, RM: Repetition Maximum; WOMAC: Western Ontario and McMaster Universities osteoarthritis index.

weeks postoperatively, both favoring the strengthening group. Other between-group differences did not reach statistical significance. At 12-month follow-up the rate of force development still differed between groups at the operated leg whereas the only significant difference in strength regarded leg press at the healthy side (which was not involved in the strengthening program).[68] At 12 months, a significant difference in work efficiency became apparent (+ 30% in the intervention group). Notably, early maximal strength training (with a load corresponding to 80% to 90% of 1-Repetition maximum) was well tolerated and none of the patients from the intervention group exited the study. The authors concluded that early maximal strength training one week postoperatively is feasible and an efficient treatment to regain muscular strength for patients with THA.

Mikkelsen *et al.* compared home based exercises with and without both rubber-band external resistance and step.[69] Significant between-group differences were found neither in the primary outcome (walking speed) nor in the secondary ones (including muscle strength, performance, function, pain, joint stiffness, activity level, patient satisfaction, and quality of life) at four and 12 weeks. Problems with the unsupervised rubber-band exercises were reported by 17.4% of the participants from the intervention group, suggesting that not all THA patients can perform their post-surgery exercises without supervision. The authors did not drive any conclusions on effectiveness, because of inadequate sample size due to impossibility to complete the planned enrollment.

Smith *et al.*[70, 71] investigated the addition of bed exercises to a standard gait re-education program be-

Follow-up	Blinding	Outcome	Dropouts	PEDro score
24 months	None	Primary: WOMAC index. Secondary: leg specific stiffness and pain, both measured by the WOMAC index; quality of life by the physical component of the SF-36; Lequesne-Hip-Score, and a question on patient satisfaction.	At training, 3, 6, 12, and 24 months they were 9, 11, 8, 6, and 4 respectively in the early intervention group (1, 9, 6, 6, and 10 in the late treatment group).	7/10
6 days (or till discharge for the length of stay in hospital)	None	ILOA scale and length of stay in hospital.	None	7/10
9 months (*i.e.*, 12 months after surgery)	Assessors	Primary: 6-minute walk test. Secondary: stair climbing test, figure-of-eight test, Index of Muscle Function, active hip range of motion in flexion, extension, and abduction, Harris Hip Score, self-efficacy, Hip Dysfunction and Osteoarthritis Outcome Score.	At 2 and 9 months (5 and 12 months postoperatively) they were 2 and 1 respectively in the intervention group (1 and 0 in the control group).	8/10

ginning on the first postoperative day. No significant between-group differences were found in quality of life or level of assistance in mobility tasks at 3-day, 6-week, and 12-month follow-up. The number of patients requiring follow-up physiotherapy was similar in the two groups. No adverse events were associated with the intervention and postoperative complications were balanced in the two groups. The authors concluded that the addition of bed exercises to a standard gait re-education program following THA did not significantly improve patient function or quality of life.

Giaquinto *et al.* assessed the effectiveness of a three-week course of hydrotherapy versus land-based physiotherapy.[72] Hydrotherapy was performed in a special non-swimming pool.[73] The authors found significantly better scores for all three the WOMAC subscales in the hydrotherapy group than in the control group at both hospital discharge and six-month follow-up. No other outcome measures were assessed. The authors concluded that hydrotherapy is recommended after THA in a geriatric population (the mean age of the participants was 70 years in this study).

Rahman *et al.* investigated aquatic physiotherapy versus either non-specific water exercise or land based physiotherapy.[74] The patients exercised from day four to day 14 after surgery. At day 14 postoperatively, no significant between-group differences were found in any of the outcome measures including assessments of pain, joint stiffness, self-reported function, performance, self-efficacy, length of stay in hospital and need for additional physiotherapy interventions. A trend toward higher hip-abductor (but not quadriceps or hamstrings) strength in the

aquatic physiotehrapy group was seen, but it did not reach statistical significance among the 27 patients with total hip replacement (the study included patients with either hip or knee arthroplasty; differences in hip-abductor strength at the 14th postoperative day were significant when the whole sample was assessed, but not in the hip-replacement subgroup). Early aquatic physiotherapy was well tolerated (only one patient stopped aquatic treatment which began on the 4th postoperative day). The authors concluded that a specific inpatient aquatic physiotherapy program has a positive effect on early recovery of hip strength after joint replacement surgery, but not specifically after THA. In the whole sample including both hip and knee replacements, no significant between-group differences were seen at 3- and 6-month follow-up. Unfortunately, data of patients with hip replacement were not shown separately at prolonged follow-up.

Liebs *et al*. investigated the optimal timing of aquatic exercises aimed at training of proprioception, coordination, and strengthening.[75] They did not show any significant differences between early treatment (beginning on the 6th postoperative day) and late treatment (beginning on the 14th postoperative day), although a trend toward better outcomes in the late treatment group was observed. As for safety, ten patients from the early intervention group and four from the late group needed hospital readmission within three months (according to the authors, readmissions could be related to the intervention in two cases from each of the two groups). The authors noticed that nine patients in the early treatment group *versus* a single patient in the late group abandoned the study before receiving the planned treatment. Overall, they found no advantages and possible disadvantages both in effectiveness and adherence which were associated with the early beginning of aquatic therapy.

Stockton et al. compared two *versus* one physiotherapy sessions a day on short term outcomes [76]. At day three postoperatively, the patients from the two-session group showed a significantly better function as assessed by the Iowa Level of Assistance (ILOA) scale than the patients in the one-session group. However, the between-group gap was not clinically relevant, given the small difference found in the functional score (mean between-group difference 3.7). At day six no more between-group differences were found. The mean length of stay in hospital (around 8 days) was not significantly different between the two groups. The authors concluded that the patients who received twice-daily physiotherapy showed a trend toward earlier achievement of functional milestones.

Interventions performed in the late postoperative phase (operation interval >8 weeks)

Heiberg et al. compared a walking skill training program initiated 3 months after surgery and performed for six weeks with no intervention (the controls were simply encouraged to continue with the exercises they had learned after surgery and to keep generally active).[77] Improvement in physical performance assessed by using the 6-minute walk test showed significant between-group differences favoring the intervention group both at five and 12 months after surgery. The number of patients with a clinically relevant improvement (a change in walking distance of at least 50m) was significantly higher in the intervention group at both the assessment times. At five months after surgery, improvement in several secondary outcome measures of impairment, pain, performance, and self-reported function and efficacy consistently showed significant between-group differences favoring the intervention group. They included stair climbing test, figure-of-eight test, index of muscle function, active hip extension, Harris hip score, and self-efficacy. The between group difference in the stair climbing test persisted at the 12-month follow-up, whereas differences in the other secondary outcome measures were no longer apparent. The Authors suggested this may depend on a ceiling effect, given relatively high scores and improvement over time in the control group. A non-significant trend toward a between-group difference in the proportion of fallers was reported. Notably, the exercise program, which was carefully reported in detail by the authors was well tolerated and no adverse events were observed. The authors concluded that walking skill training program was effective, especially in improving walking both immediately after the intervention and 1 year after THA surgery.

Discussion

In the nine RCTs included in this review, exercise therapy following THA varied greatly as for exercise

type, initiation time of the intervention, duration of each session and of the overall intervention, time interval between sessions, number of sessions, and specific equipment required.[66-72, 74-77] This finding is in agreement with the wider literature, as highlighted by two previous reviews on the topic.[44, 45]

Each of the nine RCTs addressed a specific issue and overall the results are sparse.

Early postoperative phase.

A single RCT supplied convincing evidence to support the effectiveness of ergometer cycling.[66] Benefits in relevant outcome measures including function and quality of life were statistically and clinically significant and sustained at a two-year follow-up. Sample size was unusually large. Multicenter setting supported external validity. The authors hypothesized that the beneficial effect of ergometer cycling was due to improved muscular coordination, proprioception, and range of motion. It was somewhat surprising that in the same RCT no benefits were observed in the patients who underwent total knee replacement. To explain this apparent inconsistency, the authors suggested that increased edema of knee periarticular tissues with joint effusion and pain could overwhelm the benefits of cycling after knee (but not hip) replacement. Although the study is robust, two weaknesses must be taken into account: duration of each session and overall number of sessions were not pointed out by the authors, and the study groups were unbalanced as for time treatment with longer time for the intervention group. In the previous literature a single RCT addressed the role of ergometers following THA.[78, 79] The authors showed an improvement in impairment and function due to an exercise program with an arm ergometer performed for 30-minute sessions three times a week. The two studies [66, 78, 79] cannot be compared, because in the RCT by Maire *et al*.[78, 79] the lower limbs were not involved in the exercise program, which was specifically designed to improve physical fitness by an arm ergometer. Conversely the patients studied by Liebs *et al*. performed leg cycling at low resistance and improvement of physical fitness was not the objective of the exercise program which aimed at improving coordination, proprioception, and joint motion.[66]

A single RCT showed limited benefits in muscle strength, rate of force development, and work efficiency due to maximal strength training for hip abduction and leg press.[67, 68] The authors emphasized the relevancy of muscle strengthening, because inactivity both before and after surgery is a well-known cause of severe decline in muscle mass and muscle strength which in turn can affect function.[27, 30, 31, 80] One limitation of this small study (sample size=24) is the between-group unbalance in time treatment: the maximal strength training was performed in addition to the conventional exercises performed both by the patients from the intervention group and the controls. Furthermore, setting differences may be a source of bias: all the 12 patients from the intervention group exercised as inpatients in the same center, whereas four of the 12 controls exercised in a different setting (two were outpatients and two were inpatients in other rehabilitation centers). The relatively young age of the participants (mean age <60 years) may limit the generalizability of the results (particularly as for tolerability of early training). Finally, strength training increased muscle strength and work efficiency (in some of the multiple comparisons performed), but no significant advantages were found in the other outcome measures (including function, gait pattern, and quality of life), thus weakening the clinical meaning of the between-group differences found by the authors.

A single previous RCT [81] examined the effects of a strength training program (involving the quadriceps muscle only) after THA. The authors showed several significant benefits in impairment and function and a significant reduction in the length of stay in hospital due to the intervention. Although the two studies [67, 81] differed in several aspects, including mean age of the participants, duration of treatment, maximal external resistance adopted, and muscles undergoing strength training, they had a common feature: exercise intensity progressively increased by using repetition maximum units, according to the overload principle. As suggested by the authors, this seems to be the crucial component of an effective exercise program with external resistance. In agreement with this hypothesis, other interventions that were not based on the overload principle, failed to demonstrate any benefits. Mikkelsen *et al*. did not show any significant advantages when the external resistance was applied without individual progression and continuous adjustments of the intensity level for each participant. However, other major limitations may affect the results of this study.[69] As

acknowledged by the authors, it was underpowered due to organizational changes: patients' enrollment was not completed and the final sample size was 46, whereas the powered calculated sample size was 52. Also, the authors noticed an unbalanced distribution of the patients with contralateral THA in the two groups, as a possible source of bias. Furthermore, the authors hypothesized that exercise intensity was insufficient to lead to adequate strength gains and that unsupervised patients could incorrectly perform hip abduction exercises. Smith et al. showed that bed exercises without external resistance seemed to affect neither function nor quality of life when added to a mobility training.[70, 71] Indeed, a trend toward a better functional score as assessed by the ILOA scale in the intervention group was found at 6-week follow-up (P=0.05). The authors claimed that the between-group difference, although of borderline statistical significance, was not clinically relevant, because the absolute median difference was 1.5 whilst the minimal difference of clinical relevancy should be 7. However, median ILOA score in the controls was 5 (3.5 in the intervention group). Given the favorable recovery of the controls, no interventions could obtain a further meaningful improvement (in other words, a ceiling effect was present for ILOA scale). This study has one major limitation, as acknowledged by the authors: the lack of outcome measures of impairment (including muscle strength and range of movement), joint stiffness, pain, performance, and gait quality. The lack of effectiveness of bed exercises with no external resistance showed by Smith *et al*. is consistent with the results of one previous report which investigated the early postoperative phase with a very short time span:[82] the authors emphasized the absence of beneficial effects due to bed exercises and early mobilization compared with early mobilization alone in the first eight postoperative days. Indeed, no differences in length of stay in hospital, pain severity and functional score were shown. However, 2 of the 6 categories of the functional score (*i.e.*, walk 15 feet and climbing stairs) were significantly better in the treatment group and a trend toward an overall better functional score (that also includes supine to sitting, sitting on the edge of the bed to standing and walking speed over 13.4 meters) was observed (P=0.07). Data from the assessment of hip range of motion showed a non-significant trend toward a better outcome in the treatment group for hip flexion.

Overall, both these two negative studies on bed exercises without external resistance [70, 82] cannot be considered conclusive, because both of them found between-group differences in function of borderline statistical significance favoring the intervention group. Finally, bed exercises without external resistance or with external resistance with no individual progression, are not supported by the literature, although definitive demonstrations of their uselessness are not available. Conversely, exercises with progressive increase of external resistance according to the overload principle are supported by the results of two RCTs.[67, 81]

Two studies addressed the role of aquatic versus land-based exercise therapy, with inconsistent results. Giaquinto *et al*. found significant advantages favoring the aquatic group in pain, and self reported stiffness and function.[72] Conversely, Rahmann *et al*. did not show any significant between-group differences in the same outcome measures performed by Giaquinto *et al*. and in several other outcome assessments.[74] The conflicting results may depend on the variations in the specific aquatic exercise programs adopted. However, several weaknesses of the two studies must be considered when data is interpreted. In the study by Giaquinto *et al*., despite randomization, a significant difference was found at baseline between the two groups in joint stiffness. Selection of the patients and dropouts were not adequately reported (a CONSORT flow diagram was not available) and "non-compliance" was considered an exclusion criterion. Difference of interventions between groups was clearly stated (hydrotherapy *versus* land-based), but overall the description of the exercise programs was lacking. No information was available on adverse events and reasons for exiting the study. A proper discussion of the study limitations was not performed. The statistical significance of the between-group difference was emphasized, but its clinical relevancy was not discussed. The study by Rahmann *et al*. has three weaknesses: short-term follow-up, small sample size, and mixed sample. The limitations of the two studies and their conflicting results, together with the absence of previous RCTs on the same topic, prevent firm conclusions on the effectiveness of aquatic physiotherapy after THA. The potential benefits of underwater exercises, including pleasurable skin sensations, promotion of social relationships, lymphatic drainage, easy and safe mobilization due to weight reduction, muscle

strengthening, and proprioception stimulation, need further investigations. One more RCT included in this review examined aquatic physiotherapy, focusing on its optimal timing,[75] without performing any comparisons between aquatic and land-based exercises. Overall, no advantages and a trend toward disadvantages both in effectiveness and adherence were associated with the early beginning (*i.e.*, on the 6th postoperative day) of the aquatic exercises versus late beginning (*i.e.*, on the 14th postoperative day). Sample size was large (N.=280), follow-up was adequate (24 months), and several outcome measures were performed including assessment of pain, joint stiffness, self-reported function and activities of daily living, quality of life, and patients' satisfaction. Multicenter setting ensured external validity. Finally, the results of this study are in line with the usual rule of waiting for wound healing before initiating aquatic therapy after THA.

A single RCT investigated the number of daily physiotherapy sessions with uncertain results.[76] The patients who received twice-daily physiotherapy showed a trend toward earlier achievement of functional milestones which was of doubtful clinical significance: the between-group difference was small (not clinically significant), transient (no more found at day six after surgery) and it did not translate to decreased length of stay in hospital. In their discussion the authors pointed out a number of treatment-independent variables that can affect the length of stay in hospital and the limitation of the ILOA scale which does not capture qualitative differences in gait pattern (and was the only functional scale performed). One major limitation of this study that focuses on treatment time is the lack of a standard duration of each physiotherapy session: the authors compared two sessions *versus* one session, but physiotherapy time was neither standardized nor computed. One limitation of the generalizability is the relatively low level of disability prior to surgery in the study sample (likely due to private-hospital setting). A single previous study addressed the exercise time: consistently with the results by Stockton *et al.*,[76] Munin *et al.*[83] found a trend toward earlier achievement of functional milestones due to enhanced exercise time in the patients with THA. However, the previous study [83] found a significant reduction in the length of stay in hospital in disagreement with the recent study [76] and a lower total cost for surgery and rehabilitation due to early long-time therapy. Indeed, comparisons between the two studies cannot be easily performed, because Stockton *et al.* compared one *versus* two physiotherapy daily [76] whereas Munin *et al.* compared early (on postoperative day three) versus late (on postoperative day seven) beginning of a four-hour daily treatment.[83] Furthermore, the length of stay in hospital is affected by a lot of factors independent of physiotherapy, including social, economic, organization of the healthcare system, and reimbursement criteria and it has substantially decreased in the eleven-year time span between the two studies. Overall, no firm conclusions can be drawn on optimal physiotherapy time.

In the literature before 2008, one more issue regarding exercise programs, *i.e.*, postoperative weight bearing, was addressed by two RCTs. Unver *et al.* examined early full versus partial weight bearing.[84] Full weight bearing led to earlier achievement of transfer activities, more walking distance at the time of discharge, and a shorter hospital stay. Furthermore, at a three-month follow-up, early full weight bearing was associated with significantly better function, muscle strength, and performance, and with an overall reduction in the duration of crutch use. A major limitation in the generalizability of these results is the inclusion of patients with thrust plate prosthesis only. Hesse *et al.* examined treadmill training with partial body-weight support, which significantly improved function at the end of a ten-day training.[85] The difference in favor of the treatment group persisted at the 3- and 12-month follow-up. Furthermore, hip extension deficit, gait symmetry, hip-abductor strength, and the amplitude of gluteus medius activity assessed by electromyography were all better in the treatment group, with significant differences that persisted during the follow-up period. Finally, patients in the treatment group abandoned their crutches far sooner than controls (mean operation intervals were 3.2 and 7.9 weeks, respectively). A safety concern raised, because one patient in the treatment group died of pulmonary embolism during the treatment phase: the firm pressure of the harness around patient's thighs possibly played a causal role in the genesis of deep vein thrombosis and pulmonary embolism. Overall, the two studies do not lead to firm conclusions on postoperative weight bearing.[84, 85] Anyway, the traditional restriction of weight bearing for defined periods such as six-week period, are not sup-

ported by any RCTs, and may obstacle functional recovery.

Late postoperative phase

A single RCT supplied convincing evidence on the effectiveness of a walking skill training program in ameliorating physical performance, especially walking, with sustained statistically and clinically significant benefits.[77] The main weakness of this study is the lack of any interventions in the controls, who did not attend any supervised physiotherapy programs. As acknowledged by the authors, the physiotherapist's supervision and guidance alone may have a substantial effect independently of the specific exercise intervention.

In the previous literature, three RCTs consistently showed favorable results due to exercise programs performed in the late postoperative phase. Jan *et al*.[86] showed that a 12-week exercise program increased hip muscle strength, fast walking speed, and self-reported function, although most of the significant improvements were found in the highly compliant group only. Trudelle-Jackson *et al*.[87] showed that an 8-week exercise program significantly increased muscle strength and postural balance. Unlu *et al*.[88] showed that a 6-week exercise program significantly increased hip abductor muscle torque, gait speed and cadence. Although the exercise programs differed in several aspects, the pivotal component seems to consist of weight bearing exercises, which were performed by the patients in the intervention groups from all the four studies.[77, 86-88] Consistently with a crucial role exerted by weight bearing, Trudelle-Jackson *et al*. found better outcome measures in their intervention group performing weight-bearing exercises only, than in the control group performing both isometric and range of movement exercises. However, a single previous RCT published in 1988 did not show any significant advantages due to a two-three-month exercise program which included weight-bearing exercises.[89] The authors examined several outcome measures including joint range of motion, muscle strength, maximum walking speed, stair climbing, pain, and ability to function in activities of daily living. Two major limitations weakness this negative study: the treatment groups were unbalanced in muscle strength at baseline with significant between-group differences, and a substantial part of the results was not shown in detail. Finally, despite one negative report,[89] four studies support exercise interventions with weight bearing in the late postoperative phase.[77, 86-88]

Limitations of the studies reviewed and recommendations for further research

Overall, we found a limited number of RCTs which addressed a limited number of issues. As a consequence, the results are sparse and a detailed evidence-based protocol on optimal exercise type and timing after THA cannot be built up. Low study quality was a relevant problem in the past.[44] In the recent years, a trend toward increased study quality is evident. Among the most recent RCTs, there are multicentre studies, sample size of adequate power, detailed description of randomization with allocation concealment, and overall high PEDro scores, but methodological limitations persist in some of the studies. Patients included in the RCTs were selected, mainly to avoid comorbidities and/or post-surgery complications. This may limit generalizability of the results (indeed, this is a general problem for clinical trials).[90] No trials have been performed for homogeneous subgroups of patients with relevant comorbidities (such as neurologic diseases, rheumatoid arthritis, diabetes, arterial diseases) or complications (such as nerve injuries, length difference between lower limbs, recurrent dislocations) that may affect the effectiveness of rehabilitation and need specific interventions. Further potential sources of variability not investigated were arthroplasty type and surgical approach. New studies should take into account these sources of variability by either selecting homogeneous patients as for type of prosthesis and surgical operation, or stratifying participants for these variables in adequately powered trials. Outcome assessments were not homogeneous across studies. "Standard" rehabilitation varied across studies. These differences mirror discrepancies among rehabilitation protocols from various institutions throughout the world. Efforts should be made to minimize differences in standard rehabilitation by preferring interventions whose effectiveness was supported by previous controlled trials. Overall time of treatment and/or presence of supervision often differed between groups thus generating a potential source of bias. Finally, at prolonged follow-up, the amount of training performed by the patients was not systematically recorded.

Limitations of this article

A review protocol was not registered. Articles from journals not indexed in Medline, PEDro, Cochrane Library, and Cinahl were not searched for, so as articles written in a language other than English. We focused on exercise type and timing in the postoperative phase. Additional relevant sources of variation we did not consider in this review include either pre- or post-operative initiation of treatment, setting, presence or absence and type of supervision, and either group or individual practice. Furthermore, we did not evaluate components other than exercise which are included in the rehabilitation of THA patients: pre- and post-operative education, range-of-motion restrictions, sport activity, treatment both of comorbidities and complications, and pain management.[17-19, 36-40, 46-52] We did not adopt a metanalytic approach to address the issue of the effectiveness of physiotherapy considered as a single, homogeneous intervention. Indeed, we were specifically interested in the potential differences between exercise types and timing, and our review is complementary to metanalyses aimed at answering the question on the effectiveness of "physiotherapy" [45] or "rehabilitation" [36] as single, homogeneous interventions.

Conclusions

We examined nine RCTs. The results were sparse and no detailed evidence based protocols on type and timing of exercise therapy after THA can be built up at the present time. However, few specific interventions are selectively supported by the available studies. The most robust evidence corroborates ergometer cycling, and resistance strength training in the early postoperative phase, and weight bearing exercises in the late phase.

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Research

Physiotherapists may stigmatise or feel unprepared to treat people with low back pain and psychosocial factors that influence recovery: a systematic review

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KEY WORDS

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Qualitative
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ABSTRACT

Question: What are physiotherapists' perceptions about identifying and managing the cognitive, psychological and social factors that may act as barriers to recovery for people with low back pain (LBP)? **Design:** Systematic review and qualitative metasynthesis of qualitative studies in which physiotherapists were questioned, using focus groups or semi-structured interviews, about identifying and managing cognitive, psychological and social factors in people with LBP. **Participants:** Qualified physiotherapists with experience in treating patients with LBP. **Outcome measures:** Studies were synthesised in narrative format and thematic analysis was used to provide a collective insight into the physiotherapists' perceptions. **Results:** Three main themes emerged: physiotherapists only partially recognised cognitive, psychological and social factors in LBP, with most discussion around factors such as family, work and unhelpful patient expectations; some physiotherapists stigmatised patients with LBP as demanding, attention-seeking and poorly motivated when they presented with behaviours suggestive of these factors; and physiotherapists questioned the relevance of screening for these factors because they were perceived to extend beyond their scope of practice, with many feeling under-skilled in addressing them. **Conclusion:** Physiotherapists partially recognised cognitive, psychological and social factors in people with LBP. Physiotherapists expressed a preference for dealing with the more mechanical aspects of LBP, and some stigmatised the behaviours suggestive of cognitive, psychological and social contributions to LBP. Physiotherapists perceived that neither their initial training, nor currently available professional development training, instilled them with the requisite skills and confidence to successfully address and treat the multidimensional pain presentations seen in LBP. **Registration:** CRD 42014009964. [**Synnott A, O'Keeffe M, Bunzli S, Dankaerts W, O'Sullivan P, O'Sullivan K (2015) Physiotherapists may stigmatise or feel unprepared to treat people with low back pain and psychosocial factors that influence recovery: a systematic review. *Journal of Physiotherapy* 61: 68–76**].

Introduction

Low back pain (LBP) is no longer accurately viewed as a purely structural, anatomical or biomechanical disorder of the lumbar spine. Research in recent decades has highlighted that LBP is a complex disorder, which can be influenced by a wide range of other factors.[1,2] These include cognitive (eg, catastrophic thoughts and beliefs, unhelpful expectations, poor motivation), psychological (eg, depression, anxiety), social (eg, low job satisfaction, interpersonal relationship stress, cultural factors), physical (eg, guarded and restricted movement patterns), and lifestyle (eg, physical inactivity) factors.[2] These factors are seen to act as catalysts for chronicity, contributing to poorer recovery and prolonged disability in at least some people with LBP.[3,4]

Guidelines for LBP treatment generally acknowledge a shift towards a biopsychosocial management approach.[3,5] However, physiotherapists have mostly received training of a more biomedical nature, at least in their initial education, similar to many other healthcare professionals (eg, chiropractors, osteopaths, medical doctors).[6] Management of physical factors, such as guarded movement patterns and muscle tension, and lifestyle factors, such as sedentary behaviour and deconditioning, have been a focus of physiotherapy training for many decades. However, the need to incorporate consideration of cognitive, psychological and social factors in LBP management may pose a greater challenge for physiotherapists.[7–9]

Physiotherapy students have been found to have relatively evidence-based attitudes and beliefs about pain compared to other healthcare students.[10–12] However, even recently graduated physiotherapists demonstrate some attitudes and beliefs about pain that are not fully in line with LBP guidelines and contemporary research findings.[10,12,13] Physiotherapists increasingly receive training in treatment packages that take into account cognitive, psychological and social factors in LBP;[14–18] however, it is unclear as to whether such training adequately equips them with the requisite skills to change patient management and outcomes.[19] A recent review of

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several different study designs concluded that whilst physiotherapists theoretically support a biopsychosocial approach to LBP, in practice, very few are doing so adequately, despite training in cognitive behavioural principles.[20] However, that review[20] focused primarily on return to work rather than the wider population of people with LBP. Furthermore, that review included only a limited number of qualitative studies that offered useful methodology to investigate physiotherapists' perceptions and identify potential barriers, and facilitators to incorporate such factors into clinical practice. Gaining a detailed insight of physiotherapists' perceptions about these factors could be very useful in order to evaluate whether such factors are considered in LBP assessment and management. Qualitative metasynthesis is 'an interpretive integration of qualitative findings that are themselves interpretive syntheses of data' [21] that may contribute to clinically oriented theory.[22]

Therefore, the research question for this systematic review and metasynthesis was:

What are physiotherapists' perceptions about identifying and managing cognitive, psychological and social factors that may act as barriers to recovery in people with LBP?

Box 1. Eligibility criteria.

Design
- Qualitative studies
- Published in English

Participants
- Physiotherapists with experience in treating LBP

Outcomes
- Physiotherapists' perceptions regarding identifying and managing the cognitive, psychological and social factors that may act as barriers to recovery in people with non-specific LBP

Method

Identification and selection of studies

This review has been reported in accordance with the enhancing transparency in reporting the synthesis of qualitative research (ENTREQ) guidelines;[23] the checklist for the synthesis of qualitative data is detailed in Appendix 1 on the eAddenda. The databases EbscoHost (Academic Search Complete, AMED, Biomedical Reference Collection, CINAHL, Medline, PsychArticles, PsychInfo, SportDiscus), Embase, Scopus and Web of Science were searched between March 2014 and May 2014 by two independent reviewers.

The search strategy was developed by the authors and key words were compiled based on systematic searches of key words utilised in systematic reviews[20,24] performed in this area. The strategy used four groups of key words, to ensure that the selected studies included: qualitative research methodologies; physiotherapists as the treating healthcare professional; cognitive, psychological and social factors; and LBP as the condition of interest. The specific key words had to be included in the abstract to be shortlisted for this review. The full search strategy is detailed in Appendix 2 on the eAddenda.

The search was limited to English-language papers involving humans; no year limits were applied. Titles and abstracts were screened by two independent reviewers. Full-text versions of potentially eligible articles were retrieved. Manual searches of reference lists of the shortlisted articles were also performed by two independent reviewers. Recent systematic reviews of qualitative literature on LBP [20,24] were also shortlisted and searched for references. The primary authors of the studies that were initially shortlisted were contacted to identify any additional studies of potential relevance. The eligiblity criteria are detailed in Box 1. Mixed-method studies were included if the qualitative analysis could be isolated. Studies investigating the perceptions of physiotherapists and other healthcare professionals or patients were only included if the physiotherapists' data could be isolated. The physiotherapists' perceptions had to relate to non-specific LBP or chronic LBP but not specific diagnoses such as cauda equina syndrome, radicular syndrome, infection, inflammatory disorders, tumour, fractures, osteoporosis or pregnancy.

Assessment of characteristics of studies

The Critical Appraisal Skills Programme (CASP) qualitative assessment tool was applied by two authors working independently to evaluate the trustworthiness of the eligible articles. Articles were not excluded on the basis of the CASP criteria. The trustworthiness criteria evaluated within CASP are listed in Table 1, with more detailed explanation in Appendix 3 on the eAddenda. For each article, the reasoning for the unfulfilled CASP criteria is detailed in Appendix 4 on the eAddenda.

Data extraction and synthesis

The data extracted using a purpose-designed format were: a description of the participants, the sample sizes, the methods of data collection, the aims of the studies, and the main findings related to the metasynthesis.

Data synthesis was conducted by the first author (AS), an undergraduate physiotherapy student. The analytic process described by Sandelowski and Barroso[21] was adapted for the review. The first stage of the process was the extraction of findings and coding of findings for each article. The second stage was grouping of findings according to their topical similarity to determine if findings confirm, extend or refute each other. The third stage was abstraction of findings – analysing the grouped findings to identify additional patterns, overlaps, comparisons and

Table 1
Achievement of the Critical Appraisal Skills Programme criteria by the included studies.

Study	Clear statement of aim	Qualitative methodology appropriate	Appropriate research design	Sampling	Data collection	Researcher reflexivity	Ethical consideration	Appropriate data analysis	Clear statement of findings	Research value
Billis et al 2005[25]	Y	Y	N	N	N	Y	Y	Y	N	Y
Bond et al 2012[29]	Y	Y	N	Y	Y	N	Y	N	N	Y
Côté et al 2009[31]	Y	Y	Y	Y	N	N	Y	Y	N	Y
Daykin et al 2004[13]	Y	Y	Y	Y	Y	N	Y	Y	N	Y
Dean et al 2005[26]	Y	Y	Y	N	N	Y	N	Y	Y	Y
Jeffrey and Foster 2012[32]	Y	Y	Y	N	N	Y	Y	Y	N	Y
Josephson et al 2011[34]	Y	Y	N	N	N	Y	N	Y	N	Y
Josephson et al 2013[36]	Y	Y	N	N	N	Y	N	Y	N	Y
Sanders et al 2013[30]	Y	Y	N	Y	Y	N	Y	Y	N	Y
Sanders et al 2014[37]	Y	Y	N	Y	Y	N	Y	Y	N	Y
Slade et al 2012[35]	Y	Y	Y	Y	Y	N	Y	Y	N	Y
Wynne-Jones et al 2014[33]	Y	Y	N	Y	Y	N	Y	Y	Y	Y

Y = yes, N = no.

redundancies to form a set of concise statements (themes), which capture the content of all findings. The three stages were completed simultaneously rather than sequentially. The emerging groupings of early codings were cross-checked with on-going codes and were used to inform future codes. Final groupings were reviewed by all authors to ensure homogeneity of the codes between groups, and to ensure no potential groupings were overlooked during the analysis. To ensure that the findings were grounded in primary data and to guide the interpretive process, the coding and thematic analysis was presented to, discussed with, and critiqued by two co-authors (KOS, MOK both clinical and research physiotherapists). The suitability of the fit of the final themes to early codes/grouping was further reviewed by another author (SB) with experience in qualitative analysis.

Results

Identification and selection of studies

The identification and selection of studies for analysis is summarised in Figure 1. In total, 6338 articles were found in the databases. After 1133 duplicates were removed, 5205 titles and abstracts were scanned. Thirteen articles were retrieved, with four articles being excluded because they did not fulfil the inclusion criteria. One study was deemed suitable from hand searching of relevant systematic reviews. Two articles recommended by relevant authors in the LBP area fulfilled the inclusion criteria. Twelve articles in total were included in the metasynthesis. A summary of the included articles is presented in Table 2. Nine studies were located in Europe, two in Australia and one in Canada, with the majority taking place between 2004 and 2013 in physiotherapy settings. A total of 182 participants were interviewed in the 12 studies.

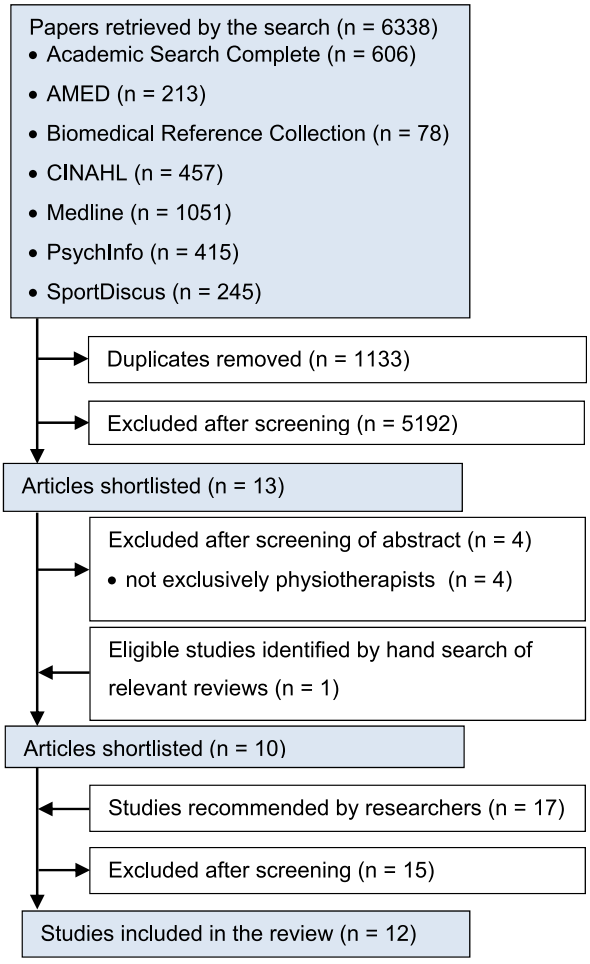

Figure 1. Flow of studies through the review.

Description of studies

Confounding factors

Two studies in this review interviewed physiotherapists who primarily had experience in treating an acute LBP population.[25,26] Physiotherapists rarely use validated outcome measures to screen for psychosocial issues in acute LBP patients,[27] due to the traditional thinking that acute episodes of LBP resolve rapidly,[28] with outcome measures often reserved solely for those who present with poor clinical improvement. As a result, physiotherapists in the two studies that primarily had experience with an acute LBP caseload may not have had a comparable awareness of the cognitive, psychological and social factors that physiotherapists treating chronic or non-specific LBP may have had in the remaining studies.

One study[29] recruited physiotherapists who were employed within a military setting and were involved in treating a non-specific LBP population. It is not clear how this military setting and experience influenced these physiotherapists and if their experiences were comparable to those of the physiotherapists treating LBP recruited by the remaining studies. Participants in the remaining studies were all based within either public or private health settings.

Trustworthiness of results

The CASP criteria of trustworthiness met by each study are presented in Table 1. Further details about the specific reasons that individual studies failed to meet the criteria are presented in Appendix 4. For example, ten studies failed to fulfil criterion 9 due to an absence of member checking, where the original data and study findings are cross-checked with the participants. Because some studies did not meet some of the criteria, the completeness, interpretation and generalisability of the results may each have been affected. However, the studies all had clear aims research value, with consistent use of appropriate qualitative methodology and data analysis.

Themes identified in the metasynthesis

Table 3 provides an overview of the themes and subthemes identified. Table 4 presents the number of times each subtheme was identified by a study, and the total number of times it was supported by a statement in any of the included studies.

Theme 1. Limited recognition by physiotherapists of the role that cognitive, psychological and social factors play in LBP

Subtheme 1.1. Patients' biomedical expectations

Physiotherapists in several studies described how patients' biomedical treatment expectations influenced their management approach. Some physiotherapists seemed to struggle when communicating with patients in these situations, with a view that treatment should involve either education or passive treatment, but not both.

> *You certainly get a gut feel of the ones that you're wasting your time on… they perhaps think they're coming to me for a massage or something to be done to make them feel better… so they are difficult and I have to say… well, look if you don't want to follow what I'm saying I'm afraid I can't help you.*[30]

> *Let's say you give them a nice little speech… it would surprise me if they were satisfied and if they would come back. You know they're just going to think… there's not much point in going for treatment.*[31]

> *They don't want to hear what you're saying. They want you to make them better.*[32]

Consequently, the default position of many physiotherapists seemed to involve yielding to these patient expectations and administering passive treatments.

Table 2
Characteristics of the included studies.

Study	Participants	Data collection	Aim	Main findings
Billis et al 2005[25]	PTs dealing with a LBP population N = 18 (22% female) Qualified *(yr)* = 3 to 28 Workplace = 83% private	Three focus groups, each containing 6 to 8 participants	To evaluate the clinical and social factors that practising PTs and post-graduate PTs recognise as important in the assessment and management of LBP patients.	PTs readily recognised social factors such as marriage and family life as contributors to the patient's pain. However, PTs were less cognisant of the role that cognitive and psychological factors may play in the patient's pain presentation. Only a small group of PTs who had received post-graduate training paid attention to these factors in their initial examination of the patient. PTs were comfortable in utilising a biomedical approach in treating this patient caseload and often negatively stereotyped those presenting with non-specific LBP as attention seeking.
Bond et al 2012[29]	PTs dealing with LBP in a military population N = 14 (60% female) Qualified *(yr)* = 5 to 30 Workplace = military	Semi-structured interviews	To understand civilian PTs' attitudes and beliefs towards assessing and managing LBP in a military population.	PTs recognised the influence of social factors on pain; however, they often administered contradictory biomedically-oriented treatment with weak evidence. Patients that were seen to have poor compliance and motivation for treatment were often referred onto other healthcare providers.
Côté et al 2009[31]	PTs dealing with a LBP population (> 25% of caseload) N = 16 (gender n/s) Qualified *(yr)* = half < 10, half >10 Workplace = 50% private	Semi-structured interviews	To identify perceived barriers and facilitators to PTs' use of clinical practice guidelines in management of LBP.	PTs recognised that cognitive factors such as patient expectations were barriers to recovery in LBP, as many patients expected hands-on treatment and were intolerant of a hands-off approach. PTs lacked confidence in their training to implement the recommended biopsychosocial approach clinically.
Daykin et al 2004[13]	PTs dealing with a chronic LBP population N = 6 (100% female) Qualified *(yr)* = 15 to 27 Workplace = 0% private	Semi-structured interviews	To explore PTs' pain beliefs and their influence on the management of patients with chronic LBP.	PTs labelled those presenting with behaviours suggestive of cognitive, social and psychological factors as difficult. The self-perceived inexperience, and lack of training of PTs, may have contributed to this labelling.
Dean et al 2005[26]	PTs dealing with a LBP population N = 8 (100% female) Qualified *(yr)* = 5 to 13 Workplace = 75% private	Semi-structured interviews	To explore PTs' perceptions of LBP patient's adherence to treatment.	PTs recognised cognitive factors such as unhelpful patient expectations as barriers to both patient adherence and treatment.
Jeffrey and Foster 2012[32]	PTs dealing with a LBP population N = 11 Gender = 45% female Qualified *(yr)* = 10 to 39 Workplace = 36% private	Semi-structured interviews	To understand the personal experiences and beliefs of PTs that influence relevant decision making and management of a LBP patient population.	Even in the absence of a definitive mechanical diagnosis, PTs still classified patients purely on a mechanical basis. Cognitive factors such as patient expectations were barriers to successfully managing LBP patients. PTs questioned the value of intervention in patients that were perceived as passive or unmotivated, with some stigmatising such patients.
Josephson et al 2011[34]	PTs dealing with LBP N = 21 Gender = 17% female Qualified *(yr)* = 6 to 40 Workplace = 19% private	Four focus groups, each containing 4 to 6 participants	To explore PTs' opinions about gaining the esssential knowledge or information to successfully manage LBP.	PTs deemed those LBP patients that did not present with cognitive, psychological and social factors as 'easy'. In contrast, those that did present with these factors were described as 'complex' and posed a challenge to clinical practice.
Josephson et al 2013[36]	PTs dealing with a LBP population N = 21 Gender = 71% female Qualified *(yr)* = 6 to 40 Workplace = 19% private	Four focus groups, each containing 4 to 6 participants	To learn how PTs describe reasoning behind their management interventions in LBP patients, and how they manage challenging patient presentations.	PTs believed that they had a responsibility to treat the easy cases. However, they were unsure of their role in the management of more complex cases when patients presented with cognitive, psychological and social factors, describing limitations in their expertise and scope of practice when managing such cases.
Sanders et al 2013[30]	PTs dealing with a LBP population N = 12 (50% female) Qualified *(yr)* = 4 to 33 Workplace = 80% private	Semi-structured interviews	To learn how PTs incorporate a biopsychosocial approach into LBP management, and how they manage to balance the mechanical and psychosocial aspects of LBP patient care.	Combining both a biomedical and biopsychosocial approach in the management of this patient population posed a significant challenge amongst the PTs. While many recognise the importance of cognitive, psychological and social factors, they believe that addressing these factors extends beyond their scope of practice.
Sanders et al 2014[37]	PTs dealing with a LBP population N = 26 (gender n/s) Qualified = n/s Workplace = 0% private	Semi-structured interviews	To evaluate perceived barriers among PTs to the implementation of a new biopsychosocial intervention in clinical practice.	PTs recognised LBP as a complex problem which involves social and psychological contributions. However, PTs felt inadequately prepared by their biomedically-oriented training to successfully address these factors in practice and advocated the need for further training.
Slade et al 2012[35]	PTs dealing with a chronic LBP population N = 23 (56% female) Qualified *(yr)* = 1 to 37 Workplace = 43% private	Four focus groups, each containing 4 to 6 participants	To learn how PTs manage a LBP population in the absence of a definitive mechanical diagnosis.	PTs often lacked confidence or felt inadequately prepared to treat patients with non-specific LBP who did not have a clear biomedical diagnosis, due to their own biomedically-oriented training.

Table 2 (*Continued*)

Study	Participants	Data collection	Aim	Main findings
Wynne-Jones et al 2014[33]	PTs dealing with a LBP population N = 6 (100% female) Qualified = n/s Workplace = 0% private	Semi-structured interviews	To explore both GPs' and PTs' views of managing LBP in the context of work.	While PTs routinely discussed work in the context of an assessment of a patient with LBP, their advice and treatment was often functional and mechanical in nature, perceiving that their profession is limited in instilling any change in the work environment.

GP = general practitioner, LBP = low back pain, n/s = not stated, PT = physiotherapist.

Table 3
Overview of themes and subthemes.

Themes	Subthemes
Limited recognition by physiotherapists of the roles that cognitive, psychological and social factors play in LBP.	1. Biomedical expectations of patients 2. Biomedical preferences of physiotherapists
Some physiotherapists stigmatise patients whose behaviour indicates that cognitive, psychological or social factors are influencing their LBP.	No subthemes identified
Limited role in managing cognitive, psychological and social factors.	1. Limited willingness to discuss with patients that these factors may influence their LBP 2. Concerns about training, expertise and exceeding professional scope of practice

Table 4
Number of contributing statements and articles that identified subthemes.

Subthemes	Contributing statements (n)	Contributing articles (n)
Biomedical expectations of patient	13	6
Biomedical preferences of the physiotherapist	18	7
Stigmatising of behaviours suggestive of cognitive, psychological and social factors	15	5
Limited willingness to identify factors as contributors to LBP	17	7
Concerns about training, expertise and exceeding their scope of practice	16	8

Most people come in and they're looking for a diagnosis and therefore a click, crunch, and off they go they'll be fine.[26]

Subtheme 1.2. Physiotherapists' biomedical preferences

Many physiotherapists believed that their role was mainly to address the mechanical aspects of LBP. Whilst there are no details on the training received by the physiotherapists, their own comments suggest that their preference for dealing with the 'mechanical' aspects of LBP reflects their own previous training and their professional confidence.

Everyone (of my patients) gets stability exercises cause that's in fashion at the moment, so it's almost a case they get it whether they need it or not… so you are basing a lot of input on very little evidence base and yet it seems to be in fashion.[29]

Even among patients who had been told that their LBP was non-specific in nature, physiotherapists preferred to explore the mechanical nature of LBP, either oblivious to the other dimensions of LBP, or choosing not to address it.

I would probably explain to her that it was most likely postural strain… There could be an underlying facet joint degenerative problem evident.[32]

Testament to this, amongst physiotherapists, there was an overwhelming preference for the biomedical pain presentation.

I like clear pictures! It's easier isn't it, more straightforward.[13]

An uncomplicated back that feels well and allows someone to lead a rewarding life while still experiencing back pain is easy to treat.[30]

Whilst physiotherapists recognised the implications of social issues, such as the influence of work-related factors on a patient's pain disorder, their advice was often linked to the functional and mechanical adaptations that patients can make in the context of work.

If it (work) comes up in the questioning, in terms of either why they're off work, or the problems they're having at work, then yes, we'll look at, you know, the postures and the function, and any sort of ways round it or who they need to speak about it.[33]

In fact, some physiotherapists attributed a progression to chronicity solely to a lack of understanding or awareness of the biomedical and mechanical drivers of pain, with no acknowledgement of the cognitive, psychological and social drivers of chronicity in back pain.

Especially since our role as physiotherapists is to make sure that movement is restored, but we need to know what is preventing movement. Giving exercises to promote activity is fine but not enough. If you don't resolve the physical or biomechanical components, I think you will be heading towards chronicity.[31]

Given the biomedically oriented preferences of patients and physiotherapists, it appeared that the cognitive, psychological and social factors were not widely recognised. Some physiotherapists seemed to recognise the significant influence on LBP of certain life events, as well as social factors such as the patient's family life and occupational environment. Very little mention of psychological factors was observed, apart from some mention of the role of fear in LBP. Overall, there was little discussion of if, or how, these factors were considered in the treatment program.

It could be a lot of life problems behind (LBP) as the most important factor.[34]

… yea she may even need to switch jobs.[34]

Fear. Fear they might reproduce their symptoms, especially if they're not completely pain free, erm, and I think also they're worried about taking sick time again, erm, from the employers' perspective, losing their job if they keep taking sick leave.[33]

Theme 2. Some physiotherapists stigmatise patients whose behaviour indicates that cognitive, psychological or social factors are influencing their LBP

Several physiotherapists described some LBP patients as poorly motivated, demanding, attention-seeking and, in some cases, self-centred and not interested in helping themselves to recover.

Whether they're (patients) motivated to actually do something for themselves or they want you to, sort of… click your fingers; wave your magic wand and the pain'll be gone.[32]

This group of people (chronic LBP patients) are very self-centred self-focused group of people who are very interested in themselves. They're a self internal, internalizing group.[30]

Those extravagant pain people.[30]

Some do not get better with treatment due to their attention seeking need usually the neglected by their husbands women.[25]

Neglected women tend to moan I'm in pain… for attention.[25]

This suggests some recognition by physiotherapists of the cognitive, psychological and social factors that might influence the pain experience. This includes depression or low mood contributing to low motivation, anxiety contributing to hypervigilance, low self-efficacy and an external locus of control contributing to a desire for passive treatment, and catastrophising contributing to extravagant behaviours.[1,2] However, physiotherapists neither seemed to identify cognitive, psychological or social factors as underlying causes for these observed behaviours, nor considered them as potentially modifiable factors for targeted intervention. From the language used in the above examples ('those' people, 'that' group), it appears that at least some physiotherapists in the included studies had little empathy for the cognitive, psychological or social aspects of the pain experience.

Some physiotherapists alluded to the possibility that some LBP patients may be in receipt of financial aid or disability and, as a result, are driven by a financial incentive and consequently lack a motivation for recovery.

I suppose, I mean, if you really went down to it, you could talk about those people who are, or you know, poverty in patients, little money, sometimes, is quite, you know, they're quite willing to be ill, if you understand me?[30]

Maybe their own benefits, they will be earning more through that way than going back to work… but although I'm saying that, it's very hard to prove anything. You always have your own suspicions.[30]

Theme 3. Limited role in dealing with the cognitive, psychological and social factors

Subtheme 3.1. Limited willingness to discuss with patients that these factors may influence their LBP

Physiotherapists recognised the need to provide a clear and simple explanation for the patient's pain and felt that a biomedical diagnosis offered the best framework for this, even amongst those diagnosed as having non-specific LBP and where evidence for the explanation was lacking.

The explanation is tailored entirely… on how much you feel they can understand without scaring them.[35]

Simplistic (mechanical) explanations (for their back pain), so the patients have something to hang their hat on… without saying that's the absolute truth.[35]

It's very easy to say, you've got a disc that's bulging out this way, if you do this McKenzie technique that pushes it back in… and we know that that's probably not true, but it's a simplistic way for patients to understand and you can give them a model.[35]

You have to give them some sort of diagnosis… even if I'm not a hundred per cent sure that it's facet I'll just tell them it's facet, tell them it's a disc strain so they know it's going to get better.[35]

Physiotherapists expressed concerns about discussing with patients the influences that cognitive, psychological and social factors have on the presentation of pain, for fear of it 'going wrong'. Consequently, physiotherapists preferred it when patients brought up the certain cognitive, psychological or social factors related to their pain themselves, relieving the physiotherapists from this responsibility and the fear of it 'going wrong'.

It was if I placed all the emphasis on the fact that she didn't like her job. She didn't like that; she really reacted then because I managed to identify too clearly the fact that she didn't like her job.[31]

I prefer a person (LBP patient) who can vent for herself and tell me things herself without me asking questions… cause it can go wrong.[36]

Other physiotherapists described how experience from treating similar LBP patient presentations facilitated them being willing, or able, to identify these factors.

Just through experience, you know, is that there are some joints that physios would call emotional joints.[30]

You're going to get a lot more of the psychological side coming in and that's why you need far more experienced physiotherapists, I think, to cope with that.[13]

Subtheme 3.2. Concerns about training, expertise and exceeding professional scope of practice

Physiotherapists recognised the limitations of their professional training in dealing with influencing cognitive, psychological and social factors. Physiotherapists described a lack of adequate skill acquisition and were often unable to implement skills learned during training when working in clinical practice, which posed a barrier to addressing these issues in practice. In many cases, where cognitive, psychological and social factors were implicated, there was considerable pessimism about the potential for therapy to result in clinical improvement.

I think that we are really not well equipped to give the right message across to these patients… I don't think we have enough training and background to maybe to know exactly what to say to these people, to be positive but to be realistic. I think we need more input with that kind of thing, the right things to say and the wrong things to say, would help.[37]

There is a limitation to what I can achieve with regard to, say, my counselling skills and my skills of helping them modify their pain behaviour and helping them with their cognitive, you know, construct if you like, regarding LBP.[30]

We can guide them as to ways of avoiding sitting all day, trying to encourage them to get up and move around regularly, as to make sure that they're sitting in a correct position as possible, but as far as changing what they're actually doing at work, I don't think I have much influence at all really.[33]

Some physiotherapists described how their lack of expertise in these domains was so profound, there was no point even asking about them, since they could not treat them. Furthermore, even among those physiotherapists who recognised that these factors were important in LBP, many considered that the management of them was beyond their professional role and scope of practice, as they were not equipped with the knowledge or skills to have any successful input.

Why would I give a questionnaire to my patient to identify whether he is afraid to move, if I don't know what to do about it?[31]

If there's a relationship issue and things like that, that's stuff that I won't necessarily address, because I don't think it's my area. I mean, I'm not going to start saying to patients, you know, how is your relationship with your husband at the minute, because… what am I going to do about it, if you know what I mean? If they start bringing up those sort of issues?[30]

That is where I feel I don't have much to offer, only to lend a listening ear and a bit of advice if I can, but I have no way of knowing whether that advice is appropriate.[37]

This was often described in such a way as to absolve the profession from having any professional involvement. Consequently, the responsibility for treating patients presenting with cognitive, psychological and social factors is often shifted on to other healthcare professionals.

I mean, it can't be our, we who fail (physiotherapy profession), and take the blame for it. I don't think we're barking up the wrong tree either. You can't dump it (patients' psychosocial issues) over on somebody else like that.[36]

Is that really what we think is better (physiotherapy) than just letting things take their natural course?[36]

In the event that such 'difficult' patients were offered treatment, physiotherapists reported feeling pessimistic about these interactions and expected patient outcomes, which in turn reduced their own job satisfaction and their self-confidence about being capable of helping people.

You can treat again until you're blue in the face, but you'll take two steps forwards and the patient will go away, do whatever they want, and take two steps back… and this is when you get frustrating… unresolved cases.[13]

A physiotherapist who is treating a difficult patient may switch off a little bit… I think you become less sympathetic.[13]

Difficult patients were not expected to have good treatment outcomes so the physiotherapist would write them off quickly.[13]

The sort of patient who you've been seeing for twice a week for 10 weeks, 12 weeks, 14 weeks, and yeah, when you say Mrs So-and-So's coming in and you see Mrs So-and-So's name on the books, your heart sinks down into your boots. You think 'Oh no!' That's a 'heart sink' patient.[13]

Discussion

The first theme that was identified in this review was that physiotherapists displayed limited recognition of the roles that cognitive, psychological and social factors play in LBP. Physiotherapists appeared to be more comfortable with the concept of LBP as a mechanical disorder of the spinal tissues. This is consistent with patients requesting passive 'hands-on' therapy for the spine, and physiotherapists being quite happy to provide advice on local structural diagnoses, and exercise or manual therapies directed at a local mechanical spinal disorder.

Some physiotherapists appeared to readily recognise and discuss social factors, such as family life and work, as being relevant to LBP. The main cognitive barrier to recovery that was identified was patients' biomedical treatment expectations. The issue of how to handle patients' expectations, that are deemed by physiotherapists to be unhelpful, is an interesting one. On the one hand, it has been suggested that patients' expectations and preferences should be elicited and used in the clinical decision-making process to help select treatments that have the best chance of promoting recovery.[38] On the other hand, by ceding to patients' expectations and providing biomedical explanations of pain and treatments, physiotherapists may be perpetuating patients' biomedical beliefs and fears that pain indicates significant tissue damage.[39] It is possible that the perceived expectations of patients are heavily influenced by the beliefs and attitudes of their physiotherapists, and that patients may be more open to 'non-physical' treatment, if high-quality two-way communication is used. In addition, it may be more relevant to challenge patient beliefs around the overall range of factors involved in their LBP rather than worrying unduly about which specific treatment or exercise is used as part of treatment.

Despite expressing frustration with patients expecting biomedically oriented treatment, many physiotherapists themselves were more comfortable with LBP presentations that were deemed straightforward and did not involve complicating factors, allowing treatment to focus on 'mechanical' factors such as mobility and movement patterns. However, there is no evidence to suggest that even in 'routine' LBP presentations that an approach which only addresses mechanical factors is optimal. Such conflicting management principles have been previously documented, with physiotherapists recognising the influence of psychosocial factors on outcome in LBP, yet advising patients to remain off work.[7] Such an approach has previously been rationalised as indicative of pessimistic beliefs about pain, and an attempt to legitimise the experience of pain for the patient and enhance patient satisfaction.[40]

Apart from one study mentioning the importance of fear in LBP,[33] there was little mention of specific psychological factors that are known barriers to recovery, including depression, anxiety and post-traumatic stress disorder. The lack of focus on some of these factors may explain why previous research has suggested that clinicians are not as capable of identifying risk or complexity among LBP patients using questionnaires that examine these factors in a standardised manner.[41,42] Several such questionnaires, including the Orebro and Startback questionnaires, are now available and, based on these results, may be worth using in clinical practice.[41,42] However, even the use of such questionnaires would not address the reported lack of competence and confidence among physiotherapists in influencing these factors.

The second theme that was identified was that physiotherapists stigmatised some behaviours that were suggestive of cognitive, psychological and social factors being involved in patients' LBP experience. Many LBP patients had negative personal characteristics attributed to them. This included accusations of patients looking for attention, lacking motivation, being dependent of others, helping them rather than self-managing, and being motivated by the prospect of financial gain. Similar findings have been reported elsewhere, where LBP is attributed to personal weakness and a desire for secondary gain with manipulative, excessively demanding patients seen to be placing huge strain on healthcare services.[43] As discussed, this may reflect a lack of awareness that these behaviours may be indicative of underlying cognitive, psychological and social factors.

Another consideration is that physiotherapists often rely heavily on a structural diagnosis to inform their treatment.[44] When a non-specific diagnosis is used, this diagnostic ambiguity poses a challenge to the physiotherapist. Consequently, this 'non-fitting' scenario threatens their professional competence, with physiotherapists attributing responsibility for poor patient outcomes to the patient.[45] Quinter and Cohen[46] have recently discussed the stigmatisation of people with chronic pain by healthcare professionals, proposing that it can be explained by a lack of empathy towards pain patients who don't 'fit' neatly into the healthcare professional's biomedical perspective of pain. Attempts to enhance empathy may first need to come from educating physiotherapists about the underlying mechanisms of chronic LBP, as empathy is at least predicated on being able to understand what is going on with patients. Perceptions of stigmatisation by health professionals are common amongst

people with LBP and may jeopardise the patient-therapist relationship, which is closely linked to patient compliance[47] and successful management.[44,48]

It is possible that the factors perceived by physiotherapists to reflect the negative personality characteristics of a patient are in fact potentially modifiable barriers to recovery that require targeted intervention. For example, rather than being a sign of laziness or being unmotivated to help themselves, the search for a 'magic-bullet' cure may reflect deeply held biomedical beliefs that, if left unchallenged, present a barrier to recovery. Equally, repeatedly seeking passive care may indicate low self-efficacy and poor coping strategies. Thus, in order to reduce perceptions of stigmatisation amongst people presenting with LBP, it may be important to educate physiotherapists about identifying what is a potentially modifiable factor.

The third, and final, theme that was identified was the limited perceived role for physiotherapists in managing cognitive, psychological and social factors among people with LBP. Patients commonly report fear and anger, and mentioning the presence of these factors in their lives may de-legitimise their LBP in the eyes of their clinician.[49,50] This appears to have been experienced by some of the physiotherapists, so that they often avoided even discussing a factor unless the patient brought it up. However, in contrast to this reluctance of physiotherapists to discuss these factors with patients, previous research has identified that acknowledgement by a clinician of the impact of pain on a person's psychological health is considered to be very valuable by patients.[51] In other words, patients may be quite happy to have the impact of pain on their lives discussed and acknowledged, as long as there is no suggestion that these factors mean that their pain is 'psychosomatic' or imagined.

Many physiotherapists reported that they lacked the requisite skills and confidence to successfully discuss and address these factors among patients with LBP. In many ways, this probably reflects their biomedically oriented nature of their training, and the absence of explicit training in communication, such as the use of role playing during training to enhance communication skills.[13] In some cases, this lack of skills and confidence seems to have been used to absolve physiotherapists of their responsibility to help patients with these issues. Linton et al[52] previously described the physiotherapy profession as 'fear-avoidant' when confronted with these issues in practice. This fear-avoidance may be employed as a defence mechanism, in order to protect their professional confidence and self-esteem, which can be threatened by repeated encounters with patients whose 'non-specific' diagnosis is outside their clinical comfort zone.

Among the physiotherapists who reported a willingness to engage with these factors, any currently available training courses were deemed to be insufficient for developing their skills and enhancing their patient management. Instead, it was considered that substantial clinical experience was needed in order to develop sufficient expertise to enable successful management of these patients. However, there is no evidence that healthcare professionals with greater clinical experience or even a special interest in LBP display better beliefs about LBP.[15,53,54] These limitations might be alleviated by attending biopsychosocially-oriented workshops on LBP. However, while such training may succeed in changing beliefs regarding pain, the skills and knowledge learned during these courses do not always translate into changes in physiotherapists' management and patient outcomes and satisfaction.[15,19,55] One possible explanation is that physiotherapists who attend such courses know what they are expected to say after training, in terms of identifying on a case vignette some important cognitive, psychological or social factors; however, this may not reflect their actual practice. Other possibilities are that they are simply overwhelmed in trying to translate this into practice, and local resource issues (eg, staffing, space, training) do not facilitate integrating the training into their clinical practice. Some other methods of helping physiotherapists to use additional training to manage these factors in their everyday clinical practice may be needed.[56]

This review has several important clinical implications. The fact that cognitive, psychological and social factors were only partially identified by physiotherapists as barriers to recovery factors in LBP supports the role for using short screening tools (eg, STarTBack[41] and Orebro[42]) to specifically highlight when such factors are present. The presence of these factors, the limited understanding of how they affect patient engagement with therapy, and a lack of confidence in exploring these factors may partly explain some of the stigmatising of patients with LBP that occurs among some physiotherapists. Physiotherapists should consider whether some characteristics such as poor motivation, or dependence on passive therapies, may indicate the presence of other factors such as depression, anxiety or poor self-efficacy, which require greater consideration. Furthermore, there may be a need for greater appreciation by physiotherapists of how important it is to manage factors like patient expectations, because they are related to clinical outcomes.[57,58] This may require expansion of the core range of clinical tools used by physiotherapists, which can be done without reinforcing passive dependence on the physiotherapist. Because some physiotherapists feel underprepared by their traditional biomedically oriented education to adequately identify and address these factors, there is a need for additional training to ensure any additional knowledge and skills gained are transferrable to clinical practice. Consequently, it may be of benefit for physiotherapists involved in treating LBP to undergo training that specifically involves the assessment and treatment of 'live' patients, to enable physiotherapists to translate the skills they have learned into practice, with ease and confidence. This may lead to improved confidence and competence of physiotherapists, and improved patient outcomes. It may also be necessary to carry out research to establish the correct language to use when explaining pain in order to legitimise patients' pain and avoid stigmatisation.[40,59] Guidance from professional organisations and/or statutory healthcare providers on how these issues can be dealt with by a physiotherapist, including when onward referral to another professional or service is indicated, is currently lacking and may be very useful.

What is already known on this topic: Recovery from *LBP* can be limited by cognitive factors (eg, catastrophic beliefs, poor motivation), psychological factors (eg, depression, anxiety), and social factors (eg, low job satisfaction, relationship stress).

What this study adds: While some physiotherapists recognise the importance of these factors as important barriers to recovery, most prefer to treat the mechanical aspects of *LBP* and some stigmatise patients who demonstrate such factors. Many physiotherapists feel underprepared to treat these aspects of *LBP*. Physiotherapists may benefit from using screening tools with which to identify these factors and from training to help discuss and manage these factors with patients.

***eAddenda*:** Appendices 1, 2, 3 and 4 can be found online at doi:10.1016/j.jphys.2015.02.016.

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Research

Home exercises and supervised exercises are similarly effective for people with subacromial impingement: a randomised trial

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KEY WORDS

Randomised controlled trial
Shoulder
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Exercise therapy
Rehabilitation

ABSTRACT

Question: Are there different effects of home exercises and supervised exercises on pain and disability for people with subacromial impingement? **Design:** Randomised trial with two treatment arms, concealed allocation, blinded assessment of some outcomes, and intention-to-treat analysis. **Participants:** Forty-six patients with subacromial impingement were recruited from an interdisciplinary outpatient clinic of physical medicine and rehabilitation at a university hospital in Norway. **Intervention:** The home exercise group had one supervised exercise treatment followed by exercises at home for 6 weeks. The supervised exercise group had up to 10 supervised exercise treatments in addition to home exercises for 6 weeks. **Outcome measures:** The primary outcome was the Shoulder Pain and Disability Index (SPADI). Secondary outcome variables were: average pain during the past week, the Fear Avoidance Beliefs Questionnaire, participant satisfaction with treatment, active range of motion, work status and clinical shoulder tests. Pain was assessed weekly and all outcomes were assessed at 6 weeks. Participants were free to seek ongoing treatment of their choice until 26 weeks, when the SPADI was assessed again. **Results:** While both groups improved considerably, the groups did not differ significantly on the SPADI after the intervention at 6 weeks (0 points, 95% CI –14 to 14) or when followed up at 26 weeks (–2 points, 95% CI –21 to 17). There were no between-group differences for pain at any time. The remaining outcomes also did not differ significantly, except for the clinical tests of shoulder impingement. In the supervised exercise group, 11 out of 23 participants had two or more positive tests, compared to 18 out of 21 in the home exercise group. **Conclusion:** Supervision of more than the first session of a 6-week exercise regimen did not cause significant differences in pain and disability in people with subacromial impingement. **Trial registration**: NCT01257113. **[Granviken F, Vasseljen O (2015) Home exercises and supervised exercises are similarly effective for people with subacromial impingement: a randomised trial. *Journal of Physiotherapy* 61: 135–141]**

Introduction

The shoulder is one of the most frequent sites of musculoskeletal pain, exceeded only by back and knee pain.[1] The incidence of shoulder pain in primary care patients is estimated to be 11.2 per 1000 per year.[2] The course varies, but a considerable number of people with shoulder pain (41%) show persistent symptoms after 1 year.[3] Many people with shoulder pain have signs of subacromial impingement,[2,4] which is characterised by pain and disability, mainly in activities above shoulder height. Subacromial impingement is reported in 30 to 86% of shoulder pain patients in primary care, [2,4,5] and 36% in secondary care.[6]

The efficacy of physiotherapy is debated, and some passive treatments are not recommended.[7,8] There is strong evidence that extracorporeal shock-wave therapy is ineffective and moderate evidence that ultrasound is ineffective for subacromial impingement.[7] Brox and colleagues reported that surgical treatment and supervised exercises were equally effective in the treatment of subacromial impingement.[9,10] In a published systematic review, Kuhn[11] reported that exercise therapy had statistically and clinically significant effects on pain and disability, but supervised exercises were no better than home exercises. Walther and colleagues[12] compared standardised self-training, conventional physiotherapy and a functional brace, which all showed significant reduction in pain levels and improvement in disability. However, no differences among the three groups were found. Senbursa and colleagues[13] also included three groups: a supervised exercise group, a supervised exercise group combined with mobilisation, and a home-based rehabilitation group. All groups experienced significant decreases in pain and increases in shoulder muscle strength and disability, but no differences between groups were found. None of these studies had any form of blinding.

In the clinic, patients with subacromial impingement receive guidance in different training principles. Guidance is believed to be particularly important in the early rehabilitation phase where the patients need help and support to deal with pain and dysfunction, and to perform the exercises correctly. It remains unclear as to whether supervised exercises provide any additional benefit over

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home-based exercises. Therefore, the main research question in this study was:

Are there different effects of home exercises and supervised exercises on pain and disability for people with subacromial impingement?

Method

Design

In this randomised trial, people with subacromial impingement were randomised to home exercises or supervised exercises. They received oral and written information about the study and informed consent was obtained before baseline measurements were taken. Allocation was concealed. The participants were randomised via online access to the randomisation program at the Unit for Applied Clinical Research at Norwegian University of Science and Technology. Randomisation was stratified by gender to obtain gender-balanced groups because symptoms and pain intensity may differ between women and men.[14,15] Randomisation also used variable block sizes to assign participants to the two treatment groups. Data were obtained before randomisation and at the end of the 6-week intervention period by an examiner blinded to the participants' group assignment. The participants were instructed not to discuss their treatment with the examiner who performed the testing. Twenty-six weeks after randomisation, participants were also assessed without blinding via a mailed questionnaire. Based on their symptoms, participants were free to choose whether they wanted to continue treatment, or not, between 6 and 26 weeks.

Participants, therapists and centres

Participants were recruited from patients who had been referred for shoulder problems to the Interdisciplinary Outpatient Clinic of Physical Medicine and Rehabilitation Department at St. Olav's Hospital, Norway, between January 2011 and August 2012. As part of the standard procedures, both a doctor in physical medicine and an orthopaedic surgeon examined all referrals in order to determine further examination and treatment in the physical medicine or orthopaedic department. Patients ineligible for consideration for the study were surgery candidates with fractures, full thickness ruptures/total ruptures, or prosthesis candidates. A doctor in physical medicine examined all of the other patients who were considered to be suitable for non-operative treatment at the outpatient clinic. From this pool, patients were screened for inclusion in the current study.

To be eligible for the study, patients had to be between 18 and 65 years old and have unilateral shoulder pain lasting more than 12 weeks. Furthermore, they underwent three diagnostic clinical tests based on criteria in previous recommendations.[16] The painful arc test[17] was positive if pain was present in any parts of the motion path between 60 and 120 deg either on the way up or down during active abduction. A positive infraspinatus test[18] was indicated by pain and/or weakness in isometric external rotation against force performed with 90 deg of elbow flexion and the upper arm in neutral position along the side of the body. The Kennedy-Hawkins test[19] was positive if pain was experienced when the arm was passively positioned at 90 deg of flexion and internally rotated by the therapist. For a patient to be included in the study, all three tests had to be positive. In addition, they had to have normal passive glenohumeral physiological range of motion.

Exclusion criteria were: glenohumeral instability, acromioclavicular joint pathology, labrum pathology on imaging, proven full thickness ruptures/total ruptures of the rotator cuff, or signs of glenohumeral osteoarthritis. Patients were also excluded if they had: undergone shoulder surgery, insufficient language capability, cervical spine problems (if the patient reported more pain in the neck than the shoulder), rheumatoid arthritis, or other physical or serious mental illness. Earlier treatment, but no other treatment during the study period, was allowed.

Interventions

Before any intervention, all participants took part in a theory lesson with other people with shoulder problems. The course was physiotherapist-led and focused on shoulder anatomy and the rehabilitation process.

The home exercise group had one supervised treatment session with a physiotherapist in order to set up a tailored home-exercise program. The supervised exercise group was offered 10 treatments of supervised exercise therapy, in addition to home exercises. Exercises and overall training dose were the same for both groups. The intervention period was 6 weeks.

For both groups, established training principles were used.[11,20] The main goal for all exercises was to re-establish normal shoulder movement patterns through awareness, which the participants could transfer to daily activities. To normalise shoulder motion, a mirror was used at the start of the rehabilitation for visual stimulation. All participants started with training of correct scapular placement. An example of this was to depress the shoulder during shoulder flexion and abduction movements to avoid pulling the shoulder towards the ear and upward rotation of the scapulae. Focus was on scapular stabilising exercises, rotator cuff exercises, and pain-free range of motion exercises. Exercises were individually adapted.

During the training, a thin rubber band was used as a training tool for many of the exercises, either to reduce the arm load, control movement or provide resistance. The exercises were performed with as little pain as possible, and the choice of exercises, starting position and range of motion were decided with this in mind. Participants used three sets of 30 repetitions for most exercises. For both groups the same exercises were performed at home with four to six exercises twice a day every day. The home training group was also instructed in the progression opportunities for the appropriate exercises.

Based on individual needs, participants were later given stretching exercises for tight structures in addition to the other exercises. Stretches were held for 30 seconds and repeated twice for each exercise. All participants were given written home exercises and they registered their training in a training diary.

Outcome measures

Baseline data included age, gender, dominant arm, painful arm, education, duration of symptoms, treatment during the last 3 years and work status.

Primary outcome

The primary outcome was the Shoulder Pain and Disability Index (SPADI).[21] This is a self-reported questionnaire for people with shoulder pain. The SPADI contains 13 items that assess two domains: a five-item subscale that measures pain and an eight-item subscale that measures disability. Items are scored on a visual analogue scale. The total score ranges from 0 to 100 points, where 0 is no pain/disability and 100 is the worst pain/disability. The questionnaire was scored as originally described[21] and a version adapted to the Norwegian language and culture was used.[22]

Secondary outcomes

Secondary outcome variables were: average pain in the past week, scored on a numerical rating scale; clinical tests (painful arc, infraspinatus and Kennedy-Hawkins tests); the Fear Avoidance Beliefs Questionnaire (FABQ); active range of motion; work status; and participant satisfaction.

The painful arc, infraspinatus and Kennedy-Hawkins tests are designed for diagnostic purposes, but the tests were repeated at 6 weeks to see if they had changed over the intervention period.

Active range of motion was measured using a digital inclinometer.[a] Maximum ranges for active flexion, abduction, external and

internal rotation were obtained. The inclinometer was placed along the forearm. Flexion and abduction range of motion were obtained in sitting with a straight elbow. Participants touched the wall with their hand during the entire movement in abduction. Rotations were tested in supine position with a starting position of the arm abducted to 90 deg, the elbow in 90 deg of flexion and the forearm pointing towards the ceiling. The participant moved the arm as far as possible, regardless of pain, for all movements. The movements were performed three times for each direction and averaged values were used for the data analyses.

Fear avoidance may have the potential to negatively affect outcomes for people with musculoskeletal disorders. To quantify fear avoidance in the participants, a modified version of the original FABQ was used,[23] where the word 'back' was replaced with 'shoulder'.[24] The questionnaire consists of 16 items, and each item is scored on a seven-point Likert scale, where 0 is strongly disagree and 6 is strongly agree. The first five questions are related to physical activity, the next 11 questions are related to work. Questions two, three, four and five are used for summing physical activity score and questions six, seven, nine, ten, eleven, twelve and fifteen are used for the work score. Higher scores represent higher fear of movement. Scores range from 0 to 24 for physical activity and from 0 to 42 for work. Self-reported work status (working, sick-listed, other) was also obtained at 6 and 26 weeks follow-up.

After 6 weeks, the participants reported how satisfied they were with the treatment. This was measured with two separate scales. First, perceived benefit of the treatment was rated as one of seven possibilities: completely recovered, much improved, slightly improved, no change, slightly worsened, much worsened, and worse than ever. Second, satisfaction with treatment was rated as one of five possibilities: satisfied, somewhat satisfied, mixed (neither satisfied nor dissatisfied), somewhat dissatisfied, and dissatisfied.[25]

Participants recorded all training in a training diary, and once a week they also registered their average pain level during the past week on a numerical rating scale from 0 (no pain) to 10 (worst possible pain).[26]

Data analysis

A change of 20 points on the Shoulder Pain and Disability Index has been defined as the minimum clinically important change.[27] This study was thus designed to detect a between-group difference of 20 points on the SPADI as statistically significant, with alpha of 0.05 and power of 0.80. The standard deviation was set to 20, according to a previous study.[28] This resulted in a sample size of 17 in each group, using standard software.[b] In order to account for dropouts during the study, the sample size was increased to a total of 23 participants in each group.

Baseline data were assessed for normal distribution. Outcome variables were analysed with linear mixed-effects models with random slope (time), and the group*time interaction term was included for comparative analysis of group effects over time. Estimates of marginal group effects for the primary outcome (SPADI) and pain (numerical rating scale) were adjusted for age and gender. For the remaining outcome variables, age, gender and baseline pain level were adjusted for. Post hoc pairwise comparisons of group mean values were performed using the pwcompare command in Stata,[c] with the Bonferroni method to adjust for multiple comparisons. The precision of the estimates was assessed with 95% CI. The Fisher's exact test was used for the clinical tests and work status. The chi-squared test was used for the satisfaction with treatment. Data were analysed according to the intention-to-treat principle.

Results

Flow of participants, therapists and centres through the study

A total of 509 patients were assessed, with further examination for entrance into the physical medicine outpatient programs. Of these, 46 were found to be eligible and agreed to participate (Figure 1). The groups were well matched at baseline in terms of age, gender, duration of symptoms, dominant arm affected, education, treatment in the last 3 years, sick leave, SPADI scores or secondary outcome measures (Table 1 and the first two columns of Table 2).

Compliance with the trial protocol

Participants randomised to supervised exercise therapy had a median of 8 (IQR 7 to 10) treatments. One participant had 2 treatments, three participants had between 4 and 6 treatments, and 19 participants had 7 or more treatments.

Participants in the home exercise group completed 88% of the total planned exercise sessions and the supervised group completed 80%. There was a median of 74 (IQR 58 to 81) workouts for the home exercise group and a median of 67 (IQR 56 to 83) workouts for the supervised group during the 6-week intervention period. Two participants in the home exercise group dropped out for unknown reasons during the intervention period. They did not differ from the other participants in baseline scores.

One other secondary outcome – the quality of life questionnaire, SF-36 – was registered but not reported because when it later became apparent that the questionnaire comes with a licence fee it was not included. There was no budget for this questionnaire.

Effect of the interventions

Group mean outcome scores and between-group differences are given in Table 2 and Figure 2. Individual participant data are presented in Table 3, which is available on the eAddenda. There were no significant differences between home exercise and supervised exercise on the SPADI at 6 weeks (MD 0 points, 95% CI –14 to 14) or at 26 weeks follow-up (MD –2 points, 95% CI –21 to 17). There were no significant between-group differences for pain at any time (Figure 3), the FABQ physical activity, the FABQ work, or active range of motion (Table 2).

The within-group improvement for pain and disability after the intervention was 30 to 40% in both treatment arms. A greater improvement was observed for the FABQ work than physical activity, while there were small changes for active range of motion. At the end of the 6-week intervention period, 18/21 in the home exercise group still had at least two positive clinical tests for shoulder impingement compared to 11/23 in the supervised exercise group (RR 0.55; 95% CI 0.35 to 0.88). This statistically significant difference means that for every 3 (95% CI 2 to 10) patients whose exercise regimen is supervised, one who would otherwise have had two or more positive clinical signs if they had not received the supervision will have one or zero positive clinical signs after 6 weeks.

Chi-squared tests showed no significant between-group differences for perceived benefit or satisfaction with treatment at 6 weeks. For perceived benefit, none of the participants reported complete recovery. In the home versus supervised exercise groups, 24 versus 52% reported being much improved, 57 versus 30% reported being slightly improved, 19 versus 9% reported no change, and none reported being much worse. In the supervised group, one participant reported being slightly worse and one reported being worse than ever after the intervention. For satisfaction with treatment in the home versus supervised exercise groups, 52 versus 83% reported being satisfied, 29 versus 4% reported being somewhat satisfied, 19 versus 9% reported being neither satisfied nor dissatisfied, and none reported being somewhat dissatisfied, respectively. One patient from the supervised exercise group reported being dissatisfied with the treatment.

Among the participants for whom work status was available at 6 weeks, 7/21 in the home exercise group and 10/23 in the supervised exercise group were on sick leave. At 26 weeks, 4/18 in the home exercise group and 3/21 in the supervised exercise group

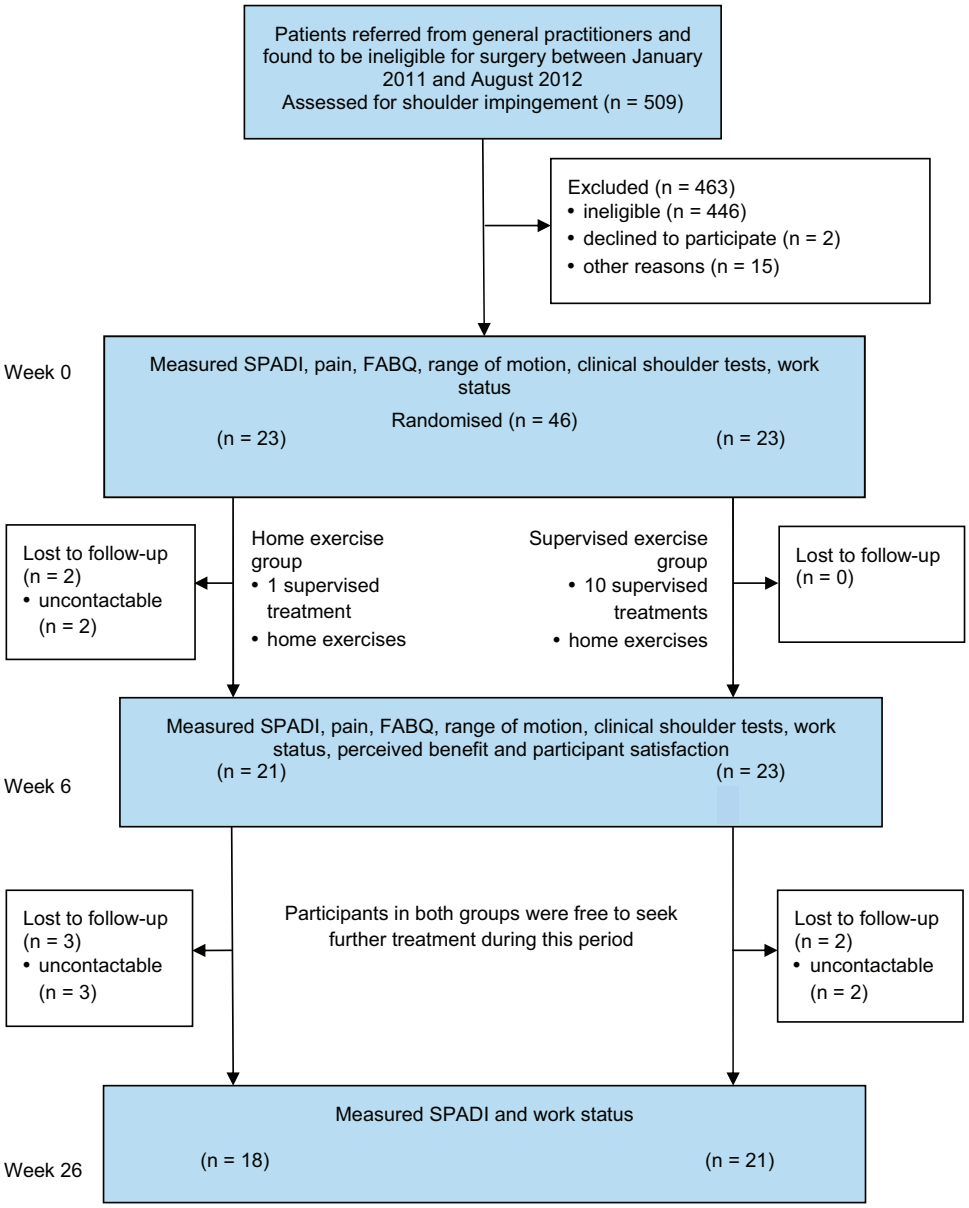

Figure 1. Design and flow of participants through the trial.
FABQ = Fear Avoidance Beliefs Questionnaire, SPADI = Shoulder Pain and Disability Index.

were on sick leave. In the home exercise group, one participant reported receiving a disability pension and one reported having retired at both 6 and 26 weeks. One participant reported being unemployed in the supervised exercise group at 26 weeks. Fisher's exact tests showed no significant differences between groups for work status at 6 or 26 weeks.

Three participants, in addition to the two dropouts in the home exercise group and two in the supervised group, did not return the 26-week follow-up questionnaire. Between 6 and 26 weeks, one participant in the home exercise group and two in the supervised group received surgery. Seventeen participants in the home exercise group received a mean of 4.4 (SD 2.0) additional treatment sessions during this period, while 15 participants received a mean of 3.3 (SD 1.6) additional treatments in the supervised group.

Table 1
Baseline characteristics of participants.

Characteristic	Home exercises (n = 23)	Supervised exercises (n = 23)
Age *(yr)*, mean (SD)	48.2 (9.8)	47.6 (10.0)
Gender, n female (%)	11 (48)	11 (48)
Duration of symptoms *(mth)*, median (IQR)	12 (6 to 36)	17 (10 to 48)
Dominant arm affected, n (%)	15 (65)	13 (57)
12 yr of school or less, n (%)	13 (57)	12 (52)
Treatment for symptoms in past 3 yr, n (%)	18 (78)	19 (83)
Exercise treatment, n (%)	10 (44)	10 (44)
Cortisone injection, n (%)	11 (48)	5 (22)
Sick leave, n (%)	10 (44)	9 (39)

Discussion

In this comparative study of home exercises and supervised exercises for shoulder impingement, no differences were found in the primary outcome, the SPADI. Furthermore, no differences were found in the secondary outcomes of pain, the FABQ (physical activity and work), participant satisfaction or active range of motion after the intervention period. A significant difference was found in favour of supervised exercise in reduced positive clinical tests for shoulder impingement at 6 weeks, where 18/21 in the home exercise group still had two or more positive clinical tests compared to only 11/23 in the supervised exercise group. Although this finding indicates that supervised exercises can reduce pain in specific testing positions of the arm, this does not carry over into

Table 2
Mean (SD) for continuous outcomes at each assessment time for each group, mean (SD) difference within groups, and mean (95% CI) difference between groups.

Outcomes	Groups						Within-group differences				Between-group differences[a]	
	Week 0		Week 6		Week 26		Week 6 minus Week 0		Week 26 minus Week 0		Week 6 minus Week 0	Week 26 minus Week 0
	HE (n = 23)	SE (n = 23)	HE (n = 21)	SE (n = 23)	HE (n = 18)	SE (n = 21)	HE (n = 21)	SE (n = 23)	HE (n = 18)	SE (n = 21)	HE minus SE	HE minus SE
SPADI *(0 to 100)*, mean (SD)	49 (12)	48 (19)	32 (15)	32 (20)	24 (24)	21 (18)	−17 (15)	−15 (17)	−27 (26)	−26 (28)	0 (−14 to 14)	−2 (−21 to 17)
Pain *(0 to 10)*, mean (SD)	6.3 (1.3)	5.9 (2.2)	4.3 (2.2)	4.1 (2.1)			−2.1 (2.0)	−1.8 (1.9)			−0.1 (−1.8 to 1.6)	
FABQ physical activity *(0 to 24)*, mean (SD)	14.0 (4.0)	14.4 (5.0)	10.6 (5.3)	12.8 (5.8)			−3.5 (4.1)	−1.7 (4.8)			2.8 (−1.0 to 6.5)	
FABQ work *(0 to 42)*, mean (SD)	20.6 (7.1)	19.3 (12.4)	17.4 (7.6)	16.2 (13.1)			−3.2 (5.5)	−3.1 (7.8)			0.0 (−7.0 to 6.9)	
Flexion *(deg)*, mean (SD)	150 (21)	151 (26)	154 (23)	156 (23)			4 (17)	6 (13)			0 (−16 to 16)	
Abduction *(deg)*, mean (SD)	119 (39)	109 (42)	128 (42)	121 (42)			11 (23)	12 (23)			−14 (−43 to 15)	
External rotation *(deg)*, mean (SD)	65 (20)	63 (23)	64 (22)	67 (23)			−2 (16)	4 (19)			2 (−14 to 18)	
Internal rotation *(deg)*, mean (SD)	62 (15)	65 (15)	63 (14)	65 (12)			2 (13)	0 (12)			0 (−10 to 11)	

FABQ = Fear Avoidance Beliefs Questionnaire, HE = home exercises, SE = supervised exercises, SPADI = Shoulder Pain and Disability Index. Shaded cells = primary outcome.
[a] Mixed-effects models for SPADI and pain were adjusted for age and gender. The remaining outcome variable analyses were adjusted for age, gender and baseline pain level.

any benefits in reported shoulder function, average pain over the past week, fear avoidance, range of motion or satisfaction. Therefore, physiotherapists should be reluctant to interpret this reduction in the number of positive diagnostic tests as an important clinical benefit of using supervision with the exercise regimen.

Strengths of this study include: a randomised design, concealed allocation, blinded assessment at baseline and 6 weeks, few drop-outs and an intention-to-treat analysis. There were no between-group differences in the overall number of training sessions. The fact that both groups had high (> 80%) and similar exercise adherence strengthens the results of this study.

Little is known about natural recovery in people with impingement. Superior effects have been reported for both surgery and supervised exercises compared to placebo laser at 6 months and 2.5 years follow-up;[9,10] this was the rationale for not including a placebo group in this study. Another study with two active interventions reported higher improvement with exercise (40 to 50%) than with shockwave therapy (20 to 30%) after 6 weeks.[28] The present study found within-group improvements of 30 to 40% for pain and disability after the intervention in both treatment arms – presumably the combined result of exercise and natural recovery. A group with no or sham treatment was not included and, thus, the natural recovery or placebo effects in this study cannot be assessed.

A large number of patients were screened for enrolment (n = 509) but only 46 were randomised for participation. The main reason for this was that there was no pre-selection of patients before the doctor visit (ie, they were referred with various shoulder symptoms from general practitioners). Therefore, all patients were screened as part of the standard hospital routine and considered as potential participants. Many did not fit the criteria for study participation. The stringent selection criteria are the main explanation for the low proportion of selected participants relative to patients available for enrolment. Shoulder impingement diagnosed by less stringent selection criteria may have given other results. This affects the external validity of the study and caution should be shown in generalising the results to all people with shoulder impingement. Local anaesthetics or imaging were not used to verify the diagnosis. However, subacromial impingement is a clinical diagnosis and a recommended combination of clinical tests was used to confirm impingement in the participants.[16]

It may be argued that 6 weeks is too short an intervention period to detect an effect of supervision. However, 6 weeks was chosen because it was believed that participants randomised to home exercise would not be motivated for a longer intervention on their own. Also, the most improvement was expected within the first few weeks. Engebretsen and colleagues[28] studied the effect of supervised exercises in people with shoulder impingement and found that the largest improvement was within 6 weeks. The baseline symptom level for the present participants was similar to that of Engebretsen and colleagues.[28] Another study of supervised exercises also found that the largest improvement was within the first 6 weeks, and the authors stated that this time period might be sufficient to detect clinical improvement.[29] In the present study, participants with small effects on the SPADI during the first 6 weeks also showed little improvement at 26-weeks follow-up.

After the 6-week intervention period, the participants in either group who did not receive full recovery were free to continue the exercises, with some supervision at the clinic. Consequently, the effects at 26 weeks cannot be ascribed to the intervention alone, since the majority in both groups sought treatment in the period from 6 to 26 weeks.

These results support previous research in the area, with no differences between home exercises and supervised exercise in groups for subacromial impingement.[12,13] This study differed from the other comparable studies in some important aspects. An independent blinded assessor was used, where neither Walther and colleagues[12] nor Senbursa and colleagues[13] had any form of blinding. The present study design was also prospectively registered.

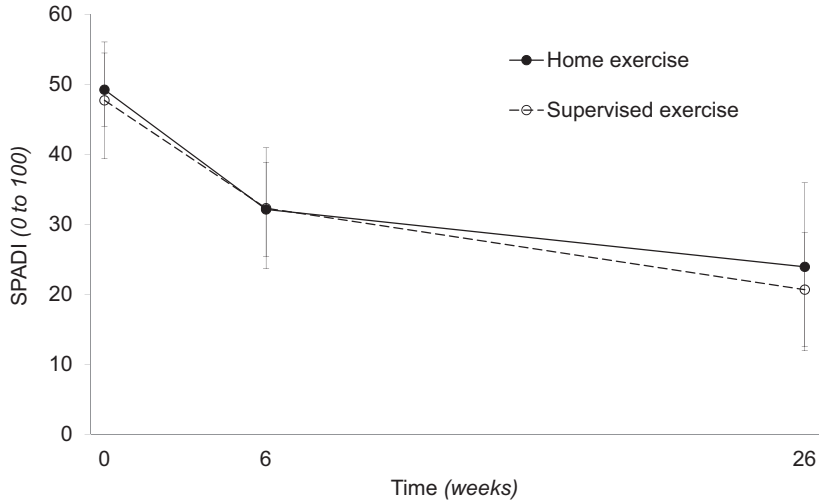

Figure 2. Mean (95% CI) Shoulder Pain and Disability Index (SPADI) scores for the two groups at baseline, 6 weeks and 26 weeks.

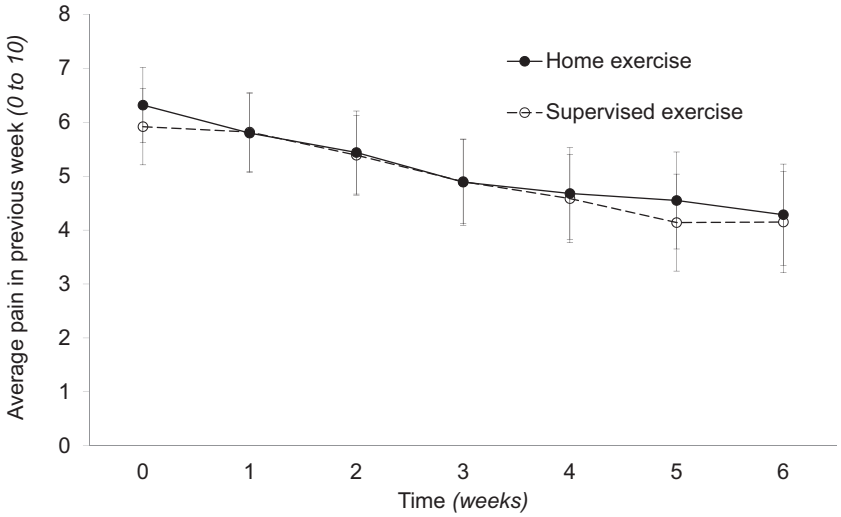

Figure 3. Mean (95% CI) scores for average pain over the past week on a 0-to-10 numerical rating scale for the two groups weekly from baseline to 6 weeks.

The emphasis in this study was on contrasting the groups in the amount of therapist guidance and attention (supervision) rather than on differences in the content or dosage of exercises. Others have also reported the lack of effect of supervision. Andersen and colleagues,[30] investigating supervised exercise relative to home exercise after subacromial decompression, found no difference between groups. The amount of supervision was similar to the present study. Supervision of exercises for shoulder impingement beyond a single session, with or without surgery, may thus be questioned.

It cannot be disregarded that certain patient subgroups may experience greater benefit from supervision than others. In post hoc analyses, it was observed that those in the supervised group with high baseline scores on the SPADI (ie, above the mean score of 49) had considerably larger improvement in pain and disability after the intervention than those with similarly high baseline scores in the home exercise group. Subgroups with higher symptoms levels should be explored in more detail in future studies.

In this comparative study, no differences were found between home exercises and supervised exercises on pain and disability for people with subacromial impingement. The results question whether extending supervision of exercises beyond an initial session is necessary for all people with subacromial impingement, as some may have similar effects of home exercises and supervised exercises when the training dose is the same.

What is already known on this topic: Subacromial impingement is a common cause of shoulder pain. Exercise improves pain, disability and range of movement. Previous trials did not identify a substantial benefit from supervision of the exercise, but limitations in the design and quality of these trials mean that the effect of supervision remains unclear.
What this study adds: People with subacromial impingement syndrome obtain similar improvements in pain, disability and range of movement after a 6-week exercise regimen, whether regular supervision is maintained or only the first session is supervised.

Footnotes: [a]Acumar, Lafayette Instrument Company, Lafayette, USA. [b]Minitab 15, Minitab Inc, State College, Pennsylvania, USA. [c]Stata v12, Stata Corp, College Station, TX, USA.

eAddenda items: Table 3 can be found online at doi:10.1016/j.jphys.2015.05.014.

Ethics approval: Central Regional Ethics Committee of Norway approved this study. All participants gave written informed consent before data collection began.

Competing interests: None.

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Prescribing exercise interventions for patients with chronic conditions

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Exercise has been shown to be beneficial in the treatment of many chronic conditions. Mortality benefits from exercise are similar to pharmacologic interventions for secondary prevention of coronary heart disease, stroke rehabilitation, treatment for heart failure and prevention of diabetes.[1] The morbidity benefits of exercise for diseases that are not life-threatening, such as back pain and osteoarthritis, are substantial. However, exercise is underprescribed and frequently overlooked, often in favour of a pharmacologic or surgical intervention.[2–4]

Factors that contribute to underprescription of exercise interventions may include a lack of awareness among many clinicians and patients about the effectiveness of exercise interventions, poor knowledge about what comprises an effective exercise intervention, a lack of relevant training and educational opportunities available to medical practitioners,[4,5] and inadequate descriptions of exercise interventions in published trials and reviews. An analysis of 137 nonpharmacologic interventions from 133 trials found that 61% did not have sufficient information reported (e.g., procedural and intensity details) to enable replication in practice,[6] thus preventing clinicians from being able to prescribe these interventions. An analysis of the reporting of the exercise component used in cardiac rehabilitation trials found that adequate descriptions of the exercise schedule were missing for 58% of the interventions.[7]

We summarize evidence of benefit for using exercise for some key chronic conditions, highlight key outcomes shown to be influenced by exercise and provide a guide to the practical how-to details for an effective disease-specific exercise. We discuss conditions that were selected for their high disability burden[8] and the strength of the evidence for the effectiveness of exercise in managing the condition. The search process we used to locate the evidence presented in this paper is provided in Box 1.

Outcomes for which exercise is effective

We review the evidence for the effectiveness of exercise interventions for osteoarthritis of the hip and knee, chronic nonspecific low-back pain, prevention of falls, heart failure, coronary heart disease, chronic obstructive pulmonary disease (COPD), chronic fatigue syndrome and type 2 diabetes (Appendix 2, available at www.cmaj.ca/lookup/suppl/doi:10.1503/cmaj.150684/-/DC1). We present the key clinical and health utilization outcomes that exercise interventions have been shown to affect and not affect in detail.

Simply prescribing exercise, in a generic sense, to a patient is insufficient guidance and is

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Box 1: Evidence used in this review

We each contributed to the review by our specialty. We searched PubMed and the Cochrane Library for publications from 2000 to February 2015, using methodological filters (for systematic reviews and randomized controlled trials [RCTs]) and a combination of medical subject headings and free-text terms (Appendix 1, available at www.cmaj.ca/lookup/suppl/doi:10.1503/cmaj.150684/-/DC1). The information presented in this article is based on evidence from systematic reviews, if available, or RCTs.

Key points

- Exercise is beneficial for many chronic conditions and can offer benefits that are comparable to pharmacologic interventions, yet exercise is underprescribed.
- Like medication and surgery, exercise is not a single entity and must be tailored to the condition. Exercise must be appropriately implemented to achieve outcomes that are consistent with those reported in intervention trials.
- To prescribe exercise for chronic conditions, clinicians must know sufficient details about the appropriate and effective exercise interventions and their components.
- We describe and discuss the evidence of effectiveness of exercise interventions for the following chronic conditions: osteoarthritis of the hip and knee, chronic nonspecific low back pain, prevention of falls, heart failure, coronary heart disease, chronic obstructive pulmonary disease, chronic fatigue syndrome and type 2 diabetes.

unlikely to achieve the desired outcomes. To help clinicians prescribe evidence-based exercise interventions, we provide practical details for some conditions in Boxes 2–4 (low-back pain, COPD, diabetes) and Appendices 3–6 (osteoarthritis, falls prevention, chronic fatigue syndrome, heart disease; available at www.cmaj.ca/lookup/suppl/doi/10.1503/cmaj.150684/-/DC1).[9–19] Where possible, we chose a single intervention for each condition that had evidence of effectiveness and for which adequate details of the intervention were available. Where this was not possible, a typical intervention or a range of practical details from various studies are presented. The information about each intervention is presented using key headings from the TIDieR (Template for Intervention Description and Replication) guide for intervention reporting.[20] Some of these interventions may be prescribed by family physicians and largely self-actioned by a patient (e.g., for falls prevention), whereas other interventions require a referral to a health care professional with expertise in exercise prescription (e.g., cardiac rehabilitation, exercise for chronic back pain or knee osteoarthritis and pulmonary rehabilitation for COPD).

Box 2: Exercise for chronic nonspecific low-back pain[12]

Rationale for exercise: Each type of exercise has a different rationale. The two main types that can be used are motor control exercises and graded activity.

Motor control exercise: Aims to retrain control of the trunk muscles, posture and movement patterns, using principles of motor learning such as segmentation and simplification. A detailed assessment of recruitment of the trunk muscles, posture, movement pattern and breathing guides the specific treatment for each patient. As control is regained, the exercises progress to more functional activities. Exercises are typically guided by pain and are mostly performed pain-free.

Graded activity: Aims to improve a patient's ability to complete functional activities and incorporates principles from cognitive behavioural therapy and exercise science. The program addresses physical impairments, such as impaired endurance, muscle strength and balance, but also considers psychological barriers to activity resumption, such as pain-related fear, low self-efficacy or misunderstandings about back pain. Principles of cognitive behavioural therapy, such as pacing, goal setting and self-reinforcement, are used. Exercises are progressed in a time-contingent rather than pain-contingent fashion.

Provider: Physiotherapist

Mode: Individual, supervised face-to-face sessions (and exercise practice at home)

Where: Primary care physiotherapy clinic

Materials needed: Simple equipment found in a typical physiotherapy gym

Procedure: A detailed treatment protocol for motor control exercises is available at http://ptjournal.apta.org/content/suppl/2009/11/25/89.12.1275.DC1/Costa_data_supp.pdf.

Number of exercise sessions: 14 sessions

Schedule details: A typical program[12] would comprise 12 sessions over an 8-week period, with 2 booster sessions at 4 and 10 months follow-up plus a concurrent home program.

Duration of each session: Sessions of 1 hour in duration

General considerations

Although there are few absolute contraindications to prescribing exercise for people with chronic conditions, it is important that patients receive a proper assessment by a physician before starting an exercise program. General considerations include an initial supervision period for most conditions, education about what the exercise program involves and how it can help, an understanding of the patient's fears and beliefs (for many conditions, such as low-back pain, cardiac conditions, COPD and chronic fatigue syndrome) and incorporation of strategies that enhance longer-term adherence.[21]

Osteoarthritis of the hip and knee

Exercise is beneficial for improving pain and function in patients with hip or knee osteoarthritis, regardless of their age, disease severity, pain or functional level. It is important to ensure patients understand that osteoarthritis is not a wear-and-tear disease and that discomfort or pain during exercise does not indicate further damage to the joint. A range of exercise types is suitable for patients with osteoarthritis, including muscle strengthening, and aerobic and range-of-motion exercise.[9–11,22] Exercise can be performed on land or in water. Supervised exercise that is supplemented with a home exercise program is preferable where possible.[9] For those who are overweight or obese, combining exercise with weight loss is more effective than either treatment alone.[23] Structured land-based exercises, usually delivered by a physiotherapist, are described in Appendix 3.

Evidence of benefit

For osteoarthritis of the knee, a recent Cochrane review of 54 randomized controlled trials (RCTs) that compared a range of land-based exercises with no-exercise controls showed evidence of benefit.[10] Of these trials, 19 were considered at low risk of bias. Evidence for the immediate benefits on mean pain scores was high quality (44 RCTs involving 3527 participants), and the effect size was considered moderate (standardized mean difference [SMD] –0.49, 95% confidence interval [CI] –0.39 to –0.59] lower in intervention groups; absolute reduction of 12 points [95% CI 10–15] on a 0–100 scale, where 0 represented no pain, compared with control groups). Evidence for the effect on physical function was of moderate quality (44 RCTs involving 3913 participants), was improved in the intervention groups (SMD –0.52, 95% CI –0.39 to –0.64; absolute improvement of 10 points [95% CI 8–13] on a 0–100 scale, where 0 represented no physical disability) and likely of clinical significance.[24] At two to six months after the conclusion

of the exercise intervention, the benefits were less extensive but still significant, and after six months, benefits for pain reduction were not maintained, but small benefits (improvement of 4 points, 95% CI 2 to 6) remained for physical function. Exercise effects on quality of life (QoL) (13 RCTs involving 1073 participants) were considered small (SMD 0.28, 95% CI 0.15 to 0.40; absolute change of 4 points [95% CI 2 to 5] on a 0–100 scale [100 was the maximum quality of life]).

For osteoarthritis of the hip, a recent Cochrane review of 10 RCTs of land-based exercise compared with no exercise (of which seven were deemed to have a low risk of bias) showed evidence of benefit.[11] High-quality evidence from nine trials (549 participants) showed that, immediately after treatment, exercise reduced pain (SMD –0.38, 95 CI% –0.55 to –0.20), with an absolute reduction of 8 points (95% CI 4 to 11) on a 0–100 scale (a lower score was better). There was also high-quality evidence (nine RCTs involving 521 participants) that exercise improved physical function immediately after treatment (SMD –0.33, 95% CI –0.54 to –0.05), with an absolute decrease of 7 points (95% CI 1 to 12) on a 0–100 scale (a lower score was better). The benefits for pain and physical function were sustained to at least three to six months after the exercise interventions. Only three small studies (183 participants) evaluated the effect of exercise on QoL, with overall low-quality evidence showing no benefit (SMD 0.07, 95% CI –0.23 to 0.36). The well-documented strong placebo effects for self-reported outcomes in osteoarthritis have not been controlled for in most studies of exercise, because participants have not been blinded to group allocation. Therefore, the exact amounts of beneficial effects directly arising from exercise cannot be determined.

Contraindications

For patients with osteoarthritis of the hip or knee, there are no absolute contraindications to prescribing exercise, although comorbidities need to be taken into account. If the joint is acutely inflamed, the exercise program may need to be modified.

Adverse effects

Studies report few adverse events associated with exercise for osteoarthritis, and they are generally minor, usually increased pain or pain at other sites.[10,11]

Chronic nonspecific low-back pain

A typical program would comprise 20 hours of individually supervised sessions over 8–12 weeks and a home program.[25] The type of exercise (e.g., yoga v. graded activity) seems less important than the quality of implementation (e.g., supervision, inclusion of a home program and duration of the program have been shown to improve treatment effect).[25] Exercise programs normally include an education component, incorporation of psychological principles, such as pacing or goal setting, and progress in functional activities.[12,25] Many programs also explicitly address psychological characteristics, such as catastrophizing, pain self-efficacy and fear of injury/movement, that can be barriers to engaging in physical activity.[12] Motor control exercises and graded activity as delivered by a physiotherapist are described in Box 2.

Evidence of benefit

In a Cochrane review of exercise for low-back pain, 43 RCTs involving patients with chronic low-back pain were included.[26] In a meta-analysis of eight RCTs (n = 370), there was mean improvement of pain at earliest follow-up in the exercise group when compared with the control group (10.2 points, 95 CI% 1.3 to 19.1) on a 0–100 pain scale.[26] A companion meta-regression study by the same authors found that the effect of exercise was associated with exercise program characteristics, such as supervision, high dose (> 20 h) and individually designed programs. The authors estimated that an exercise program incorporating the most effective intervention characteristics would provide a larger effect size on pain of 18.1 points (95% CI 11.1 to 25.0) and an effect on function of 5.5 points (95% CI 0.5 to 10.5) on a 0–100 function scale.[25] These effects are modest, although they are similar in size to that provided by other treatments. For example, a Cochrane review of nonsteroidal anti-inflammatory drugs reported an improvement in pain of 12.4 points (95% CI 9.3 to 15.5).[27] For patients with acute low-back pain, there was no significant difference between exercise groups and control groups for pain and function at earliest follow-up (three RCTs, n = 491). The Cochrane review was confined to pain and function outcomes and did not provide information on other outcomes, such as QoL, work status or prevention of future recurrence. This Cochrane review also did not use the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach (available at www.gradeworkinggroup.org) to describe the overall quality of the evidence.

Contraindications

Exercise is contraindicated in patients with low-back pain arising from a serious medical condition, such as fracture, infection, cancer or cauda equina syndrome. These conditions should be ruled out before prescribing an exercise program.

Adverse effects

The Cochrane review of exercise for low-back pain did not provide data on adverse effects.[26] In addition to the potential adverse effects of exercise in general, when exercise is used to manage low-back pain the most commonly reported adverse effect is temporary exacerbation of the back pain. In a placebo-controlled trial of motor control exercise (with 77 participants in each group), three participants in the exercise arm reported temporary exacerbation of the pain compared with two in the placebo group.[28]

Prevention of falls

Well-designed exercise programs can prevent falls in community-living older adults[14] when delivered as a single intervention or as part of a multifaceted program.[29] More effective programs include a focus on improving balance[14] (postural control), which has been identified as a key risk factor for falls.[30] Preventive exercise for community-living older adults is discussed in Appendix 4.

Evidence of benefit

In a 2012 Cochrane review, exercise as a single intervention was found to reduce the rate of falls by 30% in intervention groups when compared with control groups.[29] Both group- and home-based exercise that targeted balance, strength and/or fitness was found to be effective (rate ratio for group-based exercise 0.71, 95% CI 0.63 to 0.82, in 16 RCTs involving 3622 participants; rate ratio for home-based exercise 0.68, 95% CI 0.58 to 0.80, in seven RCTs involving 951 participants). Tai Chi was also found to reduce the risk of falling (the proportion of people falling) by 30% (risk ratio [RR] 0.71, 95% CI 0.57 to 0.87, in six RCTs involving 1625 participants).[29] Individual trials of exercise interventions have not been large enough to test exercise as a strategy for prevention of fractures, but some meta-analyses have suggested that exercise can prevent falls causing injuries[13,29,31] (rate ratio 0.63, 95% CI 0.51 to 0.77; 10 RCTs).[31]

Exercise as a single intervention has not been found to be effective in individuals with major risk factors for falls that are not amenable to change with exercise, such as patients with marked visual impairment or those taking psychoactive medications.[29] It appears from the Cochrane review that other evidence-based interventions for the prevention of falls should be prioritized in some patients. For example, the primary intervention for the prevention of falls in patients with marked visual impairment should be a home safety assessment or removal of cataracts. A gradual withdrawal of psychoactive medication should be attempted first in patients who are taking these medications.[29] These populations are likely to receive other benefits from exercise programs. Exercise as a single intervention was not found to be an effective prevention strategy for falls in patients living in high-support care facilities.[32]

Contraindications

There are no absolute contraindications to exercise for the prevention of falls; however, older adults at risk of falling may also have comorbidities (e.g., heart disease); therefore, contraindications outlined elsewhere in this review may be relevant.

Adverse effects

There is a risk that an older adult at risk of falling may fall while exercising. Prescribed exercises and the level of health professional supervision need to be appropriate for each patient's physical and cognitive abilities, and advice needs to be given about the safe conduct of exercise (Appendix 4), such as undertaking balance exercises near a firm support (e.g., a wall or table). Safe storage and application of weights or resistance bands is also important. Individual tailoring of the level of difficulty of the exercise can ensure the exercise is challenging enough to be useful, yet still safe.

COPD

Patients with COPD should be referred to pulmonary rehabilitation[33] when the condition is stable[34] or following a hospital admission for an acute exacerbation.[35] Patients should be taught how to manage symptoms during exercise, especially how to manage breathlessness. Box 3 describes pulmonary rehabilitation.

Evidence of benefit

The evidence for pulmonary rehabilitation comes from two Cochrane reviews — one for patients with stable COPD[34] and one following hospital admission for an acute exacerbation of COPD.[35] The review of pulmonary rehabilitation compared with usual care or no exercise training in patients with stable COPD (65 RCTs involving 3822 participants) found improvement in those who received pulmonary rehabilitation for a number of outcomes. There was moderate-quality evidence for the effect of pulmonary rehabilitation on QoL (MD –6.9 points, 95% CI –9.3 to –4.5, on the total score for the St. George's Respiratory Questionnaire),[34] in favour of the intervention group (a lower score is better). This effect size exceeded a minimal important difference (MID) of –4 points.[36] There were similar findings for other measures of

QoL (see Appendix 2). Maximal exercise capacity improved in the intervention groups (MD 6.8 watt [W], 95% CI 1.9 to 11.7), which exceeded the MID of 4 W,[37] although evidence quality was rated as low (16 RCTs involving 779 participants). Functional exercise capacity (measured by the six-minute walk test) also improved in the pulmonary rehabilitation groups (MD 43.9 m, 95% CI 32.6 to 55.2). This value was greater than the MID of 30 m (95% CI 25 to 33),[36] but the evidence quality was rated as very low.

In the second review (nine RCTs involving 432 participants) of patients with COPD who were randomly assigned to pulmonary rehabilitation or usual care after hospital admission for an acute exacerbation of COPD, the intervention group experienced a reduction in mortality (odds ratio [OR] 0.29, 95% CI 0.10 to 0.84) and hospital readmissions (OR 0.2, 95% CI 0.08 to 0.6; number needed to treat 4, 95% CI 3 to 8).[35] Overall, the trials were rated as moderate quality.

Contraindications

There are few absolute contraindications to exercise training within a pulmonary rehabilitation program. Most physical and medical comorbidities can be managed by expert clinicians; however, unstable cardiac disease may put patients at risk, and participation may not be possible for those with severe arthritis or severe neurologic or cognitive disorders.

Adverse effects

No adverse effects from pulmonary rehabilitation were reported in trials included in either of the Cochrane reviews.[34,35]

Type 2 diabetes

Evidence supports aerobic exercise, progressive resistance training or a combination of the two if it is structured (defined as planned, individualized and supervised) for the improvement of glycemic control.[17] Given the relative equivalency of metabolic benefits across aerobic and resistance exercise modalities, choice of exercise modality should be driven by patient choice or preference, and presence and type of comorbidities. For example, the presence of sarcopenia, mobility impairment, osteoporosis, frailty and osteoarthritis would suggest using resistance training rather than aerobic exercises, especially if the risk of falling is also present. Severe peripheral neuropathy or peripheral vascular disease with foot ulcers may also preclude weight-bearing aerobic exercise but still allows for resistance training to occur. There is a dose–response relation, with better outcomes associated with an exercise duration greater than 150 minutes per week[17] and higher intensity resistance training.[16] Exercise does not have to be performed in one session for benefits to accrue. Exercise for patients with diabetes is discussed in Box 4.

Evidence of benefit

A comprehensive meta-analysis of exercise efficacy for glycemic control in participants with type 2 diabetes that included 47 RCTs (8538 patients)[17] found that structured, supervised exercise training of at least 12 weeks duration (23 RCTs involving aerobic and/or resistance training) was associated with a decline in glycosylated hemoglobin (HbA_{1c}) level (–0.67%, 95% CI –0.84% to –0.49%) compared with participants in the control group.[17] Similar benefits, when compared with the control groups, were also found for aerobic exercise (–0.73%, 95% CI

Box 3: Exercise for patients with chronic obstructive pulmonary disease[15]

Rationale for exercise: To improve exercise capacity and quality of life, and to reduce breathlessness, hospital admissions and length of hospital stay.

Provider: Physiotherapist or exercise physiologist trained in pulmonary rehabilitation and holding current cardiopulmonary resusitation (CPR) certification

Mode: Exercise prescription should be individually tailored based on initial assessment; however, a number of patients can be supervised at the same time. It should be delivered face-to-face, although some sessions can be performed unsupervised at home.

Where: Hospital outpatient departments; appropriate community facilities

Materials needed: Flat walking track (preferably indoor and air-conditioned), resistance bands, hand weights and pulse oximeter. Optional: stationary cycle ergometer, treadmill, fixed-weight machines and supplemental oxygen. Assessment tools: Six-minute walk test (6MWT) procedures and instructions, dyspnea scale, pulse oximeter, device to measure blood pressure, spirometer, disease-specific quality of life questionnaire (e.g., St. George's Respiratory Questionnaire or Chronic Respiratory Disease Questionnaire). Assessment: Spirometry; resting blood pressure, heart rate and oxygen saturation; 6MWT performed twice to account for the known learning effect and the better walk distance recorded and used for exercise prescription; oxygen saturation and pulse rate monitored continuously throughout the 6MWT, with values recorded every minute; dyspnea during the 6MWT.

Procedure: See the Pulmonary Rehabilitation Toolkit[15] (www.pulmonaryrehab.com.au) for details on how to provide pulmonary rehabilitation.

Number of exercise sessions: 16–24 sessions face-to-face

Schedule details: 2–3 sessions per week for 8–12 weeks, with at least an extra 1–2 sessions a week unsupervised at home

Duration and intensity of each session: Each session should be about 60 minutes. The session must include aerobic training at a starting intensity for ground walking of 80% of the 6MWT speed; starting duration 10–15 minutes building to 30 minutes by the 3rd–5th session; resistance exercises for upper and lower limb muscle groups of 8–10 repetitions x 2–3 sets of each exercise. For cycle and treadmill training intensity, refer to the Pulmonary Rehabilitation Toolkit.

Other: The Lung Foundation Australia provides an online course on pulmonary rehabilitation (available at http://lungfoundation.com.au/health-professionals/training-and-education/pulmonary-rehabilitation-training-online/).

Box 4: Exercise for patients with type 2 diabetes[16,17]

Rationale for exercise: Traditionally, improving glycemic control has been the main focus of exercise interventions in patients with type 2 diabetes. However, many of the associated comorbidities are also relevant to prescribing exercise (e.g., obesity, osteoarthritis, peripheral neuropathy, falls risk, peripheral vascular disease and depression).

Provider: Physician referral to allied health provider or community fitness facility with competence in managing older adults with chronic disease. Prior to referral, physician screening for proliferative retinopathy, unstable angina, uncontrolled blood pressure, hyperglycemia or hypoglycemia, extent of peripheral vascular and neuropathic disease, and the presence of autonomic neuropathy (e.g., orthostatic hypotension, bradycardia or lack of sweating) may be indicated in patients with these comorbidities.[16]

Mode: Aerobic exercise, resistance training and a combination of both are the most effective for glucose control.[17] The combination offers the best treatment for both diabetes and common comorbidities and is recommended in current position statements.[16] The exercise needs to be structured, which is defined as planned, individualized and supervised.[17] Both group and individual training are effective. Patients with extensive comorbidities and frailty require more individualized training and supervision.

Where: Outpatient clinics of hospitals and health centres, allied health practices, community fitness facilities or at home with supervision

Materials needed: Aerobic exercise: good walking shoes, aerobic equipment if desired (treadmill, stepper, bike, etc.). Resistance training: free weights or machine-based training. Low-intensity training with bands or no equipment is not effective. A glucose-monitoring device, blood pressure cuff and easy access to high glucose drinks and snacks is recommended.

Procedure: Aerobic exercise should consist of large-muscle activities (e.g., walking, running, cycling and swimming) tailored to preferences and comorbidities, in particular to osteoarthritis. Resistance training (include multijoint exercises and large muscle groups) may include free weights or machine-based training (preferred for progression and safety in novices), with attention to rotator cuff disease and lower extremity arthritis that may require modification of exercises selected.[16]

Number of exercise sessions: 2–3 sessions per week for resistance training; 3–5 sessions per week for aerobic exercise; continue indefinitely

Schedule details: Exercise may need to be timed to coincide with peaks of glycemia postprandially and should not be undertaken after insulin or oral hypoglycemic administration without eating a meal beforehand. Shorter sessions may be accumulated across the day to achieve the full duration. No more than two consecutive days without exercising. Aerobic and resistance training may be done on separate days, which may improve efficacy and feasibility.

Duration and intensity of each session:

Aerobic exercise: Accumulate 150 minutes of moderate intensity (40%–59% VO_2 reserve [the difference between the rate of oxygen consumption at rest and at maximal exercise] or heart rate reserve, or 55%–69% of maximum heart rate or rated perceived exertion of 12–13 on a 6–20 point Borg Rating of Perceived Exertion Scale) in 3–5 sessions per week; OR 75 minutes of vigorous intensity (60%–84% VO_2 reserve or heart rate reserve, or 70%–89% maximum heart rate or rated perceived exertion of 14–16 on the 6–20 point Borg Scale) in 3–5 sessions per week.

Resistance training: Moderate to vigorous intensity (rated perceived exertion of 15–18 on a 6–20 point Borg Scale), 8–10 exercises; 2–4 sets of 8–10 repetitions per set) in 2–3 sessions per week

Other: Progression is necessary for improvement. As soon as the intensity of the workload drops below the required levels, the workload (e.g., pace, incline and amount of weight lifted) should be increased to reach the intensity targets. Intercurrent illness or laser surgery may require temporary cessation of exercise and resumption at a slightly lower intensity until former levels are regained. Communication between the physician, diabetes educator and fitness professional is necessary for optimal management of all aspects of diabetes.

–1.06% to –0.40%), resistance training (–0.57%, 95% CI –1.14% to –0.01%), and combined aerobic and resistance exercise (–0.51%, 95% CI –0.79% to –0.23%). Exercise duration of greater than 150 minutes per week was associated with a greater reduction in HbA_{1c} level (weighted mean difference [WMD] –0.89%, 95% CI –1.26% to –0.51%) compared with durations of 150 minutes or less per week (WMD –0.36%, 95% CI –0.50% to –0.23%). Physical activity advice alone was not effective (–0.16%, 95% CI –0.50% to 0.18%). This review did not use the GRADE approach to describe the overall quality of the evidence. The overall effect of structured exercise on HbA_{1c} level (–0.67%, 95% CI –0.84 to –0.49) was similar to the effect of adding metformin to insulin treatment (–0.60%, 95% CI –0.30% to –0.91%) that was reported in a meta-analysis of 35 RCTs involving patients with diabetes.[38]

Structured exercise or exercise combined with dietary advice has not been shown to reduce cardiovascular mortality in type 2 diabetes.[39] However, mortality risk associated with reductions in HbA_{1c} level was evaluated in a prospective cohort study involving 11 205 patients with type 2 diabetes in Denmark.[40] A linear relation was found in patients with an index HbA_{1c} level greater than 8%, with the lowest mortality associated with the greatest decline in HbA_{1c} level.

Contraindications

There are few contraindications to moderate or vigorous exercise for patients with type 2 diabetes and include progressive proliferative retinopathy (not the more common nonproliferative retinopathy), end-stage heart failure, malignant arrhythmias or inoperable known aneurysms. Temporary contraindications include acute retinal surgery, recovery from which precludes any activities that cause large elevations in blood pressure/intraocular pressure for one to two weeks. Temporary contraindications also include periods of hypoglycemia or poor glucose control until stabilized, acute systemic infections, severe exacerbations of inflammatory joint disease or musculoskeletal injury, or during temporary instability of ischemic heart disease, hypertension or heart failure until controlled.[16]

Adverse effects

Potential adverse effects of exercise for type 2 diabetes are linked to poor metabolic control, with further dysregulation of glucose homeostasis, as well as common comorbidities of this condition that include coronary artery disease, osteoarthritis, mobility impairment, neuropathy, peripheral vascular disease, visual impairment or

proliferative retinopathy, and orthostatic hypotension.[16] In the systematic review that included 47 RCTs, 30 did not report adverse events.[17] Of those that did, no major adverse events were reported and, in a few studies, minor events included musculoskeletal injury or discomfort, hypoglycemic episodes (in two studies) and cardiovascular disease events that were unrelated to the intervention.

Chronic fatigue syndrome

The most effective type, duration and intensity of exercise for chronic fatigue syndrome are unclear. Appendix 5 describes an example of one exercise intervention (graded exercise therapy).

Evidence of benefit

The evidence comes from a recent Cochrane review (eight RCTs involving 1518 participants) of exercise therapy compared with usual care, wait list, or relaxation and flexibility training.[41] There was moderate-quality evidence for the effect of exercise on fatigue, with a mean reduction of 2.8 points (95% CI 1.57 to 4.07) on a 0–33 point scale (a lower score indicates less fatigue). Studies that used other scoring for the fatigue scale had similar results (see Appendix 2). In four RCTs (involving 489 participants, with moderate-quality evidence) that measured self-perceived changes in overall health, more participants in the exercise groups reported improvement than in the control groups (RR 1.83, 95% CI 1.39 to 2.40). Two RCTs (low-quality evidence) measured sleep, with a mean sleep score of 1.5 points (95% CI 0.02 to 2.95) lower in the exercise groups, with a lower score suggesting improved sleep quality. There was also low-quality evidence (five RCTs) for the effect on physical functioning, with mean scores 13.10 points (95% CI 1.98 to 24.22) higher in the exercise therapy groups. The review authors were unable to draw conclusions about the effect of exercise therapy on QoL, pain, anxiety, depression, use of health service resources and drop-out rate.

Contraindications

There are no absolute contraindications to exercise for patients with chronic fatigue syndrome.

Adverse events

There is limited evidence about adverse events. In the Cochrane review,[41] serious adverse reactions (worsening symptoms and deterioration in function) were only reported by one study (n = 319) but were uncommon (two participants) in both groups (RR 0.99, 95% CI 0.14 to 6.97).

Coronary heart disease and heart failure

Patients should always work within their exercise tolerance and progress gradually. Initially, direct supervision of resistance training is advocated. Beneficial gains are possible in those at highest risk (e.g., a history of acute myocardial infarction with comorbidities or advanced heart failure) and in those who adhere to the prescription.[19] For optimal care, exercise is only one component of a comprehensive program. Appendix 6 describes the possible components of this type of program.

Evidence of benefit

A Cochrane review of 47 RCTs (10 794 participants with coronary heart disease who were predominantly male and middle-aged) found that exercise-based cardiac rehabilitation compared with usual care reduced overall mortality (RR 0.87, 95% CI 0.75 to 0.99) and cardiovascular mortality (RR 0.74, 95% CI 0.63 to 0.87) at 12 months or more, and all hospital admissions (RR 0.69, 95% CI 0.51 to 0.93) in the shorter term (< 12 months follow-up), with no evidence of heterogeneity of effect across trials.[42] There was no reduction in the risk of total myocardial infarction or revascularization. The impact on QoL was unclear, with 7 out of the 10 trials that measured it reporting a significantly higher QoL in the exercise group, but a meta-analysis was not performed because of heterogeneity.

A recent Cochrane review of 33 RCTs (4740 participants with heart failure, mostly with heart failure due to reduced ejection fraction and categorized as New York Heart Association classes II and III) found that exercise-based rehabilitation compared with no exercise controls had no effect on all-cause mortality up to 12 months follow-up (RR 0.93, 95% CI 0.69 to 1.27).[43] Compared with the control group, exercise-based rehabilitation reduced the rate, over one year, of all hospital admissions (15 trials involving 1328 participants; RR 0.75, 95% CI 0.62 to 0.92) and hospital admission specific to heart failure (12 trials involving 1036 participants; RR 0.61, 95% CI 0.46 to 0.80). There was also a statistically significant and clinically important improvement in disease-specific QoL (up to 12 months) in the exercise groups (13 trials involving 1270 participants; MD –5.8, 95% CI –9.2 to –2.4, on a 0–105 scale, where a lower score is better). The overall risk of bias across the trials was moderate.

Contraindications

Absolute contraindications to exercise for patients with coronary heart disease and/or heart

failure include unstable ischemia, uncontrolled heart failure or arrhythmias, uncontrolled hypertension or diabetes, acute systemic illness or fever, severe and symptomatic valvular heart disease or any other cardiac condition that the family physician believes is life threatening.[19]

Adverse events

Vigorous exercise can trigger a cardiovascular event, particularly in people who are habitually sedentary. Potential harms of exercise among patients with established coronary heart disease or heart failure are a nonfatal cardiac arrest (about 1 per 115 000 patient-hours of supervised exercise in patients with heart disease; about half the rate in patients with heart failure) or death (about 1 per 750 000 patient-hours of participation).[19]

Conclusion

Exercise is an effective but neglected treatment for many chronic conditions. However, similar to surgery, exercise is not a single entity but must be tailored to the condition. If exercise interventions are not implemented in a manner that is consistent with how they were used in trials (e.g., at a lower intensity, shorter duration or with different components), the fidelity of the intervention is compromised, and clinicians and patients cannot expect to realize outcomes similar to those achieved in the trials.

Unless clinicians can access sufficient details about exercise interventions to prescribe them, they either guess at how to use them or do not use them at all. General practitioners have identified the need for exercise details and resources to assist them with exercise prescription.[4,44] Even when a family physician may not be involved in delivering the exercise intervention, they should know the main elements of an evidence-based exercise intervention so they can discuss with patients and refer appropriately. We have summarized the available evidence to assist clinicians in using and prescribing exercise interventions in practice.

Exercise prescription also requires clinicians to be able to manage patients' misconceptions, fears and motivation, particularly for those who are unwell. Although these are also challenges for pharmacologic interventions, the challenges are of a higher degree for exercise. However, the potential rewards for clinicians and patients make overcoming the challenges worthwhile.

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Research

A home program of strength training, movement strategy training and education did not prevent falls in people with Parkinson's disease: a randomised trial

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KEY WORDS

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ABSTRACT

Questions: For people with idiopathic Parkinson's disease, does a 6-week, comprehensive, home exercise program reduce falls and disability and improve health-related quality of life? Is the program cost-effective? **Design**: Randomised, controlled trial with concealed allocation and assessor blinding. **Participants**: One hundred and thirty-three community-dwelling adults with Parkinson's disease. **Intervention**: The experimental group completed a 6-week home program comprising progressive resistance strength training, movement strategy training and falls education. The control group completed 6 weeks of non-specific life skills training. Participants in both groups received weekly therapist-guided sessions for 6 consecutive weeks and a weekly self-directed home program. **Outcome measures**: The primary outcome was the rate of falls, documented for the 12-month period immediately after therapy. Secondary outcomes were disability and health-related quality of life, assessed before and after intervention and at a 12-month follow-up. **Results**: A total of 2255 falls were reported by the 12-month follow-up. The proportion of fallers in the experimental and control groups was 61 and 72%, respectively, which was not statistically significantly different (RR = 0.85, 95% CI 0.66 to 1.09). There was no significant between-group difference in the rate of falls (incidence rate ratio = 1.58, 95% CI 0.73 to 3.43). A survival analysis of participant time to first fall did not show a significant between-group difference (log-rank test $\chi^2 = 0.79$, $p = 0.37$). No significant between-group differences occurred for mobility, disability or quality of life. The mean cost of delivering the experimental intervention was AUD1596. **Conclusion**: A home program of strength and movement strategy training and falls education does not prevent falls when applied at the dose used in this study. Arguably, the dosage of therapy was insufficient. Future trials need to explore further therapy content, repetitions and duration, in order to optimise outcomes and cost-effectiveness. **[Morris ME, Taylor NF, Watts JJ, Evans A, Horne M, Kempster P, Danoudis M, McGinley J, Martin C, Menz HB (2017) A home program of strength training, movement strategy training and education did not prevent falls in people with Parkinson's disease: a randomised trial. *Journal of Physiotherapy* 63: 94–100]**

Introduction

Falls and movement disorders are both common and disabling in people living with idiopathic Parkinson's disease.[1,2] Over 60% of people with Parkinson's disease are predicted to fall at least once annually, and 50% are expected to have recurrent falls.[3,4] Falls lead to a loss of independence, reduced quality of life, and increases in morbidity, mortality, need for supported care, and care-giver burden.[1,5,6] The financial costs of falls are also substantial.[7] The annual direct costs of medical care for people with Parkinson's disease in the USA was USD12 164 higher than matched controls,[8] with falls being identified as a substantial contributor to increased costs.

Physiotherapy for people with Parkinson's disease aims to keep them moving, prevent falls, and enable them to remain living at home safely for as long as possible.[9–12] Pharmacological management of symptoms coupled with movement rehabilitation have shown promise for reducing falls and improving mobility.[9–17] Hospital and outpatient trials have reported positive effects for movement rehabilitation strategies such as cueing,[18] cognitive strategies that focus attention and avoid dual task interference[19] and progressive resistance strength training.[20] Despite this, exercises and movement rehabilitation therapy have received limited attention in the published literature.[4,11] This randomised, controlled trial aimed to compare the efficacy of an integrated physiotherapy exercise and rehabilitation program delivered in the

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home with a placebo control group that received a non-specific life skills home-based program. The exercise program consisted of movement strategy training based on studies by Morris and Iansek,[18,21] progressive resistance strength training, and education on falls prevention and mobility. An integrated fall prevention program combining strengthening, cueing and education was provided, given the accumulating evidence for these interventions for Parkinson's disease.[11,18,19] The program was home based, so that participants would not have to travel and would presumably feel comfortable in their own premises.

Therefore, the research questions for this randomised, controlled trial were:

1. For people with idiopathic Parkinson's disease, does a 6-week, comprehensive, home exercise program reduce falls and disability and improve health-related quality of life?
2. Is the program cost-effective?

Method

Design

A randomised, controlled trial with concealed allocation, assessor blinding and intention-to-treat analysis was conducted in the Melbourne metropolitan region, Australia. A study protocol with more detailed eligibility criteria and intervention descriptions was previously published.[22] Blinded assessors who were registered physiotherapists performed all of the assessments.

Participants, therapists, centres

A total of 143 participants were assessed for eligibility and 133 were randomised into the study. Inclusion criteria were: idiopathic Parkinson's disease confirmed by a neurologist, modified Hoehn and Yahr (1967) stage $\leq$ IV,[23] Mini Mental State Examination score $\geq$ 24,[24] and community dwelling. Exclusion criteria were: other health conditions that preclude safe participation in the exercise program, insufficient English to follow instructions, and unwillingness to be assessed and treated at home. Eligible participants were randomly allocated to either the experimental group or the control group. Randomisation was stratified according to referral source, and performed by an independent entity using a computerised random number generator.

Intervention

Experimental group

The 6-week program included a weekly 60-minute individualised session delivered in the participant's home, supervised by a qualified and trained therapist who was guided by a physiotherapist. A physiotherapist also prescribed a weekly 60-minute unsupervised session via pre-printed, individualised worksheets that were explained to the participant by the treating therapist. Thus, the total dosage of therapy each week was 120 minutes for each of the 6 weeks.

People with Parkinson's disease are often very de-conditioned. Healthy adults typically receive up to 8 weeks of twice-weekly training to obtain strength gains. At the time of the trial design, 6 weeks of twice-weekly therapy was argued to be adequate for people with neurological impairments such as those with Parkinson's disease.[25,26] A position statement by the American Heart Association advised that 6-week interventions increased strength and endurance in people with cardiovascular problems.[27] The American College of Sports Medicine had similar advice with regards to progressive models of resistance training for healthy adults > 60 years of age.[28] Moreover, a 6-week home program was thought to be feasible for people with Parkinson's disease.

The experimental program comprised three individualised components: progressive resistance strength training, movement strategy training, and education about methods with which to prevent falls. When the allocated 60-minute session was insufficient to complete all activities, the strength-training component was prioritised. The unsupervised sessions repeated activities from the therapist-guided sessions, with modifications made for specific individual needs or safety. To evaluate adherence and compliance with the experimental intervention, each participant recorded the activities that were performed, as well as perceived exertion for each session (therapist-guided and unsupervised), on pre-printed forms. Participants were monitored for adverse events during the intervention and follow-up periods, and requested to report any muscle soreness or joint stiffness from previous sessions. If this occurred, they were also asked to report whether they required any health service due to the adverse event.

For the unsupervised sessions, participants received an information pack containing a booklet with illustrations and descriptions of exercises, and a Modified Rating of Perceived Exertion scale.[29] They also received an exercise log book, a document with answers to frequently asked questions on strength training, a booklet of falls prevention,[30] and a standard help sheet from Parkinson's Victoria, listing support and resources.

Progressive resistance strength training

The strength-training component of the experimental intervention focused on the major muscle groups that are essential for functional gait and balance (quadriceps, glutei, hip abductors, hamstrings, gastrocnemius, soleus and trunk muscles). Strength training of these muscles was incorporated within step-ups, heel raises, sit-to-stand movements, standing hip abduction exercises, and trunk extension and rotation exercises. The American College of Sports Medicine guidelines were used to develop the training protocols, to ensure that the training stimulus and progression of resistance were optimal.[28,31,32] At each session, the participant aimed to complete at least three different exercises, each performed for two sets of eight to 12 repetitions, with a 2-minute rest between sets. Participants were able to progressively increase resistance by using a weighted vest, a resistance band, weights, or by altering their starting positions. The therapists trained the participants to perform exercises safely and with correct form, and assisted them in using the Modified Rating of Perceived Exertion scale.[29]

Movement strategy training

The movement strategy training component of the experimental intervention was derived from previously established techniques for people with Parkinson's disease.[21,32] These included the use of visual, auditory, cognitive or proprioceptive cues and attentional strategies to facilitate the ability of participants to initiate and execute daily activities. Visual cues included the use of white markers on the floor to step over, as well as written instructions. Auditory cues included metronome cues and rhythmical cues from music. The activities selected for movement strategy training and their rate of progression were based on individual abilities, needs, the home environment, and caregiver support. The daily activities included: standing up and sitting down; moving from chair to chair; standing and reaching; walking; walking whilst carrying objects; turning; and bed mobility.

Falls education

The falls education component of the experimental intervention was based on a booklet published by the Commonwealth of Australia entitled *Don't Fall for It! Falls Can Be Prevented*.[30] The booklet is a guide for the prevention of falls in older people, and contains information and advice on aspects of falls and safety. Topics include: risk factors, keeping mobile, medication, vision, safety in the home, and feet and footwear. Each session of the experimental intervention reflected the booklet content, with particular emphasis put on material relevant to the individual.

Control group

The control group received a placebo intervention, which was a life skills program of equal length to the experimental intervention, and was delivered by trained allied health professionals, including occupational therapists, physiotherapists and speech pathologists. Weekly therapist contact times and self-directed homework sessions were of comparable length to the experimental group and consisted of guided education and discussion sessions on topics of interest that were selected by participants from a pre-defined syllabus. Available topics included relaxation, energy conservation, fatigue management, voice, communication, swallowing, diet, travel advice, and memory skills. None of the topics contained content related to physical activity, exercise, walking, or falls risk education. Participants in the control group were also provided with the standard help sheet from Parkinson's Victoria, and for ethical considerations, a generic falls information sheet.

Outcome measures

Primary outcome

The primary outcome measure was falls, defined as an unexpected event in which the participant comes to rest on the ground, floor or lower level.[33] All falls were monitored from the initial pre-intervention assessment until the follow-up assessment 12 months after the intervention, via monthly falls calendars returned via pre-paid mail. Each participant was required to record any falls incidents by marking the date on the calendar and indicating whether the fall was injurious (defined as any fall that required medical attention or healthcare utilisation). Telephone calls were made to remind participants to return their calendars and to investigate any injurious falls. Each injurious fall was followed up using a questionnaire to examine self-reported healthcare utilisation and out-of-pocket expenses.

Secondary outcomes

The secondary outcome measures were changes in motor disability and quality of life from the pre-intervention assessment to the post-intervention and 12-month follow-up assessments. Motor disability was scored using section III of the Movement Disorder Society Unified Parkinson's Disease Rating Scale (MDS-UPDRS).[34] The disease-specific Parkinson's Disease Questionnaire (PDQ-39)[35] was used to score quality of life, and the generic EuroQol-5D (EQ-5D-3L)[36] allowed quality of life comparisons with non-Parkinson's disease populations.[37] The EQ-5D-3L was converted to a single utility index using the UK adult weights,[38] which were based on the time trade-off method.

Economic evaluation

To determine the cost of the experimental intervention, the direct cost of implementing the experimental program was calculated, including the cost of travel, home visits, therapist training and equipment. The economic analysis assumed that the control group was a placebo intervention; therefore, no program delivery costs were attributed to the control group. A health system perspective was assumed, with the following outcomes of interest: number of falls prevented, injurious falls, and health-related quality of life.

Intention-to-treat analysis was undertaken. Costs were reported as 2016 Australian dollars (AUD), and unit costs from 2012 were inflated using the Australian Bureau of Statistics health inflation index. The questionnaire administered following an injurious fall included detail about medical, medical ancillary, diagnostic, and hospitalisation costs associated with falling events during the 12-month follow-up period. It was assumed that each person reporting an injurious fall would have a minimum of one visit to a general practitioner. Hospital activity costs were obtained from the National Hospital Cost Data Collection for 2012/2013. These included admitted same-day (average cost of a same-day admission), admitted overnight (average cost of an overnight admission), non-admitted emergency department, and sub-acute care. Unit costs for non-hospital services were based on the health service costs for fractures reported by Watts et al in the recent Osteoporosis Burden of Disease report.[39]

Data analysis

The primary outcome was analysed in several ways: the number of fallers during follow-up, the number of multiple fallers during follow-up, falls rate during follow-up, and time to first fall. A negative binomial regression model was used to compare the number of falls and the falls rate per person per year in the two groups, as this approach adjusts for varying durations of follow-up. Injurious falls were analysed using the same methods. Secondary outcome variables were compared between groups using analysis of covariance, with baseline scores and intervention group entered as independent variables.

Results

Flow of participants through the study

Of the 143 potential participants screened for eligibility, 10 were excluded and 133 were randomised (Figure 1). One patient in the experimental group and five in the control group did not receive interventions. The numbers who attended the 12-month assessment for testing of secondary outcomes were similar between groups, with 55 in the experimental group and 53 in the control group.

Baseline characteristics are reported in Table 1 and the groups appear to be well matched. The mean age of the 80 men and 53 women was 70.6 years (range 46 to 86). The majority of participants (66%) had mild Parkinson's disease, with a modified Hoehn and Yahr stage between I and II; 29% had moderate disease severity (stage III) and 5.3% severe disability (stage IV). More than half of the participants reported having had a fall in the previous 12 months. Freezing of gait was self-reported by 35% of the sample at baseline (taken from response to freezing of gait question of the UPDRS part II). All participants in the control group and all except three participants in the experimental group were taking medications specific to Parkinson's disease.

Falls during the 12-month follow-up

A total of 124 participants returned fall calendars after the intervention period: 64 in the experimental group and 60 from the control group. Table 2 summarises the data on fall rates. There

Table 1
Baseline characteristics of participants.

Characteristic	All (n = 133)	Exp (n = 67)	Con (n = 66)
Age *(yr)*, mean (SD)	71 (9)	71 (8)	71 (10)
Gender *(M:F)*, n (%)	80:53 (60:40)	45:22 (67:33)	35:31 (53:47)
MMSE *(0 to 30)*, mean (SD)	28.3 (1.6)	28.3 (1.5)	28.3 (1.8)
HY stage *(1 to 4)*, median (IQR)	2 (2 to 3)	2 (2 to 3)	2 (2 to 3)
HY stage *(1 to 4)*, n (%)			
1	13 (10)	7 (10)	6 (9)
2	73 (55)	40 (60)	33 (50)
3	38 (29)	16 (24)	22 (33)
4	7 (5)	4 (6)	3 (5)
Freezing of gait *(Y/N)*, n (%)[a]	46 (35)	25 (37)	21 (32)
Fallen in last year, n (%)	73 (55)	38 (57)	35 (53)
No PD medication, n (%)	3 (2)	3 (4)	0 (0)
Levodopa only, n (%)	68 (51)	32 (48)	36 (55)
Combination therapy, n (%)	58 (44)	32 (48)	26 (39)
Non-levodopa, n (%)	1 (1)	0 (0)	1 (2)
$\geq$ 4 prescription medications, n (%)	80 (60)	40 (60)	40 (61)
Psychotropic medications, n (%)	59 (44)	28 (42)	31 (47)

Con = control group, Exp = experimental group, F = female, HY = Modified Hoehn & Yahr scale, M = male, MMSE = Mini Mental State Exam, N = no, Y = yes, PD = Parkinson's disease.

[a] Taken from question 2.13 of Movement Disorders Society Unified Parkinson's Disease Rating Scale.

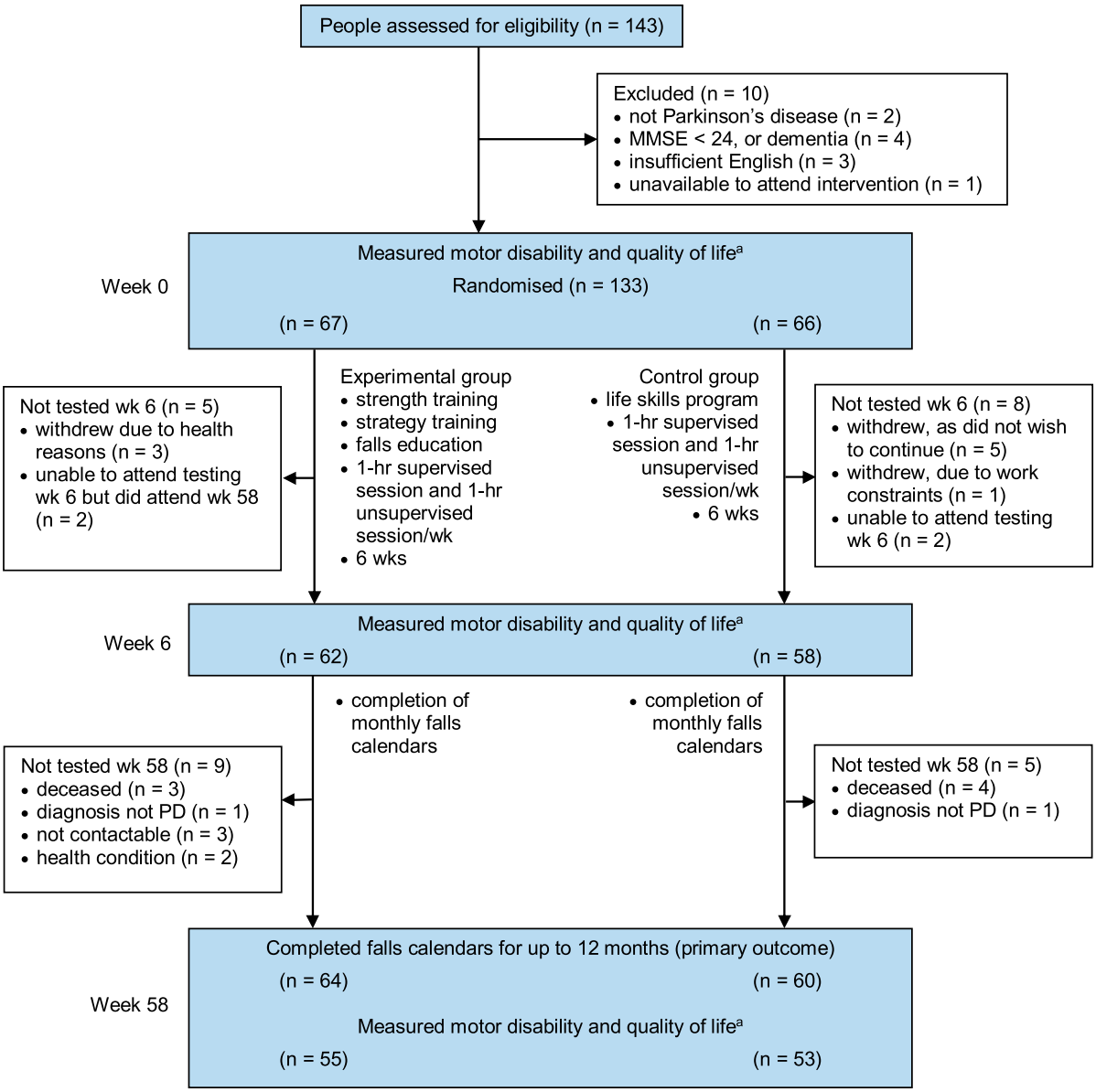

Figure 1. Design and flow of participants through the trial.
[a]Motor disability was measured with the Movement Disorders Society Unified Parkinson's Disease Rating Scale and quality of life was measured with the EuroQol-5D questionnaire and the Parkinson's Disease Questionnaire-39.
MMSE = Mini Mental State Examination, PD = Parkinson's disease.

were 2255 falls reported over the 12-month follow-up period: 1401 in the experimental group and 854 in the control group. In the experimental group, five participants reported > 100 falls over this period (range 176 to 275), compared with one participant in the control group, who reported 207 falls. There was no significant between-group difference in the rate of falls (incidence rate ratio [IRR] = 1.58, 95% CI 0.73 to 3.43). In the experimental group, 25 people did not fall and, in the control group, 17 did not fall.

There were 31 injurious falls. These were defined as a fall resulting in attendance to a health service, and were reported by 24 participants. There were eight injurious falls in the control group reported by eight participants and 23 injurious falls in the experimental group experienced by 16 participants. One participant in the experimental group reported five separate injurious falls. Detailed information was available from 22 participants for 27 of the injurious falls. Nine injurious falls resulted in a visit to a hospital, of which six then required at least a one-night stay in hospital. Seventeen participants consulted a general medical practitioner on 21 occasions following a fall. Three participants had a fracture due to a fall during the follow-up period: two from the experimental group and one from the control group. The affected sites included vertebrae, hip and ankle. The mean health service cost of an injurious fall was AUD1995 (SD 4097) and the median cost was AUD83. Amongst those who experienced an injurious fall, the mean cost of the injurious fall was lower in the experimental group compared with the control group; this difference was not significantly different (MD AUD3055, 95% CI −244 to 6355).

A survival analysis of participant time to first fall did not show any significant difference between the experimental and control groups (log-rank test $\chi^2 = 0.79$, $p = 0.37$) (Figure 2).

Changes in disability and health-related quality of life

Post-intervention measures of disability, as measured by the MDS-UPDRS (part I, II and III), and health-related quality of life (PDQ39, EuroQol VAS and EQ-5D-3L index score) are presented in Table 3. There were no significant between-group differences for the secondary outcome measures at the 12-month follow-up.

Economic analysis

The mean cost of delivering the intervention to participants in the experimental group was AUD1596 per person. The intention-to-treat analysis assumed that everyone completed the 6-week

Table 2
Number of falls and fallers in each group, and ratio of falls risk (95% CI) between groups.

Outcome measures	Exp (n=64)	Con (n=60)	Ratio of falls risk (95% CI)
All falls			
number of falls			1.58 (0.73 to 3.43) [a]
total	1401	854	
median (range)	1 (0 to 275)	1 (0 to 207)	
fallers, n (%)	39 (60.9)	43 (71.7)	0.85 (0.66 to 1.09) [b]
multiple fallers, n (%)	30 (46.9)	28 (46.7)	1.00 (0.68 to 1.45) [b]
Injurious falls			
number of falls			0.87 (0.24 to 3.10) [a]
total	23	8	
median (range)	0 (0 to 5)	0 (0 to 1)	
fallers, n (%)	16 (23.9)	8 (12.1)	1.97 (0.91 to 4.29) [b]
multiple fallers, n (%)	4 (6.0)	0 (0)	8.87 (0.49 to 161.52) [b]

[a] Incidence rate ratio.
[b] Relative risk.

program. The analysis included the costs of equipment, the training physiotherapists, travel, and treatment time in the home environment. The control group received placebo usual care; therefore, no program delivery costs were attributed to the control group. As there was no significant difference in outcomes between the experimental and control groups, an incremental cost-effectiveness ratio was not determined.

Compliance with the interventions

Regarding adherence, 66 participants in the experimental group and 61 in the control group attended one or more sessions. Adherence to the unsupervised sessions was high, with 62 of experimental group and 51 of control group participants receiving 5 to 6 weeks of therapy. Four participants in the experimental group and five in the control group attended three or fewer sessions. No adverse events related to the intervention were reported in the trial.

Discussion

This randomised trial found that 66% of people with Parkinson's disease experienced one or more falls during the testing period. There were no significant differences between groups in falls rates during the 12-month follow-up period after therapy. Similarly, there was little difference between groups at the 12-month follow-up for disability or health-related quality of life.

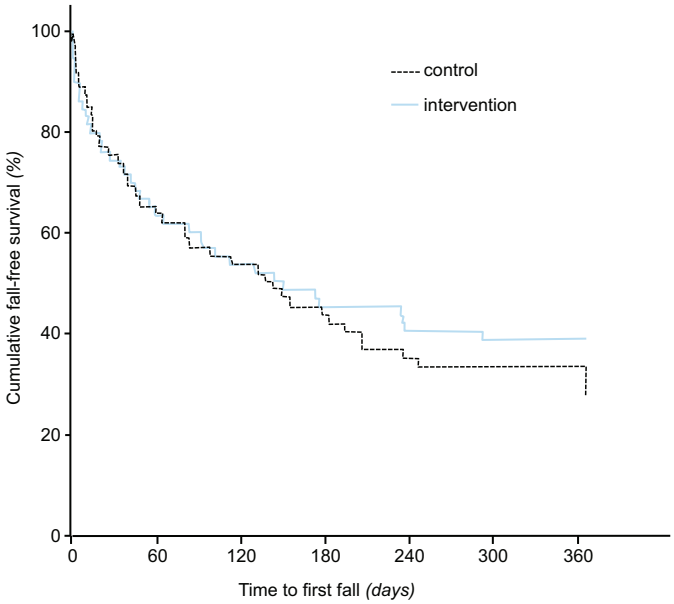

Figure 2. Kaplan-Meier survival curve showing time to first fall.

In relation to falls, the null findings of this placebo-controlled, randomised trial agree with several recent large clinical trials of movement rehabilitation, exercise therapy or physiotherapy for people with mild to moderately severe Parkinson's disease. For example, an Australian trial with 231 participants by Canning et al found that community-dwelling people with Parkinson's disease who received a 6-month home exercise program that included progressive resistance strength training and falls education had similar falls rates to those who received usual care.[40] Therapeutic exercises were performed for 40 to 60 minutes, three times a week, for 6 months. Likewise, a large cluster-randomised trial in the Netherlands with 699 participants reported similar falls rates and health outcomes in people with Parkinson's disease who received intensive community-based therapeutic exercises for 16 weeks compared to those who received standard care.[15] Goodwin et al conducted a pragmatic randomised trial in the UK, finding no difference in falls between those who received 10 weeks of therapy compared to usual care.[13] Likewise, the UK trial by Ashburn et al, with 142 participants, did not show significant differences in falls rates for those who received 6 weeks of physiotherapy compared to usual care.[4] A recent UK trial by Clarke et al reported that low-dose,

Table 3
Mean (SD) of groups and ANCOVA-adjusted mean difference (95% CI) between groups.

Outcome	Groups						ANCOVA-adjusted mean between-group difference (95% CI)
	Week 0		Week 6		Week 58		
	Exp (n=67)	Con (n=66)	Exp (n=62)	Con (n=58)	Exp (n=55)	Con (n=53)	Exp minus Con
UPDRS Part I non-motor aspects of experiences of daily living							
Questions 1.1 to 1.6 *(0 to 16)*	3.66 (3.27)	3.89 (3.84)	2.59 (2.45)	2.32 (2.56)	3.01 (2.59)	2.57 (3.31)	0.56 (−0.30 to 1.43)
Questions 1.7 to 1.13 *(0 to 28)*	8.04 (4.51)	7.57 (4.58)	6.91 (4.12)	7.07 (3.48)	7.65 (4.47)	7.32 (3.11)	0.45 (−0.82 to 1.72)
UPDRS Part II motor aspects of experiences of daily living *(0 to 61)*	15 (9)	16 (8)	13 (8)	15 (7)	14 (9)	16 (8)	1 (−1 to 3)
UPDRS Part III motor examination *(0 to 77)*	35 (15)	36 (15)	28 (14)	30 (13)	28 (13)	33 (15)	−2 (−7 to 2)
UPDRS Part IV motor complications *(0 to 24)*	4.00 (4.23)	3.37 (3.95)	3.81 (4.51)	3.85 (4.65)	3.70 (4.33)	3.52 (3.90)	−0.02 (−1.09 to 1.05)
PDQ-39 Summary Score Index *(0 to 100)*	23 (14)	24 (15)	21 (14)	20 (14)	22 (13)	22 (14)	1 (−2 to 5)
EQ-5D Visual Analogue Scale *(0 to 100)*	73 (15)	72 (16)	68 (15)	76 (12)	72 (17)	71 (14)	0 (−5 to 5)
EQ-5D Index Score *(0 to 1)*	0.67 (0.27)	0.63 (0.28)	0.66 (0.29)	0.65 (0.27)	0.67 (0.25)	0.64 (0.30)	0.01 (−0.08 to 0.11)

ANCOVA = analysis of covariance, Con = control group, EQ-5D = EuroQol 5D, Exp = experimental group, PDQ-39 = Parkinson's Disease Questionnaire, UPDRS = Unified Parkinson's Disease Rating Scale.

patient-centred, goal-directed physiotherapy and occupational therapy was not associated with significant gains; this was possibly related to the modest dosage of therapy.[41]

In contrast, a large US study of 200 participants by Li et al showed a significant reduction in falls for people who performed intensive therapy twice weekly for 6 months.[12] The intervention group showed beneficial results from intense practice of physical activities to improve balance, such as Tai Chi, highlighting the importance of dosage in therapy outcomes. Likewise, the randomised trial by Smania et al on 64 Italian participants found beneficial effects on falls for an intensive program of balance therapy delivered for 21 sessions of 50 minutes each.[42] Gao and colleagues explored the effects of regular Tai Chi on balance, mobility and falls in 37 Chinese people with Parkinson's disease compared to a control group of 39 people who received no intervention.[43] By the 6-month follow-up, 22% of the group who received 36 sessions of Tai Chi for 1 hour per session had experienced a fall compared with 49% of control participants. Along the same lines, in a study of 35 people with Parkinson's disease, Shen and Mak reported that 12 weeks of technology-assisted balance and gait training five times per week reduced falls to a greater extent than comparable dosages of strength training.[44] Our own recent randomised trial of outpatient physiotherapy to reduce falls in people with Parkinson's disease[17] showed a positive effect on fall reduction. This used similar intervention, including strength training, and movement strategies and fall education twice weekly, but had an 8-week duration.

Other Parkinson's disease physical rehabilitation trials of comparatively high intensity and duration have shown positive outcomes, highlighting the relevance of dosage to therapy outcomes. For example, Monticone et al reported that people with Parkinson's disease who received intensive in-patient rehabilitation within the context of a multi-disciplinary team showed significantly better balance, mobility and quality of life than people who received usual care of lower intensity.[45] As pointed out by Rochester and Espay,[16] many exercise and rehabilitation Parkinson's disease trials appear to have delivered relatively modest dosages of therapy. Some of these trials might not have delivered sufficient intensity to afford the physiological adaptations required to improve balance, mobility, strength and falls in people living with Parkinson's disease. The notable feature of the trial of 70 people by Monticone et al was that participants were admitted to hospital for a period of 8 weeks, where they received high-dosage physiotherapy for 90 minutes daily from expert clinicians.[45] They also confined their sample to people with comparatively mild Parkinson's disease, who are more likely to be responsive to physical therapy interventions. However, it is unclear whether the improvements in balance in the Monticone trial translated to reductions in falls. In sum, the literature shows that both the content of therapy and the dosage appear to be very important, as shown by the differential results for therapies that targeted motor disabilities in many investigations.[4,12,46]

As there was no between-group difference in the primary outcome (falls rate) or secondary outcomes, the appropriate economic method was a cost-minimisation analysis. The higher resource costs for the experimental group suggest that intervention should not be implemented in its current form. The resource component was relatively intensive, as it relied on physiotherapists attending individuals in their home environment. The low capital costs (weighted vests and steps were reusable across participants) meant that there were few opportunities to improve efficiency, for example if the scale (number of participants) was increased. Increasing the intensity of the intervention would require a significant improvement in the primary outcome in order for the intervention to be considered cost-effective from a health system perspective. In the current study, there were three fractures in 2255 falls, which is much less than previous hospital and outpatient clinic trials in Parkinson's disease.[3,4] It could be speculated that providing therapy in the familiar environment of the person's own home minimised the likelihood of injurious falls, although this needs to be confirmed with further research.

Despite being one of the largest trials of movement rehabilitation for falls in people with Parkinson's disease, the present study did have some limitations. The dosage of intervention was modest and, in particular, the length of the program was 6 weeks, which was comparatively short. This low dosage could have been a factor that contributed to the failure to find a difference between groups in people with mild to moderately severe Parkinson's disease. The combined therapy intervention was associated with a reduced falls rate for infrequent fallers, yet was not as effective for very high frequency fallers who fell > 100 times in the follow-up period. This result is consistent with Canning et al, who showed that exercise therapy was associated with fewer falls in patients with mild disease severity compared with those who were more severely affected.[40] It is possible that physiotherapy of much greater intensity is required for people with high levels of disability or very high fall rates. Moreover, there may be a need for supervised, centre-based programs for those with very severe disease compared to home-based therapy with less supervision for those with lower disease severity. This trial was entirely in people's homes. It cannot necessarily be generalised to interventions delivered in hospital, clinic or multi-disciplinary team settings. It is also possible that therapy provided in the early stages of disease progression is most helpful. Our experimental group did not receive balance training, as there was no evidence at the time of designing the trial that balance training reduced falls in Parkinson's disease. This too could be a topic of further research. Another limitation of this trial was that participants were only tested whilst 'on' their Parkinson's disease medication, and the relative contributions of movement rehabilitation and medication to therapy outcomes could not be separated.

To conclude, fall rates were not substantially different in a group that received 6 weeks of home physiotherapy compared to a control group. The higher resource costs of the experimental group intervention suggest that this particular program should not be implemented in its current form. The dosage of therapy in the experimental group might not have been high enough to enable people to achieve long-term gains. Alternatively, the combination of strength training, movement strategy training and falls education might have been too complex to successfully implement in a relatively short, home-based program. Future studies need to more successfully optimise the content and dosage of therapy, as well as tailoring treatment to individual needs.

What is already known on this topic: People with Parkinson's disease commonly fall, leading to injury, loss of independence and reduced quality of life. Movement rehabilitation strategies delivered in hospital and outpatient settings have benefits for people with Parkinson's disease.
What this study adds: A home program of strength and movement strategy training and falls education does not prevent falls when applied at the dose used in this study (6 weeks). The intervention did not significantly improve disability and health-related quality of life.

Ethics approval: Ethics approval was obtained from The University of Melbourne (0824406) and La Trobe University (FHEC08-145). All participants gave written informed consent before data collection.

Competing interests: Nil.

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Research

Additional weekend therapy may reduce length of rehabilitation stay after stroke: a meta-analysis of individual patient data

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KEY WORDS

Physical therapy
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ABSTRACT

Questions: Among people receiving inpatient rehabilitation after stroke, does additional weekend physiotherapy and/or occupational therapy reduce the length of rehabilitation hospital stay compared to those who receive a weekday-only service, and does this change after controlling for individual factors? Does additional weekend therapy improve the ability to walk and perform activities of daily living, measured at discharge? Does additional weekend therapy improve health-related quality of life, measured 6 months after discharge from rehabilitation? Which individual, clinical and hospital characteristics are associated with shorter length of rehabilitation hospital stay? **Design:** This study pooled individual data from two randomised, controlled trials (n = 350) using an individual patient data meta-analysis and multivariate regression. **Participants:** People with stroke admitted to inpatient rehabilitation facilities. **Intervention:** Additional weekend therapy (physiotherapy and/or occupational therapy) compared to usual care (5 days/week therapy). **Outcome measures:** Length of rehabilitation hospital stay, independence in activities of daily living measured with the Functional Independence Measure, walking speed and health-related quality of life. **Results:** Participants who received weekend therapy had a shorter length of rehabilitation hospital stay. In the un-adjusted analysis, this was not statistically significant (MD –5.7 days, 95% CI –13.0 to 1.5). Controlling for hospital site, age, walking speed and Functional Independence Measure score on admission, receiving weekend therapy was significantly associated with a shorter length of rehabilitation hospital stay ($\beta = 7.5$, 95% CI 1.7 to 13.4, $p = 0.001$). There were no significant between-group differences in Functional Independence Measure scores (MD 1.9 points, 95% CI –2.8 to 6.6), walking speed (MD 0.06 m/second, 95% CI –0.15 to 0.04) or health-related quality of life (SMD –0.04, 95% CI –0.26 to 0.19) at discharge. **Discussion:** Modest evidence indicates that additional weekend therapy might reduce rehabilitation hospital length of stay. **Clinical Trial Registration:** ACTRN12610000096055, ACTRN12609000973213. **[English C, Shields N, Brusco NK, Taylor NF, Watts JJ, Peiris C, et al. (2016) Additional weekend therapy may reduce length of rehabilitation stay after stroke: a meta-analysis of individual patient data. *Journal of Physiotherapy* 62: 124–129]**

Introduction

Rehabilitation for people who have had a stroke is expensive, costing an estimated AUD150 million per year in Australia.[1] One of the most powerful ways of reducing cost is reducing the number of days spent in hospital.[2] Providing therapy services on weekends has become a more common part of usual care for rehabilitation facilities in Australia,[3] although until recently there was little published evidence to support its clinical effectiveness or impact on length of rehabilitation hospital stay.

Two recent, large, randomised, controlled trials investigated the effectiveness of weekend therapy services for people during rehabilitation after stroke. One trial,[4] referred to here as the Saturday trial, investigated the effectiveness of additional physiotherapy and occupational therapy services provided on Saturdays, compared to usual care for people with a range of diagnoses, including stroke. The other trial,[5] referred to here as the CIRCIT trial, included only participants with stroke, and included three arms: weekend physiotherapy services provided on Saturdays and Sundays; group circuit class therapy provided 5 days per week; and usual care physiotherapy. In both trials, participants receiving weekend therapy had a shorter mean length of rehabilitation hospital stay (by 2 days[4] and 3 days[5]), compared to usual care consisting of therapy 5 days per week. However, in both trials, the

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between-group difference in length of rehabilitation hospital stay did not reach statistical significance.

Individual patient data meta-analyses provide the opportunity to pool data from trials at a participant level, resulting in greater statistical power to test secondary hypotheses more conclusively and to conduct further exploratory analyses.[6] The aim of the present study was to conduct an individual patient data meta-analysis, combining data from the CIRCIT and Saturday trials, to investigate the effectiveness of providing additional weekend therapy services to people with stroke, compared to usual care in the Australian context.

Therefore, the primary research question for this study was:

1. Among people receiving inpatient rehabilitation after stroke, does additional weekend physiotherapy and/or occupational therapy reduce length of rehabilitation hospital stay compared to those who receive a weekday-only service, and does this change after controlling for individual factors?

The secondary research questions were:

1. Does additional weekend therapy improve the ability to walk and to perform activities of daily living, measured at discharge?
2. Does additional weekend therapy improve health-related quality of life, measured 6 months after discharge from rehabilitation?
3. Which individual, clinical and hospital characteristics are associated with shorter length of rehabilitation hospital stay?

Method

Design

Both trials were Phase-III multicentre, randomised, controlled trials with concealed allocation and blinded assessment of outcomes. The full trial protocols have been published elsewhere.[7,8] Randomisation in both trials, across seven hospital sites, occurred within 1 week of admission to rehabilitation.

Participants

Briefly, the inclusion criteria for people with stroke in the CIRCIT trial were: diagnosed stroke of moderate severity, defined as a Functional Independence Measure (FIM) total score between 40 and 80 points or a motor subscale score between 38 and 62 points; and ability to mobilise independently prior to their stroke. There were no stroke-specific inclusion criteria for the Saturday trial.

Interventions

In the CIRCIT trial, participants allocated to the 7-day arm received additional physiotherapy services on Saturday and Sunday. In the Saturday trial, participants in the intervention arm received additional physiotherapy and occupational therapy on Saturdays only. In both trials, usual care participants received physiotherapy and occupational therapy Monday to Friday only. The treating therapists recorded the amount of therapy time received by participants in both trials. In the CIRCIT trial, therapists recorded the time that participants spent in physiotherapy sessions on trial-specific data sheets, up to the first 4 weeks of their rehabilitation stay. In the Saturday trial, therapy time was recorded as part of routine hospital data collection procedures for the entire length of stay.

Outcome measures

Length of rehabilitation hospital stay was defined as the number of days between admission to, and discharge from, the rehabilitation facility. Measures of walking speed and independence in activities of daily living (FIM scores) and health-related quality of life were made 4 weeks after randomisation (CIRCIT trial), at discharge from rehabilitation (Saturday trial), and at approximately 6 months after discharge (in both trials). Health-related quality of life was measured with the Australian Quality of Life tool in the CIRCIT trial and the EQ5D-3L tool in the Saturday trial. The average time post-randomisation for the discharge assessment point in the Saturday trial for people with stroke was 34 days (SD 23); therefore, these data were pooled with the 4-week data from the CIRCIT trial.

Data analyses

Data were pooled from the CIRCIT trial (all participants from the usual care group and the group that received therapy 7 days per week) and the Saturday trial (participants with a diagnosis of stroke from the usual care group and from the group that received additional therapy on Saturdays). Univariate analyses (Chi-squared or Fisher's exact test for categorical variables, *t*-tests or Mann-Whitney U for continuous variables) were used to compare participant characteristics at baseline between the two trials, and outcomes between intervention and control groups in the pooled dataset. Descriptive statistics were used to summarise the average weekly (Monday to Friday) therapy time provided to the usual care groups in the two trials, and the amount of additional weekend therapy provided. As length-of-stay data were not normally distributed, the between-group difference was first examined using a Mann-Whitney U test. Independent *t*-tests were also conducted to determine the mean differences and 95% confidence intervals (CI) to allow interpretation of the size of effect. Multivariate regression was used to explore the independent effect of providing weekend therapy services on rehabilitation length of hospital stay. A theoretically based model, which included factors known to influence length of hospital stay, was developed. As it was a secondary analysis of existing data, the choice of variables was constrained by the data available. Therefore, these participant factors were included: age, gender, co-morbidities, and baseline walking speed and FIM score. As length of rehabilitation hospital stay differed both between trials (CIRCIT versus Saturday trial), and across hospital site within the trials, both of these factors were also included in the model, and collinearity between variables within the model was assessed. Between-group differences in self-selected walking speed and independence in activities of daily living (FIM scores) were examined using Mann-Whitney U tests (as data were not normally distributed), and independent *t*-tests (to allow for interpretation of the size of the effect). Analyses were conducted using commercial software[a] with significance set at $\alpha = 0.05$. As health-related quality of life data were collected using two different tools, group data (means and standard deviations) were pooled in meta-analysis software[b] using a fixed-effect model and reported as a standardised mean difference. A fixed-effect model was chosen because heterogeneity between the trials was assumed to be low. This assumption was verified by checking heterogeneity using the I^2 statistic.

Results

Flow of participants through the study

All participants that were randomised to therapy 7 days a week (n = 96) or usual care (n = 94) in the CIRCIT trial, and all participants in the Saturday trial with a diagnosis of stroke (usual care n = 79, weekend therapy n = 81) were included in the pooled analysis. Figure 1 presents the flow of participants through the trials. Table 1 compares baseline characteristics of all included participants. Table 2 compares baseline differences between usual care and weekend therapy participants for the pooled dataset.

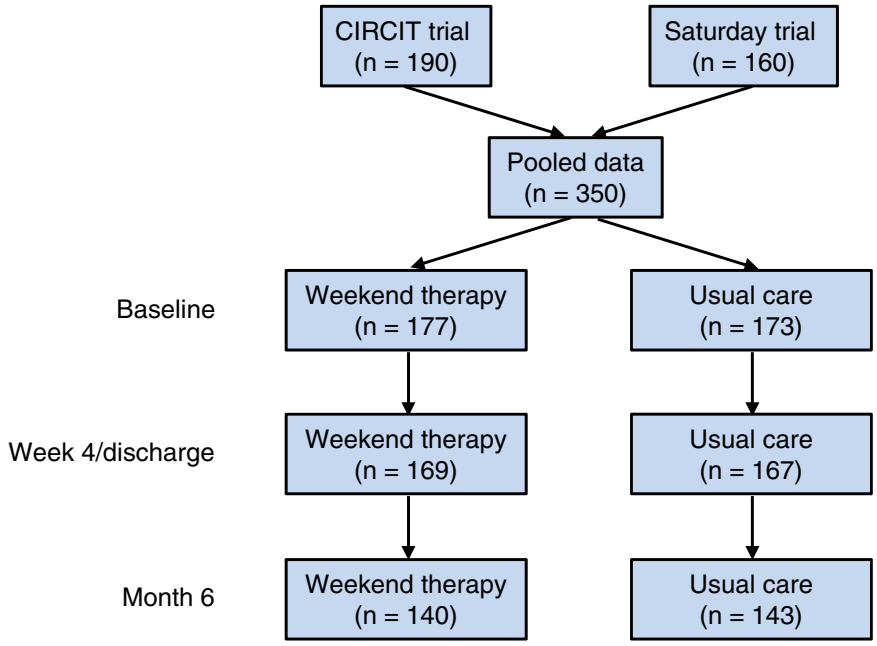

Figure 1. Flow of participants through the included studies. Reasons for loss to follow-up are reported in the main results papers of the included trials.[4,5]

Table 1
Baseline characteristics of participants, amount of therapy received and length of stay, by trial.

Characteristic	CIRCIT (n = 190)	Saturday trial (n = 160)	MD (95% CI)[a] or *p*-value for Chi^2 test
Age *(y)*, mean (SD) range	70 (13) 23 to 91	75 (12) 36 to 92	5 (2 to 7)
Gender, n male (%)	111 (58)	86 (54)	0.22
First stroke, n (%)	153 (81)	129 (81)[b]	0.11
Living prior to admission, n (%)			1.0
home	183 (96)	150 (94)	
residential aged care/other	6 (3)	5 (3)	
missing	1 (1)	5 (3)	
Charlson co-morbidity index score, n (%)			0.001
0	89 (47)	51 (32)	
1	53 (28)	38 (24)	
> 1	48 (25)	71 (44)	
FIM total *(18 to 126)*, mean (SD) range	66 (16) 40 to 112	72 (25) 19 to 123	5 (1 to 10)
FIM motor *(13 to 91)*, mean (SD) range	41 (3) 15 to 78	46 (21) 13 to 88	6 (2 to 9)
Participants unable to walk, n (%)	96 (51)	76 (48)	0.11
Gait speed of those able to walk *(m/s)*, mean (SD) range	0.43 (0.24) 0.05 to 1.20	0.63 (0.34) 0.09 to 1.92	0.20 (0.11 to 0.29)
Weekday therapy time *(min/wk)*, mean (SD) range	134 (75) 19 to 483	267 (115) 28 to 595	133 (113 to 154)
Extra weekend therapy time *(min/wk)*, mean (SD) range[c]	36 (23) 0 to 140	76 (32) 0 to 168	41 (33 to 49)
Length of stay *(d)*[d]	58.6 (37.6) 14 to 240	34.1 (23.2) 4 to 119	−24.4 (−17.6 to −31.2)

[a] MD is calculated as Saturday trial minus CIRCIT.
[b] Participants with previous hemiplegia as recorded by the Charlson co-morbidity index.
[c] For the CIRCIT trial this is physiotherapy time provided Saturday and Sunday. For the Saturday trial this refers to physiotherapy and occupational therapy time provided on Saturdays.
[d] 12 participants had missing data for length of stay in the CIRCIT trial.
FIM = Functional Independence Measure.

CIRCIT versus Saturday trial

Participants in the Saturday trial had higher FIM scores on admission to rehabilitation, suggesting that they were less disabled than those in the CIRCIT trial. A similar proportion of participants in both trials were able to walk at admission to rehabilitation, and of those able to walk, the average walking speed was faster in the Saturday trial participants. Significantly more people in the Saturday trial had at least one co-morbidity.

Participants in the CIRCIT trial received an average of 134 minutes/week (SD 75) of physiotherapy during weekdays. This was significantly less than the 267 minutes/week (SD 115) of physiotherapy provided during weekdays in the Saturday trial (mean difference 133 minutes/week, 95% CI 113 to 154). The CIRCIT trial participants in the intervention arm received an average of 36 minutes/week (SD 23) of additional weekend physiotherapy. Again, this was significantly less than the average additional therapy (physiotherapy and occupational therapy) provided to intervention participants in the Saturday trial, which was 76 minutes/week (SD 32). The mean difference was 41 minutes/week (95% CI 33 to 50).

Additional weekend therapy compared to usual care

Pooling the individual data, participants receiving weekend therapy had, on average, 5.7 days shorter length of rehabilitation hospital stay, although in the unadjusted model this difference did not reach statistical significance (MD −5.7 days, 95% CI −13.0 to 1.5, 90% CI −11.8 to 0.3), as shown in Table 3. The multivariate regression model showed that age, baseline FIM score, baseline walking speed, hospital site and treatment group (weekend therapy versus usual care) all contributed significantly to length of rehabilitation hospital stay (Table 4). As there was co-linearity between trial and hospital site, the model was first tested with trial only, then with hospital sites only. Including hospital sites explained more of the variance (adjusted r^2 0.386 versus 0.356); therefore, the final model included dummy variables for hospital sites. Controlling for all these variables, randomisation to the

Table 2
Baseline characteristics of participants by group.

Characteristic	Con (n = 173)	Exp (n = 177)
Age *(y)*, mean (SD) range	72 (13) 23 to 92	73 (12) 36 to 91
Gender, n male (%)	93 (54)	104 (59)
Living at home prior to admission, n (%)	164 (95)	169 (97)
No important co-morbidities, n (%)[a]	72 (42)	68 (38)
FIM total *(18 to 126)*, mean (SD) range	70 (21) 21 to 123	67 (21) 19 to 118
FIM motor *(13 to 91)*, mean (SD) range	45 (18) 13 to 88	42 (17) 13 to 88
Gait speed of those able to walk *(m/s)*, mean (SD) range	0.55 (0.31) 0.10 to 1.90	0.51 (0.31) 0.05 to 1.61

[a] Charlson co-morbidity index = 0.
Con = control group (usual care only), Exp = experimental group (extra weekend therapy), FIM = Functional Independence Measure.

Table 3
Mean (SD) range of continuous outcomes by group, and mean difference (95% CI) between groups.

Outcome	Con (n = 173)	Exp (n = 177)	MD (95% CI)[a] Exp minus con
Length of stay *(d)*	49.9 (36.7) 6 to 240	44.1 (30.7) 4 to 199	−5.7 (−13.0 to 1.5)
Gait speed of those able to walk at 4 wk/discharge[b] *(m/s)*	0.71 (0.45) 0.07 to 2.27	0.65 (0.40) 0.07 to 2.08	−0.06 (−0.16 to 0.04)
FIM total at 4 wk/discharge[b] *(18 to 126)*	95 (22) 18 to 125	97 (22) 26 to 126	2 (−3 to 7)
FIM total at 6 months *(13 to 91)*	102 (22) 33 to 126	102 (23) 22 to 126	0 (−5 to 5)

[a] All comparisons were non-significant on Mann-Whitney U tests.
[b] At discharge in the Saturday trial and at 4 weeks in CIRCIT.
Con = control group (usual care only), Exp = experimental group (extra weekend therapy), FIM = Functional Independence Measure.

Table 4
Multivariate regression analysis of factors associated with length of hospital stay.

Independent variable	Unstandardised ß (SE)	95% CI for ß	Standardised ß	*p*-value
Group	7.5 (3.0)	1.7 to 13.3	0.111	0.011
FIM total at baseline	−0.4 (0.1)	−0.6 to −0.2	−0.263	< 0.001
Walking speed at baseline *(m/s)*	−23.1 (5.7)	−34.3 to −11.9	−0.226	< 0.001
Age *(y)*	−0.3 (0.1)	−0.6 to −0.1	−0.125	0.006
Female	−4.9 (3.1)	−10.9 to 1.1	−0.710	0.112
CCI = 1	−3.5 (3.7)	−10.8 to 3.9	−0.045	0.354
CCI > 1	−2.9 (3.6)	−10.0 to 4.1	−0.041	0.412
Hospital site 1	3.1 (4.5)	−5.8 to 11.9	0.035	0.490
Hospital site 3	18.8 (4.0)	11.0 to 26.6	0.252	< 0.001
Hospital site 4	66.2 (11.6)	43.4 to 89.1	0.259	< 0.001
Hospital site 5	20.0 (5.5)	9.2 to 30.8	0.176	< 0.001
Hospital site 6	11.5 (6.4)	−1.3 to 24.2	0.082	0.077
Hospital site 7	11.9 (8.0)	−3.8 to 27.6	0.068	0.136

CCI = Charlson co-morbidity index, where the referent is Charlson co-morbidity index = 0, a CCI of 1 means one co-morbidity, and CCI > 1 means 2 or more co-morbidities; FIM = Functional Independence Measure.
Hospital sites were entered as dummy variables; the referent is Hospital 2. The variables of trial (CIRCIT vs Saturday trial) and hospital site had high collinearity, therefore the variable of trial was removed from the model.

weekend therapy group was found to be an independent predictor of shorter rehabilitation hospital length of stay (MD 7.5 days, 95% CI 1.7 to 13.4), accounting for 39% of the variance in length of rehabilitation hospital stay.

The FIM scores at discharge/4 weeks were not different between usual care and weekend therapy participants (MD 1.9 points, 95% CI −2.8 to 6.6). At the same time point, walking speed was also not significantly different between the groups (MD −0.06 m/second, 95% CI −0.15 to 0.04); see Table 3. Similarly, there was no significant between-group difference in FIM scores at

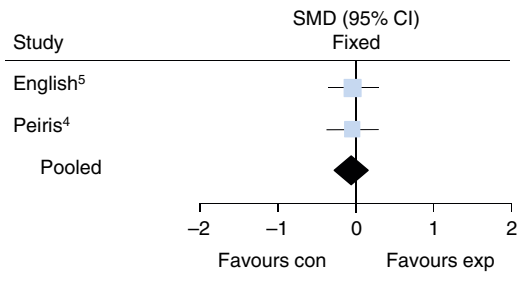

Figure 2. Standardised mean difference (95% CI) of the pooled effect of adding extra weekend therapy on health-related quality of life at discharge/4 weeks.
Con = control group = usual care; Exp = experimental group = extra weekend therapy.

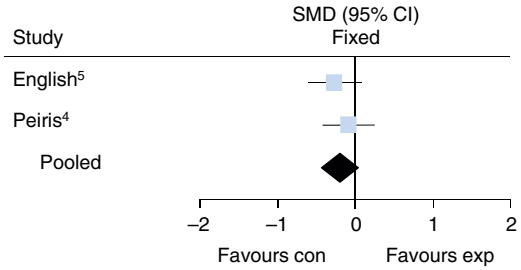

Figure 4. Standardised mean difference (95% CI) of the pooled effect of adding extra weekend therapy on health-related quality of life at 6 months.
Con = control group = usual care; Exp = experimental group = extra weekend therapy.

6 months (MD 0 points, 95% CI −5 to 5). There was no significant difference between usual care and weekend therapy participants in health-related quality of life at discharge/4 weeks (SMD −0.04, 95% CI −0.26 to 0.19, $I^2 = 0\%$), as shown in Figure 2. For a more detailed forest plot, see Figure 3 on the eAddenda. At 6 months, there was a trend toward participants who received usual care therapy to report a higher quality of life compared to participants who received weekend therapy (standardised mean difference −0.17, 95% CI −0.41 to 0.06, $I^2 = 0\%$), as shown in Figure 4. For a more detailed forest plot, see Figure 5 on the eAddenda.

Discussion

Pooling data from two Australian rehabilitation trials in an individual patient data meta-analysis identified that participants who received additional therapy services on the weekend had an average shorter length of rehabilitation hospital stay of 5.7 days. Despite the increased sample size, this difference was still not statistically significant in an unadjusted analysis. When analysis was adjusted to control for person-related factors known to influence recovery trajectories (severity of disability, age, co-morbidities) and health service-related factors (hospital site), a significant and independent association was found between weekend therapy provision and shorter length of rehabilitation hospital stay. The difference in the outcome for the adjusted and unadjusted analysis highlights that there is not a simple causal pathway between increased weekend therapy service provision and rehabilitation hospital length of stay. This is not surprising. It is known that there are many complex, interrelated factors that influence when someone is discharged from a rehabilitation hospital. The present model was not perfect, in that it explained only 38% of the variance in length of stay. This is because it was limited by the data collected in the original two randomised, controlled trials. There were other factors that were likely to have influenced rehabilitation hospital length of stay, including: additional person-related factors (cognition, depression, fatigue), social factors (availability of a carer, home environment, financial issues) and hospital system-related factors (accessibility of outpatient services, discharge planning practices).

The present results confirm that there is considerable variability in length of rehabilitation hospital stay for people with stroke. It was found that participants with slower walking speeds and those requiring more assistance with activities of daily living on admission to rehabilitation had a longer length of rehabilitation hospital stay. This was not surprising and was consistent with other research findings.[9,10] In the present analysis, it was found that the hospital in which people with stroke received their rehabilitation care contributed significantly to the variance in length of rehabilitation hospital stay. The key factors that drive variation in length of stay are unknown, but may include: hospital and health service policies and practices; the level of demand for access to rehabilitation centres; the time taken for approval and completion of essential home modifications; access to funding for carer and domiciliary support; and access to ongoing therapy services. Identifying the key factors driving variation in length of stay is likely to be a complex task, but is one that is vital to understanding how to improve the cost effectiveness of care for people with stroke. Without a thorough understanding of what the key service-related factors are, and how to control them, the impact of changes in clinical care provision on length of rehabilitation hospital stay will not be accurately determined.

This was an exploratory secondary analysis of clinical trial data and should be considered hypothesis-generating rather than definitive evidence of cause and effect. While a full cost-effectiveness analysis was not conducted, the results lend weight to the economic argument for implementing weekend therapy. Average rehabilitation bed-day costs vary between and within countries. Based on 2013 estimates of bed-day costs in the two main states of Australia in which the CIRCIT and Saturday trials were conducted,[11] a reduction of between 5 and 7 days represents a cost-saving of between AUD4855 and AUD6797 in South Australia and between AUD3770 and AUD5278 in Victoria. These savings would need to be offset against the cost of providing weekend therapy. These findings are in line with the published cost-effectiveness evaluation of the Saturday trial.[12]

Health-related quality of life is an important outcome to be included in rehabilitation trials, and both the CIRCIT and Saturday trials measured this construct. Because different instruments were used in the two trials, however, data could not be pooled at an individual level. When data were pooled in a traditional meta-analysis utilising standardised mean differences to account for differences between the outcome measures used, there was no significant between-group difference in health-related quality of life at discharge from hospital, and a trend toward better quality of life for participants who received usual care therapy at 6 months. Given the large amount of missing data at 6 months, this result should be interpreted with caution.

The present study has shown the value of using individual patient meta-analyses, and the complexities and challenges with such an approach. Despite having very similar a priori hypotheses, there were only three common outcome measures across the two trials (length of rehabilitation hospital stay, FIM and walking speed). Lack of commonality in outcome measures is a real issue for rehabilitation trials. An exploration of the Virtual International Stroke Trial Archives (VISTA) database in 2012 found that there were 69 different outcome measures used across 38 rehabilitation trials.[13] Twenty-five (36%) of these measures were used in only one trial. Reaching consensus in outcome measures is a fraught issue, but one that must be tackled to enable future pooling of trial data. The first Stroke Recovery and Rehabilitation Roundtable is currently working on consensus statements regarding measurement in clinical trials.[14]

Controlling for person-related and hospital system-related factors, some evidence of benefit for providing weekend therapy services on length of rehabilitation hospital stay was found, with a resultant possibility of cost savings to the healthcare system. This work highlighted what could be achieved with collaboration between trialists.

What is already known on this topic: Provision of weekend therapy for people in inpatient rehabilitation after stroke varies nationally and internationally. Trials of additional weekend physiotherapy are promising but inconclusive about the effect on length of stay.

What this study adds: Unadjusted pooling of individual patient data from existing trials does not identify a significant improvement in length of stay. When the analyses were adjusted for important patient-related factors and hospital site, there was significantly shorter average length of stay in the rehabilitation hospital for people receiving additional weekend therapy.

Footnotes: [a] SPSS Statistics Version 21, IBM Corp, Armonk, USA. [b] Review Manager Version 5.3, The Cochrane Collaboration, Copenhagen, Denmark.

eAddenda: Figures 3 and 5 can found at doi:10.1016/j.jphys.2016.05.015.

Ethics approval: Ethical approval for the CIRCIT trial was granted by the University of South Australia Human Research Ethics Committee, Southern Adelaide Health Service/Flinders University Clinical Research Ethics Committee, Sir Charles Gardiner Group Human Research Ethics Committee, Royal Adelaide Hospital Research Ethics Committee, Central Northern Adelaide Health Service Ethics of Human Research Committee and the St Vincent's Hospital Human Research Ethics Committee. Ethics approval for the Saturday trial was granted from the Eastern Health Research and Ethics Committee and La Trobe University Human Research Ethics Committee. All participants (or their proxy) in both trials provided informed written consent prior to data collection.

Competing interest: Nil.

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Research

Home-based telerehabilitation is not inferior to a centre-based program in patients with chronic heart failure: a randomised trial

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KEY WORDS

Cardiac failure
Exercise
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ABSTRACT

Question: Is a 12-week, home-based telerehabilitation program conducted in small groups non-inferior to a traditional centre-based program in terms of the change in 6-minute walk distance? Is the telerehabilitation program also non-inferior to a centre-based program in terms of functional capacity, muscle strength, quality of life, urinary incontinence, patient satisfaction, attendance rates, and adverse events? **Design**: Randomised, parallel, non-inferiority trial with concealed allocation, intention-to-treat analysis and assessor blinding. **Participants**: Patients with stable chronic heart failure (including heart failure with reduced or preserved ejection fraction) were recruited from two tertiary hospitals in Brisbane, Australia. **Intervention**: The experimental group received a 12-week, real-time exercise and education intervention delivered into the participant's home twice weekly, using online videoconferencing software. The control group received a traditional hospital outpatient-based program of the same duration and frequency. Both groups received similar exercise prescription. **Outcome measures**: Participants were assessed by independent assessors at baseline (Week 0), at the end of the intervention (Week 12) and at follow-up (Week 24). The primary outcome was a between-group comparison of the change in 6-minute walk distance, with a non-inferiority margin of 28 m. Secondary outcomes included other functional measures, quality of life, patient satisfaction, program attendance rates and adverse events. **Results**: In 53 participants (mean age 67 years, 75% males), there were no significant between-group differences on 6-minute walk distance gains, with a mean difference of 15 m (95% CI −28 to 59) at Week 12. The confidence intervals were within the predetermined non-inferiority range. The secondary outcomes indicated that the experimental intervention was at least as effective as traditional rehabilitation. Significantly higher attendance rates were observed in the telerehabilitation group. **Conclusion**: Telerehabilitation was not inferior to a hospital outpatient-based rehabilitation program in patients with chronic heart failure. Telerehabilitation appears to be an appropriate alternative because it promotes greater attendance at the rehabilitation sessions. **Trial registration**: ACTRN12613000390785. **[Hwang R, Bruning J, Morris NR, Mandrusiak A, Russell T (2017) Home-based telerehabilitation is not inferior to a centre-based program in patients with chronic heart failure: a randomised trial. *Journal of Physiotherapy* 63: 101–107]**

Introduction

Exercise-based rehabilitation has emerged as a safe and effective intervention for patients with chronic heart failure and is now recommended as standard practice.[1,2] Specifically, exercise-based rehabilitation increases physical function, improves quality of life, and lowers hospital admission rates.[3] Despite this, participation in rehabilitation remains low.[4] Reported barriers to participation include transport difficulties, financial cost, embarrassment about participation, and program availability.[4,5] Telerehabilitation may be an alternative approach that could alleviate some of these barriers.

Telerehabilitation is the delivery of rehabilitation services at a distance via telecommunication technologies, such as telephone, internet and videoconference.[6] This delivery model has been successfully trialled in patients with various cardiopulmonary diseases.[6–9] In a pilot study of home-based rehabilitation delivered via a tablet computer, all participants with chronic obstructive pulmonary disease (COPD) remained actively participating in the program after 1 year, and (although statistically non-significant) COPD-related hospital costs were reduced by an average of 27%.[7] In people with chronic heart failure, a home-based telerehabilitation program was delivered individually three times per week for 8 weeks, using mobile phones for voice communication and electrocardiogram transmission.[8] This program produced equivalent increases in peak oxygen consumption and quality of life as a centre-based program of the same duration and frequency.[8] Home-based telerehabilitation could also have similar benefits

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in other outcomes (such as functional exercise capacity and balance) for patients with chronic heart failure.

International experience shows that rehabilitation programs for people with heart failure can be delivered using various models, including centre-based, home-based or a hybrid of these approaches. For example, home-based and centre-based cardiac rehabilitation programs have been shown to be equally effective in improving health-related quality of life and reducing mortality rates in patients with heart disease.[9] A flexible or remote model has also been proposed to improve attendance.[4] However, the feasibility of a group-based, video-linked telerehabilitation program delivered into the home has not yet been investigated in patients with chronic heart failure.

The aim of the present study was to determine the efficacy and safety of a short-term, real-time, group-based heart failure rehabilitation program delivered into each participant's home via an online telerehabilitation system.

Therefore, the research questions for this randomised trial were:

1. Is a 12-week, home-based telerehabilitation program conducted in small groups non-inferior to a traditional centre-based program in terms of the change in 6-minute walk distance?
2. Is the telerehabilitation program also non-inferior to a centre-based program in terms of functional capacity, muscle strength, quality of life, urinary incontinence, patient satisfaction, attendance rates, and adverse events?

Method

Design

A two-group, parallel, non-inferiority trial with blinded outcome assessors was undertaken. Participants were randomised to either: an experimental group, who were provided with a 12-week home-based telerehabilitation program delivered twice-weekly; or a control group, who were provided with a traditional centre-based program of the same duration and frequency. Consenting participants were allocated 1:1 using a non-blocked random allocation sequence. Allocation was concealed through the use of opaque, sealed and numbered envelopes, and administered by an experienced, independent researcher at a central location. While the treating healthcare professionals could not be blinded to group allocation, participants were asked not to disclose their group allocation to the blinded assessors. All assessments were undertaken at the hospitals using a standardised protocol at baseline (Week 0), immediately after completion of the rehabilitation program (Week 12) and at follow-up 12 weeks later (Week 24). The assessors were 19 hospital physiotherapists with an average of 9 years of work experience in physiotherapy.

Participants, therapists and centres

Patients were recruited from cardiology and general medical wards of two tertiary hospitals in Brisbane, Australia, between July 2013 and February 2016. The patients who were recruited had a recent hospital admission for heart failure and were referred to heart failure services. Patients were eligible if they: had a diagnosis of chronic heart failure confirmed by an echocardiogram (heart failure with reduced or preserved ejection fraction), presented with clinical heart failure symptoms, and were aged over 18 years. Patients were excluded if they: did not meet safety screening criteria as outlined by the Australian exercise guidelines for patients with chronic heart failure,[1] such as symptomatic severe aortic stenosis and significant ischaemia at low exercise intensity; lived in an institution such as a nursing home; lived more than an hour driving distance from the treating hospital; or had no support person at home, which was important for those recruited to the home-based telerehabilitation program for safety reasons. Healthcare professionals at each site were physiotherapists who were highly experienced in prescribing exercise for patients with chronic heart failure.

Intervention

The control group received a centre-based rehabilitation program based on current recommended guidelines encompassing education, aerobic and strength training exercise.[1] This traditional heart failure rehabilitation program was led by physiotherapists over a 12-week period; it consisted of 60 minutes of exercise per session, two sessions per week, at the treating hospital. Each session consisted of a 10-minute warm-up, 40-minutes of aerobic and strength exercises, and a 10-minute cool-down. Exercise intensity commenced at 9 (very light) and gradually progressed towards 13 (somewhat hard) on the rate of perceived exertion scale.[10] Exercise prescription was tailored to the participant's goal and the treating physiotherapist continuously reviewed it to ensure appropriate progression. The control group attended education sessions at the hospital on the same day as the exercise sessions. These sessions were delivered by a multidisciplinary team including the nurse, dietitian, physiotherapist, occupational therapist, social worker and pharmacist. The topics that were covered included self-management, nutritional counselling, physical activity counselling, psychological interventions, medications and risk factor management, where appropriate. Participants were provided with additional home exercises to be undertaken three times per week, at a similar intensity as prescribed for the supervised exercise sessions.

The telerehabilitation program was delivered via a synchronous videoconferencing platform[a] across the internet to groups of up to four participants within the home. Two-way audiovisual communication enabled interaction of all parties, and the physiotherapist guided participants through an exercise program similar to the control group. This approach enabled the physiotherapist to watch participants performing the exercises and provide real-time feedback and modification, as required, as well as facilitating peer support from other participants. A group-based program was selected because many people undertaking cardiac rehabilitation value the guidance from healthcare professionals and enjoy the group interaction and social support.[4] Participants were provided with additional home exercises similar to the control group. Educational topics were delivered as electronic slide presentations with embedded audio files,[b] which were recorded from the education sessions delivered for a centre-based program. Participants were encouraged to watch the designated presentation individually or with their support person, in their own time in preparation for subsequent online group discussions. A 15-minute interaction period was held at the start of each telerehabilitation session to facilitate these discussions. A range of resources were accessed through the videoconferencing platform to facilitate these discussions, such as screen and document sharing, collaborative drawing and chat functions.

Telerehabilitation equipment was loaned to participants as required, including a laptop computer,[c] a mobile broadband device[d] connected to 3G wireless broadband internet,[e] an automatic sphygmomanometer,[f] a finger pulse oximeter,[g] free weights and resistance bands. Participants received an equipment familiarisation session either in-person at the hospital or during a home visit, which covered operating the laptop, accessing the online videoconferencing software[a] and using the monitoring equipment. An equipment manual with written and pictorial instructions was also supplied. Telephone contact details to access technical support were included in the event that participants needed additional assistance or encountered technical difficulties. Participants were guided to self-monitor and verbally report their blood pressure, heart rate and oxygen saturation levels at the start of each rehabilitation session. Other measurements such as

weight, blood sugar level, extent of peripheral oedema and general wellbeing were also undertaken, where relevant.

Outcome measures

Primary outcome

Participants performed the 6-minute walk test in accordance with recommended guidelines, including standardised encouragements,[11] on a 30-m walk track in hospital at a face-to-face appointment. The 6-minute walk distance (6MWD) was recorded to the nearest metre. The test was performed twice, as recommended, to account for a learning effect,[11] and the longer distance was used in the analysis.

Secondary outcomes

Other outcomes included balance tests, a 10-m walk test, grip strength, quadriceps strength, urinary incontinence, quality of life, patient satisfaction, program attendance and adverse events. Balance was measured by the Balance Outcome Measure for Elder Rehabilitation (BOOMER),[12] which consisted of four components: the timed up and go test (TUGT), functional reach, static standing with the eyes closed and feet together, and step test. Each BOOMER component was converted into a 5-point ordinal scale, and then combined to provide a total score out of 16, with higher scores representing better balance.[12] The 10-m walk test (at both comfortable and fast pace) was undertaken on a straight walking track from a static start.[13] The time taken to walk 10 m was recorded in seconds, with two decimal places. Each test was measured twice, with the average of the two tests recorded. Maximum grip strength for each hand was measured in kilograms three times with a hand-held dynamometer,[h] as described previously,[14] and the best measurement was used in the analysis as the maximum voluntary contraction. Quadriceps strength was also measured in kilograms three times with a hand-held dynamometer,[h] as per previous methodology,[15] with an adjustable strap, and the best measurement was used in the analysis.

Validated surveys were used to measure health-related quality of life and patient satisfaction. The Minnesota Living with Heart Failure Questionnaire (MLWHFQ) is a disease-specific questionnaire that contains 21 questions determining the key physical, emotional, social and mental dimensions of quality of life.[16] Scores range from 0 to 105, with higher scores representing worse quality of life. The Revised Urinary Incontinence Scale (RUIS) consists of five questions that rate aspects of incontinence severity.[17] The scores are summed to give a total from 0 to 16, with higher scores indicating worse severity. Quality of life was also measured using a generic tool, the EuroQol five-dimensional (EQ-5D) questionnaire.[18] This questionnaire has two sections: the EQ-5D descriptive system (which measures mobility, self care, usual activities, pain/discomfort, and anxiety/depression) and the visual analogue scale (which measures self-rated health status from 0 to 100).[18] Responses on the EQ-5D were converted to a utility score of 0 (worst) to 1 (best) using a scoring algorithm based on the United Kingdom general population.[19] Patient satisfaction was measured by the Client Satisfaction Questionnaire (CSQ-8).[20] This eight-item questionnaire measures the participant's perspective of the value of services received, and has a total score ranging from 8 to 32, with high scores indicating greater satisfaction.[20]

Additional outcomes included program attendance rates and the number of adverse events. Attendance rates were presented as the number of sessions attended by each participant, also categorised into adherent (>80%), partly adherent (20 to 80%) and non-adherent (<20%) based on the proportion of sessions attended.[5] Serious adverse events were defined as death, cardiac arrest and syncope, and minor adverse events included angina, diaphoresis, palpitations and falls. Healthcare professionals who delivered the rehabilitation programs recorded any adverse events after each exercise session. A list of potential adverse events was attached to the exercise recording form. At completion of the 12-week rehabilitation program, the assessors tallied the number of adverse events and recorded them in a database. The research team also reviewed the number and type of adverse events.

Demographic and clinical information were obtained from participant interview and the medical records. These included the New York Heart Association (NYHA) functional classification; self-reported falls in the previous 12 months; and left ventricular ejection fraction reported from echocardiography performed in the previous 6 months.

Data analysis

The study was powered to detect non-inferiority of the slope of 6MWD change from Week 0 to Week 12 between the two intervention groups. An a priori, non-inferiority margin of –28 m (which corresponds to 20% less than the minimum clinically important difference reported for the 6MWD)[21] was adopted as per recommendations.[22,23] Using a standard deviation (SD) of 31 m, based on previous data,[24] a one-sided significance level of 2.5% and allowing for a 10% drop-out rate, a sample of 48 participants was required in order for the study to have 80% power to detect the non-inferiority margin.

Statistical analysis was performed using commercial software.[i] Data were checked for missing values, distribution and outliers; and descriptively summarised as means (SD) or counts (%), as appropriate. A strong positive skew in the TUGT and 10-m walk test data was successfully resolved using logarithmic transformations, and the data were back-transformed. The analyses for the primary and secondary outcomes were on an intention-to-treat basis, supplemented by a per-protocol analysis of the primary outcome similar to a previous research approach.[25] Participants were considered as per-protocol if they were in the adherent and partly adherent groups. The primary outcome was analysed using a linear mixed-effects model, which is recommended for its ability to account for repeated measures and missing data.[26] The model (using maximum likelihood method, unstructured covariance type and controlling for baseline variables) included group, time and group-by-time interaction as fixed-effect covariates, and intercepts and participants as random-effects. In this model, the coefficient associated with the interaction represented the difference between the 6MWD slopes. This coefficient and its 95% CI were used to estimate the between-group difference. Telerehabilitation was considered non-inferior if the lower limit of this 95% CI was below the pre-determined margin.[22,23] Similar analyses were applied to secondary outcome measures collected at three time points. Between-group comparisons for continuous data collected at the end of the intervention period were analysed using independent t-tests. Ordinal data were analysed with a non-parametric equivalent. *P*-values less than 0.05 were considered to be significant in all analyses.

Results

Flow of participants through the study

As shown by the flowchart in Figure 1, 53 participants were enrolled. Slight over-enrolment in the study was required to achieve the 24 participants in each group, as per the sample size calculation, given the non-block randomisation design. Fifty-five percent had ischaemic cardiomyopathy and 57% were NYHA II. Table 1 summarises participant characteristics and shows that the groups were well matched.

Compliance with the study protocol

As illustrated in Figure 1, 50 and 49 participants attended post-program and follow-up assessments, respectively. Of the 51 participants who attended the rehabilitation programs, 49 were categorised as adherent (>80% of sessions attended) or partly adherent (20 to 80% of sessions attended). Compared to the control

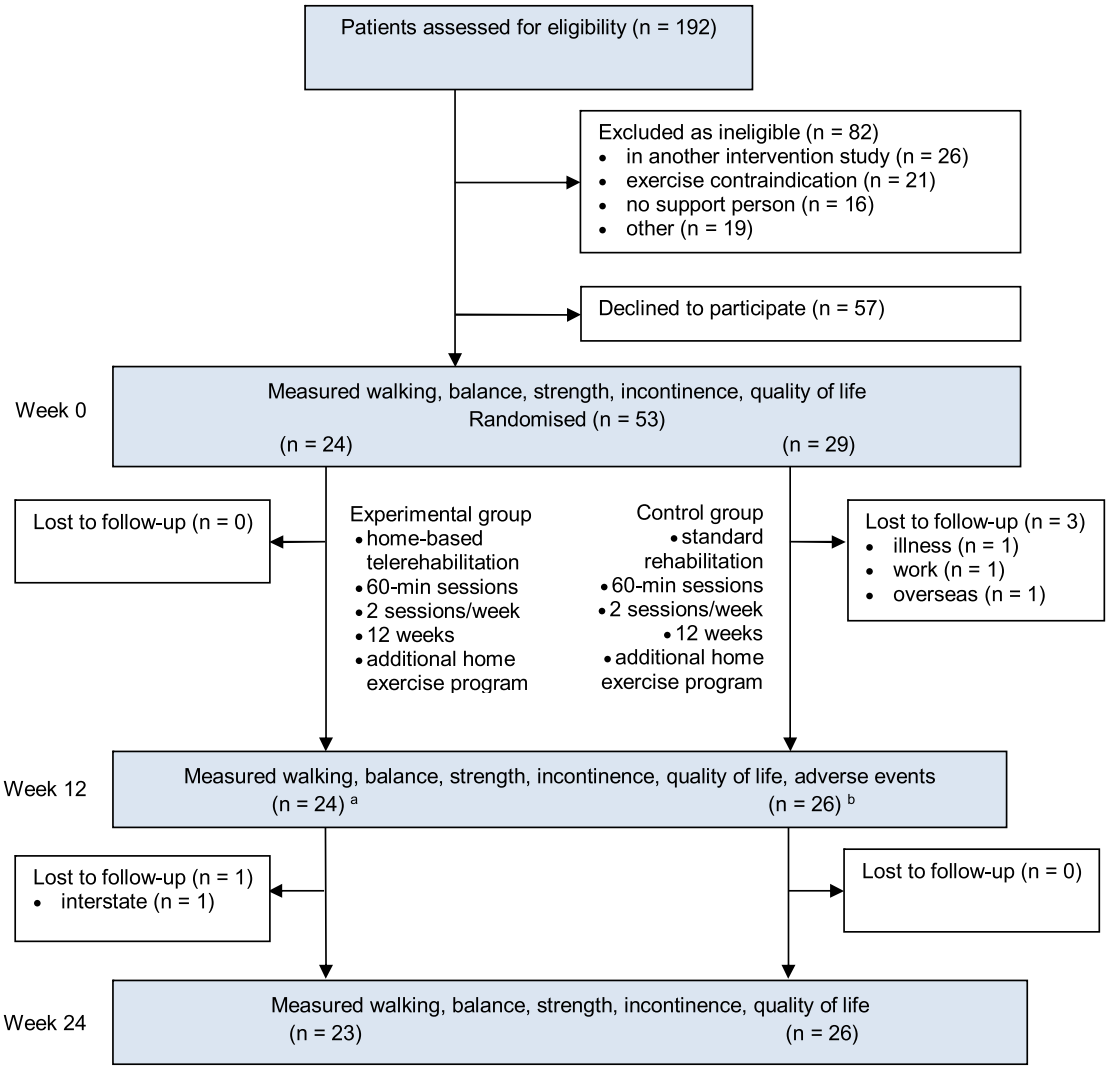

Figure 1. Design and flow of participants through the trial.
[a] None attended < 20% of available exercise sessions.
[b] Two attended < 20% of available exercise sessions.

group, participants in the experimental group were significantly more likely to be categorised as adherent (RR 2.39, 95% CI 1.27 to 4.51) and significantly less likely to be categorised as partly adherent (RR 0.46, 95% CI 0.23 to 0.92). The only participants categorised as non-adherent (<20% of sessions attended) were in the control group. Further data are presented in Table 2.

In the registered version of the protocol, falls were the only adverse event. For completeness, other unregistered adverse events will also be reported in this paper.

Effect of the intervention

Primary outcome

The 6MWD results at each assessment time and the between-group differences are presented in Table 3. Individual participant data are presented in Table 4 (see eAddenda for Table 4). There was no significant overall between-group difference in the 6MWD ($F_{(1,6)} = 1.39$; $p = 0.24$), with an estimated between-group difference in favour of the experimental group of 15 m (95% CI –28 to 59) at Week 12. At Week 24, this difference was non-significant at 2 m (95% CI –36 to 41), again in favour of the telerehabilitation group. As illustrated in Figure 2, the lower limit of the 95% CI was within the non-inferiority margin at Week 12, but slightly outside of the margin at Week 24. There was no significant overall group-by-time interaction effect.

Table 5 (see eAddenda for Table 5) shows the within-group differences from baseline to Week 12 and to Week 24 assessments, for both groups combined. There was a significant overall improvement in the 6MWD over time ($F_{(2,6)} = 3.23$; $p = 0.048$). Specifically, there was a non-significant post-program improvement over baseline of 14 m for both groups combined and a significant follow-up improvement over baseline of 24 m ($p = 0.046$). The per-protocol analysis performed for the partly adherent to adherent participants demonstrated similar results, with an estimated between-group difference of 11 m (95% CI –31 to 54) at Week 12 and 3 m (95% CI –36 to 43) at follow-up, both in favour of the telerehabilitation group.

Secondary outcomes

As presented in Table 3, the between-group differences in the other functional, balance and muscle strength measures did not substantially differ. Similarly, no between-group differences were found in quality of life and urinary incontinence.

Mixed-model analyses showed that both intervention groups experienced significant improvements in their quality of life from pre-program to post-program, and improvements were sustained at follow-up (Table 5, see eAddenda for Table 5). However, no significant time effects were observed for most other outcome measures.

Table 6 outlines other outcome measures, including patient satisfaction and adverse events. Both intervention groups reported

Table 1
Baseline characteristics of participants.

Characteristic	Exp (n = 24)	Con (n = 29)	Total (n = 53)
Age (*yr*), mean (SD)	68 (14)	67 (11)	67 (12)
Gender, n male (%)	19 (79)	21 (72)	40 (75)
Ethnicity, n Caucasian (%)	22 (92)	27 (93)	49 (92)
Aetiology, n (%)			
ischaemic cardiomyopathy	14 (58)	15 (52)	29 (55)
valvular	1 (4)	1 (3)	2 (4)
idiopathic dilated cardiomyopathy	4 (17)	6 (21)	10 (19)
heart failure with preserved ejection fraction	3 (13)	2 (7)	5 (9)
LVEF (%), mean (SD)	36 (16)	35 (17)	35 (17)
Atrial arrhythmia, n (%)	9 (38)	12 (41)	21 (40)
Co-morbidities, n (%)			
diabetes mellitus	13 (54)	10 (35)	23 (43)
chronic respiratory conditions	5 (21)	13 (45)	18 (34)
depression	5 (21)	3 (10)	8 (15)
stroke	6 (25)	1 (3)	7 (13)
arthritis	7 (29)	10 (35)	17 (32)
NYHA functional class, n (%)			
I	3 (13)	2 (7)	5 (9)
II	9 (37)	21 (72)	30 (57)
III	12 (50)	6 (21)	18 (34)
IV	0 (0)	0 (0)	0 (0)
Medications, n (%)			
ACE-I or ARB	23 (96)	25 (86)	48 (91)
beta-blockers	22 (92)	23 (79)	45 (85)
diuretics	21 (88)	26 (90)	47 (89)
Walking aid, n (%)			
none	18 (75)	22 (76)	40 (76)
stick	5 (21)	3 (10)	8 (15)
walker	1 (4)	4 (14)	5 (9)
Social situation, n (%)			
lives alone	0 (0)	5 (17)	5 (9)
lives with others	24 (100)	24 (83)	48 (91)
Home oxygen, n (%)	3 (13)	0 (0)	3 (6)
BMI (kg/m^2), mean (SD)	31 (8)	32 (6)	31 (7)
Resting SBP (*mmHg*), mean (SD)	124 (21)	123 (19)	123 (20)
Resting DBP (*mmHg*), mean (SD)	70 (14)	73 (11)	71 (12)
Resting HR (*beats/min*), mean (SD)	66 (13)	73 (12)	69 (13)
Fallers, n (%)	5 (21)	11 (38)	16 (30)

ACE-I = angiotensin-converting enzyme inhibitor, ARB = angiotensin receptor blocker, BMI = body mass index, Con = control group, DBP = diastolic blood pressure, Exp = experimental group, HR = heart rate, LVEF = left ventricular ejection fraction, NYHA = New York Heart Association, SBP = systolic blood pressure.

high levels of satisfaction with the program, with no significant between-group difference. The telerehabilitation group had significantly higher attendance rates than the control group, with a mean difference of 6 (95% CI 2 to 9) sessions. No significant difference was found in the number of adverse events between the two groups. There were no occurrences of death, cardiac arrest, syncope or fall in either group during the exercise session. There were some minor adverse events in both groups, including three incidences of angina, three of diaphoresis and two of palpitations.

Table 2
Attendance data for the participants who participated in any rehabilitation sessions (n = 51). Mean (SD) sessions attended in each group, mean difference (95% CI) between groups, and number (%) in each attendance category in each group and the relative risk (95% CI) between groups.

Adherence measure	Exp (n = 24)	Con (n = 27)	MD (95% CI)	Relative Risk (95% CI)
Sessions attended (*n*), mean (SD)	20 (6)	14 (7)	6 (2 to 9)	
Category, n (%)				
adherent [a]	17 (71)	8 (30)		2.39 (1.27 to 4.51)
partly adherent [b]	7 (29)	17 (63)		0.46 (0.23 to 0.92)
non-adherent [c]	0 (0)	2 (7)		not estimable

Con = control group, Exp = experimental group.
[a] > 80% of sessions attended.
[b] 20 to 80% of sessions attended.
[c] < 20% of sessions attended.

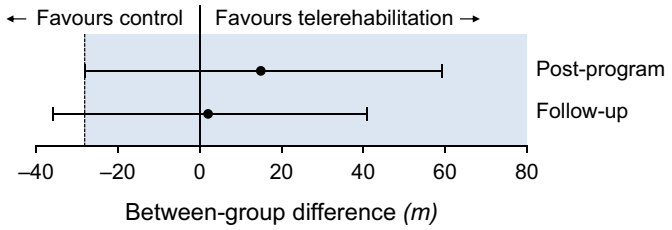

Figure 2. Non-inferiority plot of 6-minute walk test distance. Difference between the experimental and control groups in the change in 6-minute walk distance from Week 0 to 12 and from Week 0 to 24. Error bars indicate the 95% confidence intervals and the shaded area indicates the non-inferiority zone.

Discussion

This innovative study is the first to test a group-based video telerehabilitation program delivered in the home against a traditional centre-based rehabilitation program for people with chronic heart failure. Results verified the primary research hypothesis that the 6MWD change from baseline to Week 12 in the experimental group was not inferior compared with that in the control group. However, non-inferiority of telerehabilitation compared with traditional rehabilitation could not be proven for the 6MWD change from baseline to follow-up. This may have been influenced by the small improvements observed in both groups during this unsupervised exercise phase at follow-up, which is in line with a previous study[27] that reported difficulty in maintaining benefits gained from a supervised exercise program after program cessation. There were also no differences between the two intervention groups in most other functional capacity measures, muscle strength, quality of life, urinary incontinence, patient satisfaction and adverse events. The only significant differences were relatively minor, but they did favour the telerehabilitation group. The telerehabilitation group had higher attendance rates compared with the control group.

These results resonate with previous research on telerehabilitation. For instance, home-based telemonitored Nordic walking training has been demonstrated to be safe, effective and well-accepted in patients with chronic heart failure.[28] In telecoaching studies, the use of text messaging was reported to be as effective as a centre-based cardiac rehabilitation program in terms of 6MWD change,[29] as well as lower costs and fewer days lost to cardiovascular readmissions.[30] Higher attendance rates were found in the telemonitored exercise programs,[8,28] which is also in agreement with our results. The low number of adverse events experienced in our study is also consistent with the results of those same studies,[8,28] suggesting that telerehabilitation is safe in patients with chronic heart failure who meet the recommended exercise screening criteria.[1] These minor adverse events are not uncommon in an exercise program, and the healthcare professionals adequately addressed the events in our study.

Few studies have been performed on cardiac 'telerehabilitation', and 65% of these predominantly focused on phone-based interventions.[6] Our study has added to this evidence by using a video-based intervention and a range of core cardiac rehabilitation components.[31] Video-based telerehabilitation is a new approach that enables patients to exercise in the comfort of their home, whilst maintaining real-time communication with healthcare professionals. For example, the patient can demonstrate how they have been performing the exercises and the physiotherapist can monitor the accuracy of the exercises performed, modifying and progressing them accordingly through a practical demonstration. It is also possible to generate discussions through online tools such as video sharing and collaborative drawing. This modality may help to improve access to those with travel or cost barriers, whilst exercising under supervision. Furthermore, with a rapid expansion of internet usage in health, this mode of healthcare delivery should be further explored. Telerehabilitation has been suggested to allow

Table 3
Mean (SD) of groups, mean (95% CI) difference between groups, and non-inferiority range.

Outcome	Groups [a]						Between-group difference [b]		Non-inferiority range
	Week 0		Week 12		Week 24		Week 12 minus Week 0	Week 24 minus Week 0	
	Exp (n = 24)	Con (n = 29)	Exp (n = 24)	Con (n = 26)	Exp (n = 23)	Con (n = 26)	Exp minus Con	Exp minus Con	
6MWD *(m)*	346 (104)	382 (106)	364 (96)	394 (119)	374 (89)	410 (103)	15 (−28 to 59)	2 (−36 to 41)	−28 to positive
TUGT *(s)*	9.4 (2.8)	9.6 (3.7)	8.9 (3.0)	9.7 (5.4)	8.5 (2.2)	9.7 (6.6)	1.0 (0.8 to 1.1)	1.0 (0.9 to 1.1)	negative to 1.2
10-m walk test *(s)*									
comfortable	10.2 (2.6)	11.0 (5.4)	9.3 (2.1)	10.2 (4.5)	9.4 (2.2)	9.7 (3.1)	1.0 (0.8 to 1.2)	1.0 (0.9 to 1.2)	negative to 1.5
fast	7.2 (1.8)	7.4 (2.5)	7.1 (2.4)	7.4 (3.0)	6.9 (1.6)	7.5 (3.0)	1.0 (0.9 to 1.1)	1.0 (0.9 to 1.1)	negative to 1.5
Strength *(kg)* [c]									
grip	27 (11)	31 (10)	30 (9)	32 (9)	30 (7)	32 (9)	0 (−3 to 4)	1 (−2 to 4)	−5 to positive
quadriceps	24 (10)	26 (11)	25 (11)	25 (11)	25 (10)	25 (11)	1 (−4 to 6)	1 (−3 to 5)	−6 to positive
BOOMER *(0 to 16)*	13 (2)	13 (3)	13 (2)	13 (2)	13 (2)	13 (3)	0 (−1 to 1)	−1 (−2 to 0)	−2 to positive
RUIS *(0 to 16)*	4 (5)	4 (4)	4 (5)	4 (4)	4 (5)	4 (4)	1 (−1 to 2)	0 (−1 to 2)	negative to 2
EQ-5D									
VAS *(0 to 100)*	62 (19)	69 (18)	70 (17)	70 (18)	69 (17)	75 (14)	7 (−3 to 17)	−1 (−9 to 8)	−6 to positive
Utility *(0 to 1)*	0.73 (0.13)	0.69 (0.26)	0.73 (0.21)	0.74 (0.21)	0.73 (0.22)	0.74 (0.25)	−0.06 (−0.17 to 0.05)	−0.06 (−0.16 to 0.03)	−0.02 to positive
MLWHFQ *(0 to 105)*	47 (19)	41 (22)	32 (19)	35 (24)	34 (23)	33 (21)	−7 (−20 to 6)	−4 (−17 to 10)	negative to 4

BOOMER = balance outcome measure for elder rehabilitation, Con = control group, EQ-5D = EuroQoL, Exp = experimental group, MLWHFQ = Minnesota Living With Heart Failure questionnaire, RUIS = Revised Urinary Incontinence Scale, TUGT = Timed Up and Go test, VAS = visual analogue scale, 6MWD = 6-minute walk distance.
Shaded cell = primary outcome.
[a] Descriptive statistics using non-transformed data.
[b] Using a linear mixed-effects model.
[c] Right side.

early advice, detection and intervention in a similar approach as telemonitoring.[8] For people with chronic heart failure, structured telephone support and non-invasive home telemonitoring have been shown to reduce the risk of all-cause mortality and heart failure-related hospitalisations, with concomitant improvements in quality of life.[32] Telerehabilitation has the potential to monitor clinical symptoms, as well as improve the equity of access to high-quality heart failure rehabilitation programs, and thereby narrow the gap between recommended clinical practice and current feasibility.

Our study was strengthened by the direct comparison of two different delivery models for heart failure rehabilitation programs and the same staff contact frequency for both groups. The generalisability of the results to the typical heart failure population is boosted by the recruitment of participants who were older, female, and with a broad range of aetiology and computer experience. Relatively low-cost technologies that are available in most clinical settings were chosen, which increases the likelihood of translation into usual practice. However, there were some limitations: there may have been recruitment bias, as patients enrolled in a rehabilitation trial may have been more motivated than the general heart failure population. As the study was conducted in a metropolitan area with reliable internet coverage, further research will be required to determine the applicability of telerehabilitation in rural and remote areas with variable internet coverage. A non-block randomisation design was used for the study, which resulted in uneven group allocation. Small improvements from baseline were noted in many outcome measurements, which may have been related to a low training volume; however, these results represent everyday clinical practice and are not uncommon in the literature. The extent to which participants carried out independent home exercises beyond the formal program sessions was not objectively evaluated; therefore, the exact training volume could not be ascertained. No formal cost evaluation was performed in this study and this should be the focus of future work; however, anecdotally, the cost for the delivery of both programs in this study was similar.

In conclusion, telerehabilitation was not inferior to centre-based rehabilitation program in patients with chronic heart failure on the primary measure of 6MWD change from baseline to the end of the rehabilitation program. The between-group differences for the other outcomes suggest that telerehabilitation is at least similarly effective to traditional rehabilitation. Telerehabilitation appears an effective and safe option for the delivery of heart failure exercise-based rehabilitation program.

Table 6
Outcomes finalised at the end of the intervention period, by group and statistical significance of the between-group comparison.

Outcome	Exp (n = 24)	Con (n = 26)	*p*-value
CSQ-8 *(8 to 32)*, median (IQR)	32 (31 to 32)	32 (30 to 32)	0.17 [a]
Adverse events, n (%)	6	2	0.89 [b]
angina	3	0	
cardiac arrest	0	0	
death	0	0	
diaphoresis	1	2	
fall	0	0	
palpitations	2	0	
syncope	0	0	

CSQ-8 = client satisfaction questionnaire, Con = control group, Exp = experimental group.
[a] Mann–Whitney U test.
[b] Independent samples median test.

What is already known on this topic: For people with chronic heart failure, exercise rehabilitation increases physical function, improves quality of life, and lowers hospital admission rates. Telerehabilitation with monitoring via telephone-based technologies is an effective way to provide rehabilitation in the home for this population.

What this study adds: Telerehabilitation can be provided for people with chronic heart failure using internet-based video links and a group format. Such rehabilitation appears to be at least as effective as traditional hospital outpatient-based rehabilitation, with the added advantage of making participants significantly more likely to attend the majority of the scheduled sessions.

Footnotes: [a]Adobe Connect 9.2, Adobe Systems Inc, San Jose, USA; [b]Microsoft PowerPoint, Microsoft, Redmond, USA; [c]Inspiron 15, Dell Inc, Round Rock, USA; [d]E3131 modem, Huawei Technologies Co Ltd, Shenzhen, China; [e]Optus, Australia; [f]ri-champion N, Rudolf Riester GmbH, Jungingen, Germany; [g]Digit 3420 BCI, Smiths Medical PM Inc, Waukesha, USA; [h]Jamar dynamometer, Jamar, Lafayette, USA; [i]SPSS Statistics 22, SPSS Inc, Chicago, USA.

eAddenda: Tables 4 and 5 can be found online at http://dx.doi.org/10.1016/j.jphys.2017.02.017

Ethics approval: This project received ethics approval (HREC/12/QPCH/86 and The University of Queensland 2013000796), with site-specific approvals at the Princess Alexandra Hospital (AU/3/FDD1118) and The Prince Charles Hospital (AU/3/3501113). All participants gave written, informed consent before data collection began.

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Provenance: Not invited. Peer reviewed.

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ORIGINAL ARTICLE

EPIDEMIOLOGY, CLINICAL PRACTICE AND HEALTH

Effectiveness of weekend physical rehabilitation for functional recovery in geriatric patients with hip fracture

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Aim: To test the hypothesis that the functional outcome of hip fracture patients who receive weekend rehabilitation is better than that of similar patients who undergo non-weekend rehabilitation.

Methods: The present retrospective observational study used data from the Japan Rehabilitation Database spanning 2005–2015. We identified in-hospital hip fracture patients admitted to acute hospitals. After applying exclusion criteria, 469 patients were eligible. The primary outcome was motor Functional Independence Measure (FIM) efficiency.

Results: Of the patients with hip fracture, 68.0% received weekend rehabilitation. The patients who received weekend rehabilitation had significantly higher scores in motor FIM efficiency (mean 1.08 *vs* 0.73, $P < 0.001$), FIM efficiency (mean 1.12 *vs* 0.79, $P = 0.001$) and shorter length of stay (mean 32 *vs* 54, $P < 0.001$) than the patients without weekend rehabilitation. Multivariate linear regression analysis identified the weekend rehabilitation as a significant factor in motor FIM efficiency (coefficient 0.237, 95% confidence interval 0.074–0.400, $P = 0.004$), FIM efficiency (coefficient 0.235, 95% confidence interval 0.079–0.391, $P = 0.003$) and length of stay (coefficient −9.649, 95% confidence interval −18.194 to −1.104, $P = 0.027$).

Conclusions: The present cohort analysis showed that weekend rehabilitation for hip fracture patients can lead to functional recovery and reduce the length of stay. **Geriatr Gerontol Int 2018; ••: ••–••.**

Keywords: activities of daily living, hip fracture, physical therapy, retrospective study, weekend rehabilitation.

Introduction

Hip fracture is the most common fracture in older adults. The aging of populations in developed countries has led to a worldwide increase in the number of patients with hip fractures.[1] Hip fracture is associated with a reduced ability to carry out activities of daily living, and rehabilitation is an important aspect of care in these patients.[2]

Clinical studies on rehabilitation management have shown that intensive rehabilitation therapy improves functional recovery in hip fracture patients.[3] However, there is no agreement on the most appropriate frequency of rehabilitation therapy. Several studies investigated the benefits of weekend rehabilitation in patients with stroke or other diseases during the acute or subacute phase, and reported that the impact of such programs on functional recovery was questionable.[4–9] To our knowledge, there is no clinical information on the impact of weekend rehabilitation on the functional recovery of acute hip fracture patients.

We hypothesized that weekend rehabilitation in acute hip fracture patients enhances functional recovery compared with infrequent rehabilitation therapy. To test this hypothesis, we carried out a cohort study to clarify the impact of weekend rehabilitation on functional recovery in geriatric patients with hip fracture using the Japan Rehabilitation Database, which contains clinical data from a large number of acute hospitals throughout Japan.

Methods

The present study was carried out with approval from the institutional review board of the Japanese Association of Rehabilitation Medicine; however, the requirement for informed patient consent was waived because of data anonymity.

Data source

The Japan Rehabilitation Database was established with financial support from the Ministry of Health, Labor and Welfare, Japan.[10] From 2005, data on clinical information were collected for rehabilitation patients discharged from participating hospitals; only voluntary samples, not random samples, were included. This database also contains distinct identifiers for data on patients with hip fracture, including: age/sex, Functional Independence Measure (FIM) scores (range 18 [totally dependent] to 126 [totally independent]),[11] duration of stay, number of days from onset of injury; fracture type, and availability of rehabilitation services on Saturdays and Sundays. Rehabilitation personnel collected baseline data on admission to hospital, and data that could not be obtained at admission were collected at discharge. These data

were subsequently submitted to the Japan Association of Rehabilitation Database, extracted and then disseminated to researchers. In total, data from 78 participating hospitals had been added to the structured data for 29 339 patients as of 2015. To preserve anonymity, personal data were coded and all individually identifiable information was removed.

Patient selection

Data on patients with a diagnosis of hip fracture admitted between August 2005 and September 2015 to acute hospitals were obtained from the Japan Rehabilitation Database. We included only hospitals with information regarding weekend rehabilitation, and for whom FIM data at admission and discharge were available. Also, we included only patients admitted to acute hospitals within 1 day after injury in order to exclude chronic patients and limit our analysis to patients in the acute phase.

Rehabilitation programs

In the present study, rehabilitation therapy provided by physical therapists on Saturdays and Sundays was referred to as weekend rehabilitation services. The emphasis of the rehabilitation schedules was gait and exercise related to activities of daily living, with a typical gym exercise schedule comprising approximately 40–80 min of physical therapy daily for 5–7 days a week.[12] Muscle-strengthening exercises and walking were also included, and all patients were further requested to be ambulatory during the day. Weekend rehabilitation is usually provided at the discretion of the attending physiatrist based on their prescription of rehabilitation therapy and the setup of rehabilitation therapy services in that particular hospital.

Variables and outcomes

The following data were extracted from the database: age, sex, motor FIM score on admission, day of onset of rehabilitation from admission (day), duration of physical rehabilitation (min), fracture type and laterality, whether the patient underwent surgery, and comorbidity, including cerebrovascular and orthopedic disorders and neurological disorders, such as dementia. The FIM score is an established index of severity of disability commonly used in Japanese rehabilitation centers and is well known among physical therapists. The instrument comprises 18 specific items, each assessed on a 7-point ordinal scale; higher scores correlate to higher levels of independent activity by patients in the ability to carry out the required tasks for that item. FIM can be further divided into a motor subscale consisting of 13 items (eating, personal grooming, bathing, upper body dressing, lower body dressing, personal hygiene, bladder management, bowel management, bed-to-chair transfer, toilet transfer, shower transfer, walk or wheelchair and stairs) and a cognitive subscale with five items (comprehension, expression, social interaction, problem solving and memory). For the motor and cognitive subscales, the scores range from 13 to 91 (motor FIM) and from 5 to 35 (cognitive FIM). Under the Japanese national health insurance scheme, the degree of bedriddeness is used to determine the level of long-term care, which then serves as an indicator of the level of independence in daily living activities of handicapped older patients.[13] The range is from independent to completely bedridden, as follows: independent (fully independent), J1 and J2 (independent with some disability), A1 and A2 (moving around indoors independently, but needing some assistance when they go out), B1 and B2 (mostly bedridden) or C1 and C2 (completely bedridden). In the present study, this range of independence was further divided into four variables as follows: independent (independent, J1, or J2), homebound (A1 or A2), mostly bedridden (B1 or B2) or completely bedridden (C1 or C2).

The primary outcome was motor-FIM efficiency determined with the following equation: (discharge motor FIM score – admission motor FIM score) / length of stay in days.[14] FIM efficiency and length of hospital stay in days were secondary outcomes; the calculation used for FIM efficiency was (discharge FIM score – admission FIM score) / length of stay in days.[15]

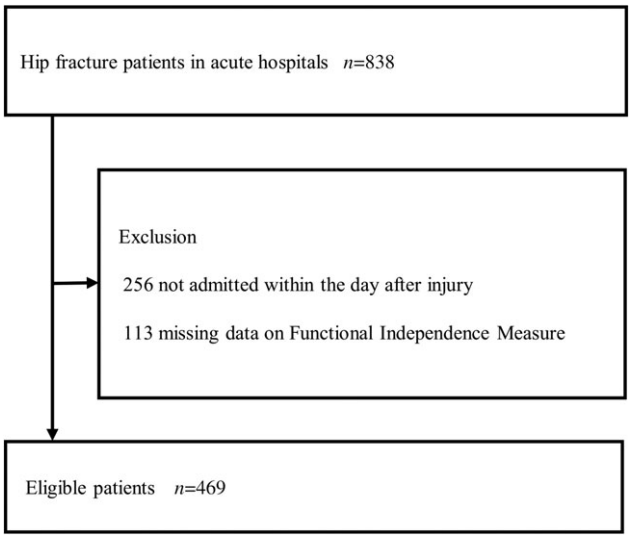

Figure 1 Flow chart of patient selection.

Statistical analysis

We compared the demographic and clinical characteristics of patients between the weekend rehabilitation and non-weekend rehabilitation groups with the χ^2-test for categorical variables, and the unpaired *t*-test for continuous variables.

We also carried out multivariate linear regression with motor FIM efficiency as the dependent variable in order to calculate the correlation coefficients of independent variables including age, sex, motor FIM score at admission, day of onset of rehabilitation from admission (day), duration of physical rehabilitation (min), fracture type and laterality, whether surgery had been carried out, comorbidity (cerebrovascular and orthopedic disorders, and dementia), and the presence or absence of weekend rehabilitation. Furthermore, we carried out multivariate linear regression analysis with FIM efficiency and length of stay as dependent variables. With regard to length of stay, we included the patient's year of admission as an additional independent variable in a regression model. Generalized estimation equations were used to account for clustering of observations within hospitals and for more precise confidence intervals (CI). The SPSS 19.0 software (IBM SPSS, Armonk, NY, USA) was used for all analyses. A *P*-value <0.05 was considered statistically significant.

Results

During the study period, we identified 838 patients with hip fracture from 11 acute hospitals for whom clinical information on weekend rehabilitation was available. In total, the present study excluded 256 patients not admitted until 1 day after injury and 113 patients for whom FIM data were incomplete. Ultimately, 469 patients from six acute hospitals were eligible and were included in the analysis (Fig. 1).

The clinical characteristics of the enrolled patients are shown in Table 1. There were 319 (68.0%) patients in the weekend rehabilitation group. Compared with the non-weekend rehabilitation group, patients in the weekend rehabilitation group had higher rates of femoral neck fracture, cerebrovascular disease and surgery. Also, patients in the weekend rehabilitation group had significantly higher motor FIM score on admission and amount of physical rehabilitation. The number of days of rehabilitation onset after admission was significantly lower for patients in the weekend rehabilitation group.

Table 1 Patients' characteristics

	Total (n = 469)	Weekend rehabilitation group (n = 319)	Non-weekend rehabilitation group (n = 150)	P-value
Mean age ± SD (years)	82.5 ± 10.9	82.5 ± 11.1	82.5 ± 10.6	0.78
Female (%)	384 (81.9)	262 (82.1)	122 (81.3)	0.83
Fracture type (%)				
Femoral neck	200 (42.9)	144 (45.1)	56 (37.3)	<0.01
Non-operative (%)	33 (7.0)	21 (6.6)	12 (8.0)	<0.01
Comorbidities (%)				
Cerebrovascular disease	68 (14.5)	54 (16.9)	14 (9.3)	0.03
Orthopedic disease	101 (21.5)	74 (23.2)	27 (18.0)	0.20
Dementia	245 (52.2)	160 (50.2)	85 (56.7)	0.18
Pre-injury bedridden degree (%)				
Independent	184 (39.2)	137 (42.9)	47 (31.3)	<0.01
Homebound	133 (28.4)	100 (31.3)	33 (22.0)	
Mostly bedridden	87 (18.6)	65 (20.4)	22 (14.7)	
Completely bedridden	36 (7.7)	14 (4.4)	22 (14.7)	
Unknown	29 (6.2)	3 (0.9)	26 (17.3)	
Admission motor FIM ± SD	29.4 ± 14.8	31.3 ± 14.7	25.4 ± 14.4	0.01
Rehabilitation starting day from admission (day)	1.7 ± 2.6	1.05 ± 1.9	3.1 ± 3.1	<0.01
Amount of physical rehabilitation (minutes/ day)	35.6 ± 12.8	37.7 ± 10.9	31.2 ± 15.3	<0.01

FIM, Functional Independence Measure; SD, standard deviation.

Table 2 Comparison of outcomes

	Total (n = 469)	Weekend rehabilitation group (n = 319)	Non-weekend rehabilitation group (n = 150)	P-value
Motor FIM efficiency ± SD	0.97 ± 0.78	1.08 ± 0.82	0.73 ± 0.62	<0.001
FIM efficiency ± SD	1.01 ± 0.81	1.12 ± 0.85	0.79 ± 0.68	<0.001
Length of stay ± SD (days)	39.56 ± 27.47	32.71 ± 20.40	54.14 ± 34.16	<0.001

FIM, Functional Independence Measure; SD, standard deviation.

Table 3 Multivariable liner regression analysis for outcomes

	B	95% CI (B)	Coefficients (β)	95% CI (β)	P-value
Motor FIM efficiency ± SD	0.237	0.074–0.400	1.267	1.077–1.267	0.004
FIM efficiency ± SD	0.235	0.079–0.391	1.265	1.082–1.478	0.003
Length of stay ± SD (days)	−9.649	−18.194 to −1.104	0.000	0.000–0.332	0.027

FIM, Functional Independence Measure; SD, standard deviation.

We compared outcomes between both groups (Table 2). Significantly higher motor FIM efficiency (mean 1.08 *vs* 0.73, $P < 0.001$) and FIM efficiency (1.12 *vs* 0.79, $P = 0.001$) scores, and shorter length of stay (32 *vs* 54, $P < 0.001$) were seen in patients that received weekend rehabilitation compared with those who did not. Multivariate linear regression analysis for the outcomes (Table 3) showed that weekend rehabilitation was a significant factor in motor FIM efficiency (coefficient 0.237, 95% CI 0.074–0.400, $P = 0.004$), FIM efficiency (coefficient 0.235, 95% CI 0.079–0.391, $P = 0.003$) and duration of stay (coefficient −9.649, 95% CI −18.194 to −1.104, $P = 0.027$).

Discussion

The present study utilized a large rehabilitation database of inpatients to evaluate the effect of weekend rehabilitation in older patients with hip fracture in acute hospitals. Our findings showed an association between weekend rehabilitation and higher motor FIM efficiency, as well as higher FIM efficiency. Duration of stay was significantly smaller in patients who received weekend rehabilitation compared with those who did not receive weekend rehabilitation.

Previous reports have identified the importance of weekend rehabilitation services,[8,9] and a meta-analysis showed moderate evidence for shortened duration of hospital stay in stroke patients after additional weekend rehabilitation therapy.[9] Furthermore, a systematic review described increased physical activity and possible improved activities of daily living with added after-hours rehabilitation.[15] To our knowledge, the present study is the first to investigate the association between weekend rehabilitation and favorable functional recovery and shortened duration of hospital stay in hip fracture patients.

This association between weekend rehabilitation and functional recovery could be attributable to high frequent mobilization, which apparently improves functional outcome. Also, the patients had rehabilitation therapy every day of the week with no break or day of bed rest throughout. A report by Kinoshita *et al.*, states that continued weekend rehabilitation with no rest from weekly rehabilitation therapy possibly did not promote functional decline, but rather enhanced recovery.[16] Another study by Askim *et al.*, identified bed rest as a significant factor for poor functional outcome in acute stroke patients after 3 months.[17] The findings of the present study are consistent with the results of the aforementioned study in which reduced bed rest decreased disability and shortened the duration of hospital stay.

Nevertheless, there are challenges to clinical generalizability in this context. For example, the number of therapists engaged in acute rehabilitation is rather limited. Thus, provision of weekend rehabilitation services requires an increase in the number of available physical therapists. In addition, weekend rehabilitation is not cost-effective and rather increases healthcare expenses. In a previous report, provision of inpatient rehabilitation therapy was found to probably reduce costs.[18] This present study did not investigate costs in terms of rehabilitation for hip fracture patients. However, further research is required to elucidate the cost-effectiveness of weekend rehabilitation in patients with hip fracture.

The present study included unmeasured confounding factors, such as surgical method and discharge policy adopted by each hospital. However, surgical method is strongly correlated with fracture type. We adjusted for the fracture type, so we believe that the surgical method has been adjusted for to some extent. In addition, we adjusted interhospital correction with generalized estimation equations. Therefore, we believe the discharge policy in each hospital has been adjusted for to some extent.

The present study had certain limitations. First, the Japan Rehabilitation Database comprises only voluntary and not random samples. Thus, the present findings are not readily applicable to hip fracture patients undergoing rehabilitation. Second, information about the type of surgery and social or family factors, surgical skill, rehabilitation methods, and the type and amount of weekend rehabilitation was limited.

In conclusion, the present study showed that weekend rehabilitation is associated with improved recovery in patients with hip fracture in acute hospitals. Weekend rehabilitation is possibly a practicable alternative for improving quality of rehabilitation therapy services.

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Disclosure statement

The authors declare no conflict of interest.

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