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ALICE MIRANDA DOS SANTOS

ANÁLISE DA FUNCIONALIDADE DE PACIENTES SOBREVIVENTES A CONDIÇÃO CRÍTICA APÓS ALTA IMEDIATA DA UNIDADE DE TERAPIA INTENSIVA

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Dissertação apresentada ao Programa de Pós-Graduação em Fisioterapia da Universidade Federal de Pernambuco, como requisito parcial para a obtenção do título de Mestre em Fisioterapia.

Área de concentração: Fisioterapia na atenção à saúde.

Linha de pesquisa: Instrumentação e intervenção fisioterapêutica

Orientador: Profº. Dra. Shirley Lima Campos

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Dedico esse trabalho a Família Miranda, que é a representação do amor de Deus por mim.

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RESUMO

O avanço tecnológico e o acesso à informação têm impactado positivamente na redução da taxa de mortalidade de pacientes críticos no ambiente de terapia intensiva. Os sobreviventes críticos apresentam múltiplos comprometimentos, associados aos longos períodos de internamento, que se estendem ao pós-alta hospitalar e caracterizam a *Post-Intensive Care Syndrome (PICS)*. As alterações englobam os domínios físico, mental e cognitivo e se apresentam através de sinais, sintomas e graus variados o que torna difícil o diagnóstico e a instituição de protocolos de tratamento adequados. Sendo assim, devido à variabilidade de apresentação e à gravidade dessas alterações, é necessário identificar ferramentas que auxiliem na sistematização da avaliação e no diagnóstico da PICS. O presente estudo teve como objetivo avaliar e descrever o impacto do processo de internação na Unidade de Terapia Intensiva (UTI) sobre os domínios físicos, mental e cognitivo, bem como, definir as principais variáveis relacionadas à funcionalidade de pacientes sobreviventes a UTI a partir de uma análise de componentes principais (ACP). Trata-se de um estudo transversal, no qual sobreviventes à internação na UTI, com uso prévio de ventilação invasiva ≥ 48 horas foram avaliados após à alta através de uma estratégia de avaliação multidimensional composta por: Espirometria, Ventilometria, Manovacuometria; Dinamometria manual; *Medical Research Council* (MRC), Índice de Barthel, Escala Perme, Escala Hospitalar de Ansiedade e Depressão (HADS), e Mini Exame Pós-Estado Mental (Mini-mental). O teste binomial foi aplicado para comparar as proporções das funções preservadas e reduzidas na amostra. A análise exploratória foi realizada através da ACP, sendo adotadas 13 variáveis oriundas dos 9 instrumentos da avaliação multidimensional. Um total de 30 pacientes (15 homens) com média de idade de 52 anos foram avaliados. Foi observado função reduzida em: capacidade vital forçada (83,3%; $p<0,001$), pressão inspiratória máxima (60%), Escala Perme (90%, $p< 0,001$) e Escala Barthel (73%, $p< 0,001$). O modelo de avaliação por ACP explica 69,4% da variação total para detecção de alteração funcional em 3 componentes principais. Os componentes principais 1, 2 e 3 responderam, respectivamente, por 40,4% (variáveis de desempenho funcional, função pulmonar e força respiratória), 17,1% (predomínio de função mental) e 11,9% (reduzindo as variáveis Handgrip e MRC) da variância explicada. A força de prensão palmar, a capacidade vital lenta, o *Medical Research Council* e o Mini-mental foram

desconsiderados do modelo sintetizado. Pode-se concluir que, em nosso perfil amostral, pacientes sobreviventes ao estado crítico apresentam maiores percentuais de função reduzida respiratória e funcional, sendo apontados a escala Perme e o Índice de Barthel, como as principais ferramentas relacionadas à detecção de alterações funcionais.

Palavras-chave: Cuidados Críticos. Terapia Intensiva. Desempenho Físico Funcional.

ABSTRACT

Technological advances and access to information have had a positive impact on reducing the mortality rate of critically ill patients in the intensive care environment. Critical survivors have multiple impairments, associated with long periods of hospitalization, which extend after hospital discharge and characterize the Post-Intensive Care Syndrome (PICS). The changes encompass the physical, mental and cognitive domains and present themselves through signs, symptoms and varying degrees, which makes the diagnosis and the establishment of adequate treatment protocols difficult. Therefore, due to the variability of presentation and the severity of these changes, it is necessary to identify tools that assist in the systematization of the assessment and diagnosis of PICS. Evaluate and describe the impact of the hospitalization process in the Intensive Care Unit (ICU) on the physical, mental and cognitive domains, as well as, define the main variables related to the functionality of ICU surviving patients from an principal component analysis (PCA).This is a cross-sectional study, in which ICU survivors, with previous use of invasive ventilation ≥ 48 hours, were assessed after discharge through a multidimensional assessment strategy comprising: Spirometry, Ventilometry, Manovacuometry; Manual dynamometry; Medical Research Council (MRC), Barthel Index, Perme Scale, Hospital Anxiety and Depression Scale (HADS), and Mini Post-Mental State Examination (Mini-mental). The binomial test was applied to compare the proportions of the preserved and reduced functions in the sample. The exploratory analysis was carried out through the PCA, adopting 13 variables from the 9 instruments of the multidimensional assessment. A total of 30 patients (15 men) with a mean age of 52 years were evaluated. A reduced function was observed in: Forced vital capacity (83.3%; $p < 0.001$), maximum inspiratory pressure (60%), Perme scale (90%, $p < 0.001$) and Barthel scale (73%, $p < 0.001$). The PCA evaluation model explains 69.41% of the total variation for detecting functional changes in 3 main components. The main components 1, 2 and 3 accounted, respectively, for 40.4% (variables of functional performance, lung function and respiratory strength), 17.1% (predominance of mental function) and 11.9% (reducing the variables Handgrip and MRC) of the explained variance. The handgrip strength, the slow vital capacity, the Medical Research Council and the Mini-mental were disregarded from the synthesized model. It can be concluded that, in our sample profile, patients surviving the critical condition have higher percentages of reduced

respiratory and functional function, with the Perme scale and the Barthel Index being pointed out as the main tools related to the detection of functional changes.

Keywords: Critical Care. Intensive Therapy. Functional Physical Performance.

LISTA DE ILUSTRAÇÕES

LISTA DE SIGLAS

CEP	Comitê de Ética e Pesquisa
CVF	Capacidade Vital Força
CVL	Capacidade Vital Lenta
FPP	Força de Preensão Palmar
HADS	Escala Hospitalar de Ansiedade e Depressão
HADS-A	HADS Ansiedade
HADS-D	HADS Depressão
ICU	*Intensive Care Unit*
IRA	Insuficiência Respiratória Aguda
Mini-Mental	Mini Exame do Estado Mental
MRC	*Medical Research Council*
PEMAX	Pressão expiratória máxima
PICS	*Post Intensive Care Syndrome*
PICS-F	*Post Intensive Care Syndrome – Family*
PIMAX	Pressão inspiratória máxima
SDRA	Síndrome do desconforto respiratório agudo
SPTI	Síndrome Pós-Terapia Intensiva
TEPT	Transtorno de Estresse Pós-Traumático
UTI	Unidade de Terapia Intensiva
VEF1	Volume Expiratório Forçado no primeiro segundo
VMI	Ventilação Mecânica Invasiva

SUMÁRIO

1 INTRODUÇÃO

O comprometimento do nível funcional com consequente perda da qualidade de vida é uma das características mais impactantes em pacientes críticos que recebem alta hospitalar após estadia na Unidade de Terapia Intensiva (UTI). Os longos períodos de imobilização durante a internação, o uso de medicamentos como bloqueadores neuromusculares, corticoides, sedativos e analgésicos, além da necessidade prolongada de ventilação mecânica, repercutem a longo prazo no desempenho de atividades da vida diária, devido ao declínio nas funções motora e respiratória, experimentado por esses pacientes nesse período (SVENNINGSEN et al.,2015; CABRINI et al., 2016; CARVALHO; JUNIOR; FRANCA, 2007; FOSTER, 2016; MERBITZ et al., 2016; RAWAL; YADAV; KUMAR, 2017).

Embora as taxas de mortalidade de indivíduos submetidos ao suporte intensivo tenham diminuído, em decorrência do avanço tecnológico e de equipes multiprofissionais qualificadas, o aumento da sobrevida muitas vezes está associado à redução da funcionalidade (MALEY et al., 2016). Porém, mesmo com toda evolução da assistência em terapia intensiva, as sequelas adquiridas pela internação podem persistir após a alta e caracterizar um quadro atualmente conhecido como Síndrome Pós-Terapia Intensiva, ou *Post-Intensive Care Syndrome* (PICS).

O termo PICS foi estabelecido durante uma conferência da *Society of Critical Medicine*, no ano de 2010, quando profissionais e pesquisadores do âmbito de cuidados críticos se reuniram com o objetivo de compreender as consequências a longo prazo de estados críticos e do estágio pós-UTI, além de estabelecer parâmetros avaliativos, metas de tratamento e identificação das necessidades de pesquisas científicas na área (FAN et al., 2014; NEEDHAM et al., 2012).

A PICS é caracterizada por um conjunto de sinais e sintomas físicos, cognitivos e psicológicos não causados pela doença em si, mas como reflexo da estadia na UTI, que se prolongam após a alta hospitalar (CONNOLLY et al., 2016; HUGGINS et al., 2016; MAJOR et al., 2016). Recentemente, o conceito vem sendo ampliado, e o termo usado não somente para descrever comprometimentos adquiridos, mas também a piora de sequelas pré-existentes à internação em terapia intensiva (TEIXEIRA; ROSA, 2018).

De acordo com Rawal et al. (2017), a apresentação da PICS pode ser variada, e os sintomas podem surgir de forma isolada ou combinada, com prevalência variada

de cada sintoma, que são dependentes da forma de tratamento oferecida ao paciente no ambiente de UTI e com o histórico do paciente previamente à internação.

Quadros de *delirium*, sedação prolongada, ventilação mecânica, uso de bloqueadores musculares, déficits na comunicação e imobilização prolongada no leito (DENEHY; ELLIOTT, 2012; JACKSON et al., 2015; VOLK; GRASSI, 2009), além de fatores preexistentes, como o sedentarismo, a presença de déficits motores, cognitivos e sintomas de doenças psicológicas, como depressão e ansiedade, podendo colaborar para um pior quadro funcional diante da instalação da PICS. (JACKSON et al., 2015; RAWAL; YADAV; KUMAR, 2017).

Revisão sistemática e estudo *Delphy* demonstram que pacientes sobreviventes à internação na UTI apresentam alterações principalmente na função física, mental e cognitiva, com alta variabilidade de sinais, sintomas e graus de comprometimento, sugerindo o uso de mais de 20-25 instrumentos para rastreamento dessas disfunções por uma equipe multiprofissional (CONNOLLY et al., 2016; MAJOR *et al*., 2016). Esses estudos sugerem que a presença de disfunções seja rastreada a partir da alta hospitalar e siga em follow-up em intervalos de 3, 6 e 12 meses, por anos (ROBINSON *et al*., 2018).

Em função da variabilidade de sintomas e disfunções e da diversificação de instrumentos de avaliação, diagnosticar a Síndrome Pós-Terapia Intensiva e/ou déficit funcionais nos sobreviventes após a alta hospitalar é uma tarefa difícil e que pode levar horas, cansaço, estresse, ansiedade, adequação entre tempo de avaliação e a disponibilidade profissional (ROBINSON *et al.,* 2017). Assim, torna-se necessário investigar metodologias capazes de reduzir a necessidade de instrumentos de avaliação, sem perda da informação, e assim, tornar a sistematização da avaliação mais viável.

De modo que, esse estudo se propõe a descrever o status funcional, com enfoque na função física, mental e cognitiva, de pacientes sobreviventes a UTI, a partir de uma avaliação sistematizada com 12 instrumentos, selecionados a partir de uma base sugerida no *Improving Long-Term Outcomes Research for Acute Respiratory Failure, buscando responder os seguintes questionamentos:*

1. *Quais componentes principais da avaliação em relação a detecção da mudança da funcionalidade em pacientes sobreviventes ao estado crítico?*

2. *Quais as principais disfunções encontradas em pacientes sobreviventes ao estado crítico, inseridos em um cenário com assistência multidisciplinar, incluindo fisioterapia de rotina, no momento da alta da UTI?*

2 REFERENCIAL TEÓRICO

2.1 Problemas associados à permanência em terapia intensiva

Estima-se que os problemas associados à redução da qualidade de vida e função física atinjam cerca de um terço dos pacientes que são submetidos a cuidados intensivos, e a incidência aumente para 50% em pacientes submetidos à ventilação mecânica ou que apresentaram quadro de *delirium* durante a internação, e sua sintomatologia pode perdurar por meses ou anos após a alta da UTI (DAVIDSON *et al*., 2013). Ademais, cerca de 50% dos pacientes só retornam ao trabalho após um ano da alta hospitalar, devido a problemas cognitivos e psicológicos, enquanto 33% não retornam ao trabalho (DAVIDSON *et al*., 2013).

Com relação aos sinais e sintomas, dos 50% que receberam alta hospitalar, 28% são acometidos com neuromiopatia, 28% têm sintomas depressivos clinicamente significativos, 24% têm ansiedade, 22% apresentam sintomas clinicamente significativos de transtorno de estresse pós-traumático (TEPT) e 79% têm comprometimento cognitivo (DESAI, 2011; STEVENS, 2007; DAVYDOW, 2008; GIRARD, 2010).

Diante disso, estudos recomendam a realização de tratamento regular e individualizado desde a internação na UTI, até cerca de dois a três meses após a alta hospitalar. No Reino Unido, esta forma de tratamento constitui um padrão nacional de qualidade, visto que, mais de 120.000 pessoas necessitam de internação na UTI por ano e 78% destes recebe alta hospitalar. Entretanto, menos de 30% dos órgãos de saúde do Reino Unido, oferecem um serviço específico para a reabilitação pós-UTI e poucos dados são encontrados para outros sistemas de saúde (CONNOLLY *et al*., 2015).

Atualmente, a PICS vem sendo amplamente discutida e o seu surgimento deve-se a um conjunto de sinais e sintomas associados ao tempo de permanência em terapia intensiva. Trata-se de um quadro de origem multifatorial e o seu acometimento abrange aspectos físicos, cognitivos e psicológicos do paciente. Com relação ao domínio físico, os pacientes podem relatar fadiga, fraqueza muscular, dispneia, redução da capacidade física, comprometimento significativo da qualidade de vida e incapacidade de realizar atividades básicas de vida diária (NEEDHAM *et al*., 2012; GRIFFITHS *et al*., 2010).

Dentre os sintomas cognitivos, foram observados os déficits de memória, redução na função executiva e no raciocínio lógico, dificuldade de concentração e atenção, menor velocidade no processamento e no entendimento de informações (DENEHY; ELLIOTT, 2012; JACKSON *et al*., 2015; MERBITZ *et al*., 2016; VOLK; GRASSI, 2009). Estas alterações na capacidade cognitiva dos pacientes dificultam o retorno dos mesmos para o convívio social, problematizando não só a execução de tarefas de vida diária, mas também protelando o seu retorno ao trabalho (DAVIDSON *et al*., 2013; RAWAL; YADAV; KUMAR, 2017; VOLK; GRASSI, 2009).

Além dos déficits cognitivos, a PICS também gera impactos à saúde mental dos pacientes críticos. Os três principais sintomas abordados na PICS relacionados à saúde mental são a TEPT, a ansiedade e a depressão (RAWAL; YADAV; KUMAR, 2017). De modo que, as alterações nos hábitos de sono, a fragmentação do sono, experiências de quase morte e a ventilação mecânica prolongada podem levar a um quadro de TEPT, o que caracteriza uma série de sintomas como pensamentos intrusivos (memórias ruins e pesadelos) relacionados a internação, hipervigilância, distúrbios no sono e episódios de agressividade súbita (JACKSON *et al*., 2015).

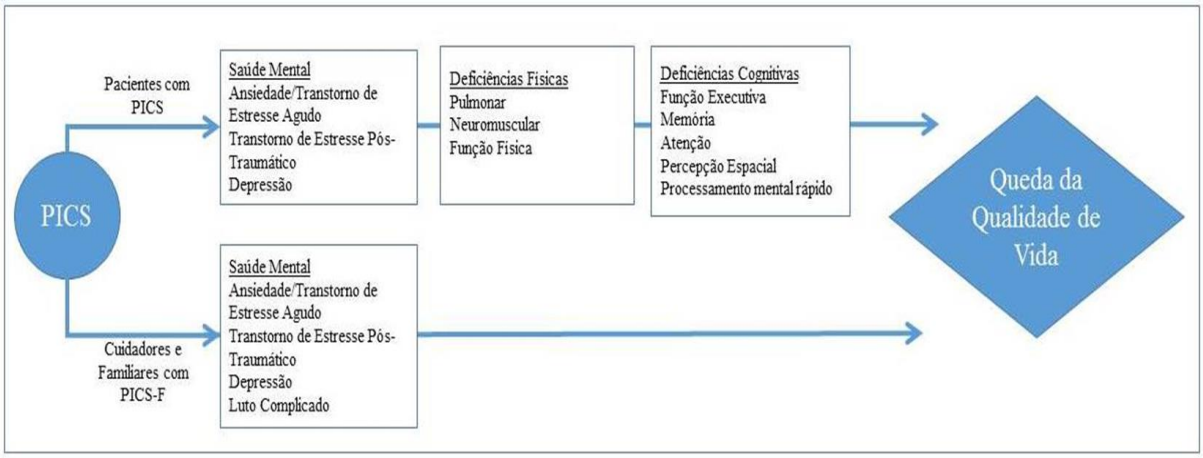
Os sintomas de TEPT impactam tanto a vida pessoal do paciente como também seu convívio interpessoal e familiar, sendo que pacientes que apresentam sintomas da síndrome encontram dificuldades nas interações sociais e relações profissionais, culminando em isolamento social e impactando na redução da qualidade de vida e funcionalidade (DENEHY; ELLIOTT, 2012).

A ansiedade e a depressão também estão presentes em pacientes com PICS. Quadros depressivos são vistos principalmente em pacientes que desenvolveram lesão pulmonar aguda ou que apresentaram sintomas da Síndrome do Desconforto Respiratório Agudo (SRDA) durante a internação, ou ainda aqueles pacientes submetidos a sedação profunda e pacientes jovens que não conseguiram retomar a sua rotina devido aos impactos físicos da internação na UTI (VOLK; GRASSI, 2009). A ansiedade está relacionada principalmente à falta de memórias íntegras sobre a internação na UTI, causadas principalmente pela sedação e o delirium. Entretanto, os sintomas de ansiedade tendem a desaparecer naturalmente, mas de forma lenta, podendo levar até anos para que seja totalmente superada (JACKSON *et al*., 2015; VOLK; GRASSI, 2009).

Ainda, é importante salientar que os sintomas da PICS não estão limitados apenas aos pacientes, mas também atingem seus familiares, em quadro conhecido

como PICS-F (Figura 1). De acordo com a literatura, cerca de 33% dos familiares de pacientes críticos desenvolvem sintomas semelhantes aos da Síndrome do Estresse Pós-Traumático, e essa prevalência é ainda maior quando há óbito do familiar durante a internação (MYERS *et al*., 2016).

Figura 1 – Sinais e sintomas da PICS e PICS-F



Fonte: Elaborado com adaptações a partir de Needham *et al. (*2012).

2.2 Fatores de Risco e etiologia dos problemas associados a PICS

É importante destacar que nem todos os pacientes que estão internados na UTI desenvolvem problemas associados a PICS. Todavia, alguns fatores de risco são observados nos pacientes que desenvolvem a síndrome. Esses fatores predisponentes estão associados ao tempo de permanência na UTI (≥48h), gravidade da doença, episódios de *delirium*, ventilação mecânica invasiva, uso de sedativos, corticoides e bloqueadores neuromusculares, indivíduos mais velhos e do sexo feminino (KHAN *et al*., 2015; SVENNINGSEN *et al*., 2015; PORHOMAYON *et al*., 2016).

Os pacientes acometidos com a síndrome apresentam sintomas em três domínios: físico, cognitivo e mental (Quadro 1). As alterações físicas estão relacionadas ao descondicionamento cardiorrespiratório e a degeneração muscular, o comprometimento cognitivo inclui o déficit de atenção, concentração e memória; e às mudanças mentais abrangem ansiedade, depressão, insônia, distúrbios do sono e estresse (KHAN *et al*., 2015; PORHOMAYON *et al*., 2016).

Os principais fatores associados ao desenvolvimento de fraqueza muscular são o tempo de ventilação mecânica, o uso de corticoides, o tempo de internação e a sepse (BORGES *et al*., 2015). A fraqueza muscular pode prolongar o desmame da ventilação mecânica, aumentar o tempo de internação e levar os pacientes à incapacidade de realizar às atividades de vida diária após a alta hospitalar (DE JONGHE *et al*., 2013).

Além disso, a estadia prolongada no ambiente de UTI leva a um quadro de debilidade cognitiva relacionada à experiência da internação, bem como pelo uso de substâncias sedativas. O surgimento do *delirium*, a hipoglicemia decorrente de uma dieta imprópria ou insuficiente para suprir as necessidades metabólicas, a hipóxia decorrente da insuficiência respiratória, da própria ventilação mecânica, ou de paradas cardiorrespiratórias, e o uso exagerado de sedativos e narcóticos para manter o controle do paciente e reduzir a dor podem causar sofrimento ao sistema nervoso central, ocasionando uma repercussão negativa na cognição e função executiva do paciente (JACKSON *et al*., 2015; RAWAL; YADAV; KUMAR, 2017).

Quadro 1 – Principais causas e comprometimentos funcionais relacionados a PICS

Domínio	**Comprometimento**	**Causa relacionada**
Físico	Função Pulmonar e esqueléticas prejudicadas (dificuldades para caminhar, para realizar às atividades de vida diária e incapacidade de voltar ao trabalho)	Tempo de Internamento Ventilação Mecânica Invasiva Restrição ao leito Uso de Sedativos, Corticoides e Bloqueadores Neuromusculares
Cognitivo	Déficits de Memória, Atenção e Orientação Espacial	Experiência da Internação Uso de Substâncias Sedativas
Mental	Transtornos de Depressão, Estresse e Ansiedade	Estadia Prolongada Uso de Substâncias Sedativas *Delirium*

Fonte: Elaborado pela autora a partir de Khan *et al.* (2015) e Porhomayon *et al*. (2016).

2.3 Diagnóstico da Síndrome Pós-Terapia Intensiva

Marra *et al*., (2018) citam a presença de dificuldade para realização do diagnóstico da PICS. Isso se deve à variabilidade dos sinais e sintomas, que comprometem principalmente três diferentes domínios, físico, cognitivo e mental, evidenciando a necessidade de atuação de uma equipe multidisciplinar para um diagnóstico mais preciso, bem como para que o processo de reabilitação atenda às necessidades particulares de cada indivíduo.

Major *et al*., (2016), em um consenso internacional de profissionais das mais diversas áreas de saúde experientes em terapia intensiva, consideraram que a triagem deve ser realizada ainda na fase hospitalar, contemplando a avaliação da funcionalidade relacionada às atividades de vida diária (KATZ-ADL/Índice de Barthel), informações relevantes para a recuperação a longo prazo da PICS e a educação de pacientes e familiares sobre a PICS-F são importantes para o processo diagnóstico e manejo terapêutico. Os autores descreveram também componentes de interesse a serem rastreados no período de alta hospitalar (Quadro 2).

Quadro 2 - Componentes de interesse de rastreamento de informações no momento da alta hospitalar

Classificação dos componentes de interesse		
Essenciais	**Muito importantes**	**Adicionais**
• Nível funcional pré-morbidade • Progressão da cura durante a estadia hospitalar (mental/cognitiva/física) • Situação atual (mental/cognitivo/físico)	• Comorbidades • Sintomas psiquiátricos prévios a UTI • Delirium • Diagnóstico de fraqueza muscular adquirida na UTI (MRC≤48) pontos	• Características específicas dos pacientes e/ou familiares • Fatores ambientais • Dias de imobilismo • Tipo de cirurgia (se aplicável)

	• Tempo de internação hospitalar e na UTI • Severidade da doença • Complicações durante a estadia hospitalar • Resposta fisiológica ao exercício	

Fonte: Elaborado a partir de adaptação de Major *et al.* (2016).

Centros de reabilitação específicos para esta população são escassos e necessitam de equipes treinadas sobre o contexto da variabilidade de sinais e sintomas associados a permanência em terapia intensiva, além de habilidades diagnóstica e terapêutica, incluindo profissionais de diversas áreas, como médico, equipe de enfermagem, fisioterapeuta, terapeuta ocupacional, fonoaudiólogo, nutricionista, psicólogo, garantindo uma ampla assistência (KHAN *et al*., 2015; LASITER *et al*., 2016).

Muitos autores ao se referirem a PICS, utilizam os termos sobreviventes a cuidados críticos ou sobreviventes a doença ou estado crítico, para delimitar uma condição após a alta hospitalar, mostrando que independente da presença ou diagnóstico da PICS, após permanência em UTI, faz-se imprescindível que o tratamento deste perfil de pacientes seja em torno da reabilitação funcional (HERRIDGE, 2011; ELLIOT *et al*., 2011; JACKSON *et al*., 2012; GRANJA *et al*., 2012; BERNEY *et al*., 2012; CALVO-AYALA *et al*., 2012; DENEHY *et al*., 2014; BATTERHAM *et al*., 2014; CONNOLLY *et al*., 2015; CONNOLLY *et al*., 2016; VITACCA *et al*., 2016; PARRY *et al*., 2017; SHELLY *et al*., 2017).

2.4 Instrumentos de Avaliação

No consenso internacional publicado por Major *et al*., (2016), além da recomendação de instrumentos para triagem, os autores apresentam sugestões de medidas de avaliação, objetivos e modalidades terapêuticas para os comprometimentos funcionais associados a PICS.

Consensualmente, os objetivos principais da fisioterapia foram a melhora da capacidade funcional desses pacientes, aumento da força muscular esquelética e respiratória, visando alcançar uma melhora na execução de atividades de vida diária e na qualidade de vida (MAJOR *et al*., 2016).

Em relação aos instrumentos avaliativos, os especialistas sugerem o Teste de Caminhada de 6 minutos (TC6) para mensurar o desempenho cardiorrespiratório e para definir a intensidade do exercício associado à escala de Borg modificada para percepção de esforço. Na avaliação da capacidade funcional ao exercício os autores indicam o instrumento *Short Physical Performance Battery* (SPPB) que também vem sendo bastante adotado nos ensaios clínicos que ainda estão em curso. Para quantificar a mobilidade funcional, o *Time Up and Go Test* (TUG) foi indicado como importante marcador. Os autores recomendam a utilização da Dinamometria Manual e da Manovacuometria para avaliação da musculatura periférica e respiratória. Quanto a avaliação da qualidade de vida, o questionário SF-36 foi consensualmente classificado como método de análise muito importante (MAJOR *et al*., 2016).

Após a publicação do consenso em 2016, diante de discordâncias na literatura referentes à apropriação dos instrumentos de mensuração, uma recente revisão sistemática realizada por Robinson *et al.,* (2017) investigou as ferramentas empregadas na avaliação de pacientes sobreviventes ao estado crítico, tendo como estratégia descrever a validade, confiabilidade e responsividade de 21 instrumentos utilizados em pelo menos dois estudos envolvendo essa população.

Tendo em vista a necessidade de disseminar ferramentas e programas estatísticos para o rastreamento de disfunções, tratamento adequado das alterações funcionais e para fornecimento de subsídios a pesquisa para população de pacientes sobreviventes a insuficiência respiratória aguda e Síndrome da Angústia Respiratória Aguda (IRA / SARA), um grupo de pesquisadores liderados por Needham, PhD, Diretor do *Outcomes After Critical Illness and Surgery* (OACIS) da Escola de Medicina

da Universidade Johns Hopkins, receberam uma bolsa do *National Heart, Lung and Blood Institute* (NHLBI).

A iniciativa deste grupo de pesquisadores gerou o projeto intitulado *"Improving Long-Term Outcomes Research for Acute Respiratory Failure"*, com o objetivo de criar recursos para pesquisadores que conduzem o acompanhamento de pacientes sobreviventes a IRA/SARA. Em 2018, pesquisadores do NHBLI (PubMed) recomendaram especificamente o *Core Outcome Measurement Set* (COMS) deste projeto para todos os estudos que avaliam os resultados dos pacientes pós-hospitalares.

Além disso, uma conferência do consenso da *Society of Critical Care Medicine* de 2019 sobre a avaliação da PICS em pacientes adultos sobreviventes a internação na UTI recomendou os instrumentos do COMS do *Improvelto* para rastreio de disfunções dessa população.

Tendo como referência as bases *Core Outcome Measures in Effectiveness Trials Initiative* (www.comet-initiative.org/) e o *National Institutes of Health-funded Improve LTO project* (www.improvelto.com/) analisou-se os instrumentos descritos para avaliação de alterações da função nos domínios físico, mental e cognitivo. A análise considerou os desfechos testados, propriedades psicométricas, quantidade de artigos publicados descrevendo o uso do instrumento e tempo estimado de execução da avaliação. Diante desses instrumentos pré-selecionados, investigou-se a presença de versão validada para a população brasileira nas bases cientificas. Como resultado, consideramos que nove instrumentos de avaliação podem ser capazes de rastrear alterações da função nos domínios físico, mental e cognitivo de pacientes sobreviventes a doença crítica na população brasileira (QUADRO 3), e que serviram de base para uma estratégia de avaliação multidimensional, após consenso entre os pesquisadores do presente estudo.

Quadro 3 – Objetivos e medidas de desfecho para a fisioterapia após estado crítico usados na população brasileira

Desfecho	Instrumento	Propriedades Psicométricas dos instrumentos*	Tempo estimado*	População Brasileira
Função Pulmonar	Espirômetro	Nenhuma avaliação concluída	30 minutos	Pereira *et al*., 2007
Capacidade Pulmonar	Ventilometria	Nenhuma avaliação concluída	15 minutos	Fernandez *et al*., 2020
Força muscular respiratória	Manovacuometria	Nenhuma avaliação concluída	20 minutos	Pessoa *et al*., 2014
Força muscular periférica	Medical Research Council	Nenhuma avaliação concluída	10 minutos	Rodrigues *et al*., 2010
Força muscular esquelética em membros	Dinamometria de preensão palmar	Nenhuma avaliação concluída	5 minutos	Novaes *et al*., 2009
Funcionalidade relacionada às atividades de vida diária	Índice de Barthel	Nenhuma avaliação concluída	3 minutos	Araújo *et al*., 2007
Mobilidade Funcional	Escala Perme	Nenhuma avaliação concluída	60 minutos	Pereira *et al*., 2019

Estresse Pós-Traumático	Escala do Impacto do Evento-Revisada	**COSMIN de Bienvenu, 2013** <u>Consistência Interna</u> (*α Cronbach's* 0.96, n=60); COMIN: RUIM <u>Validade de Critério</u> (Pearson r=0.80, Spearman r=0.69); COSMIN: RAZOÁVEL	6 minutos	Caiuby *et al*., 2012
Ansiedade e Depressão	Escala Hospitalar de Ansiedade e Depressão	**COSMIN de Sukantarat, 2007** <u>Consistência Interna</u> (*α Cronbach's* 0.83 e 0.86 para ansiedade; 0.82 e 0.86 para depressão) n =51; COSMIN: RUIM **COSMIN de Jutte, 2015** <u>Consistência Interna</u> (*α Cronbach's* 0.79 e 0.70 para ansiedade e depressão) n=60; COSMIN: BOM <u>Validade de Constructo</u> Comparado ao EQ-5D, correlação de Spearman para Ansiedade 0.54 e para Depressão 0.41. Comparada a *Medical Outcomes Study Short Form -36* (*Social Functioning , Vitality , Role Emotional & Mental Health*) correlação de	8 minutos	Botega *et al*., 1998

		Spearman 0.48 a 0.70, p<0.0005 para todos os testes, n=151)		
Cognição	Mini Mental	**COSMIN de Pfoh, 2015** Validade de critério Especificidade ≥93% Sensibilidade 19-37%. Cada domínio correlacionado a *The Cognitive Test Battery* (r=0.09 - 0.34), n=242; COSMIN: BOM	8 minutos	Da Silva *et al.*, 2010

* Segundo descrição disponível no site do *Improvelto*

Fonte: Elaborado a partir do site da Improvelto. Disponível em: https://www.improvelto.com/. Acesso em: ago. 2018.

3 OBJETIVO GERAL

Avaliar e descrever o impacto do processo de internação em UTI nos domínios físicos, mental e cognitivo, bem como, definir as principais variáveis mais relacionadas à funcionalidade de pacientes sobreviventes a UTI a partir de uma análise de componentes principais.

3.1 Objetivos específicos

- Descrever as características sociodemográficas dos pacientes;
- Apresentar os fatores clínicos relacionados a internação na UTI;
- Retratar o status funcional de pacientes sobreviventes a condição crítica no pós-alta imediata da unidade de terapia intensiva, considerando as seguintes variáveis e instrumentos de avaliação:
  - pressões inspiratória e expiratórias máximas (Manovacuometria)
  - força de preensão palmar (Dinamometria de preensão manual);
  - função pulmonar (Espirometria);
  - capacidade vital lenta (Ventilometria);
  - força muscular periférica (*Medical Research Council*);
  - independência funcional (Escala de Barthel);
  - nível de atividade física (Questionário Internacional de Atividade Física);
  - mobilidade funcional (*Perme Intensive Care Unit Mobility Score)*;
  - desempenho cognitivo (Mini Exame do Estado Mental);
  - sintomas de ansiedade e depressão (Escala Hospitalar de Ansiedade e Depressão);
  - sintomas de estresse pós-traumático (Escala do Impacto do Evento);
  - percepção sobre o estado de saúde (Escala de Percepção Global de Mudança);
- Comparar o status de saúde até três meses pré-admissão na UTI e após alta imediata da UTI pela Escala de Barthel;

- Calcular a prevalência das funções preservada ou reduzida após estratificar cada variável por paciente conforme equações de predição de normalidade ou pontos de corte;
- Executar um modelo de análise de componentes principais com para avaliação de mudança da funcionalidade em pacientes sobreviventes ao estado crítico;
- Definir as principais variáveis mais relacionadas à funcionalidade de pacientes sobreviventes a UTI a partir de uma análise de componentes principais.

4 MATERIAIS E MÉTODOS

Desenho, local e período do estudo

Trata-se de um estudo descritivo e transversal, seguido de uma análise exploratória das variáveis analisadas. A coleta de dados foi realizada nas enfermarias do Hospital Miguel Arraes (HMA) na cidade de Paulista, estado de Pernambuco, entre Junho de 2019 até Fevereiro de 2020. O estudo foi aprovado pelo Comitê de Ética em Pesquisa (CEP) da Empresa Brasileira de Serviços Hospitalares / Hospital das Clínicas (EBSERH/HC) conforme Resolução 466/12 e parecer de aprovação n° 3.419.821. Publicado no Registro Brasileiro de Ensaios Clínicos sob número RBR-9wghvc. Contudo, em função de aspectos operacionais a coleta de dados foi efetuada apenas no HMA.

Amostra

A amostra do estudo foi composta por pacientes sobreviventes ao estado crítico, em até 48 horas após a alta da UTI. Após análise prévia dos prontuários na UTI para verificação dos critérios de elegibilidade, os pacientes foram recrutados nas enfermarias do hospital e todos os pacientes que obedeceram aos critérios foram avaliados sistematicamente. Respeitando o sigilo e a confidencialidade dos dados, foi entregue o Termo de Consentimento Livre e Esclarecido (TCLE) e após aceite e assinatura, os pacientes foram convidados a participar do estudo.

Critérios de Elegibilidade

Critérios de inclusão

Foram incluídos pacientes de ambos os sexos, com idade acima de 18 anos, que foram submetidos à ventilação mecânica invasiva por tempo $\geq$ 48 horas; tempo de internação na UTI $\geq$ 72 horas e que aceitasse ser avaliado em até 48 horas após alta da UTI.

Critérios de exclusão

Foram excluídos pacientes com neoplasias ou em paliação, pacientes previamente acamados ou que tiveram alta da UTI sob uso de cânula de

traqueostomia, pacientes iletrados, com alterações cognitivas que limitassem a avaliação, obesidade grau III, disfunção neurológica e/ou cardíaca e/ou ortopédicas prévias ou novo evento neurológico e/ou cardíaco e/ou ortopédico no período da admissão hospitalar à alta da UTI.

Procedimentos para coleta de dados

A coleta de dados foi realizada em duas etapas: A primeira pela análise dos prontuários para identificar a possibilidade de inclusão no estudo. Após a análise foram registradas e coletadas variáveis de interesse para o estudo, como idade, sexo, estado civil, anos de estudo, autodeclaração de raça, renda mensal, religião, hábitos de vida (tabagismo e etilismo), IMC, data de admissão e motivo de internamento. Medicamentos usados na UTI (opióides, sedativos, bloqueadores neuromusculares, drogas vasoativas, corticoides), nível de gravidade e tempo de ventilação mecânica. A segunda etapa se deu pela visita do pesquisador ao leito do paciente na enfermaria num período de até 48 horas após alta da UTI, seguida de avaliação funcional.

A estratégia de avaliação foi aplicada sem uma sequência predeterminada, dependendo da condição clínica e sendo respeitados os intervalos entre a realização de cada teste conforme tolerabilidade dos pacientes.

Instrumentos para avaliação e coleta de dados

Para a avaliação foram adotados os instrumentos descritos a seguir:

Espirometria

A espirometria é o teste da função pulmonar que mede o volume de ar inspirado, o volume de ar expirado e os fluxos respiratórios obtidos por meio de uma manobra denominada capacidade vital forçada (CVF). No presente estudo, foi realizada por meio de um espirômetro portátil digital do fabricante EasyOne® Spirometer, sendo possível verificar a gravidade e as alterações dos padrões ventilatórios. O teste foi realizado de acordo com a metodologia de ATS/ERS (2002), e para comparação com os valores preditivos de normalidade, foram utilizadas as equações para a população brasileira propostas por Pereira *et al.* (2007).

Ventilometria

A ventilometria é um teste não invasivo da função pulmonar, que tem como objetivo mensurar os valores ventilatórios do paciente. Para a avaliação foi utilizada um ventilômetro analógico do fabricante Ferraris Wright® Mark8, Middlesex, Inglaterra. Para mensuração da capacidade vital lenta (CVL), os candidatos foram orientados a inspirar até a capacidade pulmonar total e expirar de forma lenta e prolongada até o volume residual. Um valor de 20ml/kg foi adotado como ponto de corte, pois uma CVL abaixo desse valor pode apresentar risco de complicações pulmonares decorrentes de hipoventilação (FRANÇA et al., 2012).

Manovacuometria

A avaliação da força muscular respiratória inspiratória e expiratória foi realizada através da Manovacuometria. Foi utilizado um manovacuômetro da fabricante GlobalMed®, modelo MVD300. De acordo com Major *et al.* (2016), a medida da PImáx e PEmáx são ferramentas importantes para o acompanhamento de pacientes que sobrevivem a doenças críticas e monitoramento após alta hospitalar. As manobras foram realizadas de acordo com as normas da ATS/ERS (2002). Os valores obtidos foram comparados com os valores previstos e os limites inferiores de normalidade utilizados propostos por Neder *et al.* (1999).

Dinamometria de preensão palmar

A Dinamometria de preensão palmar é um teste de força isométrica que pode ser realizado em pacientes cooperativos e que possuam score MRC acima de 3 para a musculatura do membro superior. Também é utilizado para o diagnóstico da fraqueza muscular adquirida na UTI, em associação com a MRC, a eletromiografia e os estudos de condução nervosa. Para realização do teste foi utilizado um dinamômetro digital da marca Saehan®, modelo DHD-1. Para a realização do teste, foi adotada a posição padrão proposta pela *American Society of Hand Therapists* (ASHT) (1992), enquanto que, para comparação de valores de normalidade aplicou-se os pontos de corte de 7kgf (mulheres) e 11kgf (homens) para diagnóstico de fraqueza adquirida na UTI, propostos por Ali *et al.* (2008) e Bragança *et al.* (2019).

Medical Research Council (MRC-s)

O MRC-s é uma escala confiável e frequentemente utilizada na avaliação da musculatura periférica. É mensurada de forma bilateral nos seguintes grupos musculares: abdutores do ombro, flexores do cotovelo, extensores do punho, flexores do quadril, extensores do joelho e dorsiflexores. A força muscular foi graduada de zero a 5 pontos, sendo zero ausência de contração muscular e 5 para força muscular normal (PEREIRA et al, 2019). A pontuação final varia de 0 (tetraparesia completa) a 60 (força muscular normal), onde uma pontuação igual ou abaixo de 48 é considerada como fraqueza muscular adquirida (INOUE et al, 2019; GOSSELINK et al, 2015).

Índice de Barthel

O Índice de Barthel pertence ao campo de avaliação das atividades da vida diária (AVD's) e mede a independência funcional em situações como alimentação, banho, vestuário, higiene pessoal, eliminações intestinais, eliminações vesicais, uso do vaso sanitário, transferências cama-cadeira, deambulação e uso de escadas (SILVEIRA *et al*, 2019). É pontuado de acordo com o desempenho do paciente em realizar essas tarefas de forma independente, com alguma ajuda ou de forma dependente, atribuindo-se pontos em cada categoria, a depender do tempo e da assistência necessária. A pontuação em cada categoria varia de 0 a 15 em intervalos de cinco pontos, resultando em um score final que varia de 0 a 100 onde as pontuações mais elevadas indicam maior independência. O Índice de Barthel é um instrumento para avaliação de AVD's que apresenta resultados de confiabilidade e validade muito consistente (MINOSSO et al, 2010). Um ponto de corte de 60 no score final da escala de Barthel corresponde ao ponto de transição entre dependência/independência segundo Granger *et al.* (1979) e Sulter, Steen e Keyser *et al.* (1999).

Perme Intensive Care Unit Mobility Score

A *Perme Intensive Care Unit Mobility Score* tem como objetivo verificar a condição de mobilidade funcional do paciente, avaliando-se 15 itens agrupados em 7 categorias: estado mental, potenciais barreiras a mobilidade, força funcional,

mobilidade no leito, transferências, marcha e resistência. A pontuação vai de 0 a 32 pontos; quanto maior o escore, menor a necessidade de assistência (SULTER et al, 1999; PERME et al, 2014). Os pacientes que não atingiram a pontuação máxima em cada categoria, foram classificados como função reduzida.

Escala Hospitalar de Ansiedade e Depressão (HADS)

A Escala Hospitalar de Ansiedade e Depressão possui 14 itens, sendo sete para ansiedade e sete para depressão, apresentando um sistema com uma escala de 0 a 3 pontos para cada questão e dando uma pontuação de 0 a 21 para cada um dos dois parâmetros (SUKANTARAT et al, 2007). É um instrumento de alta sensibilidade que demonstrou sua validade no contexto hospitalar e em pacientes críticos (CAIUBY et al, 2010). Pacientes com uma pontuação ≥ 9 na HADS foram associados à presença de sintomas de ansiedade e depressão segundo o estudo de Marcolino *et al.* (2007).

Escala do Impacto do Evento (IES-R)

A Escala do Impacto do Evento tem sido referida como o instrumento de rastreamento da sintomatologia do transtorno do estresse pós-traumático (TEPT), que demonstra melhor validade discriminante e é uma medida amplamente utilizada em pesquisas sobre esse transtorno em pacientes críticos, podendo ser utilizada em qualquer fase do desenvolvimento dos sintomas (BIENVENU et al, 2013). É uma escala na qual o indivíduo responde as questões baseando-se nos 7 dias anteriores à aplicação. É composta de 22 itens com um total de 88 pontos, onde cada questão varia de 0 a 4 pontos. O cálculo do escore de cada subescala foi realizado segundo o estudo de adaptação transcultural brasileira de Caiuby *et al.,* (2010) e pacientes com uma pontuação ≥ 22 foram associados a presença de sintomas de TEPT segundo o estudo de Rash, *et al.* (2008).

Mini Exame do Estado Mental (MEEM)

O MEEM é constituído de duas partes, uma que abrange memória, atenção, e orientação têmporo-espacial, com pontuação máxima de 21 pontos, e outra que aborda habilidades específicas como nomear e compreender, com pontuação máxima

de 9 pontos, totalizando um escore de 30 pontos. Os valores mais altos do escore indicam maior desempenho cognitivo. O exame aborda questões referentes à memória recente, registro da memória imediata, orientação temporal e espacial, atenção, cálculo e linguagem. Para classificar o desempenho cognitivo como preservado ou afetado, foi adotado uma pontuação de corte padrão de 24, e para indivíduos com menos de 4 anos de escolaridade, o ponto de corte descia para 18 (BERTOLUCCI et al, 1994).

Análise dos dados

No decorrer da coleta de dados, estes foram armazenados em uma planilha no Excel XP 2010 Microsoft®. A análise estatística foi realizada através do *software* estatístico *Statistical Package for the Social Sciences* (SPSS) versão 20.0, com aplicação deteste de normalidade *Kolmogorov-Smirnov* para variáveis quantitativas.

A análise estatística descritiva foi realizada através de medidas de média, desvio padrão para variáveis paramétricas ou mediana e percentil 25 e percentil 75 para as variáveis não paramétricas quantitativas e porcentagem para as variáveis qualitativas.

Também foram calculadas as frequências das funções preservadas e das funções reduzidas, utilizando equações de predição ou pontos de cortes, cujas proporções foram comparadas pelo teste de hipótese para proporções “qui-quadrado” de *Pearson*, utilizando-se um nível de significância para p-valor <0,05. Para as comparações entre os valores da escala de Barthel pré-admissão e após a alta foi utilizado o teste *Wilcoxon*.

Para realização da análise de componentes principais, deve-se inicialmente padronizar as variáveis com a mesma unidade de medida através da seguinte fórmula:

$$Valor\ padronizado = \frac{Xi - média\ de\ X}{Desvio\ padrão\ de\ X}$$

Onde “X” é a variável a ser padronizada.

A posteriori, gerou-se a matriz de correlação e os testes de *Kaiser-Meyer-Olkin* (KMO*)* e o *de esfericidade de Bartlett,* foram realizados para verificação de correlação e significância. Segundo Kaiser (1974) valores acima de 0,5 são adequados para análise de componentes principais. Já o teste de esfericidade de Barlett fornece o p-

valor, que em caso de significância, expressa a existência de mais de uma correlação significante na matriz de correlação.

A escolha das variáveis principais obedeceu aos seguintes critérios:

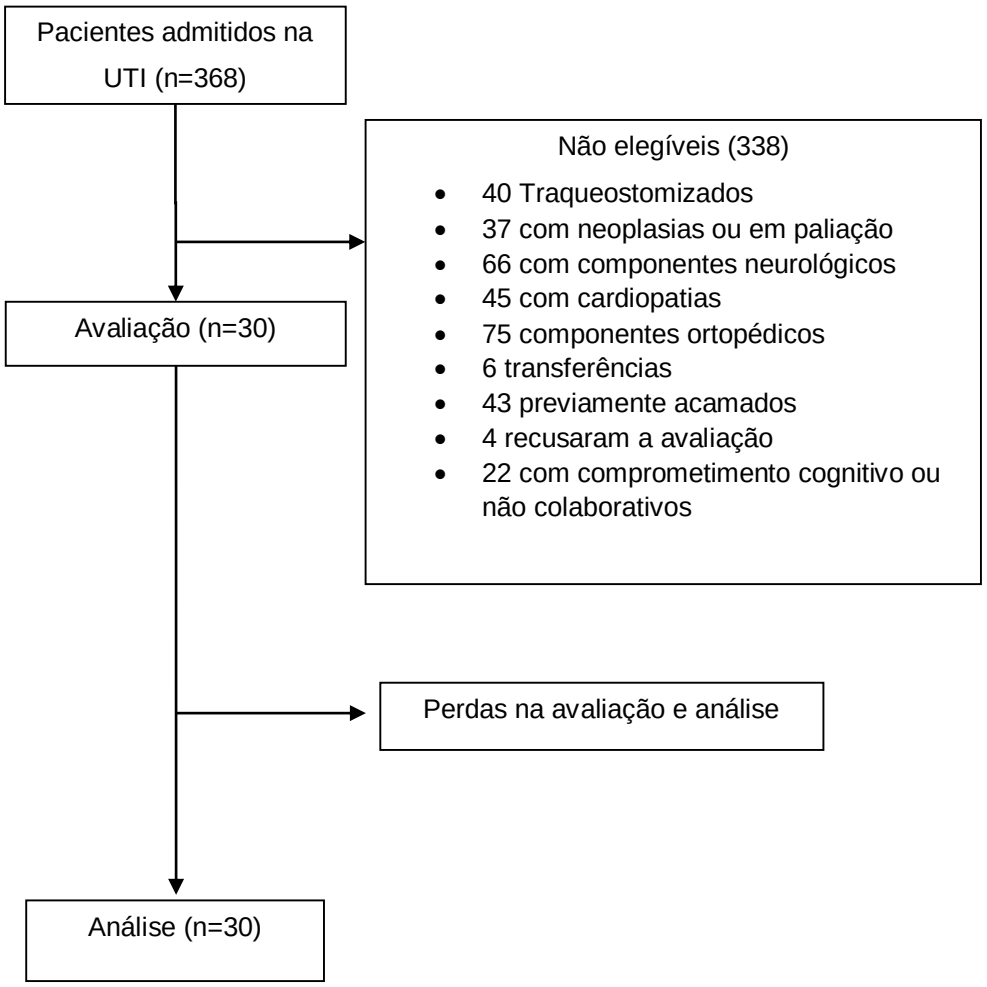
- Valor de *eigenvalues* >1 na tabela de variância total explicada.
- Observar no gráfico *scree plot* o local onde os *eigenvalues* fazem uma representação de um “*elbow*”.

Por fim, através da análise de rotação oblíqua foi possível definir as variáveis principais, considerando as que possuíam maior carga fatorial dentro de cada componente.

5 RESULTADOS

O fluxograma de captação dos pacientes segue na Figura 2.

Figura 2 - Fluxograma de captação dos pacientes



Fonte: Dados da pesquisa (2020).

Este estudo resultou na elaboração de 2 artigos originais, apresentados nos Apêndices.

ARTIGO 1

FUNCTIONAL STATUS OF CRITICALLY ILL SURVIVORS AT IMMEDIATE INTENSIVE CARE UNIT DISCHARGE a ser submetido à revista *Journal of Critical Care,* percentil (80%) e fator de impacto (5.30).

ARTIGO 2

ANALYSIS OF PRINCIPAL COMPONENT AS A METHODOLOGICAL TOOL IN SCREENING OF DYSFUNCTIONS IN PATIENTS SURVIVING ICU INTERVENTION a ser submetido à revista *Disability and Rehabilitation,* percentil (83%) e fator de impacto (4.58).

6 CONSIDERAÇÕES FINAIS

Este estudo trouxe aspectos importantes no processo de avaliação do paciente sobrevivente à condição crítica após a alta da UTI, mas ainda sob internação hospitalar. O primeiro artigo retrata que, a maioria dos pacientes com tempo de VM até três dias e internação até sete dias, apresentam disfunções funcionais e respiratórias, mesmo recebendo assistência fisioterapêutica respiratória e motora durante o período de internação na UTI. Nossos dados revelam uma condição de pós-alta imediata da UTI, definida dentro de 24-48 horas, não havendo dados da funcionalidade durante a permanência em ambiente crítico.

Tal fato atenta para a necessidade da continuidade do cuidado e reabilitação na unidade de internação. Ressalta-se que, em muitos serviços não é comum a prescrição de fisioterapia após alta da UTI em pacientes que “aparentemente” encontram-se em quadro geral estável e responsivos. Nossos pacientes foram capazes de compreender comandos verbais para execução de testes e responder questões relacionadas a orientação espacial, estresse pós-evento, sintomas relacionados à ansiedade e depressão.

Uma estratégia de avaliação multidimensional capaz de detectar mudanças funcionais é imprescindível durante internação na UTI, permanência hospitalar e no pós-alta para o domicilio. A estratégia utilizada neste estudo representa um consenso dos pesquisadores envolvidos após análise de medidas psicométricas dessas avaliações quando aplicada a pacientes com Insuficiencia Respiratória.

Ao aplicar a análise de componentes principais à esta estratégia multidimensional evidenciou-se que os domínios físicos e mentais são mais sensíveis a alteração da funcionalidade e em nosso perfil amostral a avaliação da CVL, Mini-mental, o FPP e MRC não trouxeram contribuições na variação dos dados, o que sugere que poderiam ser suprimidos da avaliação, o que deve ser observado com cautela, quando aplicado a diferentes perfis populações.

Estudos futuros com diferentes populações e/ou incluindo diferentes tipos de estratégias de avaliação devem ser incentivados para o rastreamento de disfunções de pacientes sobreviventes ao estado crítico de modo a melhor planejar a terapêutica e redução de danos.

O presente estudo teve a coleta de dados interrompida por solicitação da diretoria hospitalar devido a pandemia em vigência pelo SARS-COV-2.

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APÊNDICE A – TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO (TCLE)

HOSPITAL DAS CLÍNICAS DA UFPE
FILIAL DA EMPRESA BRASILEIRA
DE SERVIÇOS HOSPITALARES

TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO

(PARA MAIORES DE 18 ANOS OU EMANCIPADOS)

Convidamos o (a) Sr. (a) para participar como voluntário (a) da pesquisa "Eficácia de um protocolo de tratamento fisioterapêutico na qualidade de vida e na função física de adultos sobreviventes a internação em terapia intensiva - ensaio clínico randomizado controlado", que está sob a responsabilidade da pesquisadora Shirley Lima Campos, Telefone 81- 2126-7383, e-mail: shirleylcampos@uol.com.br , Endereço: Av. Jorn. Aníbal Fernandes, 173 - Cidade Universitária, Recife - PE, CEP 50740-560.

Também participam desta pesquisa os pesquisadores: Alice Miranda dos Santos, Telefone (81) 99717 4074; e-mail: alicemsantos08@gmail.com, Endereço: Av. Jorn. Aníbal Fernandes, 173 - Cidade Universitária, Recife - PE, CEP 50740-560 e está sob a orientação de Shirley Lima Campos, Telefone 81- 2126-7383, e-mail: shirleylcampos@uol.com.br , Endereço: Av. Jorn. Aníbal Fernandes, 173 - Cidade Universitária, Recife - PE, CEP 50740-560.

Todas as suas dúvidas podem ser esclarecidas com o responsável por esta pesquisa. Apenas quando todos os esclarecimentos forem dados e você concorde com a realização do estudo, pedimos que rubrique as folhas e assine ao final deste documento, que está em duas vias. Uma via lhe será entregue e a outra ficará com o pesquisador responsável.

Você estará livre para decidir participar ou recusar-se. Caso não aceite participar, não haverá nenhum problema, desistir é um direito seu, bem como será possível retirar o consentimento em qualquer fase da pesquisa, também sem nenhuma penalidade.

INFORMAÇÕES SOBRE A PESQUISA:

- A proposta do projeto de pesquisa é oferecer tratamento fisioterapêutico para pacientes que permaneceram na Unidade de Terapia Intensiva (UTI) e que necessitam de reabilitação funcional após a alta hospitalar em função de dificuldades na realização de atividades cotidianas e básicas da vida diária, com sintomas como fraqueza muscular, problemas de equilíbrio, fadiga, e que se encontram impossibilitados de desenvolver suas atividades domésticas e profissionais. Os pacientes podem ser incluídos no grupo controle ou no grupo intervenção. O grupo intervenção é composto por exercícios para aumento da força muscular, melhora do equilíbrio, melhora na realização das atividades domésticas e profissionais. O grupo controle receberá um manual de exercícios funcionais que serão explicados presencialmente pelo fisioterapeuta e devem ser realizados a domicílio. Os pacientes do grupo intervenção também participarão de atividades em grupo com momentos de educação em saúde.
- Para os dois grupos, os pacientes serão tratados durante oito semanas de tratamento. Os atendimentos do grupo intervenção acontecerão no ambulatório de fisioterapia do hospital das clínicas da Universidade Federal de Pernambuco, três vezes por semana em horários agendados no período da tarde (segunda-feira, terça-feira e quarta-feira).
- Os riscos envolvidos neste estudo estão relacionados a prática de exercícios físicos. Os eventos que podem ocorrer são: sensação de fadiga muscular, dor muscular tardia induzida por exercício, náusea, vertigem, dispneia, queda na saturação parcial de oxigênio (SpO2). Para minimizar os riscos decorrentes da prática dos exercícios, os pacientes serão monitorados frequentemente por meio da escala subjetiva de esforço de Borg, e por meio de oximetria de pulso para verificação da SpO2 e frequência cardíaca. Caso a percepção de esforço chegue a mais de 7 pontos, a SpO2 chegue a menos de 80%, ou a frequência cardíaca atinja mais de 90% da frequência cardíaca máxima, o exercício será interrompido. No caso de intercorrência, as medidas de emergência necessárias serão tomadas. O ambulatório de fisioterapia do Hospital das Clínicas conta com todo o equipamento necessário para os primeiros socorros, como cilindros de oxigênio, desfibriladores e profissionais capacitados para o atendimento. Entretanto, as chances de uma intercorrência desta magnitude acontecer em um ambiente controlado são mínimas.
- A partir dos resultados obtidos nesta pesquisa, esperamos elaborar um protocolo utilizável para a recuperação de pacientes críticos que passaram pela UTI, colaborando positivamente para a recuperação

e reinserção dos pacientes com as limitações ocasionadas pela permanência na UTI no ambiente familiar, profissional e social, além de melhorar a qualidade de vida. Além disso, uma melhoria no quadro funcional do paciente no contexto pós-UTI pode reduzir de forma importante o índice de reincidência da internação ou o surgimento de complicações de saúdes decorrentes das sequelas desenvolvidas durante a internação na UTI que possam levar o paciente a um maior risco de retorno ao hospital ou até mesmo à morte.

Todas as informações desta pesquisa serão confidenciais e serão divulgadas apenas em eventos ou publicações científicas, não havendo identificação dos voluntários, a não ser entre os responsáveis pelo estudo, sendo assegurado o sigilo sobre a sua participação. Os dados coletados nesta pesquisa (imagens e questionários), ficarão armazenados em computador pessoal, sob a responsabilidade da pesquisadora Shirley Limpa Campos, no endereço acima informado, pelo período de mínimo 5 anos. Nada lhe será pago e nem será cobrado para participar desta pesquisa, pois a aceitação é voluntária, mas fica também garantida a indenização em casos de danos, comprovadamente decorrentes da participação na pesquisa, conforme decisão judicial ou extrajudicial. as informações desta pesquisa serão confidenciais e serão divulgadas apenas em eventos ou publicações científicas, não havendo identificação dos voluntários, a não ser entre os responsáveis pelo estudo, sendo assegurado o sigilo sobre a sua participação. Os dados coletados nesta pesquisa ficarão armazenados em computador pessoal sob a responsabilidade da pesquisadora Shirley Lima Campos no endereço acima informado, pelo período de mínimo 5 anos.

Nada lhe será pago e nem será cobrado para participar desta pesquisa, pois a aceitação é voluntária, mas fica também garantida a indenização em casos de danos, comprovadamente decorrentes da participação na pesquisa, conforme decisão judicial ou extra-judicial. Se houver necessidade, as despesas para a sua participação serão assumidas pelos pesquisadores (ressarcimento de transporte e alimentação).

Em caso de dúvidas relacionadas aos aspectos éticos deste estudo, você poderá consultar o Comitê de Ética em Pesquisa Envolvendo Seres Humanos da UFPE no endereço: **(Avenida Prof. Moraes Rego s/n – 3º Andar- Cidade Universitária, Recife-PE, Brasil CEP: 50670-420, Tel.: (81) 2126.3743 – e-mail: cephcufpe@gmail.com).** Esta pesquisa também foi aprovada pelo Comitê de Ética em Pesquisa (CEP) do IMIP. Se você tiver alguma consideração ou dúvida sobre esta pesquisa, entre em contato com o comitê de Ética em Pesquisa Envolvendo Seres Humanos do IMIP (CEP-IMIP) que objetiva defender os interesses dos participantes, respeitando seus direitos e contribuir para o desenvolvimento da pesquisa desde que atenda às condutas éticas.

O CEP-IMIP está situado à **Rua dos Coelhos, nº 300, Boa Vista. Diretoria de Pesquisa do IMIP, Prédio Administrativo Orlando Onofre, 1º Andar tel: (81) 2122-4756 – Email: comitedeetica@imip.org.br O CEP/IMIP** funciona de 2ª a 6ª feira, nos seguintes horários: 07:00 às 11:30 h e 13:30 às 16:00h.

_____

(assinatura do pesquisador)

CONSENTIMENTO DA PARTICIPAÇÃO DA PESSOA COMO VOLUNTÁRIO (A)

Eu, _____, CPF _____, abaixo assinado, após a leitura (ou a escuta da leitura) deste documento e de ter tido a oportunidade de conversar e ter esclarecido as minhas dúvidas com o pesquisador responsável, concordo em participar do estudo "Eficácia de um protocolo de tratamento fisioterapêutico na qualidade de vida e na função física de adultos sobreviventes a internação em terapia intensiva - ensaio clínico randomizado controlado como voluntário (a). Fui devidamente informado (a) e esclarecido (a) pelo(a) pesquisador (a) sobre a pesquisa, os procedimentos nela envolvidos, assim como os possíveis riscos e benefícios decorrentes de minha participação. Foi-me garantido que posso retirar o meu consentimento a qualquer momento, sem que isto leve a qualquer penalidade (ou interrupção de meu acompanhamento/ assistência/tratamento).

Impressão digital (opcional)

Local e data _____

Assinatura do participante: _____

Presenciamos a solicitação de consentimento, esclarecimentos sobre a pesquisa e o aceite do voluntário em participar. (02 testemunhas não ligadas à equipe de pesquisadores):

Nome:	Nome:
Assinatura:	Assinatura:

APÊNDICE B – ARTIGO 1

FUNCTIONAL STATUS OF CRITICALLY ILL SURVIVORS AT IMMEDIATE INTENSIVE CARE UNIT DISCHARGE

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ABSTRACT

OBJECTIVE: Analyze the physical, mental and cognitive function of mechanically ventilated adult patients after immediate discharge from the Intensive Care Unit (ICU).

METHODS: This is a cross-sectional study, carried out in critical survivors, of both sexes, after discharge from the ICU, with previous use of invasive mechanical ventilation ≥ 48 hours. Patients underwent a multidimensional functional assessment strategy comprising: Spirometry, Ventilometry, Manovacuometry, Handgrip strength, Medical Research Council, Barthel Index, Perme Intensive Care Unit Mobility Score, Hospital Anxiety and Depression Scale, Events Impact Scale -Reviewed and Mini Mental State Examination. The binomial test was applied to compare the proportions of the preserved and reduced functions in the sample, admitting $p < 0.05$.

RESULTS: 30 patients, 50% male, 52.2 (18.1) years old, with APACHE II predictive mortality score 28.4 (6.34) points. Among the variables evaluated, Capacity Vital Forced and score of Perme were reduced (83.3% and 90%, respectively; both $p < 0.001$). With no differences between the proportions, the MIP was reduced by 60% ($p = 0.58$), while the MRC was preserved in 53.67% of the cases ($p = 0.855$). When comparing self-reported functional status within three months prior to admission to the ICU and applied after immediate discharge from the ICU, significance was observed in the total Barthel score ($p < 0.01$) and in all domains.

CONCLUSION: The proportion of critical survivors is high, who at immediate discharge from the ICU have reduced respiratory, mobility and functional independence functions.

KEYWORDS: Critical Care. Functionality. Functional State. Critical Patient.

INTRODUCTION

Technological advances related to the care of critically ill patients are increasingly providing a reduction in mortality in the Intensive Care Unit (ICU) [1]. However, patients who survive ICU admission frequently have dysfunctions that can lead to reduced quality of life after hospitalization [2].

It is estimated that approximately 50% of patients undergoing invasive mechanical ventilation have reduced physical function, in addition to mental and cognitive dysfunction that are associated with a worse prognosis after discharge from the ICU and present in a combined or isolated manner. In addition to the functional impact, these disorders have socioeconomic repercussions, as approximately 33% of critical survivors are unable to return to their work activities within one year after hospital discharge [3].

The most frequent physical dysfunctions in this population include reduced mobility and functional independence, decreased respiratory and peripheral muscle strength, in addition to impaired lung volumes and capacities. These dysfunctions are manifested through symptoms such as fatigue, dyspnea and muscle weakness that make it difficult to perform activities of daily living [4,5].

Individuals may also have cognitive deficits that present themselves through reduced memory, inability to develop logical reasoning, concentration and attention, in addition to interfering with the information processing capacity [2, 6,7,8]. Additionally, these individuals may present symptoms of anxiety, depression and post-traumatic stress disorder [9].

The different levels of impairment can characterize the Post-Intensive Care Syndrome (PICS) that manifest themselves in an isolated or combined way through physical, mental and cognitive signs and symptoms. These affections are directly related to clinical, social and economic repercussions, as the affected individuals experience the difficulty of being actively reinserted in society [10].

Related to these deficiencies, ICU survivors commonly also have impaired quality of life, delayed return to work and increased use of health services. The evaluation of patients on immediate discharge from the ICU provides a better understanding of the disease processes, functional changes resulting from hospitalization and the consequences of the intervention in the studied population. Consequently, the appropriate selection and definition of outcome measures are essential for planning and indicating the need for rehabilitation and can also be useful in health management programs [11].

Therefore, preventive strategies should be used during hospitalization and multiprofessional screening for risk factors or clinical conditions that predict declining functionality should be performed at the time of admission to the ICU, with the aim of improving the quality of care and directing care. clinical treatment to improve the quality of life of critical survivors [12,13].

However, the task of identifying the factors associated with the development of PICS is a challenge, as this clinical condition manifests itself from a high variability of signs and symptoms and different degrees of impairment. A recently published scope review found that there was no standardization of tools aimed at detecting dysfunctions that frequently affect critical surviving patients [14].

The heterogeneity in measuring instruments, result definitions, and covariates used creates a great barrier in the synthesis of the existing literature and in the conduct of clinical practice [15,16]. This scenario makes it difficult to understand the main dysfunctions, their different presentations and their impact on health-related quality of life after hospitalization.

The literature is generally focused on screening for isolated disorders or with some associated disorders within the ICU or after hospital discharge. Prospective studies are still scarce or do not cover a global strategy to assess the functional status of patients surviving the critical condition still under hospitalization. Thus, this study aims to track the main dysfunctions associated with critical survivors immediately after discharge from the ICU, through a multidimensional assessment strategy, covering physical, mental and cognitive function.

MATERIALS AND METHODS

This is a cross-sectional study, carried out in the wards of Hospital Miguel Arraes (HMA) in the metropolitan region of Recife, state of Pernambuco, from June 2019 to February 2020. The ICU of the hospital where the data collection was performed has professionals physiotherapists for 24 h, having motor physiotherapy protocol twice a day and respiratory physiotherapy three times a day.

The study was approved by the Research Ethics Committee (CEP) of the Brazilian Hospital Services Company / Hospital das Clínicas (EBSERH / HC) according to Resolution 466/12 and approval opinion Nº. 3,419,821. Published in the Brazilian Registry of Clinical Trials under number RBR-9wghvc.

After previous analysis of the medical records in the ICU to verify the eligibility criteria, patients were recruited from the HMA wards, within 48 hours after discharge from the ICU.

Respecting the secrecy and confidentiality of the data, the Free and Informed Consent Term (ICF) was delivered and explained and after acceptance and signature, patients were invited to participate in the study.

Patients of both sexes, aged over 18 years, who underwent invasive mechanical ventilation for> 48 hours were included; length of stay in the ICU> 72 hours and who agreed to be evaluated within 48 hours after discharge from the ICU.

Patients with neoplasms or palliation were excluded, patients who were previously bedridden or who were discharged from the ICU using a tracheostomy cannula, illiterate patients, with cognitive changes that limited their assessment, grade III obesity, neurological and / or cardiac and / or orthopedic dysfunction previous or new neurological and / or cardiac and / or orthopedic events during the period of hospital admission to discharge from the ICU.

After recording sociodemographic variables, age, sex, marital status, years of study, self-declaration of race, monthly income, religion, lifestyle (smoking and drinking), Body Mass Index (BMI), admission date and reason for hospitalization , medicines used in the ICU (opioids, sedatives, neuromuscular blockers, vasoactive drugs, corticosteroids), severity level and duration of mechanical ventilation, the researcher performed the functional assessment at the bedside in the inpatient unit within a period of up to 48 hours after discharge of the ICU.

The level of physical activity prior to admission was assessed using the IPAQ (International Physical Activity) questionnaire and the measure to assess the severity of a critical patient was the Acute. Physiology and Chronic Health Evaluation II (APACHE II).

The multidimensional evaluation strategy was elaborated based on the clinimetric properties of each instrument, evaluated outcome, number of published articles and validation for the studied population selected from the Core Outcome Measures in Effectiveness Trials Initiative (www.comet-initiative.org/) and the National Institutes of Health-funded Improve LTO project (www.improvelto.com/).

Physical function was composed of five components, pulmonary ventilatory values, respiratory muscle strength, Handgrip strength, peripheral muscle strength, Functional Independence and Functional mobility. For mental function, post traumatic stress, anxiety and depression; for cognitive function, aspects of Orientation, attention, memory, language and visual-spatial skills.

The application protocols and the reference equation / cutoff point for analysis of Spirometry, Ventilometry, Manovacuometry, Handgrip Strength, Medical Research Council, Barthel Index, Perme Intensive Care Unit Mobility Score, Event Impact Scale, Hospital Anxiety and Depression Scale and Mini Mental State Exam are listed in Table 1.

From the cutoff points or the reference equations, the performance in each test was compared with the predicted data. When the performance obtained a value compatible with the predicted value, the function was classified as preserved and when the performance was lower than expected or below the cutoff point, this function was classified as reduced function.

Statistical analysis was performed using the statistical software Statistical Package for the Social Sciences (SPSS) version 20.0, with descriptive analysis using measures of mean, standard deviation or median and 25th and 75th percentiles for quantitative variables and percentage for qualitative variables.

The frequencies of the preserved and reduced functions were also calculated, whose proportions were compared by the binomial test for proportions. For comparisons between the values of the Barthel scale before admission and after discharge, the Wilcoxon test was used. For all tests, a significance level of p-value <0.05 was adopted.

RESULTS

368 patients were assessed for eligibility and 30 volunteers met the inclusion criteria. The patient flowchart is shown in figure 1. The clinical characteristics of the 30 volunteers analyzed in the study are described in table 2.

As for the clinical profile (Table 3), patients had an average hospital stay of 15 days, of which 10 were hospitalized in the ICU. They had an average of six days of invasive mechanical ventilation and 70% were admitted to the ICU due to a surgical procedure. Approximately 64% of the sample has preexisting comorbidities (Systemic Arterial Hypertension, Diabetes Mellitus, Chronic Obstructive Pulmonary Disease, Asthma and Chronic Kidney Injury). All patients evaluated presented some type of organic dysfunction, such as renal failure, need for blood products and parenteral nutrition.

Table 4 shows the multidimensional assessment measures in hospitalized patients who survived ICU admission in the physical, mental and cognitive domains. Significant data were observed through the binomial test, between reduced and preserved function with respect to Forced Vital Capacity, Perme Scale, Slow Vital Capacity and Hand Grip strength.

Figure 2 represents the comparison between self-reported health status in up to 3 months pre-admission to the ICU and the data assessed after immediate discharge from the ICU using the Barthel Index, the total score had a value of p <0.001, as well as all sub-items.

DISCUSSION

The main findings of the present study involving patients surviving ICU admission were:

(1) The multidimensional evaluation allowed to detect dysfunction of the respiratory capacity, mobility and functional independence of patients surviving the critical condition, inserted in a scenario with multidisciplinary assistance, including routine physical therapy immediately after discharge from the ICU.

The synthesized evaluation model allowed to trace a reduction in respiratory function for Forced Vital Capacity (FVC), inspiratory muscle strength (Maximum Inspiratory Pressure), functional mobility (Perme Scale) and functional independence (Barthel Index). The dysfunctions found may be a reflection of factors related to stay in the ICU such as the time of invasive mechanical ventilation, length of stay in the ICU, sepsis and use of sedative drugs [17]. Our results are influenced by a scenario in which all patients had organ dysfunction, used analgesia and remained in the ICU for more than seven days, and in addition most of the individuals had a clinical diagnosis of sepsis and pneumonia.

Approximately 84% of the evaluated patients had a restrictive ventilatory pattern, evidenced by the reduced FVC value, when compared to the values predicted for each individual. The clinical characteristics of the individuals point to a sample of middle-aged, overweight, sedentary (68.8%), associated comorbidities (63%) and smoking habits (43.3%), factors that are related to low FVC and consequently may imply a reduction in total lung capacity [18,19].

In the present study, all patients received physical therapy during their stay in the ICU, two motor physical therapy sessions and three respiratory physical therapy sessions per day, a factor that may have contributed to the fact that the losses after hospitalization were not greater in these outcomes. The results presented for inspiratory muscle strength (MIP) signal the installation of muscle impairment that is generally associated with restrictive, obstructive and neuromuscular diseases [20]. The values of the maximum respiratory pressures achieved are compatible with the suspicion of respiratory muscle weakness, but must be confirmed by other methods, because manovacuometry is not sensitive for the diagnosis as it is a volitional method [21].

The process of hospitalization in an ICU, in most cases, is accompanied by functional decline. From admission to hospital discharge, the patient is submitted to a series of treatments and care, involving risks of long-term sequelae, which can result from the disease, treatment

performed and bed rest [22]. The decrease in functionality after discharge from the ICU, especially in the immediate discharge, can be seen in the present study, about 90% of the sample showed reduced function for the Perme scale. The Perme scale is validated to be used within the ICU [23] and even though it was applied in a ward environment, it enabled the detection of functional mobility dysfunction.

The assessed patients were functionally independent prior to admission, so that only one patient depended on a caregiver to perform basic activities of daily living. In the assessment of functional independence, practically all patients showed some degree of dependence after immediate discharge from the ICU. By comparing the self-reported assessment within three months prior to admission to the ICU, using the Modified Barthel Index and that applied after the immediate discharge from the ICU, a significant impairment is observed in the domains related to feeding, bathing, routine activities such as brushing your teeth, dressing, intestines, urinary system, using the toilet, transferring from bed to chair, mobility on flat surfaces and the ability to climb stairs.

The data found are similar to the current evidence, where survivors of the critical state have marked impairment of functionality related to the performance of basic activities of daily living [24]. With comparable methodology Moecke et al. [24] and Chivite et al. [25], verified the existence of a significant decline in functional independence by the Barthel index immediately after discharge from the ICU when compared to self-reported data obtained prior to hospitalization.

Functional changes can impact socioeconomic status and quality of life, about 50% of patients may need assistance after hospital discharge and can last up to one year after the hospitalization period. Assistance may be related to minimal or moderate help to carry out activities of daily living and may evolve to the need for total assistance [26]. After hospital discharge, the patients evaluated presented significant respiratory and functional dysfunction, and possibly still need the use of many health resources. The treatment of survivors of critical illness outside the hospital environment has been studied and there are few specialized clinics to monitor this type of patient.

Recently, the need to create exclusive treatment clinics for post-ICU rehabilitation has been assessed [27,28]. Outpatient clinics to assist this population are scarce, including worldwide, a fact that has an impact on the increase in financial costs related to health [29]. Access to the continuity of treatment of dysfunctions acquired during the ICU stay is quite limited and not very accessible, being carried out most of the time privately, a worrying factor since 50% of the population in this study has a family income of only one minimum wage.

Thus, it is essential to recognize that discharge from the ICU no longer means the end point of critical illness, requiring continuity and specificity of care after discharge, through the elaboration of individualized rehabilitation protocols, since the frequency and degree of commitment is variable, as seen in our results, when we present the percentage of altered functions.

This work is relevant for applying a multidimensional assessment strategy, identifying the main dysfunctions of patients surviving ICU admission. Thus alerting professionals about the need to evaluate and monitor these functions in order to institute early preventive measures or to track the consequences related to ICU stay, as well as optimizing the goals and the therapeutic plan to reduce complications and the development of PICS.

The main limitation of this study was the fact that the sample was for convenience. The recruited patients were those who were available during the data collection period, which may have affected the representation of the patient surviving the critical condition. Another limitation was the fact that the study was carried out in only one center, with a small number of patients, implying a low sample size. It is suggested that future studies have multicentric characteristics, with a larger sample size, and that the collection be carried out in different periods to better characterize the population.

CONCLUSION

Surviving patients in the ICU, exposed to invasive mechanical ventilation and hypomobility, present reduced lung capacity, functional mobility and functional independence immediately after discharge from the ICU.

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Table 1. Assessment tools, protocol, outcomes, cut-off points and reference equations.

Tool									
Physical assessment							**Mental assessment**		**Cognitive assessment**
Spirometry	Ventilometry	Maximal static respiratory mouth pressure	Hand grip strength test	Medical Research Council Scale	Barthel Scale	Perme Intensive Care Unit Mobility Score	Event Impact Scale	Hospital Anxiety and Depression Scale	Mini Mental State Exam
Protocol described by									
ATS/ERS [30]	*ATS/ERS* [30]	*ATS/ERS* [30]	Ali et al., [31]	Hislop et al., [32]	Granger et al., [33]	Perme et al., [34]	Rash, et al., [35]	Marcolino et al., [36]	Bertolucci et al., [37]
Outcome									
Physical assessment							**Mental assessment**		**Cognitive assessment**
Pulmonary function	Pulmonary ventilatory values	Respiratory muscle strength	Handgrip strength	Peripheral muscle strength	Functional independence	Functional mobility	Post Traumatic Stress	Anxiety and Depression	Orientation, attention, memory, language and visual-spatial skills
Reference equation/cutoff point for analysis									
Physical assessment							**Mental assessment**		**Cognitive assessment**
Linear equation height × 0,0599 – age × 0,0213 – weight ×	Slow Vital Capacity≤20ml/Kg De Ropper [39]	Regression lines MIP: Males: y = -0.80 (age) + 155.3, SEE = 17.3; Females: y	Values below 7kgf (women) and 11kgf (men) were deemed to presenting ICU-	0 (complete tetraparesis) to 60 (normal muscle strength), being less than or 48, indicating	The score in each category ranges from 0 to 15 at five-point intervals and the sum score ranges from 0 to 100, being the higher the score	The score ranges from 0 to 32 points; the higher the score, the lower the need for assistance	The partial sum score of each subscale was performed according to the Brazilian cross-cultural	Patients with a HADS score ≥ 9 were associated with the presence of anxiety and	Cognitive performance was classified as preserved for scores above 24, however for individuals

0,0106 - 3,748 De Castro Pereira et al. [38]		= -0.49 (age) + 110.4, SEE = 9.1. MEP: Males: y = -0.81 (age) + 165.3, SEE = 15.6; Females: y = -0.61 (age) + 115.6, SEE = 11.2. Neder et al. [40]	acquired weakness, as proposed by Bragança et al. [41]	ICU-acquired muscle weakness Latronico et al. [43]	the greater the independence degree. A cutoff point of 60 sum score indicates a transition point between dependence / independence on task performance, according to Sulter, Steen and Keyser et al. [44]	Perme et al. [34] Patients who did not reach the maximum score in each category were classified as reduced function	adaptation study by Caiuby et al. [42] and patients with a score ≥ 22 were associated with the presence of PTSD symptoms according to the study by Rash et al. [35]	depression symptoms Marcolino et al., [36]	with school education below 4 years, their cut-off score was dropped to 18 Bertolucci et al. [37]

SQE = Sum of squares of the error; MIP: Maximum inspiratory muscle strength; MEP: Maximum expiratory muscle strength

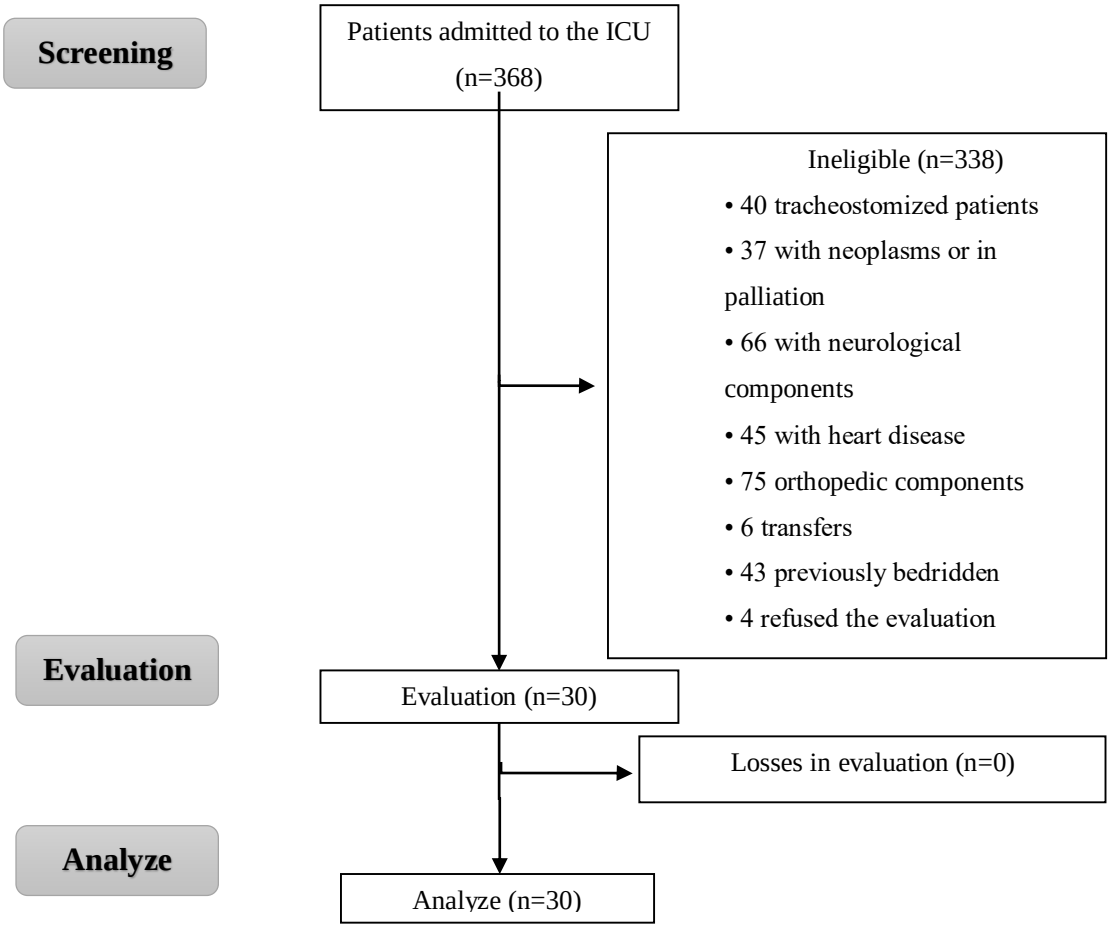

Figure 1. Study flowchart according to STROBE guidelines.

Table 2. Profile of the studied population (N = 30)

Variables	**MEAN±SD N (%)**
Age years	52.2±18.1
Weight, kg	73.7±16.2
Weight,% pred	61.4±9.3
Height, cm	167.1±9.1
BMI, kg / m2]	25.6±4.7
Male Sex	15 (50%)
Ethnicity	
Brown	20 (66.7%)
Black	6 (20%)
White	4 (13.3%)
Family income	
Unemployed	6 (20%)
1 minimum wage	15 (50%)
1-3 minimum wages	7 (23.3%)
3-6 minimum wages	2 (6.7%)
Education	
Child education	18 (60%)
Elementary School	7 (23.3%)
High school	4 (13.3%)
University education	1 (3.3%)
Physical activity level	
Active	4 (12.5%)
Sedentary	22 (68.8%)
Insufficiently active A	3 (9.4%)
Insufficiently active B	1 (3.1%)
Smoking (yes)	13 (43.3%)
Alcohol consumption (yes)	12 (43.3%)

Dependence on caregiver (yes)	1 (3.3%)
Home oxygen use (yes)	0
Non-invasive ventilation (yes)	0

BMI: Body Mass Index; SD: Standard Deviation

Table 3. Clinical factors related to ICU admission.

Variables	**MEAN ± SD Median (Q1-Q3) N (%)**
Apache II * (points)	28.4±6.3
SBT numbers	1 (1-2)
Pre-ICU time, days	1.4 ± 2.8
Length of hospital stay, days	15.0 ± 7.2
ICU days	9 (5-13)
MV days	4 (3-7)
Pre-hospital stay, days	0.5 ± 0.7
Reason for hospitalization	
Surgical	9 (30)
Clinical	21 (70)
Comorbidities (n,%)	19 (63.3)
Organ dysfunction (yes)	30 (100)
Use of vasoactive drugs (yes)	14 (46.7)
Sedoanalgesia (yes)	30 (100)
NB (yes)	3 (10)
Use of corticosteroids (yes)	14 (46.7)
Use of anxiolytics (yes)	11 (36.7)
Delirium (yes)	10 (33.3)
Need for hydration (yes)	9 (30)
Use of parenteral nutrition (yes)	14 (46.7)
Use of blood products (yes)	11 (36.7)
Sepsis (yes)	15 (50)
Septic shock (yes)	14 (46.7)
Nosocomial infection (yes)	18 (60)

Readmission to the ICU (yes)	1 (3.3)
Tracheostomy (yes)	1 (3.3)
ARDS (yes)	1 (3.3)

SBT= spontaneous breathing test; NB= Neuromuscular Blocker; SD: Standard Deviation; MV= Mechanical Ventilation; ARDS: Acute respiratory distress syndrome

Table 4. Functional multidimensional assessment of patients surviving ICU admission

	Mean ± SD	Reduced function n (%)	Preserved function n (%)	*p-value*
Physical Domain				
PERME	45.4±22.7	25 (83.3)	5 (16.7)	0.001
FVC (% pred)	41.0±16.5	1 (3.3)	29 (96.7)	<0.001
SVC (ml / kg)	67.9±24.7	18 (60.0)	12 (40.0)	0.584
MIP (% pred)	74.1±28.1	13 (43.3)	17 (56.7)	0.855
MEP (% pred)	45.8±7.3	14 (46.7)	16 (53.3)	0.855
MRC (points)	31.1±24.7	1 (3.3)	29 (96.7)	<0.001
Handgrip (dominant) (kgf)	28.9±21.4	3 (10.0)	27 (90.0)	<0.001
Handgrip (non-dominant) (kgf)	65.3±28.0	7 (23.3)	23 (76.7)	0.006
Barthel (points)	24.4±7.2	27 (90.0)	3 (10.0)	<0.001
Mental Domain				
HADS (Anxiety) (points)	6.0±4.0	7 (23.3)	23 (76.7)	0.006
HADS (Depression) (points)	7.8±3.2	10 (33.3)	20 (66.7)	0.100
Event Impact Scale (points)	19.0±11.6	12 (40.0)	18 (60.0)	0.361
Cognitive Domain				
Mini-Mental (points)	21.7±4.4	10 (33.3)	20 (66.7)	0.100

SD: Standard Deviation; FVC: Forced Vital Capacity; SVC: Slow Vital Capacity; MIP: Maximum Inspiratory Pressure; MEP: Maximum Expiratory Pressure; MRC: Medical Research Council; FPP; HADS: Hospital Anxiety and Depression Scale

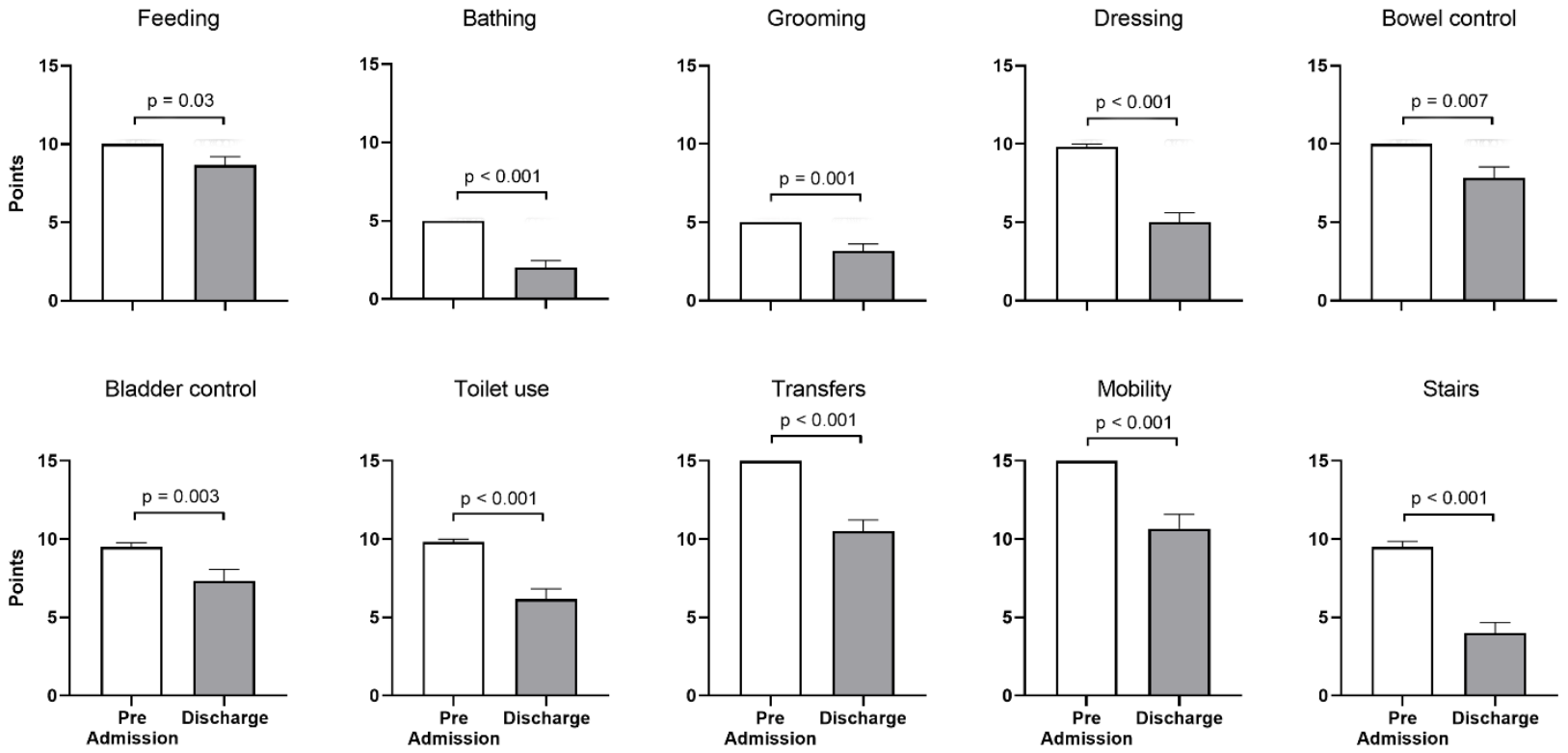

Figure 2 - Comparison of health status up to 3 months before admission to the ICU and after immediate discharge from the ICU using the Barthel Index

APÊNDICE C – ARTIGO 2

ANALYSIS OF PRINCIPAL COMPONENT AS A METHODOLOGICAL TOOL IN SCREENING OF DYSFUNCTIONS IN PATIENTS SURVIVING ICU INTERVENTION

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ABSTRACT

OBJECTIVE: To explore the use of Principal Component Analysis (PCA) in the multidimensional evaluation of screening for functional changes in patients surviving hospitalization in the Intensive Care Unit (ICU).

METHODS: Cross-sectional study, carried out with 30 ICU surviving patients, of both sexes, with previous use of invasive mechanical ventilation ≥ 48 hours. After discharge from the ICU, the patients underwent an evaluation strategy comprising: Spirometry, Ventilometry, Manovacuometry, Palmar Prism Dynamometry, Medical Research Council-score (MRC), Barthel Index, Perme Scale, Hospital Anxiety and Depression Scale (HADS), and Immediate Mini Post-Mental State Examination. The exploratory analysis was carried out through the PCA, adopting 13 variables from the 9 instruments of multidimensional evaluation.

RESULTS: The model explains 69.41% of the total variation for detecting changes in functionality, with 3 main components (PCs). The first main component (PC1) responsible for 40.4%, the second main component (PC2), responsible for 17.15% and the third main component (PC3) responsible for 11.86% of the explained variance. In PC1, the variables related to functional performance (Perme Scale and Barthel Index), lung function (FEV1, FVC and SVC) and respiratory muscle strength (MEP and MIP) were highlighted hierarchically. In PC2, the variables associated with mental function (HADS-a, HADS-d scores) predominated and the Mini-Mental variable obtained a low factor load being subtracted from the model. PC3 demonstrated that there was no additional contribution from the Handgrip and MRC-s tools, therefore being disregarded for the synthesized model.

CONCLUSION: The multidimensional evaluation strategy adopted for screening for functional changes had a high percentage of variance explained by the model generated in the PCA with greater participation of the functional and respiratory component and secondarily by the mental component, being able to point out variables with poor contribution for detecting dysfunctions in this population.

KEYWORDS: Critical Patient. Principal component analysis. Functional State.

INTRODUCTION

The Post Intensive Care Syndrome (PICS) is characterized by a set of physical, cognitive and psychological signs and symptoms not caused by the disease itself, but as a reflection of the stay in the ICU, which extend after hospital discharge [1,2,3]. The symptoms impact both the patient's personal life as well as his interpersonal and family life, and patients who have symptoms of the syndrome find difficulties in social interactions and professional relationships, culminating in isolation and a reduction in quality of life and functionality [4].

The presentation of PICS can be varied, and symptoms can appear in isolation or in combination, with varying prevalence of each symptom, which are dependent on the form of treatment offered to the patient in the ICU environment and with the patient's history prior to admission [5]. According to Major et al. [3] patients who survive ICU admission show changes mainly in physical, mental and cognitive function, with high variability of signs, symptoms and degrees of impairment, suggesting the use of more than 20-25 instruments for tracking these dysfunctions by a multiprofessional team [3]. Considering the average time of application of these instruments according to the Core Outcome Measures in Effectiveness Trials Initiative (www.comet-initiative.org/) and the National Institutes of Health-funded Improve LTO project (www.improvelto.com/) a a complete evaluation could take three to five hours, making the evaluation more than one moment.

However, due to the diversification of instruments, the variability of symptoms, the different levels of impairment of the syndrome, diagnosing this population is a difficult task. Thus, we hypothesize that the analysis of main components can be a useful tool in decision making on priority assessment instruments, without losing information, and thus, making the systematization of the assessment more viable.

Principal component analysis (PCA) is a multivariate statistical technique for modeling the covariance structure proposed by [6]. It is one of the most important statistical tools as it forms the basis on which a large part of multivariate data analysis methods are based, allowing to reveal the existence of different samples, the relationships between the measured variables and between the groups of samples, aiming at their reduction, maintaining a small group of main components that correspond to a significant portion of the total information, retaining most of the data variability. These new components are ordered in a fashion to maintain the largest portion of the original variance in the first componentes [7,8].

Thus, this study aimed to analyze a multidimensional evaluation strategy for detecting cognitive, mental and physical dysfunctions in critical survivors, seeking to identify the most

sensitive instruments for tracking functional changes, as well as verifying the possibility of reducing the instruments to be used for this purpose.

MATERIALS AND METHODS

This is a cross-sectional study carried out in the wards of Hospital Miguel Arraes (HMA) in the metropolitan region of Recife, state of Pernambuco, from June 2019 to February 2020. The study was approved by the Research Ethics Committee (CEP) of Brazilian Hospital Services Company / Hospital das Clínicas (EBSERH / HC) according to Resolution 466/12 and approval opinion Nº. 3,419,821. Published in the Brazilian Registry of Clinical Trials under number RBR-9wghvc.

The patients were recruited from the HMA wards, within 48 hours after discharge from the ICU, respecting the secrecy and confidentiality of the data, the Informed Consent Form (ICF) was delivered and explained and after acceptance and signature, the patients were invited to participate in the study. Patients of both sexes, aged over 18 years, who underwent invasive mechanical ventilation for> 48 hours were included; length of stay in the ICU> 72 hours and who agreed to be evaluated within 48 hours after discharge from the ICU.

Patients with cancer or palliation, patients previously bedridden or who were discharged from the ICU under the use of a tracheostomy cannula, illiterate patients, with cognitive alterations that limited the evaluation, grade III obesity, neurological and / or cardiac and / or orthopedic dysfunction were excluded previous or new neurological and / or cardiac and / or orthopedic events during the period of hospital admission to discharge from the ICU.

The first phase of the study consisted of the elaboration of a multidimensional assessment strategy which was carried out through a consensus among researchers on the assessment instruments to be considered for the study, having as requirements, therapeutic objective, psychometric properties, quantity of articles published using the instrument, estimated time of execution and existence of a validated version for the Brazilian population, based on the Core Outcome Measures in Effectiveness Trials Initiative (www.comet-initiative.org/) and the National Institutes of Health-funded Improve LTO project (www.improvelto.com/).

Then, the collection phase itself, in which the patients who survived the ICU stay were submitted to a multidimensional evaluation, consisting of 9 instruments (Figure 1), and finally the exploratory analysis performed through the PCA with data interpretation. Thirteen variables were included to perform the analysis with main components.

STATISTICAL ANALYSIS

The database was generated in SPSS version 21.0. The descriptive characterization of the volunteers was performed in terms of simple or percentage frequency, mean and standard deviation or median and interquartile range.

To perform the PCA, the variables were initially standardized with the same unit of measurement using the following formula:

$$\text{Standardized value} = \frac{\text{Xi-Mean of X}}{\text{Standard deviation of X}}$$

Where "X" is the variable to be standardized.

The variables selected to perform the ACP were: FEV1, FVC, SVC, MIP, MEP, MRC-s, HADS-A, HADS-D, Mini-Mental, Dominant and non-Dominant Handgrip, Barthel score and Perme score.

Exploratory factor analysis was adopted for the structure, using extraction of main components with direct oblique rotation. Factorial validity was tested using Exploratory Factor Analysis, and two methods (Kaiser-Meyer-Olkin [KMO] criterion and Bartlett's sphericity test) were applied to analyze whether the data matrix could be subjected to factorization. As a criterion it was adopted that KMO values> 0.5 are considered acceptable for factor analytical purposes [9]. As the objective of the factor analysis is to reduce the number of variables in a smaller number of factors, only those factors with an eigenvalue> 1.0 were retained for analysis. The factorability (or factor load) of the values of the correlation matrix were interpreted as follows: ≥0.30 = minimum, ≥0.40 = important and ≥0.50 = practically significant.

RESULTS

Of the 368 patients admitted to the ICU, 338 were excluded, of which 186 were due to orthopedic, neurological or cardiac diseases and / or impairments. All 30 eligible patients were fully evaluated and analyzed.

The patients were aged between 20 and 84 years, 14.29% were overweight, length of stay in the ICU varying from 3 to 33 days, time of invasive mechanical ventilation between 2 to 29 days, hospitalization around 5 to 34 days and around 43% of the sample reported drinking and smoking habits (Table 1).

According to the assessment of physical, mental and cognitive function, 29 (97%) of the patients after discharge from the ICU had some dysfunction, and of these, all showed some type

of respiratory dysfunction. Multidimensional impairment is also noteworthy, since 20 (67%) followed with four or more associated dysfunctions (Figure 2).

In the preliminary analysis, the KMO test, which assesses the adequacy of the sample, obtained a value of 0.657, which gave adherence to the assumption for PCA. In Bartlett's sphericity test (x2 = 279,152, degree of freedom = 78, p <0.001), the p-value expressed the existence of more than one significant correlation in the correlation matrix.

In the extraction matrix, the total variation explained for the 13 components included in the model is observed (Table 2), in which component 1 explains 40.4% of variance alone and added to components 2 and 3 account for 69.41% of the accumulated variation. The first 3 main components were represented because they present more than 10% of the explained variance, eigenvalues value> 1 and intersection point on the scree plot graph where the eigenvalues make a representation of an "elbow" (Figure 3).

The high percentage of total variance given to components 1, 2 and 3 is in accordance with the scree plot, in which the point of the curve of the values of eigenvalues in relation to the components presents a slope, forming an elbow after component 3.

From the analysis of oblique rotation it was possible to define the main variables, considering those that had the highest factor load within each component 1, 2 and 3 (Table 3). When analyzing the loads of each variable in the two components, it is noted that for component 1 the highest values occurred for variables in the physical domain, mainly spirometric variables, functional capacity and muscle strength when component 2 gathered variables from the cognitive and mental domains. The blank values were excluded, as they presented a value below 0.300.

Table 4 describes the factorial loads of the three components (main component [CP] 1, 2 and 3), commonality, eigenvalues, variance of each component and the accumulated variance (sum of the variance of the two main components). Higher scores can be observed for the functional scales (Perme and Barthel) but also for those related to lung function (FEV1 and FVC) and respiratory strength (MEP and MIP).

Figure 4 represents the estimate of the evaluation time for the multidimensional evaluation strategy and for the reductionist evaluation model extracted from the PCA. The assessment time for the instrument was based on data provided by the National Institutes of Health-funded Improve LTO project (www.improvelto.com/). A decrease of 40 minutes is observed for the reduced evaluation strategy.

DISCUSSION

This study aimed to clarify which instruments, within a multidimensional assessment strategy, are priorities for tracking functional changes in critical survivors, seeking to identify, as well as, verify the possibility of reducing the instruments to be used, without losing qualitative information. Thus, PCA was applied after evaluation of 30 patients, with nine instruments and thirteen variables, selected through a robust psychometric analysis by the researchers.

The main findings of the present study were:

(1) Definition of priority variables for multidimensional assessment of critical survivors - Functionality, lung function and maximum respiratory strength were identified as priority variables in screening for dysfunction, followed by mental function;

(2) Construction of a hierarchical model in the selection of the most appropriate tool - The Perme scale was able to explain the greater variability in the original data with high positive factor loads;

(3) Reductionist proposal of instruments in the evaluation strategy - The Mini-Mental variables, with a weak factor load in PC2, SVC, HANDGRIP and MRC, with negative factor loads in PC3, are not essential variables within a multidimensional assessment strategy in tracking dysfunctions in critical survivors.

The heterogeneity in the definitions of results, measurement of instruments and covariables used in studies of survivors of admission to the ICU create a great barrier in the synthesis of the existing literature and in the conduct of clinical practice [10,11]. In view of the difficulty in diagnosing PICS and tracking dysfunctions, due to the symptomatological and instrument variability, the assessment can last for hours and be exhaustive for patients, as well as requiring a greater workload from the rehabilitation team.

The PCA model with greater explanation of variance related to the pre-selected instruments for detecting changes in functionality generated 3 main components., PC1 is represented by aspects of functionality (Perme and Barthel scales), lung function (FEV1 and FVC) and respiratory muscle strength (MIP and MEP) and PC2 composed of mental function variables (HADS-A and HADS-D). The variables related to physical function (PC1), showed the ability to explain the greater variability in the data and, therefore, were identified as essential variables in the context of a multidimensional assessment strategy of patients surviving ICU admission after immediate discharge. The systematic review carried out by Gaudry et al. [12] pointed out the assessment of physical function (pulmonary function and neuromuscular

function) as an important outcome in the screening for dysfunction of patients surviving ICU admission.

CP3, on the other hand, allocated variables with negative factor loads, which in this model, can be interpreted as non-essential components, and, therefore, could be removed from the evaluation strategy. Thus, SVC measured by ventilometry, HGS by handgrip dynamometer and the MRC-score for measuring peripheral muscle strength, were disregarded in the assessment model. The evaluated patients obtained low percentages for reduced function in the variables CVL (3.3%), dominant HGS (3.3%) and non-dominant HGS (10%), these unchanged results did not reflect in contribution to the model generated.

Approximately 47% of the patients evaluated had impaired peripheral muscle strength by the MRC-s, not in line with the results of the HGS. HGS assessment is a reliable, quick and simple alternative to manual muscle testing and can be a substitute for overall strength. The MRC-s is an evaluator-dependent method and does not seem sensitive to scores above 4, since there is no standardization in the evaluation, whether isokinetic or isometric [13,14]. Both tests are voluntary and require the patient to be alert, cooperative and motivated, so it is necessary to investigate more comprehensive quantitative methods for timely diagnosis and long-term follow-up to clarify the prognosis and some algorithms that may be useful in the clinic daily practice.

This disagreement between MRC and HGS may also be related to a greater muscular deficit in lower limbs, which may imply the impossibility of making changes in decubitus and transfers, justifying the high percentage of dysfunction in the Perme scale (90%). Another justification for removing the variables (HGS and MRC-s) in the reduced evaluation strategy is due to the approach of these domains on the Perme scale, resulting in a smaller number of instruments to assess patients surviving critical illness, resulting in savings in time and resources in future works that will use this same database, without significant loss of information.

According to the researchers' analysis, the Mini-mental, in PC2, although it had a positive charge, it was weak, and only 33% of the patients had reduced cognitive function, which also reinforces the idea of removal in the evaluation strategy. Such analysis must be viewed with great caution, as it may have been influenced by the profile of patients and their results in the other evaluations of the multidimensional strategy, since the patient needs to have preserved cognitive skills to perform the evaluation tests.

It should be noted that the multidimensional strategy adopted was developed based on a robust analysis of the assessment instruments. The choice of tools and variables followed the

limits of reliability and applicability for critically ill patients, according to data available in the project entitled “Improving Long-Term Outcomes Research for Acute Respiratory Failure” (www.improvelto.com). It is a database composed of recommended research instruments and clinical testing methods to assess the results of the physical, mental and cognitive health of survivors of acute respiratory distress syndrome (ARDS) / acute respiratory failure (ARI).

Based on the multidimensional assessment strategy, the PCA made it possible to rank the most important variables, highlighting the Perme scale with high factor loads, proving to be essential and more sensitive for the screening of functional changes. The Perme scale was developed to measure the status of a patient's functional mobility, starting with the cognitive ability to follow commands and culminating in the distance covered in 2 minutes. The sequence of domains was organized using a systematic approach grouped into 7 categories: mental status, potential mobility barriers, strength, mobility in bed, transfers, gait and resistance [15]. The fact that the scale encompasses different domains may explain why it stands out in the screening for functional changes when compared to other tools that evaluate isolated functions. This study also observed a high rate of critical survivors who had four or more associated disorders after immediate discharge from the ICU.

When analyzing the functionality through the Barthel Index, a high positive charge is observed through the PCA, in addition to the high percentage of functional dysfunction in the patients evaluated, reflecting the importance of using this tool. Son et al. [16] published a cohort study evaluating the functional and cognitive impact on the functional status of critical survivors, using a sample of 152 patients, the authors observed a high percentage of functional dysfunction assessed by the Barthel Index in patients with altered cognitive.

About 96% of the studied population had functional changes, with respiratory dysfunctions that affected 29 of the 30 patients evaluated being more prevalent. The PCA pointed out that the variables related to expiratory function and expiratory muscle played an important role in screening for functional impairment in critical survivors. Several studies have demonstrated the development of expiratory muscle weakness in critically ill patients using maximum expiratory pressure (MEP) as a marker of expiratory muscle strength [17, 18]. Patients with extubation failure had lower MEP compared to patients with extubation success, suggesting that expiratory muscle weakness is a potential predictor of extubation success [19, 17].

Expiratory muscle weakness reduces cough strength and peak flow velocity, predisposing patients to conditions such as pneumonia and atelectasis [20]. However, according to the recent narrative review proposed by Shi et al. [21] the importance of expiratory muscles

in critically ill patients is not commonly explored in the literature and to date, no study has investigated the association between weakness of the diaphragm and expiratory musculature, it is not possible to point out evidence of superiority. However, our results show greater sensitivity of expiratory function markers (VEF1, FVC and MEP) for screening for dysfunction in patients surviving the critical condition.

From pre-hospital discharge to approximately one year after critical illness, spirometry and maximum inspiratory pressure (MIP) are reduced in patients who survive ICU admission [22] regardless of medical or surgical etiology and including those who developed acute respiratory distress syndrome (ARDS) [23]. These pulmonary deficiencies can manifest themselves as clinical symptoms, such as increased breathing work at rest and during effort, due to the decrease in inspiratory muscle strength [24]. Smith et al. [25] suggest the assessment of muscle strength through manovacuometry and lung function through spirometry in patients with PICS, emphasizing that the results of these assessments can instruct the physiotherapist about the impairment of lung function, and may elucidate the benefit of the training of respiratory muscles and indication of pulmonary rehabilitation.

PC2 contains variables related to mental health from the Hospital Anxiety and Depression scale (HADS-A and HADS-D). Damages in mental health, including depression and anxiety, are commonly reported by patients surviving critical illness, systematic reviews with meta-analyzes demonstrated high percentages of mental dysfunction that can last for more than 1 year after hospital discharge [26,27]. To track depression and anxiety, HADS is highly recommended for critical survivors and one of the main factors is the removal of physical changes, such as fatigue or difficulty sleeping, which can be confused with depression [28].

In summary, this study provides information on the method of statistical analysis (PCA) helping to choose specific tools for screening for dysfunction in patients surviving the critical condition. In addition, it offers a didactic and practical guide for researchers interested in applying PCA to data related to this population. It is hoped that our results will provide an impetus to further explore the usefulness of these components in guiding clinical practice, assessing their ability to predict important functional changes, such as diagnosis, prognosis and responses to treatment.

One of the limitations of this study was the fact that it was performed in a single center, with a small number of patients, impacting the sample size. In addition to the convenience sample, we recruited patients over a specific period, which could have affected the characteristics of the population. Therefore, it is suggested that future studies with a larger sample size, in different centers and periods, be carried out for greater representation of critical

surviving patients, as well as, it is expected that the results found by exploratory analysis are confirmed through confirmatory factor analysis.

CONCLUSION

The multidimensional assessment strategy synthesized an effective model for detecting functional changes analyzed by the PCA. Through the PCA 3 main components were extracted, making it possible to rank the most important variables in the context of the evaluation strategy, present in PC1 and PC2. The assessment of functionality, respiratory function and maximum respiratory strength was shown to be important by the PCA and in the analysis of isolated dysfunctions, individuals had higher percentages in these domains.

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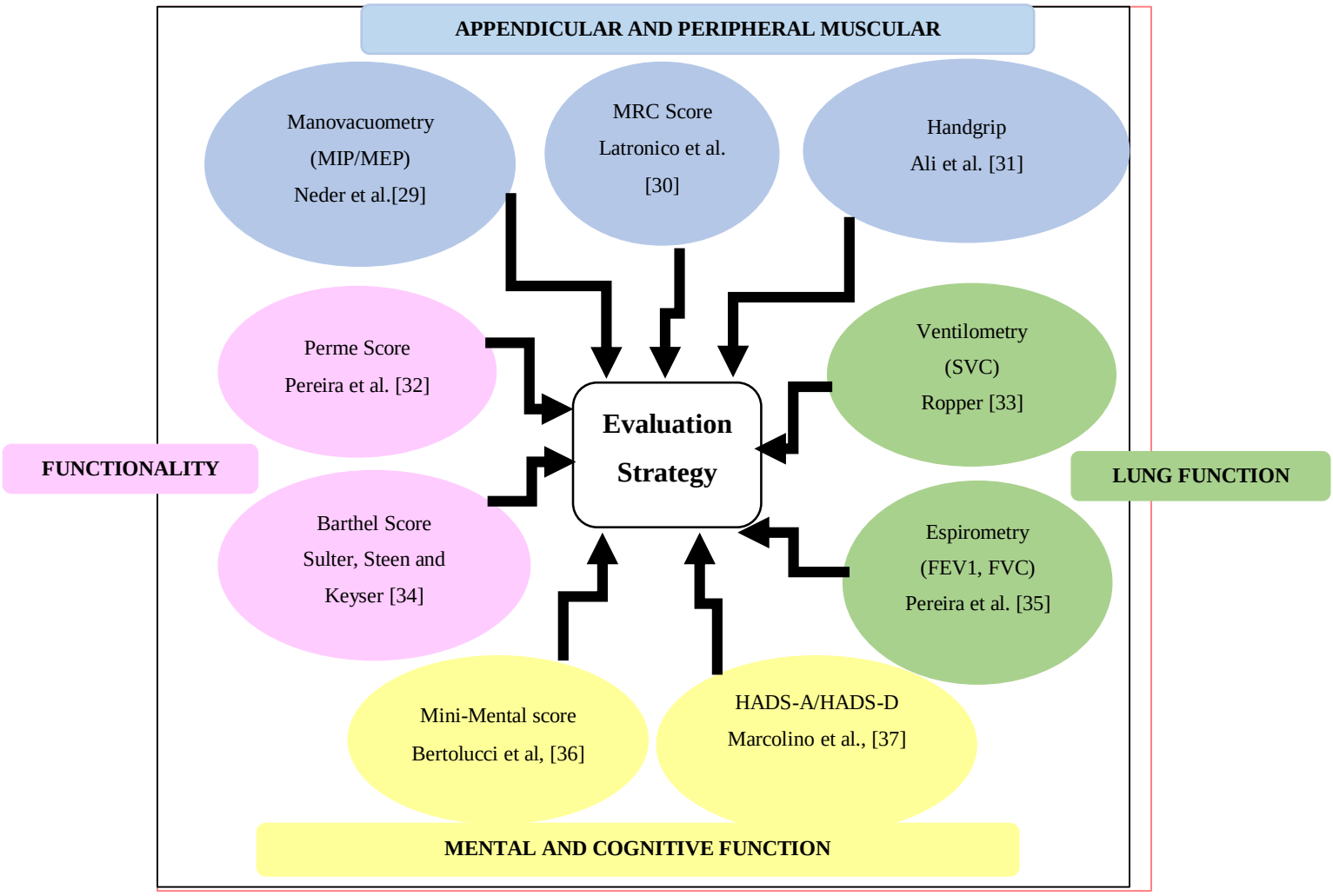


Figure 1 - Assessment tools, outcomes and references with predictive equations / cutoff points.

Table 1. Characterization of the studied population regarding sociodemographic data and factors related to ICU admission (N = 30).

	Mean ± CI95% Median (Q1-Q3) N (%)
Age years	52.2±18.1
Weight, kg	73.7±16.2
Height, cm	167.1±9.1
BMI, kg / m2	25.6±4.7
Male Sex	15 (50)
Ethnicity	
Brown	20 (66.7)
Black	6 (20)
White	4 (13.3)
Physical activity level	
Active	4 (12.5)
Sedentary	22 (68.8)
Insufficiently active A	3 (9.4)
Insufficiently active B	1 (3.1)
Smoking (yes)	13 (43.3)
Alcohol consumption (yes)	12 (43.3)
Apache * (points)	28.4±6.3
Length of hospital stay, days	15.03 ± 7.22
ICU time, days	9 (5-13)
MV time, days	4 (3-8)
Reason for hospitalization	
Surgical	9 (30)
Clinical	21 (70)
Comorbidities	19 (63.3)
Delirium (yes)	10 (33.3)
Sepsis (yes)	15 (50)
Nosocomial infection (yes)	18 (60)

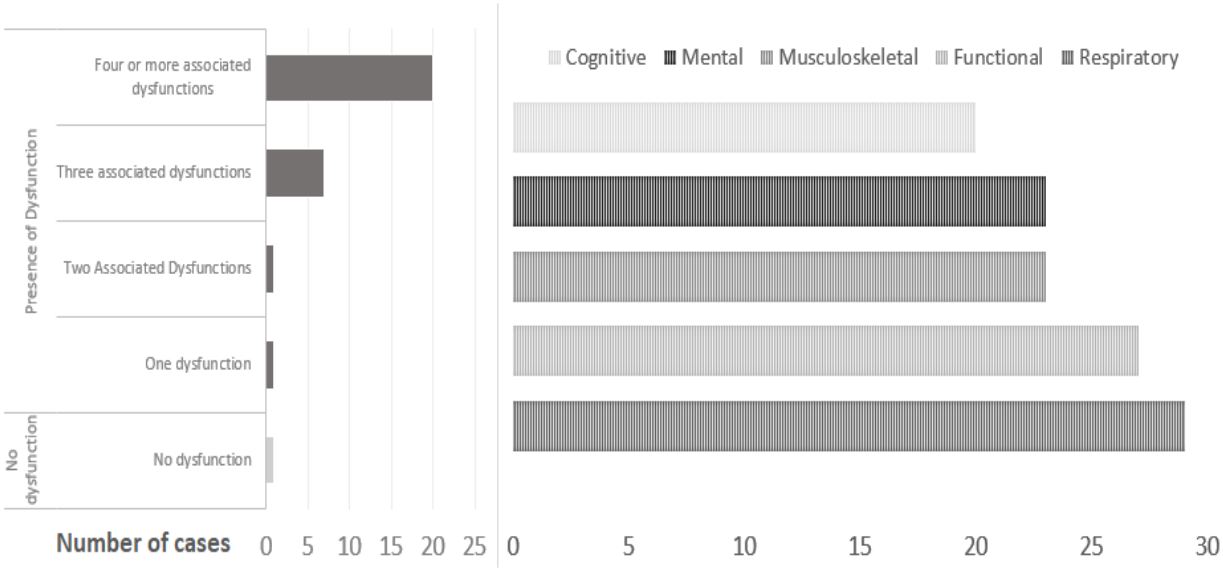


Figure 2 - Presence of functional changes in tests for assessing physical, mental and cognitive function (N = 30). Note: The first image represents the percentage of dysfunction of patients surviving the critical condition. In the second, the frequency of dysfunctions is observed for each assessed domain.

Table 2 - Generation of the extraction matrix with total variance explained for 13 main components.

	Initial eigenvalues			Extraction sums of squared loads			Rotating sums of squared loads[a]
Component	Total	% of variance	% cumulative	Total	% of variance	% cumulative	Total
1	5.252	40.397	40.397	5.252	40.397	40.397	4.711
2	2.230	17.156	57.553	2.230	17.156	57.553	2.049
3	1.542	11.865	69.419	1.542	11.865	69.419	3.621
4	1.239	9.527	78.946				
5	0.714	5.496	84.442				
6	0.549	4.220	88.662				
7	0.446	3.432	92.094				
8	0.422	3.243	95.337				
9	0.237	1.826	97.163				
10	0.202	1.552	98.714				
11	0.102	0.782	99.496				
12	0.040	0.308	99.804				
13	0.025	0.196	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, the sums of loading squared cannot be added to obtain a total variance.

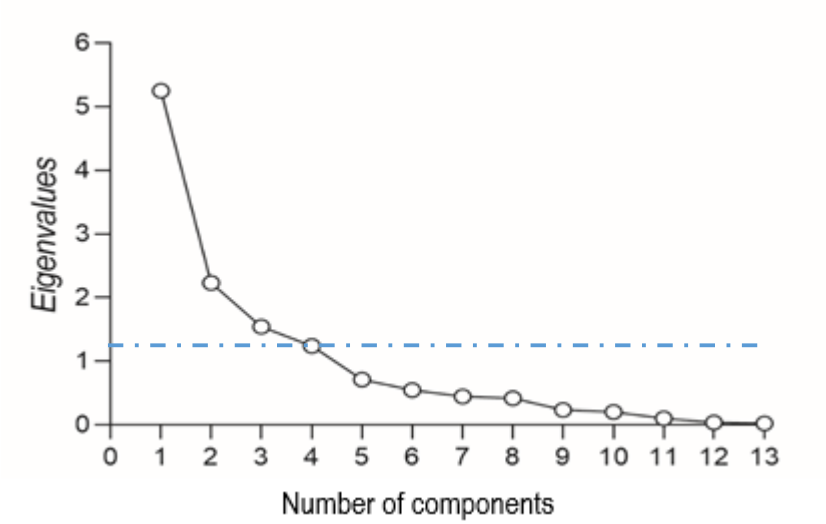


Figure 3 - Scree plot representing the eigenvalues and the number of components. Note: The choice of the main variables followed the following criteria: Percentage of total variance explained cumulatively by the components; eigenvalues value> 1 in the explained total variance table and intersection point in the scree plot graph where the eigenvalues make a representation of an "elbow".

Table 3 - Structure matrix for 3 main componentes

	Component		
	1	2	3
Perme (Score)	0.880		
Barthel (Score)	0.864		
FEV1	0.805		
FVC	0.793		
MEP	0.711		
MIP	0.612		
SVC	0.538		
HADS (Anxiety)		0.910	
HADS (Depression)		0.865	
HGS (Not dominant)			-0.959
HGS (Dominant)			-0.955
MRC (Score)			-0.696
Mini-mental		0.486	

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

Table 4- Summary of the factor loads for the variables in Components 1, 2, 3 and Communalities with Eigenvalues for each main component, with the Variants Explained and Accumulated.

	PC1	**PC2**	**PC3**	**Communalities**
Perme	0.880	0.107	-0.147	0.861
Barthel	0.864	0.096	-0.296	0.779
FEV_1	0.805	-0.248	-0.174	0.686
FVC	0.793	-0.255	-0.290	0.706
MEP	0.711	-0.105	-0.134	0.512
MIP	0.612	-0.079	-0.244	0.486
SVC	0.538	-0.179	-0.246	0.309
HADS (Anxiety)	-0.068	0.910	-0.133	0.840
HADS (Deepression)	-0.185	0.865	0.084	0.766
HGS (Dominant)	0.283	0.136	-0.959	0.916
HGS (Not-Dominant)	0.229	0.068	-0.955	0.939
MRC	0.277	-0.134	-0.696	0.607
Mini-mental	0.228	0.486	-0.268	0.617
Eigenvalues	5.252	2.230	1.542	-
Explaneid variance (%)	40.397	17.156	11.865	-
Accumulated variance (%)	69.419			-

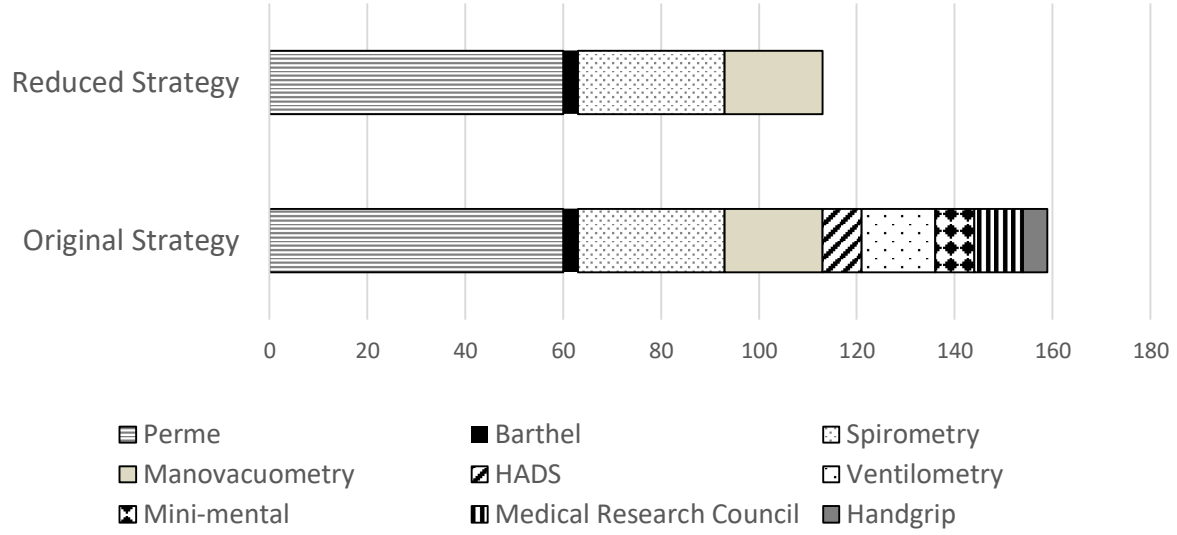


Figure 4 - Estimated evaluation time for the original and reduced evaluation strategy.

ANEXO A – PARECER CONSUBSTANCIADO DO CEP

UFPE - HOSPITAL DAS CLÍNICAS DA UNIVERSIDADE FEDERAL DE PERNAMBUCO -

PARECER CONSUBSTANCIADO DO CEP

DADOS DA EMENDA

Título da Pesquisa: EFICÁCIA DE UM PROTOCOLO DE TRATAMENTO FISIOTERAPÊUTICO NA QUALIDADE DE VIDA E NA FUNÇÃO FÍSICA DE ADULTOS SOBREVIVENTES A INTERNAÇÃO EM TERAPIA INTENSIVA - ENSAIO CLÍNICO RANDOMIZADO CONTROLADO

Pesquisador: Shirley Lima Campos

Área Temática:

Versão: 4

CAAE: 04854918.8.0000.8807

Instituição Proponente: EMPRESA BRASILEIRA DE SERVICOS HOSPITALARES - EBSERH

Patrocinador Principal: Financiamento Próprio

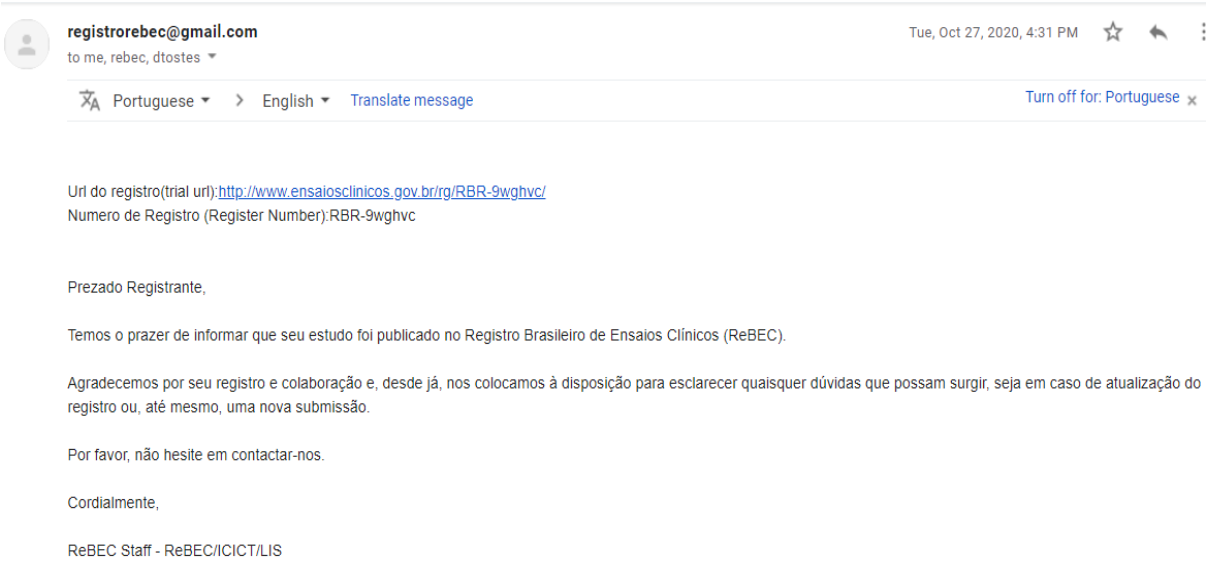
DADOS DO PARECER

Número do Parecer: 3.419.821

Apresentação do Projeto:

Trata-se de emenda ao projeto de pesquisa intitulado Eficácia de um protocolo de tratamento fisioterapêutico na qualidade de vida e na função física de adultos sobreviventes a internação me terapia intensiva - Ensaio clínico randomizado controlado, trata-se de uma pesquisa de mestrado do programa de fisioterapia da UFPE onde tem como pesquisadores responsáveis a docente Shirley Lima Campos e a mestranda Alice Miranda dos Santos, este será realizado no Laboratório Multiusuário de Inovação Instrumental e Desempenho FísicoFuncional (LINDEF), Serviço de Fisioterapia do Hospital das Clínicas (HC) da Universidade Federal de Pernambuco e Hospital Miguel Arraes, este último através da presente emenda.

ANEXO B – REGISTRO NO REBEC



registrorebec@gmail.com Tue, Oct 27, 2020, 4:31 PM

to me, rebec, dtostes

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Url do registro(trial url):http://www.ensaiosclinicos.gov.br/rg/RBR-9wghvc/
Numero de Registro (Register Number):RBR-9wghvc

Prezado Registrante,

Temos o prazer de informar que seu estudo foi publicado no Registro Brasileiro de Ensaios Clínicos (ReBEC).

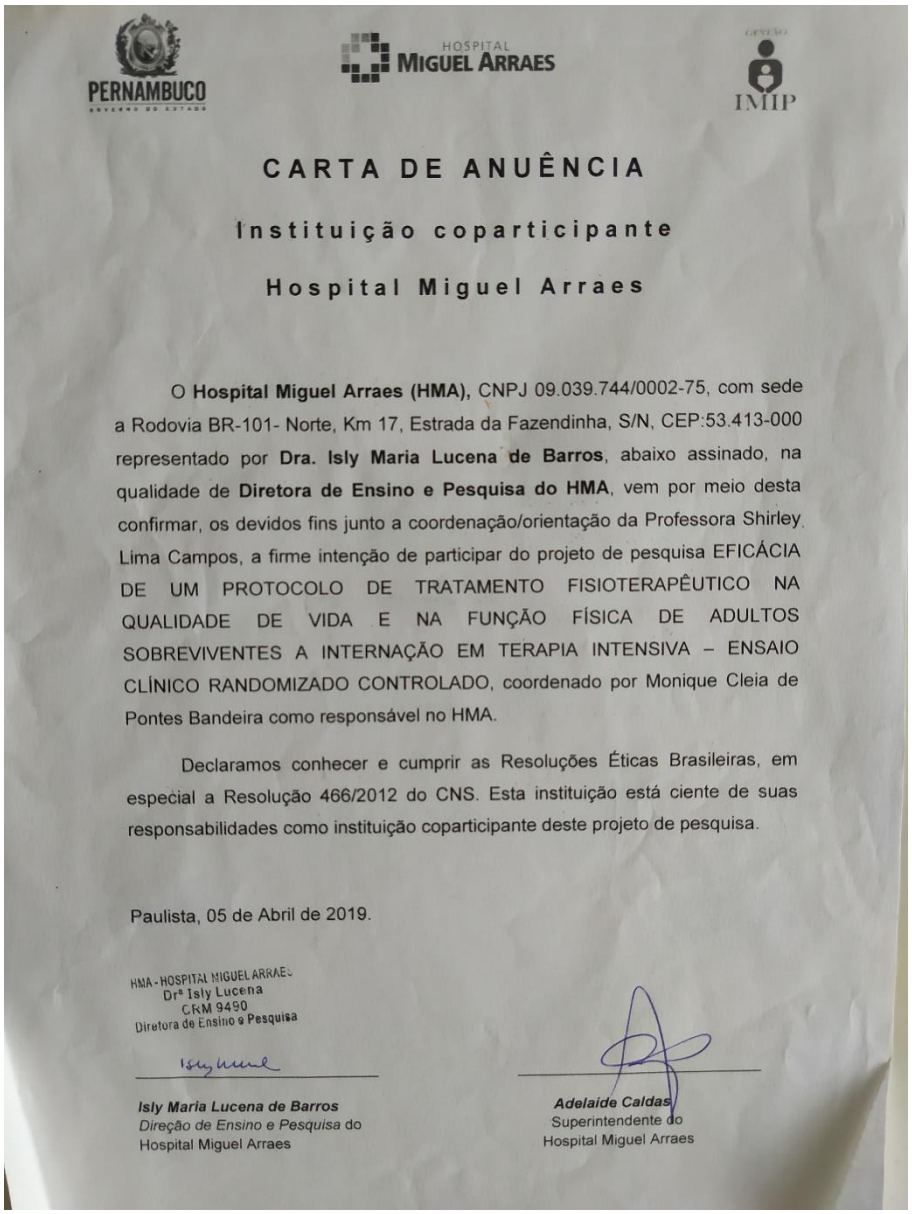
Agradecemos por seu registro e colaboração e, desde já, nos colocamos à disposição para esclarecer quaisquer dúvidas que possam surgir, seja em caso de atualização do registro ou, até mesmo, uma nova submissão.

Por favor, não hesite em contactar-nos.

Cordialmente,

ReBEC Staff - ReBEC/ICICT/LIS

ANEXO C – CARTA DE ANUÊNCIA



PERNAMBUCO
GOVERNO DO ESTADO

HOSPITAL MIGUEL ARRAES

GESTÃO IMIP

CARTA DE ANUÊNCIA

Instituição coparticipante

Hospital Miguel Arraes

O **Hospital Miguel Arraes (HMA)**, CNPJ 09.039.744/0002-75, com sede a Rodovia BR-101- Norte, Km 17, Estrada da Fazendinha, S/N, CEP:53.413-000 representado por **Dra. Isly Maria Lucena de Barros**, abaixo assinado, na qualidade de **Diretora de Ensino e Pesquisa do HMA**, vem por meio desta confirmar, os devidos fins junto a coordenação/orientação da Professora Shirley Lima Campos, a firme intenção de participar do projeto de pesquisa EFICÁCIA DE UM PROTOCOLO DE TRATAMENTO FISIOTERAPÊUTICO NA QUALIDADE DE VIDA E NA FUNÇÃO FÍSICA DE ADULTOS SOBREVIVENTES A INTERNAÇÃO EM TERAPIA INTENSIVA – ENSAIO CLÍNICO RANDOMIZADO CONTROLADO, coordenado por Monique Cleia de Pontes Bandeira como responsável no HMA.

Declaramos conhecer e cumprir as Resoluções Éticas Brasileiras, em especial a Resolução 466/2012 do CNS. Esta instituição está ciente de suas responsabilidades como instituição coparticipante deste projeto de pesquisa.

Paulista, 05 de Abril de 2019.

HMA - HOSPITAL MIGUEL ARRAES
Drª Isly Lucena
CRM 9490
Diretora de Ensino e Pesquisa

Isly Maria Lucena de Barros
Direção de Ensino e Pesquisa do
Hospital Miguel Arraes

Adelaide Caldas
Superintendente do
Hospital Miguel Arraes

ANEXO D - ARTIGO ORIUNDO DA DISSERTAÇÃO SUBMETIDO A REVISTA *PHYSIOTHERAPY THEORY AND PRACTICE*

APPLICATION OF ICF CONCEPTUAL FRAMEWORK IN CRITICAL SURVIVORS AT IMMEDIATE INTENSIVE CARE DISCHARGE

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Abstract

Aim: To evaluate and codify the functional capacity of intensive care unit critical survivors immediately after Intensive Care Unit (ICU) discharge by the International Classification of Functioning, Disability and Health (ICF) framework. **Materials and methods:** Observational study. Adult critical survivors, male and female, with prior use of invasive mechanical ventilation ≥ 48 hours were submitted 24-48 h after discharge from the ICU to an assessment strategy that includes: Spirometry, Ventilometry, Maximal Inspiratory and Expiratory Respiratory Pressures (MIP and MEP), Hand Grip Dynamometry, Medical Research Council , Barthel Scale, Perme Intensive Care Unit Mobility Score, Hospital Anxiety and Depression Scale, Event Impact Scale and ICU Mini Post Immediate Mental State Examination. **Results**: 15 patients, 53.3% females (47.5 ± 17.9 years), presented deficits in respiratory function **b449** (93.3%), respiratory muscle strength **b445** (MIP 73.3%, MEP 86.6%) and functionality, particularly in the following domains: general physical endurance **b4550** (80%), dressing **d540** (80%), barriers to mobility **b789** (80%), use of stairs **d4551** (73.3%), peripheral muscle strength **b7304** (66.6%), toileting (60%), washing oneself **d510** (53.3%), transfers, mobility **d4208** (53.3%) and walking **d450** (53.3%). **Conclusion**: The critical survivors had their health and disability classified by ICF framework with a high frequency of respiratory (b4), exercise tolerance, self-care (d5) and mobility (d4) dysfunctions.

Keywords: Critical care; evaluation functionality; functional disability; ICF; International Classification of Functioning, Disability and Health.

Implications for rehabilitation:

- Assessment of functional capacity in Intensive Care Unit (ICU) survivors showed that discharge from the unit does not mean the end of critical illness, pointing to the need for continuity of care.

- The use of the ICF in the tracking of dysfunctions allows a common language and contributes to the improvement of a specific Core set, in order to facilitate its use by health professionals.
- The stay in the ICU generates variability in the functional level of the survivors, thus, ICF is an option for characterizing the findings, as it has a wide range of information related to different health states.

Introduction

Critically ill patients tend to suffer with functional deficits during intensive care unit (ICU) stay. In order to mitigate that negative impact, physiotherapy engage them in early mobilization protocols, which has also been associated to other benefits such as reduced mechanical ventilation time, delirium, improving peripheral muscle strength and a higher rate of weaning success from mechanical ventilation (Arias-Fernández et al, 2018; McWilliams et al, 2018; Stiller, 2013) reduction in both ICU and hospital stay (Stiller, 2013). Thus, the rate of critical illness survival has increased as a result of technological, scientific and multidisciplinary interaction (Needham et al, 2012).

By contrast, complications from the deleterious effects of ICU immobility contribute to functional decline, increasing healthcare costs (Rotta et al, 2018), a lower quality of life and survival after hospital discharge, sometimes associated with the development of Post-Intensive Care Syndrome (PICS) (Inoue et al, 2019; Major et al, 2016).

This term was defined by the Society of Critical Care Medicine and compromises a set of functional, psychological and cognitive deficits acquired during ICU stay and hospitalization, despite multidisciplinary care and clinical support (Inoue et al, 2019; Kondo et al, 2017).

The PICS symptoms are diverse, either alone or combined, and range from dysphagia, organ dysfunction, chronic pain, cachexia, sexual dysfunction, acquired weakness, posttraumatic stress disorder, anxiety and depression, which may persist for months to years (Mehlhorn et al, 2014; Ohtake et al, 2018; Rawal G, Ydav S and Kumar R, 2017).

Considering that the physical and mental function of ICU survivors can be greatly compromised, it is important to monitor possible dysfunctions and their magnitude at the time of hospital discharge for the implementation of healthcare policies, therapeutic planning and

systematic adjustments to the healthcare model and counter-referral, so as to meet the therapeutic needs of this target audience (Harvey and Davidson, 2016).

Assessing the dysfunctions and severity levels presented by individuals affected by PICS is not an easy task due to the diversity of clinical and functional conditions. There is no specific instrument and several evaluation strategies, methods and instruments are necessary for accurate functional evaluation. In this scenario, the classification system for functional deficits of the International Classification of Functioning, Disability and Health (ICF) framework can be useful in standardizing the diagnostic language of patients after ICU discharge. The ICF was designed to record and organize a wide range of information related to different health conditions, with a view to standardizing functionality, disability and heath terms globally (Major et al, 2016; OMS, 2013; Stucki, 2005).

The ICF classification system encompasses 5 categories: body function and body structure, social activity, social participation and environment. Body function and structure are related to disability or disease, meanwhile social activity and participation portray disability, positive and negative factors, recording the profile of functionality on the ability to interact with oneself, with work, with family and community social life (Foster, 2016; OMS, 2013).

Thus, the present study aimed to assess, code and classify according to the ICF the functional level of critical survivors immediately after discharge from the ICU, from a multidimensional evaluation strategy.

Materials and methods

Design, place and period of study

This is a cross-sectional study carried out in the wards of a public hospital between June and November 2019. The study approved by institutional clinical research ethics committee and registered with Brazilian Clinical Trials Registry - Rebec number RBR-9wghvc.

Sample

Patients were recruited from the hospital wards within 48 hours of ICU discharge and had their eligibility evaluated priorly by consulting their medical records. This ICU has a 24-hour physiotherapy team and follows a routine protocol for assisting patients on mechanical ventilation, with three daily respiratory physiotherapy sessions associated with early mobilization. Respecting the confidentiality and confidentiality of the data, all patients provided written informed consent before participating the study.

Inclusion and Exclusion Criteria

Inclusion criteria

We included patients of both sexes, aged over 18 years old, who underwent invasive mechanical ventilation ≥48 hours, ICU stay ≥72 hours and consented by written to be evaluated within 48h after discharge from the ICU.

Exclusion Criteria

Patients with neoplasms or palliation, previously bedridden or discharged from the ICU with use of tracheostomy airway, illiterate patients with cognitive impairment that limited the volitional assessment, obesity of third degree and beyond, neurological, cardiac and/or orthopedic dysfunctions, previous or new neurological, cardiac and/or orthopedic events acquired during hospitalization were excluded.

Data Collection Procedures

Firstly, charts were consulted to register outcomes such as age, gender, civil status, years of school education, self-declared ethnicity, monthly income, religion, lifestyle habits, Body Mass Index, date of admission and diagnosis for hospitalization, use of drugs (opioids, sedatives, neuromuscular blockers, vasoactive drugs, corticosteroids), severity level and time of mechanical ventilation use.

Secondly, the main outcomes were obtained by visits to patients discharged to the wards between 24 and 48 hours after ICU. The tests and respective functional classification are noted
below:

Instruments for evaluation and data collection

For the evaluation, the instruments adopted are described in Figure 1.

Figure 1. Assessment tools, outcome and reference equation/cutoff point.

	Tool	**Outcome**	**Reference equation/cutoff point for analysis**
Physical assessment	Spirometry	Pulmonary function	Linear equation height × 0,0599 – age × 0,0213 – weight × 0,0106 - 3,748 (Pereira et al. 2007)
	Ventilometry	Pulmonary ventilatory values	Slow Vital Capacity≤20ml/Kg (De Ropper 1993)

	Maximal static respiratory mouth pressure	Respiratory muscle strength	Regression lines MIP: Males: y = -0.80 (age) + 155.3, SEE = 17.3; Females: y = -0.49 (age) + 110.4, SEE = 9.1. MEP: Males: y = -0.81 (age) + 165.3, SEE = 15.6; Females: y = -0.61 (age) + 115.6, SEE = 11.2. (Neder et al.1999)
	Hand grip strength test	Handgrip strength	Values below 7kgf (women) and 11kgf (men) were deemed to presenting ICU-acquired weakness, as proposed by Ali et al. (2008) and Bragança et al. (2019)
	Medical Research Council Scale	Peripheral muscle strength	0 (complete tetraparesis) to 60 (normal muscle strength), being less than or 48, indicating ICU-acquired muscle weakness (GOSSELINK, 2015)
	Barthel Scale	Functional independence	The score in each category ranges from 0 to 15 at five-point intervals and the sum score ranges from 0 to 100, being the higher the score the greater the independence degree. A cutoff point of 60 sum score indicates a transition point between dependence / independence on task performance, according to Granger et al. (1979) and Sulter, Steen and Keyser et al. (1999)
	Perme Intensive Care Unit Mobility Score	Functional mobility	The score ranges from 0 to 32 points; the higher the score, the lower the need for assistance (Pereira et al, 2019; Perme et al, 2014). Patients who did not reach the maximum score in each category were classified as reduced function
	Event Impact Scale	Post Traumatic Stress	The partial sum score of each subscale was

Mental assessment			performed according to the Brazilian cross-cultural adaptation study by Caiuby et al. (2010) and patients with a score ≥ 22 were associated with the presence of PTSD symptoms according to the study by Rash, et al. (2008)
	Hospital Anxiety and Depression Scale	Anxiety and Depression	Patients with a HADS score ≥ 9 were associated with the presence of anxiety and depression symptoms (Marcolino et al., 2007)
Cognitive assessment	Mini Mental State Exam	Orientation, attention, memory, language and visual-spatial skills	Cognitive performance was classified as preserved for scores above 24, however for individuals with school education below 4 years, their cut-off score was dropped to 18 (Bertolucci et al, 1994).

Maximal inspiratory pressure (MIP), Maximal expiratory pressure (MEP), Standard error of the estimate (SEE)

Spirometry

A portable digital spirometer (EasyOne® Spirometer, New Diagnostic Design, Zurich) was used to assessment the lung function following recommendations from ATS/ERS (2012). Was used forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and FEV1/FVC.

Ventilometry

The Ferraris Wright® Mark8 (Middlesex, England) analog device was used to measure the patients' slow vital capacity (SVC) after instructed to inhale to the total lung capacity and next to exhale slowly and prolonged to the residual volume.

Maximal static respiratory mouth pressure

The GlobalMed® MVD 300 manometer (HOMED EQUIPAMENTOS MÉDICO HOSPITALAR LTDA)device was used to test the respiratory muscle strength under a maximal static maneuver. Was used Maximal inspiratory pressure (MIP) and Maximal expiratory pressure (MEP).

Medical Research Council Scale (MRC-s)

The MRC scale is a reliable manual muscle strength test for 12 specified muscle groups. The muscle strength evaluates the following muscle groups bilaterally: shoulder abductors, elbow flexors, wrist extensors, hip flexors, knee extensors, and dorsiflexors. They are graded from zero to 5 points, with zero absence of muscle contraction and 5 for normal muscle strength (Pereira et al, 2019).

Hand Grip Strength Test

Hand grip strength test were tested with a Saehan®, model DHD-1 digital device (SAEHAN Corporation) following a standard technique by the American Society of Hand Therapists (ASHT) (1992).

Barthel Index

The Barthel Index was applied to patients after ICU discharge, who answered questions about functionality in the 3 months prior to hospitalization (pre-admission functional status) and the current state after discharge. The variation of the pre and post ICU index is important to be understood, since the patient's prehospital condition is an influencing factor in post discharge status.

The Barthel Index was used to measure performance in activities of daily living (ADLs) such as eating, bathing, clothing, personal hygiene, bowel elimination, bladder elimination, toilet use, bed-chair transfers, ambulation and use of stairs (Silveira et al, 2019). The sum score varies accordingly to patients' independence degree in performing tasks.

Perme Intensive Care Unit Mobility Score

The Perme Intensive Care Unit Mobility Score aims to verify the patients' functional mobility by assessing 15 items grouped into 7 categories: mental status, potential barriers to mobility, functional strength, bed mobility, transfers, gait and resistance. The score ranges from 0 to 32 points; the higher the score, the lower the need for assistance (Pereira et al, 2019; Perme et al, 2014). Patients who did not reach the maximum score in each category were classified as reduced function.

Hospital Anxiety and Depression Scale (HADS)

The Hospital Anxiety and Depression Scale has 14 items, seven for anxiety and seven for depression, presenting a system with a scale from 0 to 3 points for each question and grades from 0 to 21 for each of the two parameters (Sukantarat et al, 2007). It is a highly sensitive instrument that has demonstrated its validity in the hospital context and in critically ill patients (Caiuby, Andreoli and Andreoli, 2010).

Event Impact Scale (IES-R)

The Event Impact Scale has been referred to as the post-traumatic stress disorder (PTSD) symptomatology screening too with a better discriminant validity. This tool is widely used in research studies with critically ill patients, independently of symptom development stage (Bienvenu et al, 2013; Caiuby, Andreoli and Andreoli, 2010). It is a scale on which the individual answers the questions based on the 7 days prior to application. It consists of 22 items with a total of 88 points, where each question ranges from 0 to 4 points.

Mini Mental State Exam (MMSE)

The MMSE consists of evaluating the following domains: memory, attention, time-space orientation and specific skills such as naming and understanding. The total sum score is 30 points, thereby the higher scores indicates better cognitive performance. The mini exam includes tests of recent memory, immediate memory recording, temporal and spatial orientation, attention, calculation and language.

Data codification

Every assessment tool had their cut-off point or predictive values established by literature findings in order to classified the patients' functions into preserved or reduced. (table 1) For most tools, higher values indicate better performance thereby a preserved function. Particularly for the Event Impact Scale and Hospital Anxiety and Depression Scale scores indicate the contrary, being higher scores associated with poor outcome which is the presence of psychological symptoms.

The measurements obtained from the assessment tools were used to code the patient's functional capacity based on the International Classification of Functioning, Disability and Health (ICF) framework through the manual (ICF, 2003).

The ICF classification comprehends five components represented by letters. They are function (b), structure (s), activity and participation (d) and environment (e) followed by a numeric code representing an alphanumeric coding system. In the numerical sequence, the first number represents the corresponding domain, the second specifies the category and finally the third is a qualifier, which specifies the extent of functionality or disability in that category. The latter signals location or nature of the injury depending on the component to be classified (OMS, 2013).

ICF framework provides a common language for different healthcare professionals to describe patients' health and disability by integrating several measurable health-related domains. ICF has an organized data structure that provides basic components for statistical information and supports information systems in different healthcare policy and services (Leitão, 2014).

Data Processing and Analysis

Descriptive statistical analysis was expressed by mean, standard deviation or median and 25th and 75th percentiles for quantitative variables and percentage for qualitative variables. Preserved/reduced functions classification by equivalent ICF codes were also expressed in percentage, which proportions were analyzed by a binominal test. All the statistical analysis was performed with the Statistical Package for the Social Sciences (SPSS) version 20.0, considering a significance level for p-value <0.05.

Results

The sociodemographic characteristics of the 15 patients are represented in Table 1.

Table 1. Sociodemographic characteristics of the evaluated patients (N = 15).

	N (%) MEAN ± SD
Age (years)	**47.5** ± 17.8
BMI (kg/m^2)	**27** ± 5.6
Sex (female)	**8** (53.3)
Lifestyle habits	
Smoking (yes)	**5** (33.3)
Alcoholism (yes)	**7** (46.6)
Self-declared ethnicity	
White	**12** (80.0)
Brown	**1** (6.6)
Black	**2** (13.3)
Marital Status	
Not married	**4** (26.6)
Married	**5** (33.3)
Divorced	**2** (13.3)
Widower	**2** (13.3)
Others	**1** (6.6)
Religion	
Catholic	**7** (46.6)
Protestant	**6** (40.0)
Atheist	**1** (6.6)
Others	**1** (6.6)
Family Income	
No income	**10** (66.6)
Up to salary	**1** (6.6)
2 to 6 salaries	**2** (13.3)
3 to 6 salaries	**2** (13.3)
Years of study	
Up to 4 years	**7** (46.6)
Up to 8 years	**4** (26.6)
Up to 11 years	**3** (20.0)
> 11 years	**1** (6.6)

SD: Standard Deviation; BMI: Body Mass Index.

All patients had at least one organ dysfunction, such as Systemic Arterial Hypertension, Diabetes Mellitus, Chronic Kidney Disease, Chronic Obstructive Pulmonary Disease, comorbidities that required more attention and the need for procedures such as hemodialysis, greater glycemic control, use vasoactive drugs and longer time weaning from mechanical ventilation (Table 2).

All of them were also submitted to condition that favor mental and cognitive impairment (deep sedation) and of these 40% developed delirium. Risk factors for the development of central and peripheral muscle weakness, such as shock (46.6%), sepsis (53.3%) and the use of corticosteroids (53.3%), favoring increased ventilation weaning time and ICU stay were also observed (Table 2).

Table 2. Clinical characteristics of patients during ICU stay and length of hospital stay

Variables	N (%) MEAN ± SD MED (Q1-Q3)
APACHE II (points)	**28.1** ± 7.1
RASS (points)	**4.3** ± 1.3
Analgesia (yes)	**15** (100)
NMB (yes)	**3** (20.0)
Corticoid (yes)	**8** (53.3)
Anxiolytic (yes)	**6** (40.0)
Delirium (yes)	**6** (40.0)
vasoactive Drug use (yes)	**7** (46.6)
Hemodialysis (yes)	**5** (33.3)
Parenteral Nutrition (yes)	**14** (93.3)
Sepsis (yes)	**8** (53.3)
Shock (yes)	**7** (46.6)
ARDS (yes)	**1** (6.6)
Clinical Etiology	**9** (60.0)
Surgical Etiology	**6** (40.0)
SBT number	**1.2** ± 0.6
MV time (days)	**4** (3-6)*
ICU time (days)	**9** (7-10)*
length of hospital stay (days)	**14** (11-20)*

SD: Standard deviation, VAD: vasoactive drug, NMB: neuromuscular blocker, ARDS: Acute respiratory distress syndrome, APACHE II: Acute Physiology and Chronic Health Evaluation II, RASS: Richmond Agitation Sedation Scale, SBT: Spontaneous Breathing Test, MV: mechanical ventilation, ICU: Intensive Care Unit.
* data expressed as median and interquartile range (Q1-Q3).

The general result of the evaluation is shown in Table 3, which shows the minimum and maximum values obtained in the results for each instrument.

Table 3. Results of the multidimensional assessment strategy in the immediate post-discharge of ICU.

Variables	Minimum value	Maximum Value	Mean ±SD Median(Q1-Q3)
FEV1 (L)	**0.49**	**3.25**	**1.39**±0.91
FEV1 pred (%)	**0.50**	**0.93**	**0.70**±0.14
FVC (L)	**0.66**	**3.76**	**1.97**±10.3
FVC pred (%)	**2.50**	**5.57**	**3.84**±1.0
FEV1/FVC (%)	**50**	**87**	**68.3**
MIP (cmH_2O)	**25**	**116**	**64** (59-67)*
MEP (cmH_2O)	**40**	**106**	**62** (52-75)*
Slow Vital Capacity (ml/kg)	**26**	**81**	**51** (40-57)*
HGS left (kgf)	**4**	**77**	**28** (24-35)*
HGS right (kgf)	**4**	**98**	**32** (26-34)*
MRC-s (points)	**36**	**56**	**47.6**±5.6
PRE ICU Barthel Index (points)	**90**	**100**	**98.3**±3.6
Post-ICU Barthel Index (points)	**10**	**100**	**70**(60-75)*
Barthel Index Range (points)	**80**	**0**	**35**
Perme Score (points)	**9**	**31**	**22.8**±7.9
HADS-Anxiety (points)	**1**	**16**	**4** (4-6)*
HADS-Depression (points)	**3**	**15**	**7** (6-8)*
IER-S (points)	**4**	**39**	**21** (13-29)*
Mini-Mental (points)	**11**	**30**	**21.3**±4.6

SD: standard deviation; FEV1: forced expiratory volume in one second; FVC: forced vital capacity; MIP: maximum inspiratory pressure; MEP: maximal expiratory pressure; SVC: slow vital capacity; MRC: Medical Research Council; HGS: hand grip strength; HADS: hospital anxiety and depression scale; IER-S: event impact scale.
* data expressed as median and interquartile range (Q1-Q3).

After analyzing the results obtained in the multidimensional assesment strategy and using the cutoff points and reference equations to classify the functions as preserved or reduced, it is observed that the functionals variables most frequently affected at immediate ICU discharge were: FVC (93.3%), MIP (73.3%), MEP (86.6%) and general physical endurance (80%) (Table 4). In daily life activities, there was a reduction in functions such as dressing (80%), presence of potential barriers to mobility (80%), the presence of pain or devices connected to the body such as dialysis catheter and intravenous infusion, use of stairs (73.3%), reduction of peripheral muscle strength (66.6%) use of toilet (60%), bath (53.3%), transfers (53.3%) mobility (53.3%) and gait (53.3%). ICF codes are shown in table 4.

Table 4. Comparison of reduced and preserved function proportions with equivalent codes and categories of ICF in critically ill survivors in the immediate post-ICU discharge.

ICF Codes	ICF Categories	Reduced Function N (%)	Preserved Function N (%)	p
b449	**Respiratory functions other than specified and other**	2 (13.3) 14 (93.3) 8 (53.3)	13 (86.6) 1 (6.6) 7 (46.6)	0.035* 0.001* 1.000
b4408	**Breathing Functions, Other Specified**	0 (0)		<0.001*
b445	**Respiratory Muscle Functions**	11 (73.3) 13 (86.6)	4 (26.6) 2 (13.3)	0.118 0.007*
b7300	**Strength of isolated muscle groups**	1 (6.6) 1 (6.6)	14 (93.3) 14 (93.3)	0.001* 0.001*
b7304	**Muscle strength functions**	10 (66.6)	5 (33.3)	0.302
d550	**Eat**	4 (26.6)	11 (73.3)	0.118
d560	**Drink**			
d510	**Wash up**	8 (53.3)	7 (46.6)	1.000
d230	**Run the daily routine**	7 (46.6)	9 (60.0)	1.000
d540	**Dress up**	12 (80)	3 (20.0)	0.035*
b5253	**Fecal continuity**	5 (33.3)	10 (66.6)	0.302
b6202	**Urinary Continence**	5 (33.3)	10 (66.6)	0.302
d530	**Care with excretion processes**	9 (60)	6 (40)	0.607
d420	**Auto transfers**	8 (53.3)	7 (46.6)	1.000
d450	**Walk**	8 (53.3)	7 (46.6)	1.000
d4551	**Up down**	11 (73.3) 5 (33.3)	4 (266) 10 (66.6)	0.118 0.302
b1100	**State of consciousness**	1 (6.6)	14 (93.3)	0.001*
b789	**Motion functions, other specified and unspecified**	12 (80)	3 (20)	0.035*
b7304	**Strength of all limb muscles**	0 (0)	15 (100)	<0.001*
d4100	**Lie down**	4 (26.6)	11 (73.3)	0.302
d4153	**Stay seated**			
d4103	**Sit down**			
d4154	**Stand**	9 (60)	6 (40)	0.302
d4208	**Auto transfers**			
d450	**Walk**	8 (53.3)	7 (46.6)	0.607
b4550	**General physical endurance**	12 (80)	3 (20.0)	0.007*
b152	**Emotional functions**	4 (25)	11 (73.3)	0.118
b1263	**Physic Stability**	7 (46.6)	8 (53.3)	1.000
b140	**Attention Functions**			
b144	**Memory Functions**			
b156	**Perception Functions**			
b164	**Higher Level Cognitive Functions**	6 (40)	9 (60.0)	0.607
b167	**Mental Functions of language**			
b172	**Calculation Functions**			

Discussion

The main findings of the present study were: (1) The most frequent dysfunctions affected the respiratory system and exercise tolerance, in addition to the self-care and mobility domains; (2) After the immediate discharge from the ICU, patients surviving the critical condition have high frequencies of functional deficits with different degrees of impairment, which implies the need for follow-up rehabilitation; (3) The use of the CIF instrument allowed to code and quantify the dysfunctions presented by patients surviving the critical condition.

Our results are influenced by a scenario in which all patients had organ dysfunction, used analgesia and remained in the ICU for more than seven days, and additionally more than half were diagnosed with sepsis and used corticosteroids.

In the evaluation of the respiratory musculature, reduced values were found in the maximum respiratory pressures obtained when compared to the predictive values. This fact may be associated with factors resulting from the stay in the ICU such as the duration of mechanical ventilation, the length of stay in the ICU, sepsis and the use of sedative drugs (BORGES et al., 2015). Respiratory muscle weakness can prolong weaning from mechanical ventilation, increase hospital stay and lead patients to the inability to perform activities of daily living after hospital discharge (DE JONGHE et al., 2013). The study by Harvey et al. (2016) points out that less than 10% of patients who underwent MV for more than four days, used sedative drugs, are alive or fully functional after one year of discharge.

More than half of the patients evaluated had scores on the Medical Research Council scale for peripheral muscle strength <48 points, suggestive of muscle weakness acquired in the ICU (FMA-ICU. When using handgrip dynamometry, only one patient had reduced muscle strength, according to equations of prediction for the Brazilian population, not aligned with the interpretation given in the MRC analysis that showed impairment of muscle strength in ten individuals, which may be related to the greater muscle deficit in lower limbs, presented by patients, when evaluated only by MRC-s and preserved in MMSS, as seen by both methods.The values shown in the dynamometry when altered reflect possible motor neuromyopathy since it affects the palmar musculature early, whose condition was not present in our volunteers. quantifies the flexors (CONNOLLY, 2019).

It is important to note that the assessment of functional strength is focused on the patient's ability to move his limbs against gravity. In the present study, about 80% of the patients evaluated by the PERME scale showed reduced tolerance to exercise in the endurance domain. This result provides additional information about the patient's potential for a higher level of

activities (Nawa et al, 2014). Lower-level activities such as self-care and mobility also had a high frequency of altered function and are often associated with increased ICU stay (Katosakis et al, 2012). In our results, the subjects had an average of nine days in the ICU.

As for functional performance, there is a reduction in the score of the Barthel index in the condition after immediate discharge from the ICU (24-48 hours) when compared to the self-reported assessment of pre-hospitalization condition in the ICU. This result is similar to those found in the studies by Peres et al. (2018) and Moecke et al. (2019), with comparable methodology, verified the existence of a significant decline in functional independence immediately after discharge from the ICU.

Although there were no differences in the percentage of functions preserved and altered for mental status, we observed 43% of involvement in this domain. Regarding mental state disorders that can arise among survivors of critical illnesses, symptoms of Depression appear in approximately 30% of survivors, and Anxiety in 70%, and Post-Traumatic Stress Disorder (PTSD) in 10-50 % (Inoue, et al, 2019), values similar to those found in our study. All of our patients used sedative drugs, recognized as a factor associated with the onset of mental illness and delirium, with the consequent formation of illusory memories and PTSD (Delgado-Rodríguez et al, 2003), Other factors that increase the risk of mental illness acquired in ICUs include mechanical ventilation time, excessive alcohol use, lower educational level and pre-existing psychological diseases (Caiuby, Andreoli and Andreoli, 2010; Inoue, et al, 2019), also present in the history of the evaluated subjects.

Thus, it is essential to recognize that discharge from the ICU does not mean the end point of critical illness anymore, requiring continuity and specificity of care after discharge. In this context, the classification of functionality adds relevant information to the elaboration of protocols by the rehabilitation teams, since it allows not only to quantify the presence of dysfunction, but also to qualify the degree of commitment, which has a variable character, as seen in our results.

The study by Grill et al., 2011 suggests the use of ICF in an acute hospital environment and in the ICU as a conceptual framework, but so far there are no reports of its application in daily clinical practice in the ICU. Seguel et al., 2017 demonstrated the clinical utility of applying the ICF structure in two critical patients, and concluded that it is feasible because it provided order, synthesis and punctuated the impairment that limits functional mobility in critical patients. However, the authors point out that future “clinimetric” studies are needed to validate the psychometric properties of the ICF-based score in the ICU.

One of the limitations of this study was the difficulty in using the ICF qualifiers due to the absence in the literature of cut-off points or reference equations for the Brazilian population, but also that they were aimed at patients who survived the ICU stay, therefore, it was decided to use only the preserved or altered function. Another limitation is associated with the difficulty in finding a specific code that corresponds to lung volumes and capacities, in the absence of which, the values of ventilometry and spirometry were grouped into the domains of the ICF, respiratory functions other than specified and breathing functions, other specified.

The domains presented here are dependent on and influenced by the assessment strategy adopted and the patient profile. It is believed that different scenarios may make it necessary to evaluate other additional domains.

At last, the construction of a core set through the ICF enabled the scoring of functional changes in the physical, cognitive and mental domains of 15 patients after a critical condition. Additionally, it provided indicators and signaled the deficiencies that limit functionality, and is therefore feasible in clinical practice.

Conclusion

Respiratory strength, peripheral strength, functionality, mental and cognitive function were coded using the ICF in critical survivors in the immediate post-discharge from the ICU. The highest frequencies of dysfunctions were identified in respiratory function, exercise tolerance, self-care and mobility.

Conflict of interest

None.

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