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THAÍS REBECA PAES

**AVALIAÇÃO DAS ATIVIDADES DE VIDA DIÁRIA EM
PACIENTES COM DPOC:
REVISÃO, AVALIAÇÃO CRÍTICA E APRIMORAMENTO DAS
FERRAMENTAS DISPONÍVEIS NA LITERATURA**

Londrina
2021

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Orientadora: Profa. Dra. Nidia Aparecida Hernandes

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Dedico este trabalho à minha família.

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“É preciso que eu suporte duas ou três larvas se quiser conhecer as borboletas. Dizem que são tão belas.”

(Antoine de Saint-Exupéry)

PAES, THAÍS REBECA. **Avaliação das atividades de vida diária em pacientes com dpoC**: revisão, avaliação crítica e aprimoramento das ferramentas disponíveis na literatura. 2021. 256 f. Tese de doutorado (Programa de Pós-Graduação em Ciências da reabilitação – Programa Associado entre UEL e Pitágoras-UNOPAR) – Universidade Estadual de Londrina, Londrina, 2021.

RESUMO

Introdução: A presente tese de doutorado teve como objetivo geral contribuir cientificamente para o aprimoramento das ferramentas utilizadas na avaliação das atividades de vida diária (AVDs) em indivíduos com doença pulmonar obstrutiva crônica (DPOC). Dessa forma, os objetivos dos estudos que compõem a presente tese foram: 1) desenvolver um mapa conceitual das AVDs para indivíduos com DPOC, identificar e avaliar criticamente as ferramentas que avaliam AVDs disponíveis e verificar se as ferramentas abordam os temas encontrados no mapa conceitual; 2) Revisar sistematicamente os protocolos objetivos disponíveis para a avaliação de AVDs em indivíduos com DPOC, assim como as propriedades de medida testadas de cada protocolo; 3) Determinar a mínima diferença detectável (MDD) do desempenho funcional de indivíduos com DPOC avaliado por meio do *Londrina ADL Protocol* (LAP); 4) Desenvolver uma forma de classificação do desempenho funcional avaliado pelo LAP considerando, além de seu principal desfecho (i.e., tempo de execução), os sintomas percebidos, o estresse cardiovascular e a saturação periférica de oxigênio (SpO₂). **Métodos:** Quatro estudos foram desenvolvidos e são apresentados nesta tese. No primeiro estudo foram realizadas entrevistas com indivíduos com DPOC cujo objetivo foi identificar o que é relevante e importante em relação à realização das AVDs para, então, desenvolver um mapa conceitual e verificar se o que foi apontado pelos indivíduos é abordado nas ferramentas de avaliação de AVDs disponíveis na literatura vigente. No segundo estudo, conduziu-se uma revisão sistemática para a identificação dos testes objetivos de avaliação das AVDs em DPOC disponíveis na literatura e a verificação de suas propriedades de medida. O terceiro estudo, o método baseado na distribuição dos dados foi utilizado para determinar a MDD do LAP. No último estudo, foi realizada uma análise de clusters para dividir os indivíduos com DPOC em grupos e, na sequência, utilizou-se uma árvore de decisão para classificar os indivíduos nesses grupos utilizando-se o tempo de execução do LAP, a variação dos sintomas, das variáveis de estresse cardiovascular e da saturação periférica de oxigênio (SpO₂). **Resultados:** Os temas relevantes para a realização das AVDs identificados no mapa conceitual foram: limitação durante as AVDs; tipo de atividade; participação na vida diária; e barreiras e facilitadores. Dentre as ferramentas disponíveis, a maioria aborda a limitação durante as AVDs e o tipo de atividade; algumas ferramentas avaliam a participação na vida diária e poucas avaliam as barreiras e os facilitadores. Somente as ferramentas: Activities of Daily Living Questionnaire by Odgen et al (ADLQ); Manchester Respiratory Activities of Daily Living Questionnaire (MRADL); Pulmonary Functional Status Scale (PFSS) versão longa e curta avaliaram os quatro temas. Na revisão sistemática, foram encontrados cinco testes que avaliam objetivamente o desempenho nas AVDs, sendo que somente três são considerados confiáveis e válidos (Glittre ADL Test, MFTE e LAP), e somente um (Glittre ADL Test) teve sua responsividade testada e confirmada na população de indivíduos com DPOC. A MDD do LAP, estimada por meio do método baseado na

distribuição dos dados, varia entre 19 e 30 segundos. Por fim, a amostra de indivíduos com DPOC estudada foi dividida em quatro *clusters*, sendo identificado que a fadiga referida, o tempo de execução e a frequência cardíaca podem ser usados para classificar o grau de limitação funcional dos indivíduos nos quatro grupos: Grupo 1, que gasta mais tempo para realizar o LAP e com mais dispneia; Grupo 2, que gasta mais tempo para realizar o LAP com mais dispneia e fadiga; Grupo 3, que realiza o LAP em menos tempo e sem sintomas; e Grupo 4, que realiza o LAP em menos tempo, com poucos sintomas e com maior estresse cardiovascular . **Conclusão:** Os artigos científicos apresentados nesta tese mostraram que: 1) A Limitação durante as AVDs, o tipo de atividade, a participação na vida diária e as barreiras e facilitadores são os temas relevantes para os indivíduos com DPOC, e poucas são as ferramentas que avaliam os quatro temas; 2) Cinco teste objetivos de avaliação de AVDs foram encontrados, sendo que somente três são confiáveis e válidos e somente o *Glittre ADL Test* teve sua responsividade testada e confirmada na população; 3) A MDD do desempenho funcional avaliado pelo LAP varia entre 19 e 30 segundo; 4) Os indivíduos com DPOC podem ser classificados em quatro grupos, complementando a avaliação e facilitando a interpretação dos resultados do teste. Isso porque, alguns pacientes podem realizar o LAP com tempo similar, porém parte deles pode apresentar esforço físico e experimentar mais sintomas do que outros.

PAES, THAÍS REBECA. **Evaluation of activities of daily living in patients with copd**; review, critical appraisal and improvement of the tools available in the literature. 2021. 256 p. PhD thesis (Programa de Pós-Graduação em Ciências da Reabilitação – Programa Associado entre UEL e UNOPAR) – Universidade Estadual de Londrina, Londrina, 2019.

ABSTRACT

Introduction: This PhD thesis aimed to contribute scientifically to the improvement of the tools used in the assessment of activities of daily living (ADLs) in individuals with chronic obstructive pulmonary disease (COPD). Thus, the objectives of the studies that compose the present thesis were: 1) to develop a conceptual framework of ADLs for individuals with COPD, to identify and critically appraise existing measures that assess ADLs individuals with COPD and map each measure to the developed conceptual framework; 2) systematically review the objective protocols available for the evaluation of ADLs in COPD, as well as the measurement properties tested of each protocol; 3) to determine the minimum detectable change (MDC) in the functional performance of individuals with COPD assessed using the Londrina ADL Protocol (LAP); 4) to develop a way of classifying the functional performance assessed by the LAP taking into account, in addition to its main outcome (i.e., spent time), the perceived symptoms, cardiovascular stress and peripheral oxygen saturation (SpO₂). **Methods:** Four studies were developed and are presented in this thesis. In the first study, interviews were conducted with individuals with COPD whose objective was to identify what is relevant and important about performing ADLs, so we could develop a framework and verify that what was pointed out by the individuals is approached in the assessment tools of ADLs available in the current literature. 3) We used the distribution-based method to determine the minimum detectable change of the LAP. 4) In the last study, a cluster analysis was performed to divide individuals with COPD into groups and, subsequently, a decision tree was used to classify individuals in these groups using the spent time of the LAP, the variation of symptoms, cardiovascular stress and SpO₂ variables. **Results:** The themes for performing ADLs identified in the framework were: limitation during ADLs; type of activity; participation in daily life; and barriers and facilitators. Among the tools available, most approach the limitation during ADLs and the type of activities; some tools assess participation in daily life and a few assess barriers and facilitators. In the systematic review, five tests were found that objectively assess performance in ADLs, which only three are reliable and valid, and only one tested responsiveness in COPD population; 3) The MDC of the LAP, estimated using the distribution-based method, varies between 19 and 30 seconds; Finally, the sample of individuals with COPD studied was divided into four clusters, and it was identified that the self-related fatigue, the spent time and heart rate can be used to classify the degree of functional limitation of the individuals in four groups. **Conclusion:** The scientific papers presented herein show that: 1) Limitation during ADLs, the type of activity, participation in daily life and barriers and facilitators are the relevant topics for individuals with COPD, and few are the tools that assess the four themes; 2) five objective ADL assessment tests were found, of which only three are reliable and valid and only the Glittre ADL Test had its responsiveness tested in the population; 3) The MDC of the functional performance assessed by the LAP varies between 19 and 30 seconds; 4) Individuals with COPD can be classified into four groups: Slow doers with

dyspnea group, which spends more time to perform the LAP and with more dyspnea; Doers with dyspnea and fatigue group, which spends more time to perform the LAP with more dyspnea and fatigue; Doers and feel ok group, which performs the LAP in less time and without symptoms; and Doers with effort group, which performs the LAP in less time, with few symptoms and with greater cardiovascular stress.

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LISTA DE SIGLAS E ABREVIATURAS

6MWT:	<i>six-minute walk test</i>
ABVD:	atividades básicas de vida diária
ADLs:	<i>activities of daily living</i>
ADLI:	<i>Activities of daily living inventory</i>
ADLQ:	<i>Activities of Daily Living questionnaire by Ogden et al</i>
ADLQ:	<i>Activities of Daily Living Questionnaire</i>
AECOPD:	<i>acute exacerbation of chronic obstructive pulmonary disease</i>
AFVD:	atividade física na vida diária
AIVD:	atividades instrumentais de vida diária
AVDs:	atividades de vida diária
ATS:	<i>American Thoracic Society</i>
BMI:	<i>Body mass index</i>
CARS:	<i>Chronic Obstructive Pulmonary Disease Activity Rating Scale</i>
CAT:	<i>COPD Assessment Test</i>
CDLM:	<i>Capacity of Daily Living During the Morning</i>
CIF:	Classificação Internacional de Funcionalidade
CIT:	<i>Conditional Inference Tree</i>
COPD:	<i>Chronic Obstructive Pulmonary Disease</i>
COPM:	<i>Canadian occupational performance measure</i>
COSMIN:	<i>Consensus-based Standards for the selection of health Measurements Instruments</i>
DPOC:	doença pulmonar obstrutiva crônica
CVF:	capacidade vital forçada
ERS:	<i>European Respiratory Society</i>
FAST:	<i>Fitness and Arthritis in Seniors Trial</i>
FEV ₁ :	<i>forced expiratory volume in the first second</i>
FEV ₁ /FVC:	<i>ratio between forced expiratory volume in the first second and forced vital volume</i>
FPI:	<i>Functional Performance Inventory Long Form</i>
FPI-SF:	<i>Functional Performance Inventory Short Form</i>
FVC:	<i>forced vital capacity</i>
GARS:	<i>Groningen Activity Restriction Scale</i>

GOLD:	<i>Global Initiative for Chronic Obstructive Pulmonary Disease</i>
HR:	<i>heart rate</i>
HU:	Hospital Universitário
ICC:	<i>Intraclass Correlation Coefficient</i>
ICF:	<i>International Classification of functioning, disability, and health</i>
IQR:	<i>interquartile range 25% – 75% (intervalo interquartilico 25 – 75%)</i>
LAP:	<i>Londrina ADL Protocol</i>
LFIP:	<i>Laboratory of Research in Respiratory Physiotherapy</i>
LL:	<i>lower limb</i>
LHS:	<i>London Handicap Scale</i>
LCADL:	<i>London Chest Activity of Daily Living scale</i>
MCID:	<i>minimal clinical important difference</i>
MDC:	<i>minimal detectable change</i>
MDD:	mínima diferença detectável
MDI:	<i>minimal difference important</i>
MFTE:	<i>monitored functional test evaluation</i>
mMRC:	<i>modified Medical Research Council</i>
SD:	<i>standard deviation</i>
SEM	<i>standard error of measurement</i>
SpO ₂ :	saturação periférica de oxigênio
UEL:	Universidade Estadual de Londrina
UP:	<i>upper limb</i>
UNOPAR:	Universidade do Norte do Paraná
VEF ₁ :	volume expiratório forçado no primeiro segundo
VEF ₁ /CVF:	relação entre o volume expiratório forçado no primeiro segundo e a capacidade vital forçada

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1. INTRODUÇÃO

A doença pulmonar obstrutiva crônica (DPOC) se encontra hoje entre as principais causas de morte no mundo, representando um importante desafio na saúde pública. (1) Além disso, um estudo da *Global Burden of Disease* relatou uma prevalência de 251 milhões de casos ao redor do mundo no ano de 2016, com uma estimativa de 3,17 milhões de mortes causadas pela doença no ano de 2015. (1)

De acordo com a *Global Initiative for Chronic Obstructive Pulmonary Disease* (GOLD), a DPOC é definida como “uma doença comum, prevenível e tratável, caracterizada por sintomas respiratórios persistentes e limitação ao fluxo aéreo, geralmente, causadas por exposição significativa a partículas ou gases nocivos”. (2) Trata-se de uma doença proveniente de uma complexa interação entre a genética e o meio ambiente; além disso, o tabagismo é o principal fator de risco ambiental. (3-6) Porém, outros fatores podem influenciar o desenvolvimento e a progressão da doença, como: idade, sexo, desenvolvimento do pulmão durante a gestação e crescimento, exposição a partículas nocivas (não somente a partículas provenientes do tabaco), condição socioeconômica, asma e hiper-reatividade brônquica, bronquite crônica e infecções pulmonares. (7-15)

A doença cursa com alterações pulmonares, como a limitação ao fluxo aéreo, o aprisionamento aéreo e a inflamação das vias aéreas que são responsáveis por comprometer as trocas gasosas, podendo resultar em hipoxemia, hipercapnia e hiperprodução de secreção pulmonar. (16, 17) Apesar de se iniciar com alterações pulmonares, a DPOC é uma combinação dessas alterações somadas aos casos de

exacerbações (número e gravidade), comorbidades, e alterações extrapulmonares (ou sistêmicas). (2)

Dentre as alterações extrapulmonares estão as anormalidades nutricionais, a disfunção musculoesquelética e a intolerância ao esforço. (2) A soma das alterações pulmonares e sistêmicas podem causar sintomas, como dispneia e fadiga, que são frequentemente relatados como um fator limitante para à realização das atividades de vida diária (AVDs) pelos indivíduos com DPOC. (18-20) Com a progressão da doença, há um declínio na habilidade de realizar as AVDs, levando a prejuízos no estado funcional e incapacidades (21), gerando insatisfação com o desempenho das AVDs e, conseqüentemente, é observada uma marcante redução na qualidade de vida dos indivíduos com a doença (22, 23).

Considerando o impacto que a insatisfação com à realização das AVDs pode gerar na vida do indivíduo com DPOC, uma adequada e acurada avaliação da mesma deve ser realizada. Existem duas principais formas de avaliar as AVDs: a avaliação subjetiva por meio de questionários e a avaliação objetiva por meio de testes e protocolos. Para à realização da avaliação subjetiva existem diversos questionários relatados na literatura específicos para avaliação da realização de AVDs, como, o *Townsend's Disability Scale* (24), o *Nottingham Extended Activities of Daily Living index* (25), a Escala Katz e o *Barthel index* (26) que foram desenvolvidos para avaliação de outras populações, porém foram usados na avaliação de indivíduo com DPOC. Contudo, existem questionários desenvolvidos especificamente para avaliação desta população, alguns deles são: o *Manchester Respiratory Activities of Daily Living Questionnaire* (27), *Functional Performance Inventory* (28), *Modified Pulmonary*

Functional Status and Dyspnea Questionnaire (29) e *Canadian Occupational Performance Measure* (30). Alguns destes questionários avaliam a sensação de dispneia e fadiga durante as AVDs, outros se o paciente apresenta ou não dificuldade, outros ainda somam a pergunta o quão difícil é para realizar as AVDs a pergunta anterior. E, por fim, alguns avaliam o nível de independência do paciente (31). Essa divergência pode dificultar a comparação entre estudos e não há na literatura informações sobre a interpretação do próprio paciente sobre a realização das suas AVDs.

Apesar de os questionários oferecerem informações relevantes, foi observado que a avaliação subjetiva poderia superestimar a atividade física (32) em indivíduos com DPOC; com isso, um crescente interesse em avaliações objetivas vem surgindo. Existem poucos protocolos citados na literatura científica, entre eles estão o *Glittre ADL Test* (33), o *Monitored Functional Task Evaluation* (MFTE) (34) e o *Londrina ADL Protocol* (LAP) (35), sendo o último desenvolvido no mesmo laboratório de pesquisa no qual a presente tese foi desenvolvida. Porém, existem diferenças consideráveis entre eles. O *Glittre ADL test* é composto por quatro atividades que devem ser realizadas o mais rápido possível pelo paciente e o principal resultado é o tempo que se leva para realizar cinco vezes a sequência de atividades; além disso, o teste tem sua validade, reprodutibilidade e responsividade testados e possui valores de referência e ponto de corte. (33) O segundo teste, o MFTE, é composto de cinco atividades que devem ser realizadas no ritmo usual do indivíduo; porém, as atividades são realizadas isoladamente, com descanso entre elas. O resultado do teste é o número de repetições de cada atividade realizado em dois minutos. (34) O último, o LAP, conta com cinco

atividades que envolvem movimentos de membros superiores e inferiores e de rotação e flexão de tronco; as atividades devem ser realizadas em ritmo usual, sendo que o resultado do teste é o tempo que o indivíduo leva para realizar a sequência de atividades. Apesar de o protocolo ter a sua validade, reprodutibilidade(35) e valores de referência disponíveis(36), a MDD permanece desconhecida.

Um ponto de divergência observado entre os testes é a instrução fornecida ao indivíduo para à realização do teste. Para o *Glittre ADL Test*, solicita-se que o paciente realize o teste o mais rápido possível se aproximando das orientações dadas para à realização de testes de capacidade funcional, enquanto para o LAP e o MFTE solicita-se que o indivíduo realize as atividades em ritmo usual, ou seja, assim como eles normalmente realizam no seu dia-a-dia.

A despeito de o ritmo usual parecer mais adequado para avaliação das AVDs, foi identificado na literatura e observado na prática que outras variáveis poderiam influenciar à realização das AVDs, por exemplo, a presença de sintomas (e.g., dispneia e fadiga), a demanda cardiovascular frente ao esforço e a dessaturação de oxigênio. Sendo assim, uma nova classificação do desempenho funcional, baseada não apenas no tempo de realização dos protocolos de AVDs, mas também em outras variáveis mensuradas no teste, parece ser mais adequada e relevante para a prática profissional. A seguir se discorre uma contextualização dos temas que serão abordados nos estudos, e em seguida os artigos científicos.

2. CONTEXTUALIZAÇÃO

DOENÇA PULMONAR OBSTRUTIVA CRÔNICA: DEFINIÇÃO, MANIFESTAÇÕES CLÍNICAS E DIAGNÓSTICO

Atualmente, a doença é a terceira principal causa de morte no mundo, levando em torno de 3 milhões de pessoas a esse fim e a estimativa é que 65 milhões de pessoas apresentam moderada a grave obstrução ao fluxo aéreo. (1) Além disso, a doença pode gerar altos custos para a saúde pública, principalmente devido às exacerbações agudas da doença que necessitam de hospitalizações. A DPOC também pode prejudicar financeiramente as famílias, pois muitos dos pacientes são forçados a abandonar os seus empregos devido à incapacidade que a doença causa.(2)

De acordo com a *Global Initiative for Chronic Obstructive Pulmonary Disease* (GOLD), a DPOC é definida como “uma doença comum, prevenível e tratável, caracterizada por sintomas respiratórios persistentes e limitação ao fluxo aéreo, geralmente, causadas por exposição significativa a partículas ou gases nocivos”. (2) A inflamação crônica causa alterações estruturais, estreitamento das vias aéreas e destruição do parênquima pulmonar, levando à perda de ligação entre os alvéolos e as pequenas vias aéreas e do recolhimento elástico, contribuindo para a obstrução ao fluxo aéreo. (2, 37) Por sua vez, a obstrução ao fluxo aéreo é avaliada pela espirometria, que pode ser usada para a realização do diagnóstico e classificação da doença. O diagnóstico é realizado por presença de uma relação volume expiratório

forçado no primeiro segundo pela capacidade vital forçada (VEF_1/CVF), após o uso de broncodilatador, menor que 70%, confirmando a presença de limitação ao fluxo aéreo e sintomas clínicos (quadro 1). Ou seja, quando houver os sintomas clínicos, a espirometria deve ser solicitada de modo a realizar o diagnóstico. (2)

Quadro 1. Indicadores levados em consideração para considerar o diagnóstico de DPOC, segundo a *GOLD*.

Indicadores para considerar um diagnóstico de DPOC	
Dispneia que é:	Progressiva ao longo do tempo Caracteristicamente pior no exercício Persistente
Tosse crônica	Pode ser intermitente não produtiva; Chiado recorrente.
Produção de secreção crônica	Qualquer paciente com produção crônica de secreção.
Infecção do trato respiratório recorrente	
Fatores de risco	Fatores hospedeiros; Fumo do tabaco; Inalação de fumaça de fogão a lenha e de aquecimento doméstico.
História familiar de DPOC e/ou fator de infância	Por exemplo: baixo peso ao nascer e infecções respiratórias.

Fonte: modificado da GOLD (2)

O resultado da espirometria também é utilizado para a classificação da gravidade da doença; para isso, o VEF_1 em porcentagem do predito é utilizado, conforme vemos na tabela 1. Além disso, essa classificação também é utilizada nas decisões terapêuticas e para identificação de declínios abruptos da condição de saúde dos indivíduos.

Tabela 1. Classificação da DPOC segundo a *Global Initiative for Chronic Obstructive Pulmonary Disease*.

Classificação	VEF ₁ %predito
GOLD 1	≥ 80
GOLD 2	50-79
GOLD 3	30-49
GOLD 4	<30

Fonte: modificado da GOLD (2)

Para uma melhor compreensão da doença, uma nova forma de classificação que considera a combinação entre os sintomas avaliados e/ou o risco de exacerbação foi desenvolvida. Os sintomas podem ser avaliados usando a escala modificada do *Medical Research Council* (mMRC) ou o *COPD Assessment Test* (CAT) e o histórico de exacerbações moderadas (sem hospitalização) e graves (com hospitalização) (Figura 1). (2)

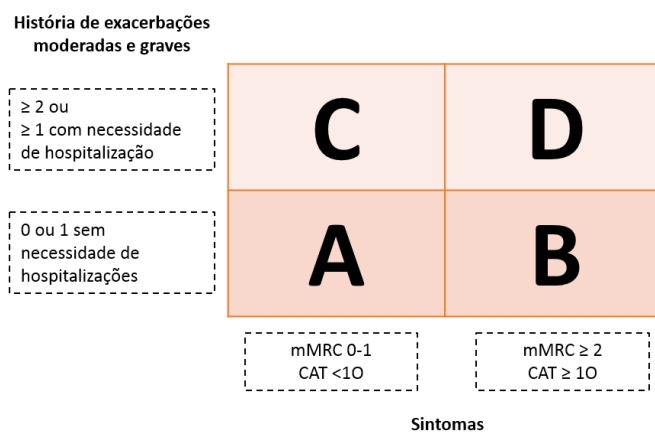


Figura 1. Classificação da DPOC segundo a *GOLD*
Fonte: modificado da GOLD (2)

Ambas as formas de classificar são úteis para o diagnóstico, prognóstico e consideração de outras abordagens terapêuticas.

Embora o comprometimento pulmonar seja a característica inicial, a DPOC apresenta manifestações sistêmicas importantes como anormalidades nutricionais, disfunção musculoesquelética e intolerância ao esforço. (2) A disfunção musculoesquelética manifesta-se por prejuízo na capacidade do músculo de gerar tensão (i.e., força) e por redução da capacidade oxidativa das fibras. Além disso, inflamação sistêmica, estresse oxidativo, inatividade física e desequilíbrio nutricional associados à hipóxia crônica são fatores que contribuem para o desenvolvimento da disfunção muscular. (2, 38) Todas essas alterações podem contribuir para uma intolerância ao exercício e piora do estado funcional. (39)

Além do mais, sintomas como dispneia e fadiga podem se manifestar em decorrência da soma das alterações pulmonares e sistêmicas comuns na doença. Esses sintomas são comumente relatados pelos pacientes e podem limitar à realização das AVDs (18-20, 40).

LIMITAÇÃO FUNCIONAL E ATIVIDADES DE VIDA DÁRIA EM DPOC

A presença de limitação ao fluxo aéreo, hiperinsuflação dinâmica e aumento do trabalho respiratório nos indivíduos com DPOC podem levar à sensação de dispneia, que é comumente relatada durante à realização das AVDs. (41, 42) Além disso, a diminuição da capacidade de gerar força e o acúmulo de lactato podem levar à sensação de fadiga que também podem contribuir para a dificuldade de realizar as AVDs. (43-45)

Estudos prévios demonstraram que indivíduos com DPOC levam mais tempo para realizar o mesmo protocolo de atividades do que indivíduos saudáveis e com maior consumo de oxigênio e produção de gás carbônico, além de apresentarem limitações ventilatórias como ausência de reserva ventilatória, diminuição do volume de reserva inspiratória, hiperinsuflação dinâmica e queixa de dispneia. (20, 41, 42)

Desta forma, na tentativa de minimizar ou evitar esses sintomas os indivíduos com DPOC podem reduzir o nível de atividade física na vida diária (AFVD), deixando de realizar as suas AVDs, adotando um estilo de vida sedentário. (32, 46)

Para facilitar o entendimento é necessário definir o que é AFVD e quais as principais diferenças entre a AVFD e AVD. A atividade física é definida como qualquer movimento corporal produzido pelos músculos esqueléticos que resultam em gasto energético e pode ser avaliada por meio de questionários e sensores de movimento (47), sendo que os últimos são mais acurados já que o paciente tende a superestimar o seu nível de atividade física. (32)

Por outro lado, as AVDs são definidas como tarefas de desempenho ocupacional que são realizadas pelos indivíduos no seu dia a dia, sendo realizadas de acordo com a necessidade e capacidade de cada indivíduo. Além disso, podem ser divididas em dois grupos principais: as atividades básicas de vida diária (ABVD) e as atividades instrumentais de vida diária (AIVD). (31)

Ao passo que as ABVD englobam atividades relacionadas ao autocuidado, por exemplo: tomar banho, escovar os dentes, vestir-se, uso do vaso sanitário, alimentação, mudança de postura (deitado para sentado; sentado para em pé), caminhar dentro de casa e dormir, entre outras. As AIVD compreendem as atividades

relacionadas com o meio no qual se vive, e geralmente são mais complexas que as ABVD, como: cuidar de animais de estimação, cuidar dos filhos, usar sistemas de comunicação, mobilidade no entorno social, controle financeiro, cuidar da saúde, preparação da comida e limpeza do lar e fazer compras, entre outras.

De acordo com a Classificação Internacional de Funcionalidade (CIF), a funcionalidade e a incapacidade estão ligadas ao bom funcionamento do corpo e a boa condição das estruturas corporais; além de dependerem da execução das AVDs e participação na sociedade. A limitação das atividades está presente quando o indivíduo apresenta dificuldade na realização das AVDs e as restrições de participação são problemas que um indivíduo pode enfrentar quando está envolvido em uma situação da realidade. Quando identificada uma limitação para a realização das AVDs é importante avaliar os facilitadores e limitadores dessa condição; além do ambiente físico, social e atitudinal em que as pessoas vivem e conduzem a sua vida. (48)

Dada a importância da realização das AVDs para os seres humanos, fica nítida a necessidade de sua avaliação em pacientes com doença crônica, considerando o quanto tal doença pode prejudicar a realização das AVDs. Na literatura há uma vasta possibilidade de ferramentas para a avaliação das AVDs. Contudo, muitas vezes há uma confusão entre os termos usados para referenciar esse constructo. É possível encontrar os termos capacidade funcional, estado funcional e desempenho. Por isso, um mapa conceitual foi desenvolvido para facilitar o entendimento desses constructos. (Figura 4)

Este estudo traz que o estado funcional se refere ao domínio total da funcionalidade, e é definido como um conceito multidimensional que caracteriza a

capacidade de alguém atender às necessidades da vida; ou seja, aquelas atividades que as pessoas realizam no curso normal das suas vidas para atender as necessidades básicas, cumprir funções usuais e manter sua saúde e bem-estar. (49)

Há quatro dimensões do estado funcional: a capacidade funcional, o desempenho funcional, reserva funcional e utilização da capacidade funcional. A capacidade funcional é definida como o potencial máximo para realizar as atividades diárias, sendo um reflexo da capacidade ventilatória e cardíaca. Já o desempenho funcional é definido como as atividades físicas, psicológicas, sociais, ocupacionais e espirituais que as pessoas realmente fazem nos seu dia-a-dia, são compostas por atividades que o indivíduo necessita, quer realizar e geralmente requer menos do que capacidade funcional, além de dependerem da motivação do indivíduo. Por sua vez, a reserva funcional é a diferença entre a capacidade funcional e desempenho funcional; de modo geral, as pessoas não usam toda a sua capacidade para realizar as AVDs. Além disso, é importante ressaltar que indivíduos treinados apresentam uma capacidade funcional melhor, e conseqüentemente uma reserva maior; enquanto indivíduos com doenças crônicas podem apresentar uma capacidade menor, usando quase toda a capacidade para realizar as AVDs. Por fim, a utilização da capacidade funcional se refere a extensão em que o potencial funcional é requisitado; de tal forma, que conforme a utilização da capacidade funcional aumenta, o esforço aumenta e o desempenho se aproxima da capacidade diminuindo a reserva funcional. (49)

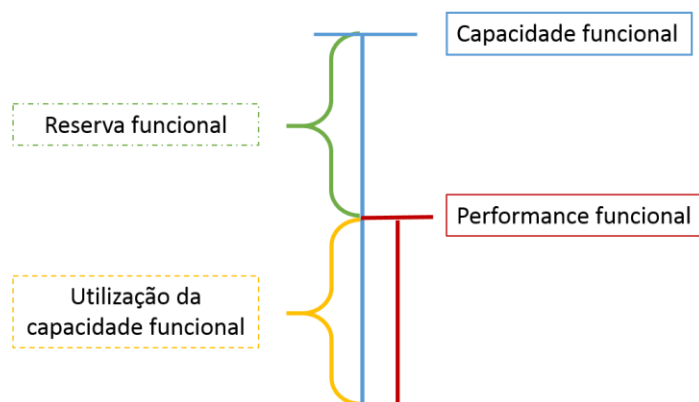


Figura 2. Mapa conceitual do estado funcional.
 Fonte: modificado de Leidy, 1994 (49)

A capacidade funcional pode ser avaliada por meio de testes como o *sit-to-stand* (50), *timed up and go*, *gait speed* (51), *step test* (52), entre outros. Em contrapartida, o desempenho pode ser avaliado de forma subjetiva e objetiva. O desempenho auto percebido e a satisfação com a realização das AVDs podem ser avaliados por meio de questionários. Enquanto a avaliação objetiva usa testes e protocolos.

FERRAMENTAS E MÉTODOS DE AVALIAÇÃO DE AVDS

Para a avaliação das AVDs o constructo que deve ser avaliado é o desempenho e os questionários auto relatados são as ferramentas utilizadas para avaliar o desempenho auto percebido. Dentre os questionários para este fim, destacam-se a Escala Katz (53), a escala Lawton and Brody (54) e a Medida de Independência funcional – sub escala motora (55); porém estas escalas foram desenvolvidas para avaliar pacientes com outras alterações e não indivíduos com doenças pulmonares

crônicas. Sendo assim, estes questionários podem não abordar questões importantes para esta população, como a falta de ar relatada durante as atividades.

Em compensação, existem alguns questionários que foram desenvolvidos especialmente para avaliação dos indivíduos com DPOC, por exemplo: *Manchester Respiratory Activities of Daily Living Questionnaire* (27), *Functional Performance Inventory—Short Form* (28), *Modified Pulmonary Functional Status and Dyspnea Questionnaire* (29) e *Canadian Occupational Performance Measure* (56). Sendo que estes questionários, por serem desenvolvidos especificamente para avaliar pacientes com DPOC, são mais adequados para uma avaliação do desempenho auto percebido nesta população.

O lado negativo de existir uma grande variedade de ferramentas é que nem sempre elas avaliam da mesma forma. Por exemplo, dentre as ferramentas disponíveis algumas avaliam os sintomas durante à realização das AVDs; enquanto, outras avaliam a dificuldade e/ou o grau de dificuldade na realização; por fim, existem algumas que questionam o indivíduo sobre o seu nível de independência. Além disso, não sabemos se as perguntas contidas nas ferramentas são realmente relevantes e significativas para os pacientes, e nem se a ferramenta foi conceitualmente baseada nos muitos fatores que podem desempenhar um papel no desempenho em realizar as AVDs. Visto isso, o primeiro estudo da tese entrevistou pacientes a fim de estabelecer o que realmente é importante para eles na realização das AVDs; realizou um levantamento das ferramentas disponíveis a fim de avaliá-las; e finalmente, verificou se as ferramentas continham as questões relevantes para esta população no seu conteúdo.

Ademais, outra forma de avaliar o desempenho é objetivamente, por meio de testes e protocolos; porém, ao contrário dos questionários não há uma variedade tão extensa de ferramentas disponíveis.

O mais comumente citado e estudado é o *Glittre ADL test*, um teste composto de quatro atividades que deve ser realizado o mais rápido possível. O indivíduo inicia o teste levantando-se da posição sentada, carregando uma mochila nos ombros (com 5kg para homens e 2,5kg para mulheres). Em seguida, ele caminha ao longo de um corredor de 10 metros interposto por dois degraus e chega até uma prateleira onde deve organizar objetos; o indivíduo então caminha de volta ao longo do mesmo circuito, sentando-se e iniciando imediatamente a próxima volta. O tempo para completar cinco voltas é usado como desfecho. (33) (figura 5)

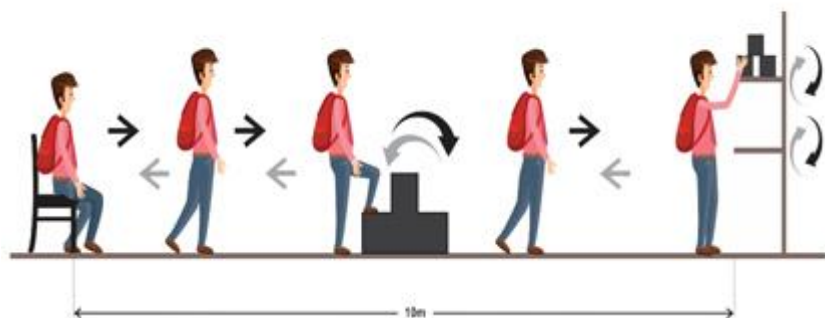


Figura 3. Glittre ADL Test.
Fonte: Silva et al. (57)

É um teste simples e fácil de aplicar, e envolve atividade de membros superiores e de membros inferiores, porém o fato de ser realizado o mais rápido possível o caracteriza como um teste que avalia capacidade funcional. Além disso, os testes não

contem movimentos essenciais para a realização das AVDs, como a rotação de tronco. (36)

Em contrapartida temos outros dois protocolos que avaliam o desempenho nas AVDs em ritmo usual, assim como na vida real, são eles: o MFTE (34) e o LAP (35). O MFTE foi pouco usado em estudos, é um teste composto de cinco atividades: caminhar, sentar e levantar, mover 12 objetos de uma prateleira na altura da cintura para uma prateleira no nível dos ombros, caminhar novamente carregando uma carga e terminar o protocolo subindo e descendo degraus. Cada tarefa deve ser realizada por dois minutos e número de vezes que realiza cada atividade é o resultado. Porém, o teste deve ser interrompido se o indivíduo exceder 70% da sua frequência cardíaca máxima, limitando a aplicabilidade clínica do teste. Além disso, os movimentos de flexão e rotação de tronco não são realizados durante o protocolo. (36)

Visto isso, o laboratório onde a presente tese foi realizada desenvolveu a Londrina ADL protocol, um protocolo composto de cinco atividades, realizadas no ritmo usual, com atividades que envolvem movimentos que estão presentes na maioria das AVDs dos indivíduos. O paciente deve iniciar o circuito em pé no ponto inicial, caminha 3 metros até uma mesa com objetos, senta em uma cadeira sem apoio para membros superiores e transfere 10 objetos (peso varia entre 250 g e 2 Kg) de um lado da mesa para o outro e depois retorna os mesmos objetos para o ponto inicial, depois caminha 1,5 metro até o ponto onde estão 2 sacolas que, juntas, contém 10% do peso corporal do indivíduo divididos igualmente entre as sacolas. Então, o indivíduo pega as sacolas e caminha em um corredor de 6 metros três vezes. Em seguida, caminha 3,5 metros e transfere 12 objetos (peso varia entre 250 g e 2 Kg) que estão em uma mesa para

estante (mesa e estante estão lado a lado) e depois retorna os mesmos objetos para a mesa. Seguindo para a próxima atividade, o indivíduo caminha 4 metros até um varal e estende 10 peças de roupa que estão em um cesto no chão e depois recolhe as peças de roupa, retornando-as para cesto. Por fim, ele caminha 1,5 metro até um corredor de 6 metros onde caminha livre de pesos por três vezes. Enquanto o paciente realiza o LAP, o tempo de execução é registrado. (Figura 4)

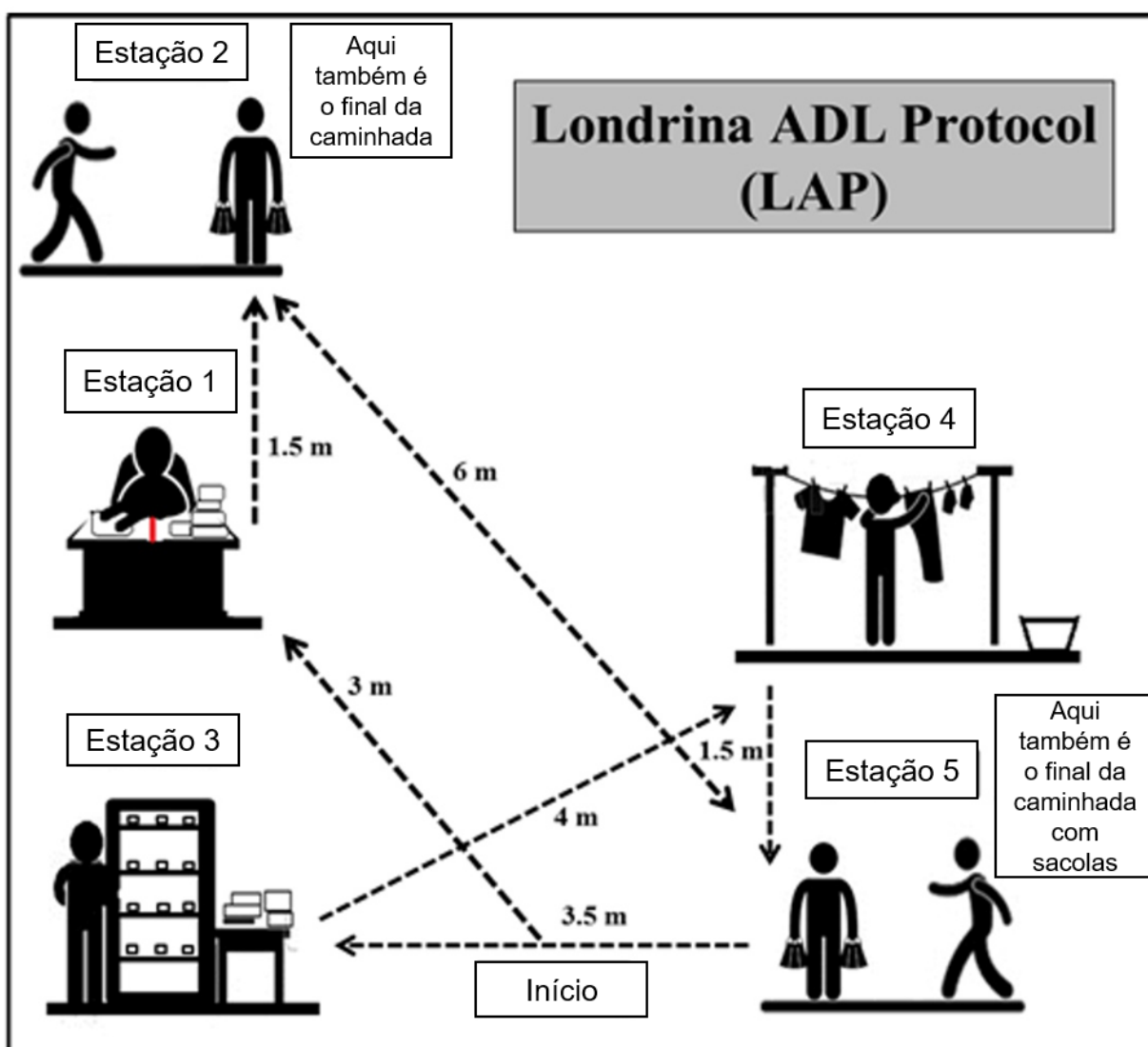


Figura 4: Londrina ADL Protocol.
Fonte: Sant'Anna et al., 2017 (35)

A escolha da ferramenta a ser utilizada na pesquisa ou na prática clínica deve considerar se: a ferramenta foi ou não desenvolvida para a população específica e também se as propriedades de medida foram testadas. O *Consensus-based Standards for the selection of health Measurements Instruments* (COSMIN) (58) visa fornecer ferramentas para seleção de instrumento baseado em evidências. Além disso, traz que a seleção do instrumento pode ser facilitada pela avaliação padronizada do conteúdo e propriedades de medidas dos instrumentos de medição. Ao avaliar a qualidade de um instrumento, evidenciamos três domínios de qualidade: a confiabilidade, a validade e a capacidade de resposta.

A confiabilidade é o grau em que a medição está livre de erro, ou seja, que as pontuações, para o paciente que não apresentou mudança, são as mesmas em medidas repetidas sob várias condições, por exemplo: ao longo de um curto período de tempo (teste-reteste) ou por pessoas diferentes (inter examinador). Em seguida, é importante verificar se o teste é válido para aquela população específica, ou seja, se avalia exatamente o que se propõe a avaliar. Por fim, é importante verificar a responsividade do teste, ou seja, a habilidade de detectar mudança temporal ou após uma intervenção. (58)

Dentre os protocolos que avaliam objetivamente o desempenho, os três citados anteriormente são válidos e confiáveis(34, 35); porém, somente o Glittre ADL Test tem a responsividade testada. Além disso, a forma de realização dos testes faz com que o Glittre ADL Test avalie um constructo diferente do MFTE e do LAP. Sendo necessária a

verificação da responsividade de um dos testes que avaliam o desempenho do paciente objetivamente.

A responsividade é avaliada por meio da detecção de mudança temporal ou após intervenção, como citado anteriormente. Existem duas diferentes formas de determinar a mínima diferença, elas serão definidas a seguir: a mínima diferença detectável (MDD) é a menor alteração que pode ser detectada pelo instrumento, além do erro de medição, e é avaliada por meio do método de distribuição de dados. Enquanto a mínima diferença importante e a mínima diferença clinicamente importante são as menores mudanças na pontuação do constructo a ser medido que é percebido como importante pelos indivíduos, médicos ou outras pessoas relevantes.

Tanto as avaliações de desempenho auto percebido como as avaliações objetivas são necessárias para uma avaliação completa do paciente, a fim de detectar quais são as dificuldades para à realização das AVDs. Para à realização da avaliação de desempenho auto percebida há diversas ferramentas com suas propriedades de medida já testadas, porém até onde sabemos não há na literatura ferramenta que avalie o desempenho objetivamente com a responsividade avaliada. Por isso, o segundo estudo fez um levantamento das ferramentas que avaliam o desempenho funcional de forma objetiva e verificou se as propriedades de medida haviam sido testadas em todas elas. Após a verificação de que somente o Glittre ADL Test havia avaliado a responsividade após a aplicação de uma intervenção, o estudo 2 teve como objetivo encontrar a MDD do desempenho funcional avaliado por meio do LAP, ferramenta que avalia o desempenho nas AVDs.

Todavia, uma dúvida surgiu: será que o tempo é a melhor variável de desfecho para o desempenho funcional, uma vez que os pacientes devem realizar as AVDs no seu ritmo usual? Será que outras variáveis influenciam o desempenho nas AVDs? A hipótese criada foi de que sim, outras variáveis devem influenciar o resultado do protocolo e que os indivíduos com DPOC podem ser classificados em quatro grupos: primeiro, os que realizam o teste mais rápido, mas sem sinais e sintomas porque têm a sua capacidade de exercício preservada; os que mesmo com sinais e sintomas optam por realizar as atividades mais rapidamente; os que realizam devagar, para se preservar e não sentir os sintomas; e por fim, existe aqueles que fazem devagar e ainda assim com sintomas, que são os mais graves. Para responder essas dúvidas um quarto estudo foi desenvolvido com o objetivo de classificar os indivíduos quanto ao tempo de realização do LAP e os sintomas de dispneia e fadiga, o estresse cardiovascular e a dessaturação de oxigênio.

3. OBJETIVOS

- Estudo 1: Desenvolver um mapa conceitual das AVDs para indivíduos com DPOC, identificar e avaliar criticamente as ferramentas que avaliam AVDs disponíveis e verificar se as ferramentas abordam os temas encontrados no mapa conceitual;
- Estudo 2: Revisar sistematicamente os protocolos objetivos disponíveis para a avaliação de AVDs pacientes com DPOC, assim como as propriedades de medida testadas de cada protocolo;
- Estudo 3: Determinar a mínima diferença detectável (MDD) do desempenho funcional de indivíduos com DPOC avaliado por meio do *Londrina ADL Protocol* (LAP);

– Estudo 4: Desenvolver uma forma de classificação do desempenho funcional avaliado pelo LAP considerando, além de seu principal desfecho (i.e., tempo de execução), os sintomas percebidos, o estresse cardiovascular e a saturação periférica de oxigênio (SpO₂)

4. ARTIGOS CIENTÍFICOS

4.1 ARTIGO 1 - Formato de acordo com:

Disability and Rehabilitation – Qualis: A1, Fator de Impacto: 2.054

Title:

DEVELOPMENT OF A CONCEPTUAL FRAMEWORK OF ACTIVITIES OF DAILY LIVING IN INDIVIDUALS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT

The objective of this study is to improve measurement of activities of daily living (ADLs) in individuals with COPD. The specific aims are three-fold: 1) to develop a conceptual framework; and 2) to identify and critically appraise existing measures that assess ADLs in COPD and map each measure to the developed conceptual framework. The study was divided in two phases: phase I focused on developing the conceptual framework and phase II identified and critically appraised the existing ADLs tools. We developed a conceptual framework with four components based on the interviews: Limitation during ADLs, type of activities, Participation in daily life and, Barriers or facilitators. Then, we checked that most of tools assess limitation during ADLs and type of activities; many tools assessed participation in daily life; and few tools assessed barriers and facilitator. A conceptual framework to support clinicians in the selection of tool to assess ADLs has been presented in this article.

Keywords: COPD, activities of daily living, disability evaluation.

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation (1). The presence of airflow limitation, lung hyperinflation and increased work of breathing associated with systemic effects, such as peripheral muscle dysfunction, physical inactivity and deconditioning may lead to progressive dyspnea and fatigue (2-4) which limits their ability to carry out activities of daily living (ADLs) (5, 6).

Simple arm elevation is involved in many ADLs and has been shown to increase ventilatory and metabolic demands in patients with COPD (7, 8). Lahaije et al. (5) demonstrated that an increase in oxygen consumption and ventilatory demand at iso- $\dot{V}O_2$ were associated with complaints of dyspnea. Furthermore, the decrease in force-generating capacity of the upper or lower limb muscles present in individuals with COPD may contribute to arm or leg fatigue and consequently to the difficulty in performing ADLs (9-12). Behavioural components such as fear, anxiety and depression may also compound the sensations of dyspnea which may lead to the avoidance of ADLs or adaptations to how they perform them (13-15).

Previous research in elderly people have shown that disability is a predictor of admission to a nursing home, use of hospital and home-care services, as well as mortality (16). In COPD, Yohannes et al. have been found that ADLs, assessed using the Manchester Respiratory Activities of Daily Living questionnaire questionnaire, is a predictor of mortality showing the importance of considering the assessment of ADLs in the management of COPD (17).

There are several approaches to assessing ADLs in people with COPD which involve either self-reported questionnaires (18-22) or performance-based tests (23-25). Most of these measures have been found to be valid and reliable for obtaining information on the ability to perform ADLs in patients with COPD (18-21, 23, 25). However, the conceptual framework each of these measures are based on has been poorly described, which leads to confusion as to what is being measured. A conceptual framework is a theoretical model that defines the concepts of interest, their interfaces and determinants (26). It also helps define the structure, content and coherence to the concepts being measured (26). Previous studies that have attempted to develop a conceptual framework of functional activities in individuals with COPD (27) focused mainly on identifying the major categories of activities that are important to their day-to-day life rather than identifying factors that may influence the performance of the desired activities such as symptoms, complaints and restrictions.

The International Classification of Functioning, Disability and Health (ICF) model (28) is a universal classification of disability and health and provides a standard language and framework for the description of health and health-related domains. Although the ICF Core Sets for COPD (29), developed specific for this disease, include some items that are important to understand the ability to perform ADLs in this population, it is not a truly framework in ADLs for this population.

The aims are two-fold: 1) to develop a conceptual framework of ADLs for individuals with COPD; 2) to identify and critically appraise existing measures that assess ADL in COPD and map each measure to the developed conceptual framework

RESEARCH PROCESS

Study design

We used a multi-method approach to examine the existing literature and the experience of patients with COPD during performance of ADLs. This approach allowed the investigators to create a conceptual framework for understanding ability during ADLs in COPD by combining their knowledge with literature information and patients' experience. The ethics approval was obtained by West Park Healthcare Centre. The study was divided in two phases: phase I focused on developing the conceptual framework and phase II identified and critically appraised the existing ADL tools.

Literature review

To identify existing tools that assess ADL in COPD we used a systematic review on measurement of ADLs by Janaudis-Ferreira et al. which was published 2014 (30). The last search conducted by the authors of this review was October 2012 so we updated the search to find new articles published after this date. The keywords used were: "Pulmonary Disease, Chronic Obstructive"[Mesh] OR COPD [Text word] AND "Activities of Daily Living"[Mesh] OR "activities of daily living Field: Title/Abstract OR "day to day activities" Field: Title/Abstract OR "daily life activities" Field: Title/Abstract OR "daily activities" Field: Title/Abstract AND instrument Field: Title/Abstract OR measure Field: Title/Abstract OR instrument Field: Title/Abstract OR test Field: Title/Abstract OR questionnaire Field: Title/Abstract OR scale Field: Title/Abstract OR assessment Field: Title/Abstract OR outcome Field: Title/Abstract. We considered published articles of any study design that assessed ADLs in individuals with COPD using a self-reported questionnaire or performance-based test.

Phase 1: Conceptual Framework

This phase consisted of two activities: patient interviews and development of the framework.

Individual patient interviews

A female trained research assistant (RA) with a master's degree who was not part of clinical team conducted face-to-face individual patient interviews which were audio recorded and transcribed verbatim by a professional transcriber. Most qualitative studies use theoretical saturation to determine the sample size. A study found that saturation occurred largely when twelve interviews were analyzed (30). Fifteen patients were recruited for the study. The aim of the interviews was to capture patients' experience during performance of ADLs in relation to their COPD symptoms, noted abilities, restrictions and required environmental supports. The interview began with an introduction by the RA to explain the purpose of the study. Thereafter, the RA used open-ended and probing questions that are focused on understanding the ability to perform ADLs. The first question asked the patients to reflect on the activities that they want or need to do in their day-to-day life. The remaining questions focus on symptoms, complaints or restrictions and required environmental support (Interview guide in Appendix 1). The methodology of interviewing patients to generate concepts and items to create a conceptual model has been extensively used in health research (26, 31, 32).

Development of the conceptual framework

Patients with COPD (41) were recruited from the pulmonary rehabilitation programs offered at West Park Healthcare Centre (WPHC) to participate in the interviews. In order to describe the patient population, demographic data such as sex,

age and measures of lung function forced expiratory volume in 1 second (FEV₁) were retrieved from their medical chart. Functional limitation from dyspnea was quantified using the mMRC scale (42).

The information retrieved from the patient interviews were analyzed using a qualitative content analysis method (33). The ICF model (28) was used as our guiding framework to create the ADLs model in COPD. We classified the concepts identified during the interviews in the context of impairments in body function and structure, limitations in activity, restriction in participation and personal and environmental factors (28). By conducting the literature review, the patient interviews and using the ICF as our guiding framework, we ensured that we incorporated the three pillars of evidence-based practice (best available research, patients' values and expert opinion) in the development of our ADLs framework.

Phase II: Creating inventory, critically appraising the existing tools and mapping with the developed framework

In this phase, we created an inventory of existing tools identified in our literature search, critically appraised the tools and mapped the tools with the developed framework.

Each instrument was critically appraised using the criteria and attributes suggested by the Scientific Advisory Committee (SAC) of Medical Outcomes Trust (34) (appendix 2). This checklist assesses the tools in terms of their conceptual basis (e.g. the rationale for and description of the concept and the populations that a measure is intended to assess) and measurement properties (reliability, validity, responsiveness, interpretability, respondent and administrative burden, alternative modes and cultural

and language adaptations). The score is 0 when the item is unclear or no and 1 when the item is yes. The total possible score is 8. One investigator (TP) appraised the tools.

Two investigators (TP and TJF) were involved in the mapping process. Each tool was evaluated carefully and mapped with the developed framework.

Data analysis

Descriptive and demographic data of the patients were reported using mean, median, range, frequencies and proportions. A qualitative content analysis method was used to analyze textual data from the interviews (33). Qualitative content analysis involves classifying large amounts of text into an efficient number of categories that represent similar meanings through a systematic process of developing codes, categorizing these codes into themes or patterns, and identifying the relationship between the categories. More specifically, we used a directed content analysis, which utilizes existing theoretical frameworks to guide the research questions, data collection and analysis. For this study we used the ICF as our guiding theoretical framework. Directed content analysis uses deductive application of codes and categories to classify relationships between categories and is used more frequently when aiming to extend existing theoretical propositions (33).

Several strategies were employed to ensure methodological rigor during data analysis and interpretation. These include triangulation and explanations of decisions made during data collection and analysis (35). Triangulation refers to using multiple methods, sources and investigators to improve the validity of the research findings. In this study we employed two triangulation strategies. First, both in-depth patient interviews and the existing literature were used to develop the model. Three

investigators (MS, TJF and TP) independently coded the first three interviews by hand in order to develop a coding book to ensure inter-rater coding and then one investigator coded the remaining interviews using the N-Vivo. In addition, several meetings between two investigators (TP and TJF) occurred to interpret the codes and create the themes which were mapped with the ICF framework.

RESULTS

Literature review

The systematic review published by Janaudis-Ferreira identified 16 generic instruments and 11 respiratory disease instruments. Of these, three were performance-based. The update search identified five additional respiratory disease-specific and two generic instruments. Of these, three were performance-based tools. The characteristics of the self-reported and performance-based tools are described in table 1 and table 2 respectively.

Table 1. Characteristics of the self-reported tools and how it matches with the developed framework

Instrument	Domains	Type of question	Scaling of items	Does this tool consider aspects of the developed framework?
ADL Hierarchy Scale	Personal hygiene; Toilet use; Locomotion; Eating.	Degree of independence	Yes or no	Yes <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked if he/she needs extensive assistance in some activities) • Type of ADL (e.g., Eating, locomotion, personal hygiene, and ADL) • Barriers and facilitators (i.e., The patient is asked if he/she needs the assistance of someone else to perform the activities)
Activities of daily living inventory (ADLI)	Physical stamina; Speech-related; Arm and trunk movement; Coordinated Dexterity; Prolonged Continuous Exercise.	Degree of difficulty	11-point scale 0 = No difficulty 10 = Extremely difficulty	Yes <ul style="list-style-type: none"> • Limitations during ADL (i.e., The patient is asked if he/she is independent to perform some ADL) • Type of activities (e.g., Toileting, dressing up, and laundry) • Participation in daily

Activities of Daily Living Questionnaire (ADLQ)	Playing a fast game Running a short distance Doing have work Sports likes golfing, bowling Active game with children Being angry or upset Walking on the level with others Carrying a load like groceries Doing light repair work Working around the house Shopping and banking Using public transportation Quiet activity, like playing cards Eating out or with company Driving a car in the	Degree of independence	5-point scale “ I do this activity with no trouble at all”; “ I do this activity but sometimes find it difficult, because of breathing trouble”; I do this activity but sometimes find it difficult, because of reason not related to breathing”; I never do this activity, because of breathing trouble”; I never do this activity, for reason not related to breathing”	life (e.g., Shopping for groceries, use of transport, and attending Clinic) Yes <ul style="list-style-type: none"> • Limitations during ADL (i.e., The patient is asked if he/she find some activities are difficult to perform) • Type of ADL (e.g., Walking on the level with others, doing light repair work, and doing heavy work) • Participation in daily life (e.g., Activity game with children, shopping and banking, and using public transportation)
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Activities of Daily Living questionnaire by Ogden et al (ADLQ)	city Eating at the table; Hygiene and grooming; Managing at the toilet; Dressing; Bathing, Meal preparation; Cleaning; Laundry; Grocery shopping; Community activities; Working	Degree of difficulty, short of breath and tired	6-point scale 0 = Not applicable 1 = I can't take this action, even with help 5 = I can do this myself. I don't get short of breath and don't get very tired	Yes <ul style="list-style-type: none"> • Limitations during ADL (i.e., The patient is asked if he/she can do or cannot do some activities) • Type of ADL (e.g., Eating at the table, dressing, and laundry) • Participation in daily life (i.e., Grocery shopping, community activities, and working) • Barriers and facilitators (e.g., The patient is asked if he/she needs a shower bench)
Barthel index	Questions regarding Feeding; Bathing; Grooming; Dressing; Bowels; Bladder; Toilet use; Transfers;	Degree of independence	Variable scale 0 = Unable 5 = Needs help 10 = Independent	Yes <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked he/she needs help to perform some activities) • Type of ADL (e.g., Feeding, dressing, and mobility)

	Mobility; Stairs.			<ul style="list-style-type: none"> Barriers and facilitators (i.e., The patient is asked he/she needs a wheelchair or someone else to be able to walk)
Chronic Obstructive Pulmonary Disease Activity Rating Scale (CARS)	Self-care activity; Domestic activity; Outdoor activity; Social interaction activity.	Degree of independence	3-point scale 0 = Dependent 2 = Completely independent	<p>Yes</p> <ul style="list-style-type: none"> Limitation during ADL (i.e., The patient is asked if he/she can do or cannot do some activities) Type of ADL (e.g., Bathing, sweeping floors, and making the bed or changing the sheets) Participation in daily life (e.g., Carrying groceries, riding on a bus, and participating in community services)
Capacity of Daily Living During the Morning	Morning activities such as: Washing face and body;	Degree of independence and degree of difficulty	3- and 4-point-scale Independence Yes I did it by myself Yes, but I needed help to	<p>Yes</p> <ul style="list-style-type: none"> Limitation during ADL (i.e., The patient is asked if he/she can or

(CDLM)	Drying the body using a towel; Getting dressed; Preparing breakfast Walking around the house	wash myself No, I was unable to wash myself No, I did not wash myself this morning for other reasons Difficulty Not at all; A little; Moderately; Very extremely	cannot perform some activities and how difficult are them) <ul style="list-style-type: none"> • Type of ADL (e.g., Washing, getting dressed, and walking around the house) • Barriers and facilitators (i.e., The patient is asked if he/she needs help from someone else to perform the activities) 	
Canadian occupational performance measure (COPM)	The patient chooses the activities that he needs to, want to or expected to perform in these three domains: Self-care; Productivity; and leisure.	Degree of importance and performance	10-point Likert scale	Yes <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked how he/she scored the performance of some activities) • Type of ADL (i.e., The patient choose the five most important activities to him) • Participation in daily life (i.e., The patient choose the five most important activities to him)

Duke activity status index	<p>Questions regarding:</p> <p>Can you take care of self?</p> <p>Can you walk a block or two on level ground?</p> <p>Can you do heavy work around the house like vacuuming, sweeping floors or carrying groceries?</p>	Limitation to perform the activity	Yes or no	<p>Yes</p> <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked if he/she can perform some activities) Type of ADL (e.g., Taking care of self, walking a block or two on level ground, and running a short distance) • Participation in daily life (e.g., Participating in moderate recreational activities like, golf, bowling, dancing, double tennis or throwing a baseball or football)
Fitness and Arthritis in Seniors Trial (FAST)	<p>Ambulation/climbing</p> <p>Transfer</p> <p>Complex</p> <p>Upper extremety</p> <p>Basic</p>	Degree of difficulty	<p>6-point scale</p> <p>1 = Usually did with no difficulty</p> <p>6 = Usually did not do for other reason</p>	<p>Yes</p> <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked if he/she find some activities that he/she usually does is difficult to perform) • Type of ADL (e.g., Walking several blocks, moving in and

Frenchay Activity Index (FAI)	Domestic chores; Leisure/work; Outdoor.	Frequency the patient performs the activity	<p>1 = Never 2 = Under once weekly 3 = 1—2 times a week 4 = Most days</p>	<p>out of a chair, and preparing your own meals)</p> <ul style="list-style-type: none"> • Participation in daily life (e.g., Participating in community activities such as religious service, social activities or volunteer work)
Functional Performance Inventory Long Form	Body Care; Household maintenance; Physical Exercise;	Degree of difficulty	<p>4-point scale 1 = No difficulty 2 = Some difficulty 3 = Much difficulty</p>	<p>Yes</p> <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked if he/she performs some activities and how often he/she do them) • Type of ADL (e.g. Washing up, washing clothes, and gardening) • Participation in daily life (e.g., Local shopping, social outings, and gainful work)
				<p>Yes</p> <ul style="list-style-type: none"> • Limitation during ADL (i.e., the patient is asked if he/she finds

(FPI-LF)	Recreation; Spiritual Activities; Social Interaction.		4 = Don't do because of health reason	<p>some activities are difficult to perform)</p> <ul style="list-style-type: none"> • Type of ADL (e.g., dressing and undressing, washing dishes, and doing the laundry) • Participation in daily life (e.g., grocery shopping, going to the movies, and going to religious ceremonies)
Functional Performance Inventory Short Form (FPI-SF)	Body Care; Household maintenance; Physical Exercise; Recreation; Spiritual Activities; Social Interaction.	Degree of difficulty	4-point scale 1 = No difficulty 2 = Some difficulty 3 = Much difficulty 4 = Don't do because of health reason	<p>Yes</p> <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked if he/she find some activities are difficult to perform) • Type of ADL (e.g., Showering or bathing, vacuuming or sweeping, and walking up and down a flight of stairs • Participation in daily life • (e.g., Grocery shopping, going to appointments [such as doctors or dentists] and, going to the

Groningen Activity Restriction Scale (GARS)	Dressing; Transfers; Grooming; Mobility, Stairs; Preparing; Meals; Making the bed; Housework; Shopping.	Degree of independence	4-point scale 1 = yes I can do it fully independently without any difficulty 4 = I cannot do it fully independently. I can only do it with someone's help Or 4 = No, I cannot do it at all. I need complete help	<p>movies)</p> <p>Yes</p> <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked if he can perform some activities independently or not and how difficult it is to do them) • Type of ADL (e.g., Getting in and out of bed, washing and drying their whole body, and getting around in the house) • Participation in daily life (e.g., Doing shopping) • Barriers and facilitators (i.e., The patient is asked if he/she needs someone's help)
Katz Activities of Daily Living scale	Bathing; Dressing; Toileting; Transferring; Continence; Feeding.	Degree of independence	Yes or no	<p>Yes</p> <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked if he/she is independent to perform some activities

Lawton and Brody Activities of Daily Living scale	Questions regarding: Feeding; Bathing; Grooming; Dressing; Bowels; Bladder; Toilet use; Transfers; Mobility; Stair.	Degree of independence	Variable scale	<ul style="list-style-type: none"> • Type of ADL (e.g., Bathing, transferring, and feeding)
				<p>Yes</p> <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked if he can perform some activities independently or not) • Type of ADL (e.g., Getting to places that are out of walking distance, preparing their meals, and doing their housework) • Participation in daily life (e.g., Using the telephone and going shopping) • Barriers and facilitators (i.e., The patient is asked if he/she needs someone's help)
London Handgrip Scale (LHS)	Mobility; Physical independence; Occupation;	Degree of limitation	6-point scale 1 = Not at all 6 = Completely	<p>Yes</p> <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked if their health

Social integration;
Orientation;
Economic self
sufficiency.

prevents them from
performing certain
activities)

- Type of ADL
(e.g., Getting around
and looking after
themselves)
- Participation in daily
life
(e.g., Working and
leisure, getting on with
people, and affording
the things you need)
- Barriers and
facilitators
(i.e., The patient is
asked if he/she needs
someone's help)

Motor scale
of the FIM

Self-care;
Sphincter Control;
Transfers;
Locomotion.

Degree of
independence

7-point scale
1 = Total assistance
(subject = less than 25%)
7 = Completely
independence (timely,
safely)

Yes

- Limitation during ADL
(i.e., The patient is
asked if he/she needs
total, maximal,
moderate, or only
supervision to perform
some activities)
- Type of ADL
(e.g., Eating, dressing,
and walking)
- Participation in daily
life

The Manchester Respiratory Activities of Daily Living Questionnaire	Mobility; In the Kitchen; Domestic tasks; Leisure activities.	Degree of limitation	4-point scale Not at all; with help; alone with difficulty; alone easily.	<p>(e.g., Social interaction)</p> <ul style="list-style-type: none"> • Barriers and facilitators (i.e., The patient is asked if he/she needs someone's help) <p>Yes</p> <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked if he/she does some activities and if you does alone easily, with difficult or with someone's help) • Type of ADL (e.g., Climbing stairs, washing and drying themselves, and managing their own garden) • Participation in daily life (e.g., Going out socially, doing shopping, traveling on public transportation) • Barriers and facilitators (i.e., The patient is asked if he/she needs someone's help)
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Nottingham Extended ADL Scale	Mobility; Performance in the kitchen; Domestic tasks; Leisure activities.	Degree of limitation	4-point-scale Not at all; with help; alone with difficulty; alone easily	<p>Yes</p> <ul style="list-style-type: none"> • Limitation during ADL (i.e. The patient is asked if he/she does certain activities and if he/she need someone's help or has difficulty to perform their ADL) • Type of ADL (e.g. Climbing stairs, washing small items of clothing, and doing their housework) • Participation in daily life (e.g. Traveling on public transport, doing their shopping, and going out socially) • Barriers and facilitators (i.e. The patient is asked if he/she needs someone's help)
Pulmonary Functional Status Scale (PFSS)	Self-care; Mobility; Household; Tasks; Grocery.	Degree of difficulty	4- and 5-point scale 1, extreme difficulty; 4, no difficulty and 1, never; 5, three or	<p>Yes</p> <ul style="list-style-type: none"> • Limitation during ADL (i.e., the patient is asked if he/she does certain ADL and if he/she has difficulty to

			more times a week	<ul style="list-style-type: none"> perform some ADL • Type of ADL (e.g., Getting dressed, climbing steps, and performing household tasks) • Participation in daily life (e.g., Doing grocery shopping) • Barriers and facilitators (i.e., There is a specific domain about relationships)
Pulmonary Functional Status Scale (PFSS) – Short form	Getting dressed; walking up a slight grade; climbing steps; performing household tasks; doing grocery shopping; and carrying food bags (also includes a dyspnea scale and emotional functioning)	Degree of difficulty	4- and 5-point scale 1, extreme difficulty; 4, no difficulty and 1, never; 5, three or more times a week	<p>Yes</p> <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked if he/she does certain AVD and if he/she has difficulty to perform some AVD) • Type of ADL (e.g., Getting dressed, climbing steps, and performing household tasks) • Participation in daily life (e.g., Doing grocery shopping) • Barriers and

				facilitators (i.e., There is a specific domain about relationships)
Pulmonary Functional Status & Dyspnea Questionnaire (PFSDQ)	Activity assessment - Body care – movement Activity assessment – Eating Activity assessment - Home management Activity assessment - Recreation/social Dyspnea - Body care /movement Dyspnea – Eating Dyspnea - Home mana - Recreation/social	Degree of change to perform activity (before and after the disease) Degree of dyspnea	11-point scale 0 = “as active as I’ve ever been” 10 =“omitted the activity entirely”	Yes <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked if he/she experience dyspnea during certain AVD and if he/she noticed a change to perform certain AVD comparing before and after breathing problems) • Type of ADL (e.g., Putting on shoes, washing face, and walking 10 feet) • Participation in daily life (e.g., Sexual activity, Grocery shopping, and recreation traveling)
Modified Pulmonary Functional	Dyspnea Fatigue Change in activities	Degree of Dyspnea, fatigue and	11-point scale 0 = “as active as I’ve ever been”	Yes <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is

Status and
Dyspnea
Questionnaire
(PFSDQ-M)

change in
activities

10 =“omitted the activity
entirely”

asked if he/she
experience dyspnea
during certain ADL
and if he/she noticed a
change to perform
certain ADL
comparing before and
after breathing
problems)

- Type of ADL
(e.g., Brushing hair,
putting on a shirt, and
walking three meters)

Stanford
HAQ 20-Item
Disability
Scale

Dressing &
grooming
Arising
Eating
Walking
Hygiene
Reach
Grip
Activities

Degree of
difficulty

With any difficulty
With some difficulty
With much difficulty
Unable to do

* There are questions
about device help and
assistance from someone
else.

Yes

- Limitation during ADL
(i.e., The patient is
asked if he/she
present difficulty to
perform certain AVD)
- Type of ADL
(e.g., Getting in and
out of bed, climbing up
five steps, and
washing and drying
their body)
- Barriers and
facilitators
(i.e., The patient is
asked if he/she uses
any AIDS or devices
to help the ADL
performance)

Valued Life Activity Scale	Self-care; Grooming, Housework; Social life with friends and family; getting around; leisure activities; Sports; Hobbies; Spiritual; Activities; Paid or volunteer work	Degree of difficulty	4-point scale 0 = No difficulty 1 = A little difficulty 2 = A lot of difficulty 3 = Unable to perform	Yes <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked if he/she present difficulty to perform certain ADL) • Type of ADL (e.g., Grooming, getting around, and self-care) • Participation in daily life (e.g., Social life with friends and family and paid or volunteer work)
Townsend's disability scale	Cut your own toe-nails; Wash all over or bathe; Get on a bus; Go up and down stairs; Do the heavy housework; Shop and carry heavy bags; Prepare and cook a hot meal; Reach an overhead shelf; Tie a good knot in a	Degree of difficulty	3-poin scale 0= Yes, with no difficulty 1= Yes, with some difficulty 2= No, needs help	Yes <ul style="list-style-type: none"> • Limitation during ADL (i.e., The patient is asked if he/she present difficulty to perform certain ADL) • Type of ADL (e.g., Cutting their toe-nails, washing all over or bathing, and preparing and cooking a hot meal) • Participation in daily life (e.g., Shopping and carrying heavy bags)

piece of string;
Need of help from
someone.

- Barriers and facilitators (i.e., The patient is asked if he/she needs someone's help)

Table 2. Characteristics of the performance-based tools and how it matches with the developed framework.

Instrument	Activities	Outcome	Other outcomes	Framework
'ADL simulation'	Getting out of bed; Putting on shoes; Making the bed; Showering; A shelf activity above the shoulder girdle; A shelf activity below the pelvic girdle.	Time to complete the circuit	Dyspnea	Yes <ul style="list-style-type: none"> • Limitation during ADL (i.e., The time to perform the ADL are measured) • Type of ADL (i.e., The ADL are described in activities topic)
ADL Simulation Test	Wiping a draw off from a blackboard; Screwing and unscrewing three light bulbs; Drying 10 dishes put them on a shelf; Putting a number of groceries on a shelf.	Number of shuttles (These four activities were considered a shuttle)	Dyspnea Fatigue	Yes <ul style="list-style-type: none"> • Limitation during ADL (i.e., How many times the patient perform the ADL during 10 min) • Type of ADL (i.e., The ADL are described in activities topic)

Glittre ADL Test	Rising from a seated position; Carrying a backpack on the shoulders; Walk 10 m over the interposed 2-step staircase; Organize objects on shelves.	Time to complete 5 laps	Dyspnea	Yes <ul style="list-style-type: none"> • Limitation during ADL (i.e., The time to perform the ADL are measured) • Type of ADL (i.e., The ADL are described in activities topic)
Londrina ADL Protocol (LAP)	Sitting and move objects placed in a table; Walking with handbags; Arranging objects on shelf; Hanging items of clothes on the clothes line; Walking again, but without carrying the handbags.	Time to complete all activities	Dyspnea Fatigue	Yes <ul style="list-style-type: none"> • Limitation during ADL (i.e., The time to perform the ADL are measured) • Type of ADL (i.e., The ADL are described in activities topic)
Monitored Functional Task Evaluation (MFTE)	Walking on level ground; Sit-to-stand activity; Lifting activity from waist level to a level 12 in above; Walking again, but carrying in each hand a load; Stepping activity.	Number of actions	Dyspnea Fatigue	Yes <ul style="list-style-type: none"> • Limitation during ADL (i.e., The time to perform the ADL are measured) • Type of ADL (i.e., The ADL are described in activities topic)

Neistadt and Crepeau Activities of Daily Living test	Buttoning and unbuttoning a shirt; Folding 10 T-shirts into a pile Lifting 10 books from a table to a shelf; Sweeping 10 clothes pins; Get-up-and-go test; Climbing up and down 20 stair steps; Number of arm raises; Sit-to-stand in 1 min.	Time to complete each activity	N/A	Yes	<ul style="list-style-type: none">• Limitation during ADL (i.e., The time to perform the ADL are measured)• Type of ADL (i.e., The ADL are described in activities topic)
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Patient interviews

Fifteen patients with COPD were included in the study to conduct qualitative interviews. The characteristics of the patients are described in table 3.

Table 3. Characteristics of the patients.

Characteristics	Values
Male/female sex, n	7/8
Age, mean \pm SD y	71 \pm 6
BMI, mean \pm SD kg/m ²	26 \pm 7
FEV ₁ /FVC Ratio (%)	41 \pm 17
FEV ₁ , mean \pm SD % predicted	43 \pm 17
mMRC	3.5 \pm 1

BMI: body mass index; FEV₁: forced expiratory volume in first second; FVC: forced vital capacity; mMRC: Modified Medical Research Council

Conceptual framework

We developed the framework from the data of the interview: The developed framework contains four domains: *Limitations during ADL*, *Type of ADL*, *Participation in daily life and*, *Barriers and facilitators* (figure1).

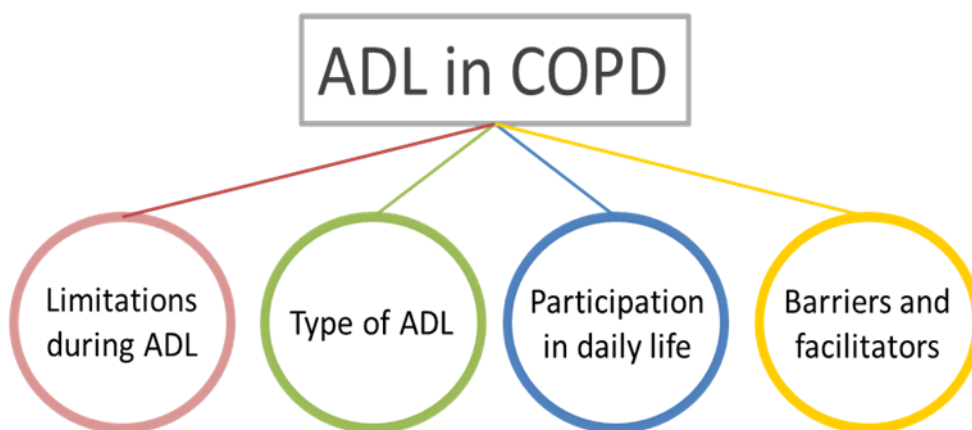


Figure 1: Framework

Limitation during ADL

This theme describes the limitations that patients with COPD have when patients perform ADLs. These limitations are related to the physiological functions of the body

system and body structures. During the interviews, most patients reported some difficulties in performing ADLs that were limited by COPD symptoms.

Patient #02: “I would I would love to be able to just go downtown and to the theatre. And you know like I was having so much trouble walking and I would tire so quickly”.

Patient #05: “I’m not walking. It’s a Catch 22. You know I don’t, I don’t walk because I can’t breath, and then when I go to walk I can’t breath because I haven’t walked”.

Patient #15: “Oh yeah, I, I, I get tired sometimes but that’s, the biggest factor is the breathing”.

In addition, some patients also described that conditions other than COPD (e.g., orthopedic disorder) limit their ability to perform their ADLs.

Patient#05: “So I wasn’t doing so much walking at first because of my knees. So that was the wheelchair”.

Patient#06: “Because I have I have low back pain. It’s not because of my //COPD it’s because I have a osteoarthritis in and in my lower back if I I can only stand usually for about 10,15 minutes and then it starts to hurt.

Patient#08: “When I get better I’ll be able to do more because right now there’s something I can’t do with this arm eh”.

Type of ADL

This theme describes basic and instrumental activities that the patients do, need to do, or would like to do in their daily life. These activities are the execution of a task or

action by an individual, as defined by ICF(36). During the interviews, patients described the ADLs patients do without difficulty that patients need to do. These ADLs were generally related to self-care and domestic life.

Patient #01: “Yeah. Wash dishes. You can see ?? look at my hands. Not bad for a mechanic eh?”.

Patient #06: “I finish the washing, clothes washing I’ll a come up and have lunch and then I watch the news on TV”.

Patient #09: “Yeah. Wash dishes. You can see ?? look at my hands. Not bad for a mechanic eh?”.

Patients also reported ADLs that patients need to do, but patients present some difficulty to perform them. These ADLs are generally related to self-care (specifically showering) and carrying weight during the ADLs.

Patient #09: “I’ve always had problem making a bed”.

Patient #15: “Well can shower but it’s too hard because I can’t breathe”.

Patient #14: “Carrying anything any distance is difficult”.

Participation in daily life

This theme describes the participation of the patient in society, according to ICF the definition of participation is involvement in a life situation(36). Most of the ADLs patients would like to do, but patients are no longer able to carry them out or patients

perform with some difficulty. Besides that, these ADLs are generally performed outside. The activities patients most cited were: going shopping and going to a social event.

Patient #02: "I would I would love to be able to just go downtown and to the theatre".

Patient #05: "On Monday night and a Wednesday night I would go to darts. I stopped that. I would go and visit my friend who quite a lot of them don't drive and we'd go shopping and that. I stopped that".

Patient #10: "But I don't go there much. I don't go to bingo much either but... I used to... um...".

Barriers or facilitators

This theme describes the barriers and facilitators that patients have to perform their ADLs. Most barriers are related to environmental factors. Moreover, the patients were encouraged to mention what helps them to carry out their ADLs. Most patients reported the following strategies: stopping to recover from shortness of breath, doing activities more slowly, and taking their medication.

Patient #06: "Where I shop and so I sit down for another maybe 15, 10, 15 minutes and then I'll shop again".

Patient #11: "I'd stop part way through and just kept... catch my breath and I'd finish the job".

Patient #12: "I just take a little longer to do it [...] more time stopping or huffing and puffing".

Patients also described the help patients received from friends, family, and housekeepers. Some patients reported receiving helping to perform their difficulty ADLs of her/his wife/husband, son, daughter, or friends. Other patients related some help of housekeeper to do the heavy ADLs.

Patient #02: “My daughter, my oldest daughter comes and we have a cup of tea and then I take her out to dinner. And she puts my heavy load from the washer in the dryer”.

Patient #07: “I usually have somebody to help me”

Patient #11 “But I don’t have to do that because I have a lady that comes in to clean up”.

Another way of getting assistance is by using some equipment or assistance device. These methods can facilitate the performance of some problematic ADLs, such as walking long distances and recovering from short of breath.

Patient #06: Interviewer: And then in your shower do you have anything in your shower that helps you.

Patient: Just two bars ...

Patient #07: “sometimes I have to go back and get my oxygen, cause I don't wear it after I get out of bed”.

Patient #10: “Interviewer: What type of supports if any do you find the help you to perform these activities. So you have a rollator? Is that your rollator?”

Patient: Yes”.

On the other hand, some patients related some issues that may difficult the performance of ADLs. These issues are more related to the environment. The patients commonly linked that extreme cold and extreme heat get in the way, as well as the humidity.

Patient #07: “If it’s too cold I have a problem and if it’s too hot I have a problem”.

Patient #13: “Uh temperature I’m in the house in the winter I don’t go out a lot”.

Patient #10: “Patient: Yeah some days. It depends on the humidity. If the humidity is bad.

Interviewer: Yeah, it’s eh, then you have a hard time.

Patient: I have a hard time”.

Critical appraisal of the existing tools

We critical appraisal of all the tools and the score of the tools lies between 0-1. Most of the tools scored 0 and few of them scored 1. (Table 4) Most tools do not assessed or mentioned all the subtopics of the topic and obtained score 0 to the topic.

Table 4. Critical appraisal of the instruments.

Instrument	Critical appraisal
ADL Hierarchy Scale	0
Activities of daily living inventory (ADLI)	0
Activities of Daily Living Questionnaire (ADLQ)	0
Activities of Daily Living questionnaire by Ogden et al (ADLQ)	0
Barthel index	1
Chronic Obstructive Pulmonary Disease Activity Rating Scale (CARS)	1
Capacity of Daily Living During the Morning (CDLM)	1
Canadian occupational performance measure (COPM)	0
Duke activity status index	1
Fitness and Arthritis in Seniors Trial (FAST)	0
Frenchay Activity Index (FAI)	0
Functional Performance Inventory Long Form (FPI-LF)	0
Functional Performance Inventory Short Form (FPI-SF)	1
Groningen Activity Restriction Scale (GARS)	0

Katz Activities of Daily Living scale	0
Lawton and Brody Activities of Daily Living scale	0
London Handgrip Score	0
London Handicap Scale (LHS)	0
Motor scale of the FIM	0
The Manchester Respiratory Activities of Daily Living Questionnaire	1
Nottingham Extended ADL Scale	0
Pulmonary Functional Status Scale (PFSS)	0
Pulmonary Functional Status Scale (PFSS)	0
Pulmonary Functional Status & Dyspnea Questionnaire (PFSDQ)	0
Modified Pulmonary Functional Status and Dyspnea Questionnaire (PFSDQ-M)	1
Stanford HAQ 20-Item Disability Scale	0
Valued Life Activity Scale	0
Townsend's disability scale	0
'ADL simulation'	0
ADL Simulation Test	0
Glittre ADL Test	0
Londrina ADL Protocol (LAP)	1
Monitored Functional Task Evaluation (MFTE)	0
Neistadt and Crepeau Activities of Daily Living test	0

Creating an inventory

We created an inventory of existing tools identified in our literature search. (Table 1 and 2)

Mapping with the framework

In Tables 1 and 2, we identified which aspects of the framework each tool included. Table 1 shows the self-reported tools. We verified all instruments have questions about the type of ADL and limitations during ADLs. Some of them include questions about participation in daily life and only a few tools included questions about barriers and facilitators. Table 2 shows the performance-based tools. All the performance based-tools include the themes: type of ADL and limitations during ADL, on the other hand, the tools do not include participation and barriers and facilitators.

DISCUSSION

The conceptual framework with four components was developed based on the interviews with the patients and the International Classification of Functioning (36): Limitation during ADL, type of ADL, participation in daily life and barriers and facilitators. Then, we checked if the tool included questions about the themes. Finally, we verified that the tools are not so good outcome trust.

The framework was composed of 4 themes that are based on the ICF (37). The ICF is a framework for describing and organizing information on function and disability. We used the ICF to standardize functionality and disability in patients with COPD. The first theme is the limitations during ADL. We found a wide variety of ways of ADLs limitation evaluations, such as symptoms, independence level, and difficulty to perform some ADLs. On the other hand, performance-based measures assess the performance using time spent to perform determined activities. Nevertheless, both quantitative and qualitative aspects can influence activity limitations: first, reducing the daily amount (intensity, frequency and duration) of activity; second, it covers the discomfort induced by the activity.(38) When assessing symptoms most of the tools assessed only dyspnea. However, Castro et al. (28) found the perception of fatigue during an ADLs protocol was greater than the sensation of dyspnea. Besides that, some patients during the interview mentioned muscle conditions that impaired ADLs performance. In other words, both symptoms should be included in the assessment. Other causes were cited as limiting the ADLs performance, such as joints and back pain showing the importance

of other causes of limitation. Lastly, the graduation of the limitation is relevant because we can assess the change after a treatment, for example.

According to ICF, activity is the execution of a task or action by an individual.(36) All the tools approach the type of ADL; it was expected since the tools assess the ADLs of the patients. The tools included a wide variety of type of ADL, including basic (showering, dressing, grooming) and instrumental activities (preparing meals, shopping, handling finances). The available tools have predominantly been developed and evaluate in English language countries in northern. Consequently, some activities may not be relevant for other countries, such as tropical countries, where shoveling snow is not performed by the patients. For transcultural adaptation and validation it will be relevant to pay attention to this type of ADL.(39) Besides that, women perform domestic activities predominantly and if the tools content a lot of this type of ADL can overestimate the functional status of the men compared to women.(40) Finally, the activities present in the tools should be relevant for the population of interest considering culture, gender, age, and weather.

Participation in daily life reflects the participation of the patient as member of society. Some tools include activities as shopping, using of public transportation and religious activities. (41, 42) Participation in daily life should be assessed because patients with COPD describe feeling socially isolated and report suffering from negative emotions. Moreover, social relationships (social support, social integration and perceived quality of social relationship) are associated with health outcomes.(43) Besides type of ADL, the *participation in daily* life is other type of ADL that should be assessed in order to carry out a complete ADLs assessment.

Finally, few tools approach the *barriers and facilitators*. The most of tools that assessed this theme focused on assistance of someone else evaluation.(21, 41, 44, 45) However, a complete evaluation of patients with COPD should content questions about air quality, products and substances for personal consumption, products and technology for use in daily living and, attitudes to facilitate the ADLs performance, including inhaler devices and natural environment (climate and air quality).(46) Only one questionnaire asks about wheelchair(47), other has a domain about relationship (48) and other one asks about the use of AIDS and device to help to perform ADLs. Nevertheless, during the interviews some patients with COPD mention the use of inhaler device and attitudes as performing activities at your own pace in order to facilitate the ADLs performance. The barriers most cited during the interviews are the air quality and climate, but none of the tools assessed these items.

We critically appraise the instruments based on Scientific Advisory Committee of the Medical Outcomes Trust to asses quality of life and health status instruments(49). However, the score is low in all tools because to answer yes in the first topic is necessary to assess and mention in a document all the concepts: Concept to be measured, conceptual and empirical bases for item content and combination, target population involvement in content derivation, information on dimensionality and distinctiveness of scales, evidence of scale variability, intended level of measurement and rationale for deriving scales scores. If the tool does not assess or mentioned the assessment of one of the topics in a paper the score was 0.

Limitations

The study was conducted in an urban setting in Canada not covering all cultures and geographical influences. However, we were not specific about *Limitations during ADL, Type of ADL, Participation in daily life, and Barriers or facilitators*. We verified if the tool assessed *limitation to perform ADLs, types of ADL and barriers and facilitators*; and not specify the type of *limitation, activities and barriers or facilitators* that can be related with cultures and geographical influences. Another limitation was the lack of information in order to critical appraisal the tools. We cannot find the answer to the topics of the Scientific Advisory Committee of the Medical Outcomes Trust recommendation in the developed paper of the tools. Hence, the next development papers need to describe all the information in detail.

A diverse range of tools are available to clinician and researcher looking to evaluate ADLs performance. Considering the diversity of measurement available for use, selection must be thoughtful based on the relevance for individual with COPD. Besides, the instrument needs to be reliable and valid in the population to be trust. A conceptual framework to support clinicians and researches in the selection of performance measure has been presented in this paper. Then, we verified that the existing tools do not assess all themes of conceptual framework being necessary the use of more than one tool to complete the assessment of this competence. Finally, we realized most of the tools do not follow the recommendation to develop the tools or do not mention all details in the studies.

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APPENDIX 1

Interview Guide

Introduction:

My name is... and I am a research assistant working with Dr. Tania Janaudis-Ferreira in this study entitled "Improving measurement of activities of daily living in individuals with chronic obstructive pulmonary disease." Thank you for meeting with me today to speak about your experiences with COPD and its effect on your ability to do the activities you want and need to do. What we learn from you will assist us to identify factors that are important to the ability to perform activities of daily living in individuals with COPD and consequently recommend what is necessary to improve assessment of activities of daily living.

Questions:

1) I would like you to think about the activities you need and want to do in your daily life and tell me about these?

Probing Questions:

- How important is it to you to be able to take care of your self-care activities (e.g. dressing, washing yourself, and looking after your own health)?

- How important is it to you to be able to do your own housework?

- How important is it to you to get around your own community?

- How important is it to you to participate in leisure and recreational activities?

- How important is it to you to be able to maintain relationships with family and friends?

- How important is it you to be able to have a paid job?

- How important is it for you to be able to drive?

2) Considering the activities you have mentioned... including (re-state some activities individual mentioned), could you please describe how you think your COPD has affected how well you can perform those activities?

- What challenges are you currently experiencing?

- Do you do anything to help you compensate for the challenges you experience? Do they work?

3) What do you think within yourself more specifically limits/restricts your abilities?

Probing Questions:

Do physical problems such as feeling tired, muscle weakness, and how well you can move your arms and legs affect your abilities?

- Does shortness of breath affect your abilities?
- Do your abilities to walk and move around affect your abilities?
- Does pain affect your abilities and if so where in the body is the pain?
- Does your ability to handle stress, motivation or depression affect your abilities?
- Are there concerns or fears you may have that affect your abilities?

4) Are there issues outside of yourself, like within your home or community environment that you have found limit your abilities to perform activities?

- Does the climate affect your ability to perform activities?
- Does the air quality affect your ability to perform activities?
- Do products or substances for personal use in daily living affect your ability to perform activities?
- Do design and construction of buildings for public or private use affect your ability to perform activities?

5) What types of supports, if any, do you find help you to perform your activities?

Probing Questions:

- Informal supports from family or friends?
- Support from health care professionals?
- Positive attitudes of family, friends, health care professionals?
- Transportation services?
- Adaptive aids?
- Public buildings that are easy to use/accessible?

6) Ideally, what would independence in your daily activities look like to you?

- What would you need to be able to be independent during your activities?

APPENDIX 2

No.	Attribute	Review criteria
1.	Conceptual and measurement model <input type="checkbox"/> Yes <input type="checkbox"/> Unclear <input type="checkbox"/> No Comments:	The rationale for and description of the concept and the populations that a measure is intended to assess and the relationship between these concepts. <ul style="list-style-type: none"> • Concept to be measured • Conceptual and empirical bases for item content and combinations • Target population involvement in content derivation • Information on dimensionality and distinctiveness of scales • Evidence of scale variability • Intended level of measurement • Rationale for deriving scale scores
2	Reliability <input type="checkbox"/> Yes <input type="checkbox"/> Unclear <input type="checkbox"/> No Comments:	The degree to which an instrument is free from random error Internal consistency The precision of a scale, based on the homogeneity (intercorrelations) of the scale's items at one point in time. <ul style="list-style-type: none"> • Methods to collect reliability data • Reliability estimates and standard errors for all score elements (classical test) or standard error of the mean over the range of scale and marginal reliability of each scale (modern IRT) • Data to calculate reliability coefficients or actual calculations of reliability coefficients • Above data for each major population of interest, if necessary Reproducibility Stability of an instrument over time (test-retest) and inter-rater agreement at one point in time. <ul style="list-style-type: none"> • Methods employed to collect reproducibility data • Well-argued rationale to support the design of the study and the interval between first and subsequent administration to support the

		<p>assumption that the population is stable</p> <ul style="list-style-type: none"> • Information on test-retest reliability and inter-rater reliability based on intraclass correlation coefficients • Information on the comparability of the item parameter estimates and on measurement precision over repeated administrations
3.	<p>Validity</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> Unclear</p> <p><input type="checkbox"/> No</p> <p>Comments:</p>	<p>The degree to which the instrument measures what it purports to measure.</p> <p>Content-related: evidence that the domain of an instrument is appropriate relative to its intended use.</p> <p>Construct-related: evidence that supports a proposed interpretation of scores based on theoretical implications associated with the constructs being measured.</p> <p>Criterion-related: evidence that shows the extent to which scores of the instrument are related to a criterion measure.</p> <ul style="list-style-type: none"> • Rationale supporting the particular mix of evidence presented for the intended uses • Clear description of the methods employed to collect validity data • Composition of the sample used to examine validity (in detail) • Above data for each major population of interest • Hypotheses tested and data relating to the tests • Clear rationale and support for the choice of criteria measures
4.	<p>Responsiveness</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> Unclear</p> <p><input type="checkbox"/> No</p> <p>Comments:</p>	<p>An instrument's ability to detect change over time.</p> <ul style="list-style-type: none"> • Evidence on the changes in scores of the instrument • Longitudinal data that compare a group that is expected to change with a group that is expected to remain stable • Population(s) on which responsiveness has been tested, including the time intervals of assessment, the interventions or measures involved in

		evaluating change, and the populations assumed to be stable
5.	<p>Interpretability</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> Unclear</p> <p><input type="checkbox"/> No</p> <p>Comments:</p>	<p>The degree to which one can assign easily understood meaning to an instrument's quantitative scores.</p> <ul style="list-style-type: none"> • Rationale for selection of external criteria of populations for purposes of comparison and interpretability of data • Information regarding the ways in which data from the instrument should be reported and displayed • Meaningful 'benchmarks' to facilitate interpretation of the scores
6.	<p>Burden</p> <p><input type="checkbox"/> Yes</p> <p><input type="checkbox"/> Unclear</p> <p><input type="checkbox"/> No</p>	<p>The time, effort, and other demands placed on those to whom the instrument is administered (respondent burden) or on those who administer the instrument (administrative burden).</p> <p>Respondent burden:</p> <ul style="list-style-type: none"> • Information on: (a) average and range of the time needed to complete the instrument, (b) reading and comprehension level, and (c) any special requirements or requests made of respondent • Evidence that the instrument places no undue physical or emotional strain on the respondent • When or under what circumstances the instrument is not suitable for respondents <p>Administrative burden:</p> <p>Information about any resources required for administration of the instrument</p> <ul style="list-style-type: none"> • Average time and range of time required of a trained interviewer to administer the instrument in face-to-face interviews, by telephone or with computer-assisted formats • Amount of training and level of education or professional expertise and experience needed by administrative staff
7.	Alternative modes of administration	These include self-report, interviewer-administered, trained observer rating,

	<input type="checkbox"/> Yes <input type="checkbox"/> Unclear <input type="checkbox"/> No Comments:	computer assisted interviewer administered, performance based measures. • Evidence on reliability, validity, responsiveness, interpretability and burden for each mode of administration • Information on the comparability of alternative modes
8.	Cultural and language adaptations or translations <input type="checkbox"/> Yes <input type="checkbox"/> Unclear <input type="checkbox"/> No Comments:	Involves two primary steps: 1. Assessment of conceptual and linguistic equivalence 2. Evaluation of measurement properties • Methods to achieve conceptual equivalence • Methods to achieve linguistic equivalence • Any significant differences between the original and translated versions • How inconsistencies were reconciled
	Total score:	

4.2 ARTIGO 2 - Publicado em:

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Title:

MULTITASK PROTOCOLS TO EVALUATE ACTIVITIES OF DAILY LIVING PERFORMANCE IN PEOPLE WITH COPD: A SYSTEMATIC REVIEW

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Abbreviations:

6MWT: 6-minute walking test

ADL: Activities of daily living

COPD: Chronic Obstructive Pulmonary Disease

CINAHL: Cumulative Index to Nursing and Allied Health Literature

Cosmin (COnsensus-based Standards for the selection of health Measurement Instruments)

FEV₁: Forced Expiratory Volume in the first second

FVC: Forced Vital Capacity

GOLD: Global Initiative for Chronic Obstructive Lung Disease

ICC: Intraclass Correlation Coefficient

LILACS: *Literatura Latino americana y del Caribe en Ciencias de la Salud* (Latin-American and Caribbean Center on Health Sciences Information)

MFTE: Monitored Functional Task Evaluation

PEDro: Physiotherapy Evidence Database

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analysis

ABSTRACT

Introduction: People with chronic obstructive pulmonary disease (COPD) present symptoms such as dyspnea and fatigue, which hinder their performance in activities of daily living (ADL). A few multitask protocols have been developed to assess ADL performance in this population, although measurement properties of such protocols were not yet systematically reviewed. **Areas covered:** Studies were included if an assessment of the ability to perform ADL was conducted in people with COPD using a (objective) performance-based protocol. The search was conducted in the following databases: Pubmed, EMBASE, Cochrane Library, PEDro, CINAHL and LILACS. Furthermore, hand searches were conducted. **Expert commentary:** Up to this moment, only three protocols had measurement properties described: the Glittre ADL Test, the Monitored Functional Task Evaluation and the Londrina ADL Protocol were shown to be valid and reliable whereas only the Glittre ADL Test was shown to be responsive to change after pulmonary rehabilitation. These protocols can be used in laboratory settings and clinical practice to evaluate ADL performance in people with COPD, although there is need for more in-depth information on their validity, reliability and especially responsiveness due to the growing interest in the accurate assessment of ADL performance in this population.

KEYWORDS: Chronic obstructive pulmonary disease; activities of daily living; aging; motor activity; chronic limitation of activity

INTRODUCTION

Rationale

Chronic obstructive pulmonary disease (COPD), a preventable and treatable disease, is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities [1]. People with COPD also present extra-pulmonary features such as systemic inflammation, increased oxidative stress, nutritional impairments, skeletal muscle dysfunction [2], and consequent reduction in both exercise capacity and physical activity in daily life [3]. As a result of the pulmonary and extra-pulmonary manifestations of the disease, symptoms such as dyspnea and fatigue are common. These symptoms make people with COPD feel uncomfortable and discouraged to perform their daily physical activities [4,5].

Activities of daily living (ADL) are defined as tasks that people perform on a daily basis. These tasks include dressing, bathing, moving about, and going from one place to another [6]. Frequently, people with COPD are not able to perform simple activities of their routine, which are of paramount importance to keep them independent. They often require assistance to perform daily activities. As a consequence, their functionality and health-related quality of life (HRQoL) are negatively affected [6,7].

Considering the impact that a reduction in ADL performance has on health outcomes in people with COPD, a suitable and accurate evaluation of ADL performance is needed both in clinical practice and in research settings. Previous research in elderly people (mean age 75 ± 7 years) has demonstrated that the limitation in the ability to perform ADL is associated with increased hospitalization and mortality [8]. In people

with COPD, studies have also shown that the limitation in the ability to perform ADL (assessed via questionnaires) was associated with increased mortality [9,10].

One way to evaluate ADL performance is through the use of questionnaires [11]. However, psychological factors and cognitive impairments might influence the answers [12,13]. There have been studies which attempted to assess ADL objectively by using functional tests (e.g. sit-to-stand test) [14]. However, functional tests evaluate functional capacity, not ADL performance. Furthermore, functional tests generally do not include a range of specific ADL-like tasks that would represent real life. There has been growing interest on the objective assessment of ADL performance through performance-based protocols. These protocols encompass some activities that people perform in their day-to-day life, and are thought to provide a more thorough evaluation of ADL performance. Previous studies in people with COPD evaluated ADL objectively using performance-based protocols and have commonly used protocols created by their own research groups [15–17]. Consequently, few protocols that assess ADL performance have been tested for their reliability or have had their measurement properties evaluated. Therefore, there is still a gap in the literature on how to choose the best protocol to assess ADL performance in the clinical and research settings pertaining to the protocol's reliability and standardization.

OBJECTIVE

The first aim of this review was to investigate the existing performance-based protocols which aim to objectively (i.e. not self-reportedly) assess ADL in people with COPD, as well as to identify the characteristics and evidence on the measurement properties of these protocols. Second, this review aimed to examine the correlation

between the performance in these protocols and clinical outcomes. Finally, we provided recommendations pertaining to the choice of protocol(s) that would be most suitable to scientific and/or clinical needs.

METHODS

Data Source and search strategy

Two review authors (TP and FVCM) developed the search strategy based on the search strategies of previously published systematic reviews with a similar topic [18]. Then, the same two investigators independently conducted the search in the following databases: Pubmed, EMBASE, CINAHL, PEDro, LILACS, and Cochrane Library, from their inception until September 2016. Key terms included: ‘COPD,’ ‘pulmonary disease, chronic obstructive,’ ‘ADL,’ ‘Activities, Daily Living,’ ‘Activity of daily living,’ ‘day to day activities,’ ‘daily life activities’ ‘daily activities,’ ‘assessment,’ ‘measure,’ ‘outcome’ and ‘test’ (Table 1). Further, bibliographic references of the included studies were hand searched, and eventual contact with researchers was attempted.

TABLE 1 – Search strategy.

Search #	Key terms
Search #4	#1 [All Fields] AND #2[All Fields] AND #3[All Fields]
Search #3	Patient Outcome Assessment [MeSH Terms] OR assessment* [Title/Abstract] OR measure* [Title/Abstract] OR outcome [Title/Abstract] OR test* [Title/Abstract] OR protocol [Title/Abstract] OR evaluation [Title/Abstract]
Search #2	Activities of daily living [MeSH Terms] OR ADL* [Title/Abstract] OR Activit*, Daily Living [Title/Abstract] OR Daily Living Activit* [Title/Abstract] OR Living Activit*, Daily [Title/Abstract] OR Activity of daily living [Title/Abstract] OR day to day activit* [Title/Abstract] OR

	daily life activit* [Title/Abstract] OR daily activit* [Title/Abstract]
Search #1	Pulmonary Disease, Chronic Obstructive [Mesh Terms] OR COPD [Text Word]

Eligibility and exclusion criteria

The inclusion criteria for the review comprised original studies that included: (i) people with a diagnosis of COPD according to the global initiative for chronic obstructive lung disease [1] (i.e. post-bronchodilator forced expiratory volume in 1 s (FEV1)/forced vital capacity <0.7); (ii) objective assessment of the ability to perform ADL using a performance-based protocol that included more than three tasks (multitask protocol). Studies were excluded if: (i) they only used self-reported or subjective measures of the ability to perform ADL; (ii) they only used ADL protocols to evaluate outcomes other than performance (e.g. dynamic hyperinflation, energy expenditure); and (iii) they were congress abstracts. No limits were applied for language since papers in non-English language were translated.

Study selection

The results of the database search were stored in a bibliographical reference manager software (Mendeley Reference Manager). The number and title of articles found by each review author were merged together and stored in a single file, and the duplicates were excluded. Two review authors (TP and FVCM) independently selected the potentially eligible studies by screening the title and abstract of every citation against the eligibility criteria. The choice of each review author of including or excluding each paper was recorded in the reference manager software. Agreements were

highlighted for full text evaluation, while disagreements were discussed and solved by either consensus or by a third reviewer (FP). The process of full text evaluation was the same as the one described for title and abstract screening. The specific reasons for excluding papers were recorded. Data extraction and quality assessment was undertaken on the included papers and their reference list was carefully checked for further potentially eligible studies.

Quality assessment

Studies which included measurement properties were evaluated by the Consensus-based standards for the selection of health status measurement instrument (COSMIN) checklist [19]. This checklist assesses methodological quality of measurement properties' studies. The review authors judged the assessment of the measurement property as excellent, good, fair, or poor. Disagreements were solved by consensus. Assessment of the quality of the other studies was beyond the scope of this review. According to the COSMIN [20], validity is defined as 'the degree to which an instrument measures the construct it intends to measure.' Reliability is defined as 'the degree to which the measurement is free from measurement error.' Responsiveness is 'the ability of an instrument to detect change over time in the construct to be measured.' These were the included measurement properties for assessment.

Data extraction and summary

Two review authors (TP and FVCM) extracted and tabulated the study details and data by using a standardized Microsoft Excel sheet. The extracted information comprised: authors, journal, year of publication, study design, sample size, the name of

the test, number of tasks, description of the protocol, final outcome, sample characteristics, correlations with other common outcomes, measurement properties, and methodological quality assessment. The results of the data extraction were summarized in structured tables. Metaanalysis was not performed because the review focused mainly on describing existing protocols to assess ADL performance. The parameters of the preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement recommendations for systematic reviews were followed [21], although the protocol of the review was not registered.

RESULTS

Quality assessment

A flow diagram including the study selection process is shown in Figure 1. Databases and hand searches identified 2384 studies. Of these, 901 were duplicates. Of the remaining studies, 1416 did not meet the eligibility criteria by the information provided in title and abstracts. Thus, 67 studies remained for the full text assessment. Out of these, 44 were excluded, leaving a total of 23 studies [22–44] for inclusion in this review. The reasons for exclusions can be found in Figure 1. In these 23 studies, five existing ADL performance based protocols were identified. The protocols' characteristics are summarized in Table 2.

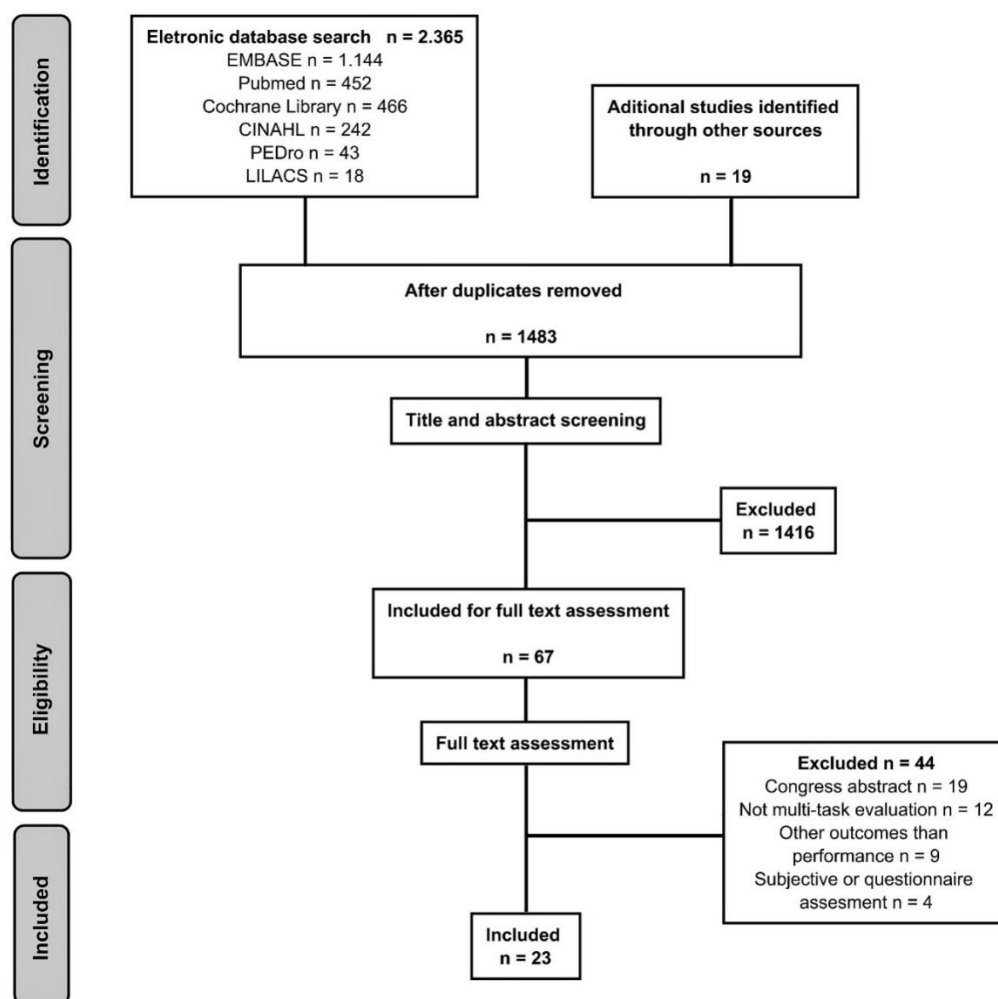


Figure 1. Flow diagram of the study

TABLE 2 – Characteristics of the protocols for objective assessment of ADL performance in patients with COPD.

Protocol	No. of activities	Description	Outcome	Instructions
Glittre ADL Test [22-33,36,37]	4	Patients start the test rising from a seated position, carrying a backpack on the shoulders. Then, they walk 10 m, over the interposed two-step staircase and organize objects on shelves, the patients then walk back along the circuit, sitting down and	Time	“as fast as possible”

		immediately beginning the next lap. It takes five laps to complete the test.		
ADL simulation test [37-39]	4	This test starts with the patient wiping a draw off from a blackboard, next they screw in and then to unscrew three light bulbs, dry 10 dishes completely and put them on a shelf and put a number of groceries on a shelf. These four activities was considered a shuttle.	No. of shuttles	“as fast as possible”
MFTE [40-42]	5	Patients start the test walking on level ground, then perform a sit-to-stand activity, followed by a lifting activity from waist level to a level 12 inches above, then they walk again, but carrying in each hand a load and finish the protocol with a stepping activity. Each task is performed within 2 minutes and patients are allowed to recover for at least 2 minutes during the interval between each individual task. For each task, there is a definition of “one action” which make up the measurement of raw score.	No. of actions	“usual pace”
Londrina ADL Protocol [43]	5	Patients start the test sitting and move objects from a half of a table to another. Next, walk with handbags. Then they perform a shelf activity followed by hanging items of clothes on the clothes line. They finish the protocol walking again, but without carrying the handbags.	Time	“usual pace”
“ADL simulation” [44]	6	This test consist of getting out of bed, putting on shoes, making the bed, showering, a shelf activity above the shoulder girdle, and a shelf activity below the pelvic girdle.	Time	“usual pace”

ADL: activities of daily living; MFTE: Monitored Functional Task Evaluation; No: number;

ADL performance-based protocols

Glittre ADL Test

This was the most widely used protocol to assess ADL performance in people with COPD. The test was used in 16 out of the 23 studies [22–37], and most studies used the original protocol described by Skumlien et al. [22] in which the activities of the test were performed during five laps, and patients were asked to complete them as quickly as possible (Table 2). Valeiro et al. [35] used a modified version of the Glittre ADL Test proposing two changes: (i) the original outcome goal of five laps was replaced by a self-paced time-limited test; thus, the main outcome variable was the number of laps that the patient could complete in 6 min; and (ii) the original 2-step staircase was replaced by 2 steps placed separately, one in front of the other.

ADL simulation test

This test was used in four studies. It was first proposed by Ries et al. [36] and originally included three tasks: dishwashing, blackboard task, and grocery shelving. Posteriorly, a modified version of this protocol was then used in three other studies [37–39]. Participants were asked to repeatedly perform a circuit containing these four standardized activities as quickly as possible, during a period of 10 min (Table 2). The number of laps completed at the end of 10 min represented the performance of the test. Of note, no study assessed measurement properties of this protocol.

MFTE (Monitored Functional Task Evaluation)

On the whole, 3 out of the 23 studies used the MFTE as a protocol to assess ADL performance in people with COPD [40–42]. This protocol was designed to test five physical components: indoor mobility, sit-to-stand transfers, lifting, carrying, and stepping. Subjects are asked to perform the activities at their usual pace. The score was

established as the number of actions the subject completes within 2 min for each activity, with an interval of at least 2 min between them. A conversion scale, with explanations of what could be considered 'one action,' was developed for each activity. Each task component then carried equal weight in the test construct. A score ranged between 0 and 4 for each activity so that total score ranged between 0 and 20, and this total value represents the overall performance of the measurement.

Londrina ADL Protocol

This is the most recently developed protocol, used in one study [43]. It comprises five activities organized in 'stations' inside a room (Table 2). The position of the 'activity stations' and the distance between them are standardized. Participants are asked to perform the activities at their usual pace, as well as to walk between the 'stations' at their usual pace. The time spent by participants to perform the protocol is its main outcome.

'ADL simulation'

One study performed a simulation of ADL in an adapted laboratory, but the protocol does not have a specific name [44]. This included six activities performed in a standardized order, as a circuit, with no intervals between activities (Table 2). Participants were instructed to perform the activities as they do at home, at their usual pace. The total time to complete the circuit was used as outcome. Of note, the measurement properties of this protocol have not been investigated.

2.5.2.6 Measurement properties and quality assessment

Only 6 out of the 23 included studies [22,24,27,32,40,43] evaluated the measurement properties of performance-based protocols: the Glittre ADL Test was evaluated by four studies [22,24,27,32]; the MFTE was evaluated by one study [40]; and the Londrina ADL protocol was evaluated by one study [43]. Information regarding the measurement properties of these tests is described in Table 3. The majority of studies were classified as 'poor' using the COSMIN quality assessment of measurement properties (Table 4).

TABLE 3 – Characteristics of measurement properties of performance-based protocols of ADL assessment.

Protocols	Validity	Reliability	Responsiveness
Glittre ADL Test		Borg score for dyspnea at the end and the lowest value for SpO ₂ of test 1 and 2 did not differ. Correlation between test 1 and 2 (r=0.93). There was a 0.37 min decline in ADL-time from test 1 to 2. This learning effect, when expressed as percentage of the first test, was (7%) [22]	
	Correlation between performance during the Glittre ADL Test and 6MWD (r=-0.82) [22]	There was no statistical difference between the duration of two Glittre ADL tests, performed at the same day. Similarly, no differences in the cardiovascular, ventilatory, and metabolic variables were seen between these two tests [24]	The improvement in ADL-time after 4 weeks of rehabilitation was substantial: -0.89 min. This response after rehabilitation was significantly larger than the learning effect [22]
		Test-Retest Glittre ADL test (ICC: 0.75) [27]	
		Test-Retest Glittre ADL test (ICC: 0.97), learning effect of 6.34% [32]	
MFTE	Correlation between Test-Retest MFTE(ICC: 0.82),		-

	performance during the MFTE and 6MWT (r=0.32), MET during an incremental cycle ergometer test (r=0.27), Fatigue dimension of CRDQ (r=0.26)	Interobserver (ICC: 0.92) [40]
	MFTE could predict correctly 52.4% of the original grouped cases classified according to Moser's ADL class [40]	
Londrina ADL Protocol	Correlation between subject's movement intensity during the protocol and subject's movement intensity during a locomotion in daily life (r=0.71) [43]	Test-Retest Protocol without mask (ICC:0.90) Test-Retest Protocol with mask (ICC: 0.97) Test-Retest between a Londrina ADL Protocol with and without a mask (ICC: 0.94) [43]

ADL: activities of daily living; 6MWT: 6-minute walk test; SpO2: arterial oxygen saturation; ICC: intraclass correlation coefficient; MET: metabolic equivalent of task; CRDQ: Chronic Respiratory Disease Questionnaire; MFTE: Monitored Functional Task Evaluation;

TABLE 4 – Methodological quality of measurement properties assessed via COSMIN.

Protocols	Studies	Measurement Properties	COSMIN
Glittre ADL Test	Skumlien et al.[22]	Validity Reability Responsiveness	Fair Fair Poor
	Tufanin et al.[24]	Reability	Poor
	Dal Corso et al. [27]	Reability	Poor
	dos Santos et al. [32]	Reability	Poor
MFTE	Fong et al. [40]	Validity Reability	Fair Poor
Londrina ADL Protocol	Sant'Anna et al. [43]	Validity Reability	Poor Poor

COSMIN: Consensus-based Standards for the Selection of Health Status Measurement Instruments; ADL: activities of daily living; MFTE: Monitored Functional Task Evaluation;

Correlation with outcomes

Correlations between the performance during these ADL protocols and other clinical outcomes commonly assessed in people with COPD (such as pulmonary function, exercise capacity, quality of life, and physical ADL) are presented in Table 5. In general, the outcomes of three protocols (Glittre ADL Test, MFTE, and Londrina ADL Protocol) were weakly to moderately correlated with other outcomes. The Glittre ADL Test was so far the most studied protocol in terms of correlations with other outcomes, since there are seven studies presenting correlations ranging from weak to strong with a variety of variables. The strongest correlations found up to this moment were between this protocol and the 6-minute walking test (6MWT) ($r > 0.82$) (Table 5).

TABLE 5 – Significant correlations between the performance in protocols of ADL assessment and other clinical outcomes in patients with COPD.

Protocols	Studies	Correlated outcome (r value)
Glittre ADL Test	Skumlien et al.[22]	PFSDQ _{dys} (r=0.30), PFSDQ ₆ (r=0.35), SGRQ _{act} (r=0.43), FEV ₁ %pred (r=-0.61), FVC %pred (r=-0.44), TLCO %pred (r=-0.65), Neuromuscular comorbidity (r=0.27), Hospitalisations (r=0.35), BMI (r=0.57), 6MWD (r=-0.82)
	Corrêa et al. [23]	Physical activity domain of LCADL scale (r=0.67), Age (r=0.66)
	Gulart et al. [25]	CAT questionnaire (r=0.52)
	Karloh et al. [28]	6MWD (r=-0.87)
	Gulart et al. [30]	LCADL _{total%} (r=0.58), Personal grooming domain of LCADL scale (r=0.45), Leisure domain of LCADL scale (r=0.55)

	dos Santos et al. [31]	SGRQ total (r=0.68), SGRQ symptoms (r=0.43), SGRQ activities (r=0.47), SGRQ impact (r=0.77)
	Karloh et al. [33]	Time sitting (r=0.50), Time walking (r=-0.46), Step count (r=-0.53), Walking movement intensity (r=-0.66), Walking energy expenditure (r=-0.50), Total energy expenditure (r=-0.33)
MFTE	Fong et al. [40]	Moser's ADL Class (r=0.48), COPD Disability Scale (r=-0.58), 6MWD (r=0.32), MET during an incremental cycle ergometer test (r=0.27), Fatigue dimension of CRDQ (r=0.26)
	Chan et al. [42]	Chinese version of CRQ: Fatigue dimension (r=0.36), Emotion dimension (r=0.30), Mastery of disease dimension (r=0.33)
Londrina ADL Protocol	Sant'Anna et al. [43]	CAT (r=0.41), LCADL: Health care domain (r=0.59), Physical activity domain (r=0.44), Total score: (r=0.48), PFSDQ-M: Dyspnea domain (r=0.48), Fatigue domain (r=0.36), Activities domain (r=0.47), 6MWD %pred (r=-0.64)

6MWD: 6-minute walk distance; ADL: Activities of Daily Living; BMI: body mass index; CAT: COPD Assessment Test; CRQ: Chronic Respiratory Questionnaire; FEV₁: forced expiratory volume in 1 second; FVC: forced vital capacity; LCADL =London Chest Activities of Daily Living Questionnaire; MET: metabolic equivalent of task; MFTE: Monitored Functional Task Evaluation; FSDQ: Pulmonary Functional Status and Dyspnea Questionnaire; PFSDQ-M: Pulmonary Functional Status and Dyspnea Questionnaire – modified version; SGRQ: Saint George Respiratory Questionnaire; TLCO: transfer factor for carbon monoxide;%pred: percentage of predicted.

DISCUSSION

This review identified 23 articles which used at least one protocol that objectively (i.e. not self-reportedly) assessed ADL performance. The performance-based protocols found were the Glittre ADL Test, the ADL Simulation Test, the MFTE, the Londrina ADL Protocol and an ADL simulation test with no specific name. The Glittre ADL Test, Londrina ADL Protocol, and MFTE have been demonstrated to be valid and reliable [21,39,42]. Only the Glittre ADL Test has shown to be responsive to change after pulmonary rehabilitation. Minimal important difference was not reported in any study. Performance in the ADL protocols was associated with important clinical outcomes,

such as functional status [22,30,32,43], HRQoL [21,30], exercise capacity [22,28,31,40,43], impact of disease [22,25,43], hospitalization [22], and physical activity in daily life [33,43]. The outcomes were reported in three different ways: time taken to complete the tasks, number of shuttles, and number of actions. Since the COSMIN [19] uses a conservative criterion, most studies were classified as having 'poor' methodological quality.

Before moving to the discussion regarding ADL performance, it is important to distinguish functional capacity from functional performance and functional status. Functional capacity is defined as the maximum potential to perform ADL. Functional performance is the ADL that the person actually performs in their daily life. Finally, functional status is the difference between the capacity of the person and what the person really does in daily life, being generally assessed via questionnaire and related with symptoms [45]. Each of the three aforementioned constructs are measured using different instruments and it is important that clinicians and researchers are able to choose the best instrument to assess each construct.

There are different ways to evaluate ADL. A systematic review on measurements of ADL in people with COPD reported that the majority of instruments identified were questionnaires (24 out of 27) and few instruments (3 out of 27) were objective measures [18]. When it comes to assessing functional status, the use of questionnaires is vital since they provide important information, such as quantifying symptoms, disease progression, and the self-perceived impact on the activities of patients [46]. However, in addition to their perceived difficulties, it is important to identify how people with COPD perform their ADL and what their limitations are. A performance-based protocol is able

to provide this. Further, self-reported instruments tend to underestimate people's inactive time and overestimate their active time [3,47–49]. This information suggests that the objective measure of physical activity in daily life is more accurate than subjective measures, such as self-reported instruments to assess the same outcome. It is important to assess ADL objectively to obtain additional information than that obtained through the questionnaires. Furthermore, objective measures seem more accurate to assess daily activities.

The Glittre ADL Test was the most frequently used in the included studies. This test is simple and easy to administer, can be performed in a laboratory setting, and comprises four activities that include both upper and lower limbs activities. The Glittre ADL Test is valid to assess ADL-time and has demonstrated to be strongly associated with the distance achieved in the 6MWT ($r = 0.82$) [22]. The performance in the test is also associated with other outcomes such as functional status, HRQoL, pulmonary function, neuromuscular comorbidities, hospitalization, body mass index, physical activity in daily life, and impact of disease [22,30,33,50]. In the original study that described the development of the test, the reliability of the Glittre ADL Test was verified through a correlation test rather than using intraclass correlation coefficient (ICC). The use of the correlation coefficients is considered not adequate, because they do not take systematic error into account [20,22]. Further, Tufanin et al. [24] showed that no differences were found in the evaluation of cardiac, ventilatory, and metabolic variables between two tests performed with a minimum 30 min resting time. The responsiveness of the Glittre ADL Test to change following a pulmonary rehabilitation program in people with COPD has been investigated [22]. The study by Skumlien et al. [22] demonstrated

the improvement in performance from baseline to completion of a 4-week pulmonary rehabilitation program to be -0.89 95%IC $[-0.48$ to $-1.30]$. This difference was significantly larger than learning effect of the test (0.37 95%IC $[-0.20$ to $-0.54]$) [22]. However, no statistical test was performed to verify the responsiveness of the Glittre ADL Test [20].

José et al. [27] verified that the Glittre ADL Test is reliable in patients with COPD hospitalized due to an acute exacerbation. Moreover, the Glittre ADL Test is able to detect difference between patients with COPD and healthy subjects [23]. Although this is the most studied protocol to assess ADL performance, there is no solid evidence showing that the duration of the test is able to differentiate the severity of the disease. Additionally, Tufanin et al. [24] observed increase in cardiac, ventilatory, and metabolic variables until the third lap followed by a plateau, similarly to the 6MWT. Lastly, a study showed similar ventilatory and cardiovascular responses between the Glittre ADL Test and the 6MWT [29]. This suggests a similar metabolic pattern between the tests, which is probably due to the fact that subjects are instructed to perform the Glittre ADL Test as fast as possible, similarly to what is instructed for the 6MWT and differently than the pattern used in daily life. One alternative version of the test is to ask the subject to perform it at his/her usual pace; this option was used in only one study [35].

Ries et al. [36] developed a protocol to assess the change in performance during ADL after an upper-extremity exercise program (the ADL Simulation Test). Properties of this protocol have not been tested and it was applied only in that original study. A modified version of this protocol was used in three other studies [37–39]. However, the validity, reliability, and responsiveness of the protocol have not been assessed. Both the

original and the modified protocols are comprised only by activities that involve upper limbs. Therefore, the protocol is recommended to be used in studies that have the aim of evaluating functional capacity of the upper limbs. The protocol requires specific instruments such as sockets, dishes, and blackboard that would limit its widespread use. Further, there was no correlation between number of shuttles completed and other functional outcomes.

The MFTE was used in three studies. This protocol comprises five activities involving upper and lower limbs, and was shown to be valid and reliable. The score of the test has demonstrated weak-to-moderate correlations with four types of criterion parameters: (1) functional parameters, which included Moser's ADL class and the COPD Disability Scale; (2) exercise tests, which included the 6MWT and metabolic equivalent of task (MET) measured by a cycle ergometer test; (3) HRQoL (Chronic Respiratory Disease Questionnaire, CRQ); and (4) percentage FEV₁, and the ratio of FEV₁ and FVC (FEV₁/ FVC). These outcomes were used as criterion for validation of the test. It is the only protocol among the five to have intervals between the activities. Continuous protocol may generate more symptoms providing more information about actual responses during ADL. Furthermore, the test is stopped if the subject's heart rate exceeds 70% of the maximum [40]. However, when the subject performs the ADL at home, heart rate is not monitored and he/she does not stop when reaching this limit. Lastly, the total score of the MFTE was correlated with some outcomes, such as disability, exercise capacity, ADL class, HRQoL, and pulmonary function [40].

Sant'Anna et al. [43] have proposed a new protocol to assess ADL performance, the Londrina ADL Protocol, which comprises five simple upper and lower limb activities

as well as trunk flexion/inclination and rotation. The subject should perform the test in the usual pace as used for those activities in real life. The Londrina ADL Protocol is a valid and reliable measure of ADL performance and has reference values, which help on the interpretation of test results [51]. The correlation between the movement intensity during the Londrina ADL Protocol and the intensity of movement in daily life, as measured by the DynaPort Move Monitor®, was used to validate the protocol. The performance in the protocol was correlated with some outcomes, such as impact of the disease, functional status, exercise capacity, and physical activity in daily life [43]. In the development study, the authors showed that there was no difference when performing the test with or without a mask for gas analysis, enabling its use in the evaluation of ventilatory variables (e.g. dynamic hyperinflation) and metabolic variables (e.g. oxygen consumption).

The fifth and last protocol found was an 'ADL Simulation' test which does not have a specific name and was used in only one included study [44]. The protocol included six activities involving more upper limbs than lower limbs, and was performed at usual pace. The measurement properties of the protocol were not studied. The protocol comprises simulated activities such as taking a shower, putting on shoes, and making the bed. In ADL performance-based protocols, perhaps it is more interesting to include activities that can be realistically assessed by the protocol (i.e. activities fully performed as in real life) because otherwise the performance of the subject in that activity during the protocol is a simulation and not the real performance. In this protocol, for example, this is the case of the activity 'taking a shower' that is a simulation and not the real performance. A few studies [52–55], although not using formal protocols to

assess ADL performance, aimed to compare the metabolic and ventilatory demand of patients with COPD in the accomplishment of domestic activities of daily life. The results of these studies show that these patients perform domestic ADL at a high proportion of their peak aerobic capacity. This could explain the fact that patients present more dyspnea and might take more time to perform ADL compared with healthy individuals. In addition, one of these studies used an interesting approach in order to standardize the performance of the ADL, in which patients were instructed to watch a videotape for each activity and to reproduce the movements as similarly as possible to what they were watching [55].

1.6.1 Recommendations on the choice among the available protocols

There are therefore a handful of available protocols that have been developed to assess ADL performance. The selection of the most appropriate protocol has to consider whether the measurement properties of the protocol have been properly assessed and whether the protocol is well standardized. In addition, it is important that clinicians and researchers consider the physical space available they have to perform the protocol, the equipment needed to run the test, individual characteristics of the target population, and the clinical applicability of the results. In order to assess functional capacity, the most appropriate protocols would be the Glittre ADL Test and the ADL Simulation Test because these tests should be performed as fast as possible, evaluating the subject's maximum capacity. However, in contrast to the Glittre ADL Test, the ADL Simulation Test was not studied concerning its measurement properties. If the main interest is to evaluate ADL performance, the best choices are the MFTE, the Londrina ADL Protocol, and the unnamed 'Simulation ADL' test (the later with no

previous assessment of measurement properties), which are performed at usual pace, therefore assessing how people actually perform the ADL in their house. Four of the five protocols involve upper and lower limbs, and only the ADL Simulation Test involves only upper limbs activities. If the interest is on assessing solely upper limbs, the most appropriate is the ADL Simulation Test. However, since the other protocols involve both upper and lower limbs, they may better reflect a real scenario of usual daily activities. If the objective is assessing ventilatory or metabolic variables during ADL, the Londrina ADL Protocol may be the option since it was the only one to evaluate the influence of wearing a mask, which was not shown to cause any significant impact. Furthermore, the only protocol that has reference values at this point in time is the Londrina ADL Protocol, which may make the interpretation of the results easier.

More studies comparing these protocols are necessary to elucidate the most suitable test for assessing each objective, intervention, and patient profile. Moreover, their measurement properties were not yet assessed in depth, what leaves open a window of possibilities for future research.

Limitations

There are a variety of terms used to define the ability to perform ADL, such as functional ability, performance, functional performance, and functional capacity. This fact made the search very challenging, and some studies were not found the first time the search was run, although careful hand search reduced the risk of selection bias.

CONCLUSIONS

Five protocols which objectively evaluate performance in ADL were found in the literature, whereas only three had measurement properties described: the Glittre ADL Test, the MFTE, and the Londrina ADL Protocol were shown to be valid and reliable and only the Glittre ADL Test was shown to be responsive to change after a pulmonary rehabilitation program. These protocols can be used in laboratory settings and clinical practice to evaluate ADL performance in people with COPD, although not all protocols used the best methodology to assess measurement properties, and therefore there is need for more indepth information on their validity, reliability, and especially responsiveness. Furthermore, the performance in most protocols is associated with important outcomes such as exercise capacity, functional status, physical activity of daily life, and HRQoL.

Expert commentary

There has been growing interest in the assessment of ADL performance in people with COPD. The best option to assess ADL performance would be assessing in the patient's own house, since this alternative could be more representative of real ADL performance and its limitations. However, it is very difficult to standardize the protocol in patient's houses and some subjects could not feel comfortable with this possibility. Nevertheless, ADL evaluation is essential in the research setting, as well as it should be incorporated in clinical practice wherever and whenever possible. The alternative is to evaluate ADL through performance-based protocols that include activities commonly present in day-by-day routine, ideally easy to apply in the laboratory setting, standardized and with the measurement properties properly evaluated. In this review, we identified a few possibilities to assess ADL performance. The main issue is to

choose the most appropriate protocol according to the research-specific requirements. The Glittre ADL Test needs only a 10-meter corridor and simple equipments, which facilitates its inclusion in clinical practice. Despite being the most studied test so far, its measurement properties were not yet properly assessed. In summary, if the objective is to evaluate the maximum capacity of the subject in performing ADL, the Glittre ADL Test is a possibility. However, if the objective is to evaluate specifically the upper limb capacity, the most suitable choice would be the ADL Simulation Test, which involves only upper limbs and should be performed as fast as possible.

Another option to evaluate ADL performance is the MFTE, a test composed by five activities performed with intervals between them. The advantages are that the protocol involves common activities and its validity and reliability were verified, although its responsiveness and minimal important difference have been not reported yet. A possible disadvantage is the standardized interval between the activities, since a protocol with intervals allows time to recover, may not generate enough symptoms, and may not reflect real ADL behavior, providing less information about actual responses. The Londrina ADL Protocol is a good choice to assess ADL performance. The protocol has measurement properties already reported (validity and reliability), although its responsiveness and minimal important difference have also not been verified yet. Additionally, there is a reference equation to facilitate the interpretation of the results. The last protocol found was an ADL simulation which also assesses performance, although its measurement properties have been not verified and the subject is instructed to simulate activities such as 'taking a shower.'

Incorporating ADL evaluation is essential both in research setting and in clinical practice in order to understand the difficulties faced by subjects with COPD. The second step would be proposing ways of how pulmonary rehabilitation could aim at improving ADL performance, resulting in better functionality and quality of life. In addition to the tests' measurement properties, researchers and clinicians should critically define the best choice according to their needs, physical space, required equipment, individual characteristics of the target population, and clinical applicability of the results.

Five years view

More studies with adequate design and methodology are still needed to further investigate the measurement properties of performance-based ADL protocols for use in research and clinical practice. Responsiveness and minimal important difference are possibly the next targets. Furthermore, new studies should be developed in order to compare the existing protocols, facilitating the choice according to the purpose of each researcher or clinician.

An important challenge is to find out to what extent these protocols can be used in clinical practice. Often times, new methods to assess subjects with COPD are mastered only by researchers, and seldom incorporated in clinical practice. A comprehensive baseline evaluation can provide important information regarding the selection of the best treatment regimen for each patient, resulting in more marked benefits. Improvement in ADL performance may lead to improvement in quality of life, functionality, and physical activity level, which is known to be related to morbidity and mortality. Therefore, in the near future, proper ADL evaluation should rank among the most important outcomes to be assessed in this population.

For these reasons, it is expected that in five years time the measurement properties and other details of ADL assessment protocols will be better studied and understood, so that these standardized tests (and others that will come) are confidently applied to provide the most accurate possible information on limitations and improvements in ADL performance of patients with COPD.

KEY ISSUES

- People with COPD present symptoms that could hinder the performance of activities of daily living.
- There were different ways to assess activities of daily living in people with COPD, but few of these assessment tools evaluate ADL objectively (i.e. not self-reportedly).
- There has been growing interest on the objective assessment of ADL performance through performance-based protocols.
- There is still a gap in the literature on how to choose the best protocol to assess ADL performance in the clinical and research setting.
- Few protocols that assess ADL performance are available and have been tested for their measurement properties.
- Only three protocols (Glittre ADL Test, Monitored Functional Task Evaluation and Londrina ADL Protocol) were shown to be valid and reliable, whereas only the Glittre ADL Test was shown to be responsive to a pulmonary rehabilitation program.

- In general, patient's performance in these protocols was weakly to moderately correlated with other outcomes such as functional status, health-related quality of life, exercise capacity, impact of the disease and physical activity in daily life.

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4.3 ARTIGO 3 - Formatado de acordo com:

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Title:

THE MINIMAL DETECTABLE CHANGE FOR THE LONDRINA ADL PROTOCOL IN SUBJECTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT

Background: The Londrina ADL Protocol (LAP) is a new performance-based protocol for assessment of activities of daily living (ADL) proposed for COPD. Its reliability and validity are already known; however, there are no data about its responsiveness and minimal detectable change (MDC). **Objective:** To determine the MDC for ADL performance measured by the LAP in individuals with COPD. **Methods:** In a prospective study, individuals with COPD had their ADL performance objectively measured by the LAP before and after an 8-week rehabilitation program. The protocol is composed by five activities organized in a circuit which must to be performed at usual pace. Time spent to complete the LAP was recorded. The rehabilitation program consisted of a high-intensity exercise training (aerobic and strength exercises; 3x/week) plus education sessions. The following distribution-based methods were used to estimate the MDC: 1) 0.5 times the standard deviation ($0.5 \cdot SD$) of the baseline measurement; 2) empirical rule effect size ($0.08 \cdot 6 \cdot SD \Delta$); 3) Cohen's effect size ($0.5 \cdot SD \Delta$); and 4) standard error of measurement (SEM). **Results:** Twenty-two individuals completed the study (9 men; 64 ± 8 years, FEV_1 50 ± 15 %pred). Time spent to perform the LAP decreased after rehabilitation (305 ± 47 vs 279 ± 40 s; $P=0.006$). Calculation of the MDC results were: 23 s ($0.5 \cdot SD$); 19 s (empirical rule effect size); 20 s (Cohen's effect size) and 30 s (SEM). **Conclusion:** The MDC of the LAP for individuals with COPD after pulmonary rehabilitation comprises a difference of 19 to 30 seconds, which can be interpreted as a meaningful change.

Keywords: Motor Activity; Physical Functional Performance; Pulmonary Disease, Chronic Obstructive; Rehabilitation; Exercise.

INTRODUCTION

The ability to perform activities of daily living (ADL) is jeopardized in subjects with chronic obstructive pulmonary disease (COPD), resulting in reduction of independence, social isolation and consequently poor health-related quality of life.(1, 2) It is well known that physical activity level, which includes performance of ADL, predicts exacerbation, hospital admission, and mortality in this population. (3) Thus, evaluation of ADL in COPD is of paramount importance.

Several questionnaires have been used to assess ADL in COPD. (4-6) There is also a growing interest in performance-based ADL protocols, since it was noticed that self-reported tools use to overestimate physical activity level. (7) The Londrina ADL Protocol (LAP), which consists of five activities involving upper and lower limbs that are performed in a circuit, is the most recent protocol validated for COPD. (8) It is a valid and reliable measurement, besides being a no time-consuming and low-cost outcome.(8) Furthermore, there are reference values for the LAP which allows better interpretation of results.(9) However, there is no data about its responsiveness and its minimal detectable change (MDC).

Responsiveness is the ability of an instrument to detect change over time in the construct to be measured (10). Minimal detectable change is defined as the smallest change that can be detected by an instrument beyond measurement error, and only when an individual score change exceeds this level, the clinician can be confident that it was a real change.(11) Considering that previous studies demonstrated that subjects with COPD significantly improved their performance of ADL after pulmonary

rehabilitation (12, 13), it is worth studying the MDC for the performance-based protocols available.

Hence, the present study aimed to determine the MDC for ADL performance improvement, measured by the Londrina ADL Protocol, after pulmonary rehabilitation in subjects with COPD.

METHODS

For this prospective study, subjects with COPD who were referred for pulmonary rehabilitation were recruited during initial evaluation at the University Hospital of the State University of Londrina (HU-UEL), Brazil from August 2016 to October 2019. The inclusion criteria were: diagnosis of COPD according to the Global Initiative for Chronic Obstructive Pulmonary Disease (GOLD) (14); clinical stability for at least 1 month before inclusion in the program; absence of severe and/or unstable cardiac disease; absence of severe neurological or musculoskeletal conditions that might interfere in the performance of ADL; and not having participated in an exercise program in the last year. The exclusion criteria were: no completion of the proposed tests for any reason; manifestation of the desire to leave the study at any time for any reason; occurrence of severe acute exacerbation requiring a prolonged hospital stay or any other serious condition that compromises the progression of the protocol (e.g. surgeries, trauma, etc.). The study was approved by the institutional ethics committee (n1.730.247/2016). All participants received information about the procedures and signed an informed consent. The study protocol consisted of evaluation of lung function, exercise capacity, dyspnea, and ADL performance, and an exercise training program.

ASSESSMENTS

For the purpose of sample characterization, participants had their lung function assessed by spirometry (15, 16) and functional exercise capacity by the 6-minute walking test (6MWT) (17, 18). Additionally, the modified Medical Research Council (mMRC) scale was used to assess limitation in daily life due to dyspnea.(19)

The Londrina ADL Protocol was used to assess performance of ADL. The protocol is composed of five activities arranged in a circuit. Subjects were instructed to perform the protocol at their usual pace. Before the protocol starting, the evaluator demonstrated the activities to the participant in the same order in which he/she should perform them. The time spent to perform the LAP was registered using a stopwatch, and it was used as the outcome. The protocol was previously described by Sant'Anna et al. (8). Other measurements before and after the protocol included: peripheral oxygen saturation, heart rate, and sensation of dyspnea and fatigue (modified Borg scale).

Exercise training program

The participants followed a high-intensity exercise-training program based on international recommendations and a previously published protocol,(2, 20, 21) during 8 weeks (3x per week). It consisted of aerobic exercises performed in arm cycle ergometer and/or treadmill and leg cycle ergometer, and strengthening exercises for pectorals, latissimus dorsi, elbow flexors and extensors, and knee extensors.

Statistical Analysis

The software IBM SPSS version 20.0 (IBM, USA) was used for data analysis. Normality in data distribution was tested using the Shapiro-Wilk test. Results were described as mean \pm standard deviation (SD) or median [interquartile range 25%-75%]. The comparison of time spent to complete the LAP between pre- and post-intervention was performed using paired t-test. The level of significance was set at $P<0.05$. The distribution-based methods used to estimate the MDC were: 1) 0.5 times the SD of the baseline measurement; 2) empirical rule effect size ($0.08*6*SD\Delta$), 3) cohen's effect size ($0.5*SD\Delta$) and 4) standard error of measurement (SEM) ($\sigma_1\sqrt{1-r}$), where σ_1 is the baseline SD and r is the test-retest (ICC). This formula represents the lowest change that can confidently be considered as exceeding measurement error and noise. (22)

RESULTS

Thirty-six subjects were included in the study; 11 subjects did not complete the exercise training program for different reasons (AECOPD, desire to leave and clinical condition) and data from three subjects were missing. The study sample was composed by 20 subjects with COPD (nine men) characterized by, in general, moderate to severe airflow obstruction, overweight, relatively preserved exercise capacity and some degree of limitation in daily life due to dyspnea (Table 1). Moreover, a post-hoc power calculation showed a probability power of 80% of rejecting the null hypothesis that the response difference is zero.

Table 1. Characteristics of the studied sample.

	n=20
Gender (M/F)	9/11
Age (years)	64±8
BMI (KG/m ²)	28±5
FEV ₁ /FVC (%)	50±8
FEV ₁ (%pred)	50±15
LAP (s)	296±46
6MWT (m)	447±62
mMRC (pts)	3±1

BMI: body mass index; FEV₁: forced expiratory volume in the first second; FVC=forced vital capacity; LAP: Londrina ADL Protocol; 6MWD: Six-Minute Walk distance; mMRC: modified medical research council.

There was a difference between the time spent to perform the LAP pre and post-exercise training (305±47 s vs 279±40 s, $P=0.006$). (Figure 1)

Based on an ICC of 0.85, the MDC of the LAP varied from 19 to 30 sec, according to the empirical rule effect size, Cohen's effect size, , 0.5 times SD and SEM (Table 2).

Table 2. Methods to estimate the minimal detectable change in ADL performance.

Method	MDC (seconds)
SEM	29.65
Empirical rule effect size	19.02
Cohen's effect size	19.81
0.5 times SD	23.13

SEM: standard error of measurement; SD: standard deviation.

DISCUSSION

This study has shown that, based on distribution-based methods, the MDC for the Londrina ADL Protocol varies between 19 and 30 seconds in subjects with COPD. This was the first study that presented values which might contribute to LAP interpretation in rehabilitation settings.

We found a difference when compared pre and post exercise training in the LAP time of 26 seconds. This could be explained by the fact that short-term exercise training programs for subjects with COPD are effective in improving exercise capacity, dyspnea and health status. (23-25) The exercise training protocol was developed based on international recommendations (2, 21) and the duration of the training was 8 weeks the minimum recommended by ATS/ERS guideline (2, 21).

Estimating a minimal important difference (MID) is valuable in the interpretation of interventions as it goes beyond the interpretation of the concept of statistical differences. However, there are two different ways to estimate the MID. The first way uses the distribution-based methods to estimate the minimal detectable change (MDC) that is the smallest change that can be detected by the instrument beyond measurement error. Already, the second way uses anchor-based methods or association of anchor-based and distribution methods to estimate the MID or the minimally clinically important difference (MCID) that is the smallest change in score in the construct to be measured which are perceived as important by subjects, clinicians. (26)

The distribution-based methods approaches are based on statistical characteristics of the sample and express the observed change in a standardized metric. On the other hand, the anchor-based methods assess which changes on the

measurement instrument correspond with a minimal change defined on the anchor. In the present study, four different distribution-based-methods to provide the MDC of LAP were used. The only objective tool that had its responsiveness and MID calculated is the Glittre ADL Test (13, 27); However, there are some differences between the LAP and the Glittre Test. In the first one, the subject needs to perform the test as fast as possible while to performing the LAP the instruction is for the subject to perform the protocol at their usual pace, being the closest to what the patient performs in their daily lives. Other important point is the activity and movement, the LAP has activities of the upper limbs in a sitting position and trunk rotation movements that the glitter does not have. Besides, the LAP is already a valid and reliable test and now it has an MDC to facilitate the interpretation. (9)

Limitations

It is not possible to use the Anchor-based method. First, we do not have a similar variable that was assessed after 8 weeks of treatment. Second, we tried to use the Likert scale as an anchor, but the area under the curve was 0.42 and the result was not reliable. On the other hand, we have done four different distribution-based to confirm our result.

CONCLUSION

In conclusion, our study provided an MDC for the Londrina ADL Protocol that lies between 19 and -30 seconds after an 8-week high-intensity exercise training program.

The MDC of the LAP will allow interpretation of exercise-based interventions in this population, adding important information to professionals and patients. Future studies investigating MID or MCID of the protocol will increase the knowledge about LAP's interpretation.

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4.4 ARTIGO 4 - Formatado de acordo com:**Respiratory Medicine - Qualis: A2, Fator de Impacto: 3.237****Title:****A NEW WAY TO CLASSIFY ACTIVITIES OF DAILY LIVING IN PATIENTS WITH COPD ASSESSED BY THE LONDRINA ADL PROTOCOL.****Authors:**

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ABSTRACT

Background: The time spent to perform an ADL protocol is an important outcome; however, we do not know whether the patient spent that time at the expense of more or fewer symptoms, high cardiovascular stress, or desaturation of oxygen. **Objective:** this study aimed to develop a way of classifying the functional performance assessed by the LAP taking into account, in addition to its main outcome (i.e., spent time), the perceived symptoms, cardiovascular stress and peripheral oxygen saturation (SpO₂). **Methods:** In a retrospective cross-sectional study, individuals with COPD had their ADL performance assessed by the Londrina ADL Protocol (LAP). Other evaluations included: pulmonary function (spirometry); exercise capacity (6-min walking test, 6MWT); dyspnea (modified Medical Research Council Scale, mMRC); health and functional status (COPD assessment test, CAT), and London Chest Activity of Daily Living, LCADL). **Results:** Ninety-two individuals completed the study. A simple way to classify patients in four groups was created. The first group was composed by patients with final lower limb fatigue ≤ 2 points and time spent at the LAP > 407 s; the second group included patients with final lower limb fatigue > 2 points; the third group was composed by patients with final lower limb fatigue ≤ 2 points and time spent at the LAP ≤ 407 and final heart rate ≤ 106 bpm; the last group was composed by patients with final lower limb fatigue ≤ 2 points and time spent at the LAP ≤ 407 and final heart rate > 106 bpm. **Conclusion:** We created a way to classify the patients with COPD in four groups using the final lower limb fatigue and heart rate in addition to the time spent to perform the protocol.

Keywords: Activities of daily living; Motor Activity; Physical Functional Performance; Pulmonary Disease, Chronic Obstructive; Exercise.

INTRODUCTION

Patients with chronic obstructive pulmonary disease (COPD) often present symptoms, especially dyspnea that can impair their performance of activities of daily living (ADL). (1) It has been demonstrated that simple ADL, such as showering and getting dressed can cause dyspnea; and common ADL, such as climbing stairs and storing groceries, increases patient's ventilatory requirements and may evoke dyspnea. (2) Additionally, patients with COPD also report that fatigue sensation leads to limitation in daily functioning, negatively influencing their quality of life. (3-5)

Two methods are available to assess ADL: self-reported and performance-based tools. The questionnaires are used to assess self-reported ADL (6, 7), whereas performance-based tools evaluate ADL objectively (8, 9). Both methods are important to fully understand how and to what extent COPD impacts on patient's daily performance, being considered complementary tools.

There are a few performance-based tools available for assessing patients with COPD whose the main outcome is time spent to complete the protocol. (8-10) Nevertheless, some differences among them can be pointed; and one of them attracts attention. Some ADL protocols, such as the Londrina ADL Procotol (LAP) (8) and the Monitored Functional Task Evaluation (12), request for performance on patients own pace; otherwise, the Glittre ADL Teste (9) requires that patients perform the activities as fast as they can. Thus, when it is considered only time spent to complete an ADL protocol to evaluate and classify patients with COPD, there would be a misinterpretation

As it is already known, the time spent to perform an ADL protocol is an important outcome; however, we do not know whether the patient spent that time at the expense of more or fewer symptoms, high cardiovascular stress, or desaturation of oxygen. Taking this into account the hypotheses of the present study is that the variables such as heart rate (HR), peripheral oxygen saturation (SpO₂), and sensation of dyspnea and fatigue, besides time, can be part of patients' classification of ADL performance when assessed by the LAP. Based on this hypothesis, patients could be grouped into: 1) Fast LAP performance without effort and symptoms; 2) Fast LAP performance with effort and symptoms; 3) Slow LAP performance without effort and symptoms; and 4) Slow LAP performance with effort and symptoms.

Hence, this study aimed: i) to investigate whether patients' performance in an ADL protocol, the LAP, will be classified into groups based on time spent, effort (HR and SpO₂) and symptoms (dyspnea and fatigue); ii) to identified what variables differentiate these patients in the groups and to compare them; iii) to demonstrate how to classify patients into four groups during ADL assessment.

METHODS

Sample and Study Design

In a retrospective cross-sectional study, all data were obtained from the database of patients with COPD previously involved in studies conducted at the Laboratory of Research in Respiratory Physiotherapy (LFIP), State University of Londrina (UEL), Brazil. The inclusion criteria consisted of: diagnosis of COPD according to the GOLD

criteria (14); clinical stability (at least one month without exacerbation); absence of severe cardiac, neuromuscular, or skeletal disorders; and not participation in pulmonary rehabilitation in the last year. The patients were excluded if they have incomplete data. All participants signed an informed consent form and the studies were approved by the Ethics Committee (031/2013; 151/2013; 1.730.247/2016).

Assessments

Activities of daily living

The ADL was assessed using the Londrina ADL Protocol. The protocol is composed of five activities organized in stations inside a room. (8) The time spent to perform the LAP activities was registered using a stopwatch. Other measurements were assessed before and after the protocol: HR, SpO₂, and dyspnea and fatigue sensation (modified Borg scale).

Pulmonary function

The assessment of pulmonary function was performed by spirometry (Vmax Carefusion, USA), according to international guidelines (11) and the reference values for Brazilian population were used (12).

Exercise capacity

The 6-min walk test (6MWT) was performed in 30- meters corridor according to international recommendations (13), and Brazilian reference values were used (14).

Dyspnea

The modified Medical Research Council Scale (mMRC) was used to assess dyspnea in daily life, rating patients into five levels of ADL limitation due to dyspnea. (15)

Health and Functional Status

Health status was assessed by the COPD Assessment Test which consider cough, phlegm, chest tightness, breathlessness, activity limitations at home, confidence leaving home, sleep, and energy. The total score ranges from 0 to 40 with low scores indicating fewer symptoms and better health status. (16) The London Chest Activity of Daily Living (LCADL) scale was used to assess functional status. (17) It include ADL divided into four domains: self-care, domestic, physical, and leisure; higher scores indicate greater limitation. (18)

Statistical Analysis

The normality of data was evaluated using the Kolmogorov Smirnov test. The results were described as mean±standard deviation or median [interquartile range 25-75%]. The variables were converted into z-score. The z-score is used to compare results between tests of different scales. Next, the factor analysis was performed to determine which characteristics (time in seconds, HR, SpO₂, and dyspnea and fatigue sensation) were closely related. The factors founded by the analyses were used to

identify the four clusters of patients by K-means cluster analyses. We performed the analyses based on the initial hypothesis of classifying patients into four groups, as previously described in the manuscript. A Conditional Inference Tree (CIT) model was done with the objective of assigning COPD patients to the groups identified by cluster analyses. The comparisons between the clusters and the groups were performed with ANOVA followed by Tukey's Multiple Comparison Test or Kruskal-Wallis test followed by Dunn's Multiple Comparison Test. The chi-square test was used to compare proportions of men/women between the clusters and groups. The statistical analysis was performed using the statistical packages SPSS 21.0 (IBM, USA) and GraphPad Prism 6 (GraphPad Software, USA). Significance level was set as $P < 0.05$.

RESULTS

Ninety two patients with COPD were included in the study; in general, they were elderly, overweight (BMI 28 ± 5 kg/m²), with moderate to severe airflow obstruction and relatively preserved exercise capacity. Entire description of the sample is shown in Table 1.

Table 1. Characteristics of the studied individuals.

	n=92
Gender (M/F)	49/43
Age (years)	67±8
BMI (kg/m ²)	28±5
FEV ₁ (%pred)	52±16
6MWD (m)	462±86
6MWD (%pred)	86±19
mMRC (pts)	3 [2-4]
CAT (pts)	15 [9-25]
LCADL – self-care (pts)	5 [4-7]
LCADL – domestic (pts)	7 [4-13]
LCADL – Physical activity (pts)	4 [3-5]
LCADL – leisure (pts)	4 [3-5]
LCADL – total (pts)	21 [15-28]
LCADL - % total (pts)	31 [24-40]
LAP time (s)	365±100
LAP (%pred)	106±29

BMI: body mass index; FEV₁: forced expiratory volume in the first second; 6MWD: six-minute walk distance; mMRC: modified Medical Research Council; CAT: COPD Assessment Test; LCADL: London Chest Activity of Daily Living; LAP: Londrina ADL Protocol.

When the factor analysis was performed, four factors were identified: *Symptoms*, composed by Borg dyspnea and fatigue sensation of both upper limb (UL) and lower limb (LL); *Physical Effort*, composed by baseline and final HR; *Oxygenation*, composed by baseline and final SpO₂; and *Performance Time*, composed by time to complete the LAP (Table 2).

Table 2. Factors loading in the total group of patients with COPD.

	Factors			
	Symptoms	Physical Effort	Oxygenation	Performance Time
LAP time				0.96
Baseline HR		0.90		
Final HR		0.89		
Baseline SpO ₂			0.87	
Final SpO ₂			0.88	
Baseline Borg dyspnea	0.66			
Final Borg dyspnea	0.57			
Baseline Borg fatigue LL	0.73			
Final Borg fatigue LL	0.85			
Baseline Borg fatigue UL	0.82			
Final Borg fatigue UL	0.89			

LAP: Londrina ADL Protocol; HR: heart rate; SpO₂: peripheral oxygen saturation; LL: lower limbs; UL: upper limbs. The values indicate the loading of factors.

Cluster analyses

Using the factors, it was performed the K-means clusters analyses that identified four clusters of patients. Cluster 1: slow with more respiratory symptoms (n= 11); Cluster 2: little slow with more respiratory and peripheral symptoms (n=13); Cluster 3: little fast without symptoms (n=58); and Cluster 4: fast with more effort signs and few respiratory and peripheral symptoms (n=10). Comparisons among the clusters are presented in Table 3.

Table 3. Comparisons among the clusters.

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	P
Gender (M/F)	7/4	6/7	32/26	4/6	0.67
Age (years)	67±8	66±7	67±7	65±11	0.74
BMI (kg/m ²)	27±5	28±5	28±5	26±5	0.65
FEV ₁ (%pred)	45 [50-67]	50 [28-73]	51 [39-62]	59 [47-67]	0.41
6MWD (m)*	450 [354-473]	439 [363-469]	469 [439-515]	489 [435-537]	0.13
6MWD (%pred)	81 [62-99]	85 [61-93]	90 [83-97]	96,2 [76-107]	0.15
mMRC (pts)	3 [2-4]	3 [3-5]	3 [2-4]	4 [2-4]	0.09
CAT (pts)	15 [9-20]	19 [15-30]	15 [8-20]	14 [7-21]	0.12
LCADL – self-care (pts)	6 [6-10]	7 [5-8]	5 [4-6] ^x	5 [5-8]	0.006
LCADL – domestic (pts)	9 [5-14]	9 [7-16]	6 [4-11]	9 [4-15]	0.43
LCADL – physical activity (pts)	5 [4-6]	4 [5-6]	4 [3-5] ^x	4 [4-5]	0.01
LCADL – leisure (pts)	4 [3-5]	5 [4-6]	3 [3-5] [†]	4 [3-8]	0.03
LCADL – total (pts)	22 [21-36]	25 [22-34]	18 [14-26]	22 [16-35]	0.04
LCADL (%total)	35 [29-48]	33 [30-48]	27 [23-37]	34 [24-47]	0.04
LAP time (s)	524 [473-620]	422 [312-446]	337 [283-374] ^x	295 [257-373] ^x	<0.0001
LAP (%pred)	153 [144-179]	121 [92-130]	96 [84-106] ^x	94 [79-107] ^x	<0.001
HR baseline (bpm)	95 [82-97]	82 [67-93]	84 [73-93]	98 [93-114] ^{†‡}	0.0007
HR final (bpm)	90 [79-103]	93 [76-103]	90 [81-99]	116 [105-121] ^{x‡}	<0.0001
SpO ₂ baseline (%)	95 [92-95]	95 [91-96]	94 [92-95]	96 [95-97] [‡]	0.01
SpO ₂ final (%)	92 [89-94]	89 [85-95]	91 [87-95]	95 [91-97]	0.30
Borg Dyspnea baseline (pts)	1[0-3]	2 [1-4,5]	0 [0-0.5] [†]	0 [0-0] [†]	<0.0001
Borg Dyspnea final (pts)	3 [2-4]	4 [3-5,5]	1 [0.5-2] ^{x†}	2 [2-4]	0.0001
Borg Fatigue UL baseline (pts)	0 [0-0]	1 [0.5-3] ^x	0 [0-0] [†]	0 [0-0]	<0.0001
Borg Fatigue UL	0.5 [0-2]	4 [3-4] ^x	0 [0-0] [†]	3 [1-4] [‡]	<0.0001

final (pts)					
Borg FatigueLL	0 [0-1]	3 [1-5] [*]	0 [0-0] [†]	1 [0-2] [‡]	<0.0001
baseline (pts)					
Borg Fatigue LL	0 [0-0]	4 [3-6] [*]	0 [0-0] [†]	2 [0.5-3]	<0.0001
final (pts)					

BMI: body mass index; FEV₁: forced expiratory volume in the first second; 6MWD: six-minute walk distance; mMRC: modified Medical Research Council; CAT: COPD Assessment Test; LCADL: London Chest Activity of Daily Living; LAP: Londrina ADL Protocol; HR: heart rate; SpO₂: peripheral oxygen saturation.

* $P < 0.005$ vs. cluster 1

† $P < 0.005$ vs. cluster 2

‡ $P < 0.005$ vs. cluster 3

CART analyses

Cart analyses was conducted in all patients and provided an algorithm that facilitated the assignment of the individuals to the subgroups identified by cluster analysis. The algorithm identified that patients who presented final Borg fatigue of LL greater than two points had more than 60% probability of composing Cluster 2. Those who presented final Borg fatigue of LL smaller than or equal to two points and that spent more than 429 seconds to perform the LAP had almost 100% probability of composing Cluster 1. Patients that presented final Borg fatigue of LL smaller than or equal to two points, spent less than or equal to 429 seconds to perform the LAP and final HR more than 106 bpm had almost 60% probability of composing Cluster 4. Finally, those patients who presented final Borg fatigue of LL smaller or equal to two points, spent less than or equal to 429 seconds in the LAP and final HR smaller than or equal to 106 bpm had about 90% probability of composing Cluster 3. The algorithm is presented in Figure 1.

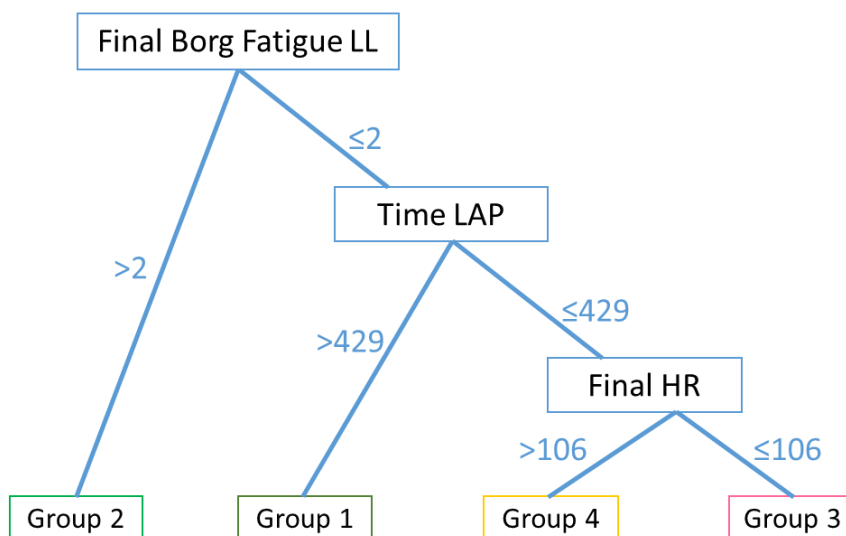


Figure 1. Algorithm developed by classification and regression tree (CART) analyses for the classification of the patients with COPD regarding the LAP. LL: lower limb; LAP: Londrina ADL Protocol; HR: heart rate.

Finally, patients were classified according to the algorithm. When comparing the four groups, it was observed that group 1 “slow doers with dyspnea group” was the one in which patients spent a high time performing the LAP with important self-reported dyspnea sensation, but with low self-reported fatigue of UL and LL. On the other hand, patients in group 2 “doers with dyspnea and fatigue group” performed the LAP a bit slower than those from group 3 “doers and feel ok group” and group 4 “doers with effort group”, but with higher levels of dyspnea and fatigue of UP and LL. In the group “doers and feel ok”, patients had the second-best performance time in the LAP with a small difference in comparison to doers with effort group group (5 seconds) and did not report or reported light symptoms during the performance of ADL. Finally, in the group “doers with effort”, patients performed the LAP in a short time but had a pronounced increase in HR, worse SpO₂, and presented light self-reported symptoms. (Table 4)

Table 4. Comparison between the groups developed after the tree analyses.

	Group 1 Slow doers with dyspnea n=10	Group 2 Doers with dyspnea and fatigue n=19	Group 3 Doers and feel ok n=54	Group 4 Doers with effort n=9	<i>P</i>
Gender (M/F)	6/4	10/9	30/24	3/6	0.63
Age (years)	68±8	67±9	67±7	67±3	0.91
BMI (kg/m ²)	27±6	28±5	28±5	27±6	0.71
FEV ₁ (%pred)	50±12	58±22	50±13	47±18	0.38
6 MWD (m)	410±126	438±103	481±64	449±96	0.01
6 MWD (%pred)	77±23	78±26	91±12	86±20	0.03
mMRC (pts)	3.5 [2-4]	3 [3-4]	2 [2-4]	4 [3-4]	0.02
CAT (pts)	14 [9-22]	20 [15-27]	14 [8-19] [†]	17 [14-25]	0.04
LCADL – self-care (pts)	6 [6-10]	6 [5-8]	5 [4-6]	6 [4-10]	0.01
LCADL – domestic (pts)	9 [6-15]	9 [2-16]	6 [4-10]	15 [7-16]	0.10
LCADL – physical activity (pts)	5 [4-6]	4 [3-5]	4 [3-5]	5 [4-6]	0.02
LCADL – leisure (pts)	4 [3-5]	5 [4-7]	3 [3-4] [†]	5 [4-7]	0.0007
LCADL – total (pts)	22 [21-37]	25 [16-35]	18 [15-25]	35 [19-37]	0.02
LCADL (%total)	35 [25-50]	33 [29-48]	27 [23-36]	47 [29-52]	0.006
LAP time (s)	574±103	369±83*	332±54*	327±73*	<0.0001
LAP (%pred)	167±34	107±21*	97±15*	96±21*	<0.0001
HR baseline (bpm)	90±17	85±14	82±13	97±11 [‡]	0.01
HR final (bpm)	91±14	94±16	89±10	119±11* [‡]	<0.0001
SpO ₂ baseline (%)	94±2	93±3	94±2	94±3	0.95
SpO ₂ final (%)	91±3	90±6	91±4	89±7	0.87

Borg Dyspnea baseline (pts)	0.5 [0-3]	1 [0.5-3]	0 [0-0.5] [†]	0 [0-1]	0.0004
Borg Dyspnea final (pts)	3.5 [2-4]	4 [3-5]	1 [0.5-2] ^{*†}	2 [2-4]	<0.0001
Borg Fatigue UL baseline (pts)	0 [0-1]	1 [0-3]	0 [0-0] [†]	0 [0-1]	<0.0001
Borg Fatigue UL final (pts)	0 [0-2]	4 [2-4] [*]	0 [0-1] [†]	0.5 [0-2] [‡]	<0.0001
Borg FatigueLL baseline (pts)	0 [0-1]	2 [0.5-3]	0 [0-0] [†]	0 [0-1]	<0.0001
Borg Fatigue LL final (pts)	0 [0-1]	4 [3-5] [*]	0 [0-1] [†]	0.5 [0-1] [†]	<0.0001

BMI: body mass index; FEV₁: forced expiratory volume in the first second; 6MWD: six-minute walk distance; mMRC: modified Medical Research Council; CAT: COPD Assessment Test; LCADL: London Chest Activity of Daily Living; LAP: Londrina ADL Protocol; HR: heart rate; SpO₂: peripheral oxygen saturation.

* $P < 0.005$ vs. cluster 1

† $P < 0.005$ vs. cluster 2

‡ $P < 0.005$ vs. cluster 3

DISCUSSION

In this study, we evaluated the performance of ADL in patients with COPD and used the assessed variables before and after the LAP to classify them, considering not only the time spent to perform the protocol but also variables that reflect their effort to execute it. Four clusters were identified which considered time to perform the ADL protocol, respiratory and peripheral symptoms. Finally, we developed a simple way to assign patients to these groups using an algorithm that takes into consideration responses during the ADL protocol.

The variables evaluated before and after the LAP were divided into four factors. The first factor included Borg dyspnea and fatigue of UL and LL. This result was expected since the same scale was used to assess both symptoms, i.e., the modified Borg scale. In addition, the scale assessed patient's effort according to their afferent feedback from the cardiorespiratory, muscular, and metabolic systems; in other words,

patients related their feeling and reported to the evaluator. (19-21) As the scale and the way of rating dyspnea and fatigue (afferent feedback) are the same, a good correlation was expected including both in the same factor. Second factor included HR before and after LAP. The third factor was composed by SpO₂ initial and final protocol. The last factor is composed only by LAP time. These three factors were divided according to the nature of what they evaluated and did not present a good correlation among them probably because these factors assess different outcomes and their variability do not behave the same, corroborating with the initial hypothesis.

The algorithm showed that self-reported fatigue of LL was an important variable to classify patients. Values above two points in the Borg scale assign patients directly to the Doers with dyspnea and fatigue group, i.e. fast to complete the LAP however with high symptoms. The sensation of fatigue may be influenced by psychological status and body homeostasis (micro-level), besides anxiety and depression, cognitive failure, dyspnea, and physical deconditioning (macro-level). Among the physiological components that can lead to fatigue, there is the muscle and blood lactate accumulation. (22) Studies have shown that patients with COPD present lactate accumulation even during performance of light physical activities (<40% of the maximum oxygen consumption). (23, 24) It is also already known that activities such as sweeping the floor and lifting pots reach an oxygen consumption of 52% and 61% of the maximum oxygen consumption, respectively. (25) Furthermore, Castro et al. showed that patients with COPD presented more fatigue sensation of LL than dyspnea during daily activities such as going up and down stairs, going up and down ramps and sweeping, and mopping two rooms. (26) The above mentioned evidences shows us that

we have been focusing on dyspnea for a long time, but fatigue can be also an important limiting factor for performing ADL in COPD.

The speed to perform the ADL is influenced by many factors, not only functional capacity but also psychological factors (27). Even so, the time spent to perform the protocol (speed) remained one of the variables that influence the classification of individuals among groups; although, the instruction to perform the protocol is for the patients to walk at their usual pace. This could be explained by the fact that walking speed during daily routine of patients with COPD is closely related to their disease severity, functional status and mortality (28). Moreover, Sanseverino et al.(29) showed that those patients walk in a speed that allow avoiding dyspnea, excessive gait variability, and cost of transport. Hence, the time to spend the protocol is an important factor to the classification of these patients.

Finally, the algorithm identified HR at the end of the LAP as an important variable to classify patients with COPD into the groups. In Doers with effort, in general, participants presented high final HR values and spent low time to perform the protocol with few self-reported symptoms, but with desaturation. Moreover, when an additional static analysis was performed, it was observed that the HR delta (i.e. final HR – baseline HR) was greater the Doers with effort group in comparison to the others ($P<0.0001$). As a consequence of low time to perform the LAP, patients in Doers with effort group presented a high physical effort, which may cause the greatest variability of the HR.(27)

As expected, when comparison among the clusters and the groups were performed, differences in most variables assessed before and after the LAP were found,

except for the baseline and final SpO₂. Probably, dyspnea and fatigue sensations limit more ADL than the SpO₂ in COPD; moreover, Barusso et al. (30) showed that dyspnea did not correlate with SpO₂ during ADL in this population. In other words, a person with COPD can present desaturation and do not feel or mention dyspnea. We also found statistical difference in some domains and total score of LCADL in both analysis, which was expected since this questionnaire assess self-reported ADL. Besides that, variables such as functional exercise capacity, health status and dyspnea during ADL were different among the groups, although post hoc analyses did not identify those differences. On the other hand, when the effect size of the variables were calculated, some had the value higher than 0.8. Thus, if the sample size was larger, possibility some differences would be observed, such as: domain physical activity of the LCADL (clusters 1 vs 2), dyspnea (Slow doers with dyspnea vs Doers with effort), health status (Doers with dyspnea and fatigue vs Doers and feel ok), self-care domain of LCADL (Slow doers with dyspnea vs Doers with dyspnea and fatigue; and Doers with dyspnea and fatigue vs Doers and feel ok), physical activity domain of LCADL (Doers with dyspnea and fatigue vs Doers with effort), total score of LCADL (Doers and feel ok vs Does with effort) and percentage of the total score of LCADL (Slow doers with dyspnea vs Doers and feel ok).

Limitations

Firstly, it was studied a convenience sample and data were retrospectively collected. Next, the studied variables were assessed immediately before and after the LAP, not during the whole protocol. It disabled us to detect the nadir of HR, SpO₂ and

symptoms; however, it was impracticable because it could to disturb and distract patients during the protocol, compromising their performance time. Finally, we did not validate our findings in an independent sample.

CONCLUSIONS

A new way to classify patients with COPD into four ADL groups using the time to spend to perform the LAP in addition to the final lower limb fatigue sensation and final heart rate was developed. Patients from the first group were those “slow doer”, i.e. performed the ADL protocol slower than the expected time for them; in addition, they performed it under high levels of dyspnoea. Patients from the other three groups were “doer”, i.e. performed the ADL protocol in the expected time for them; however, a part of them did it under high levels of dyspnoea and fatigue (group 2), others did it feeling “ok” (i.e. without pronounced symptoms – group 3), and finally part of them did it under high cardiac distress and desaturation (group 4).

The knowledge about conditions imposed to patients with COPD to perform their ADL during an initial evaluation could help professionals to better understand the mechanisms of functional limitation involved in each case, individualizing the rehabilitation process. Future researches investigating the validation of present classification of functional performance assessed by the LAP are needed.

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5. CONCLUSÃO GERAL DA TESE

Os artigos científicos apresentados nesta tese mostram que:

1) Uma grande variedade de ferramentas para avaliar AVDs está disponível na literatura. Considerando isto, a seleção deve ser cuidadosa e baseada na relevância para os indivíduos com DPOC. Por isso, nós criamos um mapa conceitual baseado no que é importante e relevante para o paciente com DPOC em relação à realização das suas AVDs e verificamos que a maioria das ferramentas disponíveis não avaliam todos os temas de relevância para eles. Sendo assim, é necessário o uso de mais de uma ferramenta para uma avaliação completa do desempenho auto percebido. Finalmente, nós percebemos que as ferramentas não seguiram as recomendações para o seu desenvolvimento ou não mencionaram isso nos estudos.

2) Cinco protocolos que avaliam objetivamente o desempenho nas AVDs foram encontrados na literatura, porém, somente três tiveram suas propriedades de medida descritas: o Glittre ADL Test, o MFTE e o LAP se mostraram confiáveis e válidos; e somente o Glittre ADL Test se mostrou responsivo para detectar mudança após o programa de reabilitação pulmonar. Estes protocolos podem ser usados em laboratórios de pesquisa e também na prática clínica. Contudo, nem todos os protocolos usaram a melhor metodologia para avaliar as propriedades de medida. Além disso, há necessidade de informações mais detalhadas sobre a validade, confiabilidade e, especialmente, capacidade de resposta dos protocolos disponíveis. Por fim, o desempenho na maioria dos protocolos está associado a resultados importantes, como capacidade de exercício, estado funcional, atividade física da vida diária e QV.

3) O estudo verificou que a MDD para o desempenho nas AVDs avaliado pelo Londrina ADL Protocol varia entre 19 e 30 segundos. A MDD facilitará a decisão de tratamentos de indivíduos com DPOC.

4) Nós criamos uma forma de classificar os indivíduos em quatro grupos após a realização do LAP utilizando a fadiga de membros inferiores, tempo gasto para realizar o teste e a frequência cardíaca. Em seguida, nós verificamos que os indivíduos do grupo 1 levam mais tempo para realizar o LAP com sintomas de dispneia; indivíduos do grupo 2 gastam mais tempo que o grupo 3 e 4 para realizar o LAP com sintomas de dispneia e fadiga; os indivíduos do grupo 3 levam menos tempo para realizar o LAP que o grupo 1 e 2 sem sintomas; e os indivíduos do grupo 4 realizam o LAP mais rápido, porém com maior estresse cardiovascular e menor SpO₂.

Nós mostramos que o indivíduo com DPOC pode ser mal interpretado quando somente o tempo despendido para realizar o LAP é considerado. Isso porque, alguns indivíduos realizam o LAP com tempo similar, porém, parte deles pode apresentar esforço físico e experimentar mais sintomas do que outros.

A classificação proposta pelo presente estudo melhorará a interpretação das avaliações das AVDs, guiando o processo de reabilitação e auxiliando os pacientes a realizar a suas AVDs com menos sintomas.

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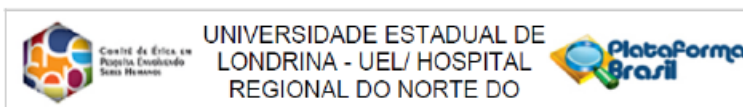
ANEXOS

ANEXO 1

Parecer do comitê de ética

ANEXO A

Parecer do Comitê de Ética em Pesquisa



PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: ESTUDO SOBRE (IN)ATIVIDADE FÍSICA DA VIDA DIÁRIA E MORTALIDADE EM PACIENTES COM DPOC

Pesquisador: KARINA COUTO FURLANETTO

Área Temática:

Versão: 2

CAAE: 41437014.0.0000.5231

Instituição Proponente: CCS - Departamento de Fisioterapia

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

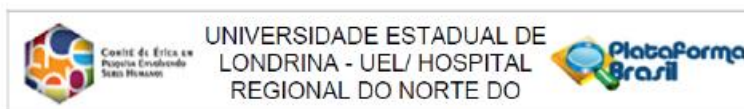
Número do Parecer: 996.413

Data da Relatoria: 20/03/2015

Apresentação do Projeto:

Trata-se de um projeto de pesquisa sob coordenação da Prof. Karina Couto Furlanetto, do Departamento de Fisioterapia da Universidade Estadual de Londrina (UEL). É um "estudo de coorte com análise retrospectiva de prontuários de pacientes com DPOC [doença pulmonar obstrutiva crônica], incluídos em um programa de reabilitação pulmonar nos anos de 2006 a 2014. Na avaliação inicial, os pacientes foram submetidos à avaliação do nível de atividade física na vida diária (AFVD) por meio de acelerômetros, além de avaliações da função pulmonar, força muscular respiratória, capacidade de exercício, força muscular periférica, qualidade de vida, estado funcional e sensação de dispneia. Os dados atuais referentes ao estado vital serão coletados por meio do acesso ao banco de dados do Núcleo de Informação de Mortalidade (NIM) da Autarquia Municipal de Saúde do Estado do Paraná. Caso o paciente tenha ido a óbito, serão coletadas informações sobre a data de morte e a etiologia no referido banco de dados. Após coletadas essas informações, os dados serão analisados levando-se em consideração dois grupos: grupo sobrevivente e grupo não sobrevivente". O estudo parte da seguinte hipótese: "[...] o tempo gasto em sedentarismo ou em atividade física seja um importante fator de predição de mortalidade em pacientes com DPOC".

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Continuação do Parecer: 996.413

Objetivo da Pesquisa:

Objetivo Primário:

Definir um ponto de corte para tempo gasto em sedentarismo em pacientes com DPOC, e investigar sua associação com a mortalidade, comparando este ponto de corte a outros fatores preditores de mortalidade já estabelecidos na literatura.

Objetivo Secundário:

- Identificar um ponto de corte para tempo gasto em sedentarismo em pacientes com DPOC a partir da recomendação de 30 minutos de atividade física de intensidade moderada a vigorosa (AFMV).
- Investigar a associação desse novo ponto de corte com a mortalidade nesses pacientes.
- Avaliar o poder de predição de mortalidade de diferentes desfechos de (in)atividade física de vida diária medida objetivamente em pacientes com DPOC e compará-los com o poder de predição de desfechos previamente conhecidos como preditores de mortalidade da doença.
- Determinar a variável de (in)atividade física de vida diária com maior poder de predição de mortalidade em pacientes com DPOC.

Avaliação dos Riscos e Benefícios:

Como não há a previsão de participantes no projeto, apenas a consulta de prontuários, não há riscos para participantes. Com relação aos benefícios, são para a área de estudos.

Comentários e Considerações sobre a Pesquisa:

A pesquisadora sanou todas as pendências, como indicado a seguir, in verbis:

1) TCLE para os participantes da pesquisa prospectiva finalizada, que figurarão como participantes na nova pesquisa;

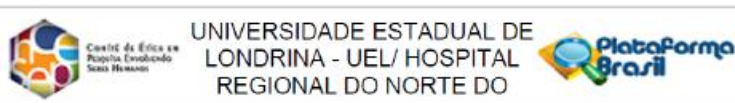
R: A nova pesquisa é um estudo retrospectivo que dispensa o TCLE, devido à metodologia proposta. Os dados sobre mortalidade dos participantes da nova pesquisa NÃO serão coletados por meio de contato telefônico ou visita domiciliar, e sim em prontuários, por meio do acesso ao banco de dados do Núcleo de Informação de Mortalidade (NIM) da Autarquia Municipal de Saúde do Estado do Paraná (adequações no sistema da Plataforma Brasil foram realizadas).

2) TCLE para os responsáveis por informações sobre a morte dos participantes da pesquisa prospectiva finalizada, que figurarão como participantes na nova pesquisa;

R: A nova pesquisa não realizará ligações telefônicas ou visitas domiciliares. Os dados atuais referentes ao estado vital serão coletados por meio do acesso ao Núcleo de Informação em Mortalidade (NIM) da Autarquia Municipal de Saúde.

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Continuação do Parecer: 966.413

3) Folha de rosto assinada pela coordenação do Programa de Doutorado em Ciências da Reabilitação UEL/UNOPAR;

R: Acredito que houve um mal entendido quanto à instituição proponente do projeto de pesquisa devido ao anexo da autorização emitido pela Autarquia. Este projeto não foi cadastrado na UEL como projeto de pós-graduação e sim no meu nome, como docente do departamento de Fisioterapia. Eu também sou aluna de doutorado do programa de Ciências da Reabilitação orientada pelo professor Fabio Pitta, que é colaborador desse projeto, e quando a solicitei a autorização na Autarquia Municipal de Saúde do Estado do Paraná, também forneci essa informação. Os dados coletados neste projeto de pesquisa provavelmente renderão um segundo artigo durante o período do meu doutorado e talvez um segundo artigo da aluna Leila Donária (citado na autorização da Autarquia), por isso achei pertinente informá-los, mas o ESTUDO SOBRE (IN)ATIVIDADE FÍSICA DA VIDA DIÁRIA E MORTALIDADE EM PACIENTES COM DPOC, não é projeto de doutorado ou mestrado e sim do departamento de Fisioterapia. Gostaria gentilmente de solicitar que fosse mantida a folha de rosto previamente enviada para que fosse levado adiante como está, pois este projeto contabiliza carga horária docente na UEL e já está até na pauta da próxima reunião de departamento.

4) Apresentação do "Termo de Sigilo e Confidencialidade";

R: Inclui o "Termo de Sigilo e Confidencialidade" (em anexo no sistema).

5) Indicação de um membro da equipe que propiciará acolhimento ou indicação do tipo de encaminhamento a ser dado no caso dos participantes se sentirem emocionalmente abalados por conta da abordagem da questão da morte.

6) Roteiro das perguntas que serão feitas aos participantes, especialmente aquelas que tratarão sobre óbitos.

R (questões 5 e 6): Visto que os dados serão coletados em prontuários, as questões 5 e 6 também não se aplicam ao presente estudo.

Considerações sobre os Termos de apresentação obrigatória:

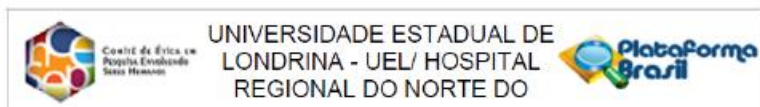
Foram contemplados todos os termos de apresentação obrigatória.

Recomendações:

Não há.

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Continuação do Parecer: 906.413

Conclusões ou Pendências e Lista de Inadequações:

Não há.

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

Considerações Finais a critério do CEP:

Prezado (a) Pesquisador (a),

Este é seu parecer final de aprovação, vinculado ao Comitê de Ética em Pesquisas Envolvendo Seres Humanos da Universidade Estadual de Londrina. É sua responsabilidade imprimi-lo para apresentação aos órgãos e/ou instituições pertinentes.

Coordenação CEP/UEL.

LONDRINA, 24 de Março de 2015

Assinado por:
Alexandrina Aparecida Maciel Cardelli
 (Coordenador)

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ANEXO 2

Normas para publicação – *Disability and rehabilitation*

1. Preparing your paper

All authors submitting to medicine, biomedicine, health sciences, allied and public health journals should conform to the Uniform Requirements for Manuscripts Submitted to Biomedical Journals, prepared by the International Committee of Medical Journal Editors (ICMJE).

We also refer authors to the community standards explicit in the American Psychological Association's (APA) Ethical Principles of Psychologists and Code of Conduct.

We encourage authors to be aware of standardised reporting guidelines below when preparing their manuscripts:

- Case reports - CARE
- Diagnostic accuracy - STARD
- Observational studies - STROBE
- Randomized controlled trial - CONSORT
- Systematic reviews, meta-analyses - PRISMA

Whilst the use of such guidelines is supported, due to the multi-disciplinary nature of the Journal, it is not compulsory.

1. Structure

Your paper should be compiled in the following order: title page; abstract; keywords; main text, introduction, materials and methods, results, discussion; acknowledgments; declaration of interest statement; references; appendices (as appropriate); table(s) with caption(s); figures; figure captions (as a list).

In the main text, an introductory section should state the purpose of the paper and give a brief account of previous work. New techniques and modifications should be described concisely but in sufficient detail to permit their evaluation. Standard methods should simply be referenced. Experimental results should be presented in the most appropriate form, with sufficient explanation to assist their interpretation; their discussion should form a distinct section.

Tables and figures should be referred to in text as follows: figure 1, table 1, i.e. lower case. The place at which a table or figure is to be inserted in the printed text should be indicated clearly on a manuscript. Each table and/or figure must have a title that explains its purpose without reference to the text.

The title page should include the full names and affiliations of all authors involved in the preparation of the manuscript. The corresponding author should be clearly designated, with full contact information provided for this person.

2. Word count

Please include a word count for your paper. There is no word limit for papers submitted to this journal, but succinct and well-constructed papers are preferred.

3. Style guidelines

Please refer to these style guidelines when preparing your paper, rather than any published articles or a sample copy.

Please use any spelling consistently throughout your manuscript.

Please use double quotation marks, except where "a quotation is 'within' a quotation".

Please note that long quotations should be indented without quotation marks.

For tables and figures, the usual statistical conventions should be used.

Drugs should be referred to by generic names. Trade names of substances, their sources, and details of manufacturers of scientific instruments should be given only if the information is important to the evaluation of the experimental data.

4. Formatting and templates

Papers may be submitted in any standard format, including Word and LaTeX. Figures should be saved separately from the text. To assist you in preparing your paper, we provide formatting template(s).

Word templates are available for this journal. Please save the template to your hard drive, ready for use.

A LaTeX template is available for this journal. Please save the template to your hard drive, ready for use.

If you are not able to use the templates via the links (or if you have any other template queries) please contact us here.

5. References

Please use this reference guide when preparing your paper. An EndNote output style is also available to assist you.

6. Taylor & Francis Editing Services

To help you improve your manuscript and prepare it for submission, Taylor & Francis provides a range of editing services. Choose from options such as English Language Editing, which will ensure that your article is free of spelling and grammar errors, Translation, and Artwork Preparation. For more information, including pricing, visit this website.

7. Checklist: what to include

1. **Author details.** Please ensure everyone meeting the International Committee of Medical Journal Editors (ICJME) requirements for authorship is included as an author of your paper. All authors of a manuscript should include their full name and affiliation on the cover page of the manuscript. Where available, please also include ORCiDs and social media handles (Facebook, Twitter or LinkedIn). One author will need to be identified as the corresponding author, with their email address normally displayed in the article PDF (depending on the journal) and the online article. Authors' affiliations are the affiliations where the research was conducted. If any of the named co-authors moves affiliation during the peer-review process, the new affiliation can be given as a footnote. Please note that no changes to affiliation can be made after your paper is accepted. Read more on authorship.

2. A structured **abstract** of no more than 200 words. A structured abstract should cover (in the following order): the *purpose* of the article, its *materials and methods* (the design and methodological procedures used), the *results* and conclusions (including their relevance to the study of disability and rehabilitation). Read tips on writing your abstract.
3. You can opt to include a **video abstract** with your article. Find out how these can help your work reach a wider audience, and what to think about when filming.
4. 5-8 **keywords**. Read making your article more discoverable, including information on choosing a title and search engine optimization.
5. A feature of this journal is a boxed insert on **Implications for Rehabilitation**. This should include between two to four main bullet points drawing out the implications for rehabilitation for your paper. This should be uploaded as a separate document. Below are examples:

Example 1: Leprosy

- Leprosy is a disabling disease which not only impacts physically but restricts quality of life often through stigmatisation.
- Reconstructive surgery is a technique available to this group.
- In a relatively small sample this study shows participation and social functioning improved after surgery.

Example 2: Multiple Sclerosis

- Exercise is an effective means of improving health and well-being experienced by people with multiple sclerosis (MS).

- People with MS have complex reasons for choosing to exercise or not.
 - Individual structured programmes are most likely to be successful in encouraging exercise in this cohort.
6. **Acknowledgement.** Please supply all details required by your funding and grant-awarding bodies as follows: *For single agency grants:* This work was supported by the under Grant . *For multiple agency grants:* This work was supported by the under Grant ; under Grant ; and under Grant .
7. **Declaration of Interest.** This is to acknowledge any financial interest or benefit that has arisen from the direct applications of your research. Further guidance on what is a declaration of interest and how to disclose it.
8. **Data availability statement.** If there is a data set associated with the paper, please provide information about where the data supporting the results or analyses presented in the paper can be found. Where applicable, this should include the hyperlink, DOI or other persistent identifier associated with the data set(s). Templates are also available to support authors.
9. **Data deposition.** If you choose to share or make the data underlying the study open, please deposit your data in a recognized data repository prior to or at the time of submission. You will be asked to provide the DOI, pre-reserved DOI, or other persistent identifier for the data set.
10. **Supplemental online material.** Supplemental material can be a video, dataset, fileset, sound file or anything which supports (and is pertinent to) your paper. We publish

supplemental material online via Figshare. Find out more about supplemental material and how to submit it with your article.

11. **Figures.** Figures should be high quality (1200 dpi for line art, 600 dpi for grayscale and 300 dpi for colour). Figures should be saved as TIFF, PostScript or EPS files.
12. **Tables.** Tables should present new information rather than duplicating what is in the text. Readers should be able to interpret the table without reference to the text. Please supply editable files.
13. **Equations.** If you are submitting your manuscript as a Word document, please ensure that equations are editable. More information about mathematical symbols and equations.
14. **Units.** Please use SI units (non-italicized).

2. Using third-party material in your paper

You must obtain the necessary permission to reuse third-party material in your article. The use of short extracts of text and some other types of material is usually permitted, on a limited basis, for the purposes of criticism and review without securing formal permission. If you wish to include any material in your paper for which you do not hold copyright, and which is not covered by this informal agreement, you will need to obtain written permission from the copyright owner prior to submission. More information on requesting permission to reproduce work(s) under copyright.

3. Declaration of Interest Statement

Please include a declaration of interest statement, using the subheading "Declaration of interest." If you have no interests to declare, please state this (suggested wording: *The authors report no conflicts of interest*). For all NIH/Wellcome-funded papers, the grant number(s) must be included in the disclosure of interest statement. Read more on declaring conflicts of interest.

4. Clinical Trials Registry

In order to be published in a Taylor & Francis journal, all clinical trials must have been registered in a public repository at the beginning of the research process (prior to patient enrolment). Trial registration numbers should be included in the abstract, with full details in the methods section. The registry should be publicly accessible (at no charge), open to all prospective registrants, and managed by a not-for-profit organization. For a list of registries that meet these requirements, please visit the WHO International Clinical Trials Registry Platform (ICTRP). The registration of all clinical trials facilitates the sharing of information among clinicians, researchers, and patients, enhances public confidence in research, and is in accordance with the ICMJE guidelines.

5. Complying with ethics of experimentation

Please ensure that all research reported in submitted papers has been conducted in an ethical and responsible manner, and is in full compliance with all relevant codes of experimentation and legislation. All papers which report *in vivo* experiments or clinical trials on humans or animals must include a written statement in the Methods section. This should explain that all work was conducted with the formal approval of the local

human subject or animal care committees (institutional and national), and that clinical trials have been registered as legislation requires. Authors who do not have formal ethics review committees should include a statement that their study follows the principles of the Declaration of Helsinki.

8. Consent

All authors are required to follow the ICMJE requirements on privacy and informed consent from patients and study participants. Please confirm that any patient, service user, or participant (or that person's parent or legal guardian) in any research, experiment, or clinical trial described in your paper has given written consent to the inclusion of material pertaining to themselves, that they acknowledge that they cannot be identified via the paper; and that you have fully anonymized them. Where someone is deceased, please ensure you have written consent from the family or estate. Authors may use this Patient Consent Form, which should be completed, saved, and sent to the journal if requested.

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Please confirm that all mandatory laboratory health and safety procedures have been complied with in the course of conducting any experimental work reported in your paper. Please ensure your paper contains all appropriate warnings on any hazards that may be involved in carrying out the experiments or procedures you have described, or that may be involved in instructions, materials, or formulae.

Please include all relevant safety precautions; and cite any accepted standard or code of practice. Authors working in animal science may find it useful to consult

the International Association of Veterinary Editors' Consensus Author Guidelines on Animal Ethics and Welfare and Guidelines for the Treatment of Animals in Behavioural Research and Teaching. When a product has not yet been approved by an appropriate regulatory body for the use described in your paper, please specify this, or that the product is still investigational.

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This journal uses ScholarOne to manage the peer-review process. If you haven't submitted a paper to this journal before, you will need to create an account in the submission centre. Please read the guidelines above and then submit your paper in the relevant Author Centre, where you will find user guides and a helpdesk. By submitting your paper to *Disability and Rehabilitation* you are agreeing to originality checks during the peer-review and production processes.

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Authors are further encouraged to cite any data sets referenced in the article and provide a Data Availability Statement.

At the point of submission, you will be asked if there is a data set associated with the paper. If you reply yes, you will be asked to provide the DOI, pre-registered DOI, hyperlink, or other persistent identifier associated with the data set(s). If you have selected to provide a pre-registered DOI, please be prepared to share the reviewer URL associated with your data deposit, upon request by reviewers.

Where one or multiple data sets are associated with a manuscript, these are not formally peer reviewed as a part of the journal submission process. It is the author's responsibility to ensure the soundness of data. Any errors in the data rest solely with the producers of the data set(s).

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We are committed to promoting and increasing the visibility of your article. Here are some tips and ideas on how you can work with us to promote your research.

ANEXO 3

Normas para publicação – *Respiratory care*

GENERAL GUIDELINES

Ethics of Publication

Manuscripts must conform to the International Committee for Medical Journal Editors' (ICMJE) Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals and to these instructions.

All authors must:

- Give consent to submission and publication of the work
- Have participated in the research and in the shaping of the manuscript
- Have read and approved the manuscript
- Be able to publicly discuss and defend the manuscript's content

Authorship is not based on obtaining funding, offering advice, or similar. Persons who contribute such may be mentioned in the Acknowledgments. Authors must take responsibility for at least one component of the work, be able to identify who is responsible for each other component, and be confident in their co-authors' integrity.

The contributions of each author must be listed on the Title Page (literature search, data collection, study design, data analysis, manuscript preparation, manuscript review).

Any editorial contributions made by outside organizations, persons, funding bodies, or persons employed by funding sources must be acknowledged on the Title Page.

Duplicate Publication and Plagiarism

The manuscript must not have been previously published elsewhere and must not be currently under consideration for publication elsewhere, including online. If any part of the material (other than a brief abstract submitted to a national or international meeting) has been published or is currently under consideration for publication elsewhere, you must provide copies of all related material at the time of submission.

Conflict of Interest

The conflict of interest policy of Respiratory Care is consistent with that of JAMA,¹ ICMJE,² CSE,³ and WAME.⁴ Disclosures must be made at the time of submission and must be indicated on the title page. The Editor will decide whether the presence of conflicts of interest affects the suitability of the manuscript for publication.

The Journal's conflict of interest policy is as follows:

- A conflict of interest may exist whenever an author (or the author's institution, employer, or immediate family member) has financial or personal relationships or affiliations that could influence or bias the author's decisions, work, or manuscript.
- All authors are required to disclose all potential conflicts of interest, including specific financial interests and relationships and affiliations
- Disclosures of potential conflicts of interest should be for the previous 2-year period. Authors must fully disclosure of all potential conflicts of interest, whether or not

related to the content of the paper. The type of relationship (eg, consultant, speaker, employee) and monetary amount need not be specified. If no financial or other potential conflicts of interest exist, a statement to this effect must be included on the Title Page.

The following examples are considered conflicts of interest and require disclosure:

- Being an employee of a company that designs, manufactures, or sells respiratory care equipment
- Serving on an advisory board or as a consultant to such a company
- Having received a research grant or other grant-in-aid from such a company
- Having received honoraria for lectures, writing, or other educational activities from such a company
- Holding a patent or having other financial interest in a respiratory care product
- Material support for research, including grants, donation of equipment and supplies, and other paid contributions

These examples are intended to illustrate the types of relationships that constitute conflicts of interest in the field of respiratory care, and are not meant to be all-inclusive.

The conflict of interest policy also applies to the Journal's Editors, Editorial Board members, and all manuscript reviewers.

Disclosure of relationships will not necessarily affect the decision to publish a manuscript. Having such relationships is not considered unethical. However, not disclosing such relationships is unethical.

1. Flanagin A, Fontanarosa PB, DeAngelis CD. Update on JAMA's conflict of interest policy. JAMA 2006;296(2):220-221. doi: [10.1001/jama.296.2.220](https://doi.org/10.1001/jama.296.2.220)
2. International Committee of Medical Journal editors. [Recommendations for the conduct, reporting, editing, and publication of scholarly work in medical journals](#). Updated December 2014. Accessed January 27, 2015
3. Council of Science Editors. Editorial policy statements approved by the CSE Board of Directors. <http://www.councilscienceeditors.org/i4a/pages/index.cfm?pageid=3332> Accessed January 27, 2015
4. World Association of Medical Editors. Recommendations on publication ethics policies for medical journals. <http://www.wame.org/about/recommendations-on-publication-ethics-policie> Accessed January 27, 2015

Industry Relationships

Respiratory Care requires authors to indicate the role of funding organizations or sponsors in the design of the study, data collection, data analysis, and interpretation of the data. Authors must also disclose the role of funding organizations in the preparation, review, and approval of the manuscript. The setting where the study was conducted must be indicated. Full disclosure of the role of funding sources must be included at the beginning of the Methods section.

Individuals who provided paid contributions to the paper (including writers, statisticians, epidemiologists, and any others involved with data management and analyses) may meet the criteria for authorship. If they do not, they should be listed in the Acknowledgment section.

Respiratory Care will not consider submissions that are ghost written by industry employees or hired writers. Nor will the Journal consider submissions of industry-sponsored studies in which the data were collected and analyzed solely by employees of the company. Such studies are considered only if there is independent analysis of the methods and data by someone at an academic institution, who has research and publishing experience (eg, medical school, academic medical center, or government research institute).

For additional information related to relationships between authors and industry, refer to: Fontanarosa PB, Flanagin A, DeAngelis CD. Reporting conflicts of interest, financial aspects of research, and role of sponsors in funded studies. *JAMA* 2005;294(1):110-111 doi: [10.1001/jama.294.1.110](https://doi.org/10.1001/jama.294.1.110).

Registration of Clinical Studies

Respiratory Care will only consider clinical trials that are registered, as appropriate, at [ClinicalTrials.gov](https://www.clinicaltrials.gov) or equivalent.

Ethics of Investigation

All studies that include human subjects must indicate in the Methods section that approval was received from the appropriate local institutional review board (IRB) or Ethics Committee. This requirement applies to retrospective studies, prospective studies, quality improvement projects, and surveys. Human research subjects may be hospital patients, healthy volunteers, clinicians, or students. It is important to note that the IRB, not the investigator, determines whether a study is exempt from full review.

Authors must comply with the Health Insurance Portability and Accountability Act (HIPAA) . This applies to any information (eg, text, photo, or radiograph) that could potentially identify a patient or subject. Authors must provide written consent from the individual, next of kin, or guardian.

All studies involving animals must indicate in the Methods section that approval was received from the local IACUC (Institutional Animal Care and Use Committee) or that the research was conducted in accordance with a national guideline (eg, Public Health Service Policy on Humane Care and Use of Laboratory Animals).

MANUSCRIPT TYPES

Original Research

Original research is a report of an original investigation. It must include: Title Page, Structured Abstract, Key Words, Introduction, Methods, Results, Discussion, Conclusions, References, and Quick Look. It may also include Tables, Figures, and Acknowledgments. Supplementary Material, such as a survey instrument or details related to the methods, may be provided for online publication only. Authors of randomized clinical trials must follow the CONSORT guidelines. One of the figures must be a CONSORT flow diagram.

Quality Improvement Projects

A well-done quality improvement project might be suitable for publication as original research. This type of research is commonly performed in the healthcare setting to understand and improve practice. Several considerations are important for a quality improvement project to be suitable for publication. It must have generalizable interest

among the readers of the Journal and it must follow the scientific method. This means that the study must have an identified question or hypothesis, approval from the Institutional Review Committee, and statistical analysis of the data is necessary. Quality improvement projects are submitted in the category “Original Research.”

Reviews

Narrative Reviews

A narrative review is a comprehensive review of the literature that does not follow the rigor of a systematic review. It must include: Title Page, Outline, Unstructured Narrative Abstract, Key Words, Introduction, Review of the Literature, Summary, and References. The review of literature is typically divided into headings and sub-heading specific to the subject matter. The Outline consists of the headings and subheading of the paper. The review may also include Tables, Figures, Acknowledgments, and Supplementary Material for online publication only. Narrative reviews are usually written by persons with established expertise in the subject area.

A newer form of review is the scoping review. This has aspects of both narrative and systematic reviews. A scoping review will typically include a detailed search for relevant studies, and will include reports of various evidence levels (eg, randomized clinical studies, observational studies, bench studies, case series). In a scoping review, there is no critique of the individual studies included. The span of a scoping review tends to be much broader than systematic reviews. A scoping review is submitted in the category “Narrative Review.”

Systematic Reviews

Because of their methodological rigor, systematic reviews have become the standard for synthesizing evidence in health care. A systematic review organizes relevant evidence that fits pre-specified eligibility criteria to answer a specific research question. It uses explicit, systematic methods to minimize bias in the identification, selection, synthesis, and summary of studies. Some, but not all, systematic reviews contain a meta-analysis. A meta-analysis uses statistical techniques to combine and summarize the results of multiple studies. The systematic review must follow the PRISMA guidelines. A systematic review must include: Structured Abstract, Key Words, Introduction, Methods, Results, Discussion, Conclusions, and References. It may also include Tables, Figures, Acknowledgments, and Supplementary Material for online publication only. One of the Figures must be a PRISMA flow diagram. Other figures might be the results of a meta-analysis (forest plots). Systematic reviews are generally written by persons with established expertise in the subject area.

Editorial

An invited manuscript related to another paper published in the same issue. Must include: Title Page, Text, and References. May also include Tables and Figures.

Correspondence

A brief communication responding to previously published material in Respiratory Care. Must include: Title Page, Text, and References. May include Tables and Figures. Correspondence is published online only.

PREPARING THE MANUSCRIPT

Title Page

For each author include:

- First name, middle initial, last name
- Academic degrees (eg, MSc, PhD, EdD). The Journal does not publish bachelor degrees
- Credentials (eg, RRT, MD, RN)
- FAARC (Fellow of the American Association for Respiratory Care). The Journal does not publish any other honorary titles
- Institutional affiliation and location (division, department, hospital, university, city, state/province, country)

Indicate the specific contributions of each author to the paper:

- Literature search
- Data collection
- Study design
- Analysis of data
- Manuscript preparation
- Review of manuscript

Title Page must also include:

- Name and location of the institution where the study was performed

- Name, date, and location of any meeting or forum where research data were previously presented, and who presented
- Sources of financial support
- Conflict of interest statement. If no potential conflicts of interest exist, a statement to this effect must be included

Identify corresponding author and provide contact information

Abstract

A structured abstract for an original research study and a systematic review includes these sections: Background, Methods, Results, and Conclusions. Abstracts must not contain any facts or conclusions that do not also appear in the text.

An unstructured Abstract for a Narrative Review is written as a paragraph of fewer than 300 words that provides a general overview of the paper.

Include the Abstract in the main manuscript text file.

Key Words

List 6–10 key words or phrases that reflect the content of your manuscript. Key words may be selected from the Medical Subject Headings (MeSH terms) used by MEDLINE.

Text

Double-space all text (including Tables and References). Number the pages. Center and bold 1st level headings; flush-left and bold 2nd level headings; indent and bold 3rd level headings.

References

References must be listed and numbered in the sequence in which they are first cited in the text. Citations *must* conform to Journal style; see examples below. Authors are responsible for accuracy of their references.

EndNote contains the style for Respiratory

Care: <http://endnote.com/downloads/style/respiratory-care>

Journal Article

Article. List the first 6 authors, then “et al”. Exception – in a paper with 7 total authors, list all 7:

Wallet F, Delannoy B, Haquin A, Debord S, Leray V, Bourdin G, et al. Evaluation of recruited lung volume at inspiratory plateau pressure with PEEP using bedside digital chest x-ray in patients with acute lung injury/ARDS. *Respir Care* 2013;58(3):416-423.

Corporate authors:

Chang SY, Dabbagh O, Gajic O, Patrawalla A, Elie MC, Talmor DS, et al; on behalf of the United States Critical Illness and Injury Trials Group: Lung Injury Prevention Study Investigators (USCIITG-LIPS). Contemporary ventilator management in patients with and at risk of ALI/ARDS. *Respir Care* 2013;58(4):578-588.

Article in a supplement:

del Giudice MM, Leonardi S, Ciprandi G, Galdo F, Gubitosi A, La Rosa M, et al. Probiotics in childhood: allergic illness and respiratory infections. *J Clin Gastroenterol* 2012;46(Suppl):S69-S72.

Corrected article:

Mireles-Cabodevila E, Hatipoğlu U, Chatburn RL. A rational framework for selecting modes of ventilation. *Respir Care* 2013;58(2):348-366. Erratum in: *Respir Care* 2013;58(4):e51.

Articles e-published online ahead of print:

Nozoe M, Mase K, Murakami S, Okada M, Ogino T, Matsushita K, et al. The relationship between spontaneous expiratory flow-volume curve configuration and airflow obstruction in elderly COPD patients. *Respir Care* 2013 [Epub ahead of print] doi: 10.4187/respcare.02296

Abstract. Citing abstracts is highly discouraged; those more than 3 years old should not be used:

Blakeman TC, Rodriguez D, Branson RD. Evaluation of five chemical oxygen generators (abstract). *Respir Care* 2012;57(10):1751.

Editorial:

Rouby JJ, Arbelot C, Brisson H, Lu Q, Bouhemad B. Measurement of alveolar recruitment at the bedside: the beginning of a new era in respiratory monitoring? (editorial). *Respir Care* 2013;58(3):539-542.

Editorial, no author given:

Asthma: not just for kids (editorial). *Johns Hopkins Med Lett Health After 50* 2012;24(8):6.

Letter:

Haynes JM. Expiratory reserve volume maneuver may be the preferred method for some patients during spirometry testing (letter). *Respir Care* 2013;58(2):e14-e15. author response: e15.

Books

Book. Corresponding pages should be cited whenever reference is made to specific statements or content:

Wilkins RL, Stoller JK, Kacmarek RM. Egan's fundamentals of respiratory care, 9th edition. St Louis: Mosby|Elsevier; 2009:400-404, 917.

Corporate authors:

Panel on Understanding Cross-National Health Differences Among High-Income Countries; Committee on Population Division of Behavioral and Social Sciences and Education; Board on Population Health and Public Health Practice; National Research Council; Institute of Medicine of the National Academies. U.S. health in international perspective: shorter lives, poorer health. Washington, DC: National Academies Press; 2013.

Chapter:

Heffner JE. Chronic obstructive pulmonary disease. In: Hess DR, MacIntyre NR, Mishoe SC, Galvin WF, Adams AB. Respiratory care principles and practice, 2nd edition. Sudbury, MA: Jones & Bartlett; 2012:735-764.

Online Material

Static material must be listed in the References and include the digital object identifier (DOI). Use a DOI for content published online only. Because these items are static, there is no need to include an access date:

Ng S, King CS, Hang J, Clifford R, Lesho EP, Kushner RA, et al. Severe cavitary pneumonia caused by a non-equi *Rhodococcus* species in an immunocompetent patient. *Respir Care* 2013;58(4):e47-e50. doi:10.4187/respcare.02017

Frequently changing material, such as an organization's homepage, should be cited within the article text using the URL and access date. Do not include in the References:

"...as recommended by the American Association for Respiratory Care (<http://www.aarc.org>, Accessed January 27, 2015) ..."

News sources:

Productivity at work improved for sleep apnea patients using CPAP. *Medical News Today*: April 15, 2013. <http://www.medicalnewstoday.com/releases/259016.php> Accessed January 27, 2015.

Unpublished Work

Manuscript accepted but not yet published. A copy of cited unpublished manuscripts should be provided upon request:

Strickland SL. Year in review: airway clearance. *Respir Care* 2015 (in press).

Research not yet accepted for publication should be cited in the text as personal communication. You must obtain written permission from the authors to cite unpublished data.

“Recently, Smith et al found this treatment effective in 45 of 83 patients (Smith R, personal communication, 2015).”

Your own unpublished work that has not been accepted for publication should be mentioned in the text: “We found this type of aerosol is no more effective than placebo (unpublished data).”

Quick Look

The Quick Look boxes in *Respiratory Care* provide readers with the concise take-home message of the study. Only Original Research articles have Quick Look boxes. Quick Look boxes have 2 headings, the first is *Current Knowledge* and the second is *What This Paper Contributes To Our Knowledge*.

Include your Quick Look text at the end of your main manuscript text file (after the References and any Figure Legends) under the heading Quick Look. Double-space all text.

Current Knowledge

Write 2–4 declarative sentences summarizing current understanding of the topic being studied. Think of it as defining the state of the art or establishing equipoise.

DO – State the current evidence on the subject

DO – Provide clear declarative statements

DO NOT – Ask a question

DO NOT – State what is not known or that a topic “requires further study” or “remains to be elucidated”

What This Paper Contributes To Our Knowledge

Write 2–4 declarative sentences summarizing the take-home message of the study. Use past tense. Provide only information supported by the data. Do not overstate the importance of your results and do not suggest further research; this section is about the paper at hand.

DO – Describe the main take-home points and findings

DO – Describe the environment (eg, if a lung model was used)

DO – Write statements that can be understood without re-stating the data

DO NOT – Allude to further work that needs to be accomplished

DO NOT – Overstate the importance of the findings or speculate. (eg, The use of APRV improved oxygenation [data from the study]. Due to improved oxygenation, APRV might reduce mortality in ARDS [speculation]).

DO NOT – Include statistics or numerical data

The Editors reserve the right to edit Quick Look boxes for accuracy, style, and length.

Example Quick Look

Current knowledge

The endotracheal tube cuff allows positive pressure ventilation and protects the airway from aspiration. Standard cuff pressures of 20–30 cm H₂O are typically used to prevent leakage of fluid around the cuff and to prevent mucosal injury. In recent years, laboratory evaluations of cuffs in glass models have demonstrated reduced fluid leakage, but clinical studies have not confirmed these findings in vitro.

What this paper contributes to our knowledge

In a realistic viscoelastic model of the trachea, endotracheal tube cuffs of different designs provided an adequate seal at a pressure of 12 cm H₂O. With increased PEEP, higher cuff pressures were required. Tubes with a subglottic suction channel performed best in the lateral position.

Figures

Use of Figures is encouraged. Include only Figures that clarify and augment the text. All Figures must be called-out in the text. Number consecutively as Figure 1, Figure 2, etc.

The first Figure in the report of a clinical trial must be a flow diagram showing phases of the trial (ie, enrollment, subject allocation, follow-up, and analysis). See CONSORT.

Each Figure must be uploaded to Manuscript Central as a separate image file, NOT embedded in the text.

Minimum 1200 dpi required for line art (graphs or drawings), 600 dpi required for images with labeling, and 300 required dpi for images (color or black and white) without labeling.

Radiographs must clearly identify the relevant details and contain no patient identifiers.

Any identifiable image must be accompanied with written consent (see Ethics of Investigation).

Identify stains and magnifications for all photomicrographs.

Arrows, numbers, letters, lines and other markers used to identify parts of a Figure must be defined in the Figure Legend.

Figures are redrawn for stylistic consistency. Contact the Editorial Office if you would like assistance in creating an original Figure.

Figure Legends

Every Figure must have a legend explaining every component of the Figure. The legend should be self-sufficient and allow the reader to understand the figure without referring to the text.

Legends are placed at the very end of the manuscript text file. Do not include legends in the Figure image files.

Tables

Each Table must be uploaded to Manuscript Central as a separate Microsoft Word file, NOT embedded in the text. Tables must have a title. The title should be self-sufficient and allow readers to understand the Table without referring to the text.

Tables should be numbered and cited consecutively in the text, Table 1, Table 2, etc. Any abbreviations and symbols must be explained in footnotes at the bottom of the Table. For footnotes use the following symbols, superscripted, in the following order: *, †, ‡, §, ||, ¶, **, ††.

Borrowed Figures and Tables

To include previously published Figures and Tables, you must obtain permission from the original copyright holder. Provide the reference citation in the Table footer so that appropriate credit can be acknowledged in accordance with copyright law.

Copyright is most often held by the publisher of the journal or book in which the Figure or Table originally appeared. It is the author's responsibility to secure permission.

Payment of any fees required for borrowed material is the responsibility of the author.

Upload permissions documentation with your manuscript files.

Acknowledgements

Names of persons not eligible for authorship, and their contribution and institutional affiliation, should be listed in the Acknowledgments. You must obtain written permission from all individuals named in the Acknowledgments because inclusion can be taken as the individuals' approval of the paper's contents.

Equations

Write equations as normal text. Do not use the equation function in Microsoft Word or other mathematics software.

Statistical Analysis

For original research papers, the Editor recommends working with a biostatistician to assure appropriate analysis. The Editor may request a letter from your biostatistician assuring that the analysis is correct.

In the Methods section, identify the statistical tests used to analyze the data. Indicate the *P*-value that was taken to indicate significance. State whether tests were one-tailed or two-tailed; justify the use of one-tailed tests. Identify post-hoc analyses. Cite references to support your choice of tests and identify any statistical analysis software used. Indicate how the power analysis was conducted to determine appropriate sample size.

Report measurements with an appropriate degree of precision. Report both numerators and denominators for percentages.

For continuous data, description statistics should be expressed as mean and standard deviation (not standard error). For ordinal data, median and interquartile range should be reported.

For ratios (odds ratio, relative risk, etc.), provide 95% confidence interval.

Report actual *P* values rather than thresholds. Example: write "*P* = .18", not "*P* > .05" or "*P* = NS." Note that *P* cannot equal 0 or 1.

P values should be expressed to 2 digits for $P \geq .01$. $P < .001$, rather than $P < .0001$ or $P = .00001$. If $P > .99$, $P = .999$ for example, it should be expressed as $P > .99$.

An exception is *P* values between .07 and .03, which the Journal expresses to 3 digits. This is to preserve potential meaning of values near .05.

Authors are encouraged to enlist the expertise of a local statistician. If questions arise during the peer review process regarding the statistical analysis, the Editor may ask for proof of input from a statistician when the revised manuscript is submitted.

Units of Measurement

Always report the units of measurement according to current scientific usage. Standard units of measurement and scientific terms may be abbreviated without explanation (eg, L/min, mm Hg, pH, O₂). The Journal uses most values in Systeme Internationale (SI) units. For blood gas values, we prefer mm Hg to kPa. For airway pressure, we prefer cm H₂O rather than mbars.

Pulmonary Terms and Symbols

Use the Preferred Pulmonary Terms and Symbols (Appendix 1). Use abbreviations sparingly. Do NOT invent new abbreviations for terms with long-held standard abbreviations. Use an abbreviation only if the term occurs 4 or more times in the manuscript.

The following commonly used abbreviations do not need to be defined: ARDS, CI, COPD, CPAP, DNA, FDA, FEV₁, F_IO₂, FVC, ICU, P_aO₂, P_aCO₂, P_O₂, P_{CO}₂, PEEP, SD, S_pO₂. We also do not define units (eg, mL, cm, μm, μL).

Drugs and Commercial Products

Precisely identify all drugs and chemicals, doses, and methods of administration.

Use generic names instead of trade (proprietary) names for both drugs and equipment.

At first mention, trade names may be given parenthetically after generic names, including the name and location of the manufacturer. For equipment, provide model numbers if available.

Subjects versus Patients

Individuals enrolled in research are referred to as subjects, not patients. This applies to both retrospective and prospective studies.

Ventilator Modes

Use the Preferred Ventilator Mode Nomenclature (Appendix 2).

Language Editing Services

Poorly written papers will not be accepted. Particularly for authors whose native language is not English, it is strongly recommended to work with someone fluent in English science writing. If the quality of the English is not acceptable, the Editor may ask the author to submit evidence of help by someone fluent in English science writing when the revised manuscript is submitted. If you need assistance, below are some companies that provide language and copyediting services. Use of such a service is at the discretion and cost of the authors, and does not guarantee acceptance. Inclusion on this list does not represent endorsement by the Journal.

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Bio Science Writers

Boston BioEdit

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Editage

Enago

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ScienceDocs

SPI Publisher Services

Text Check

SUBMITTING THE MANUSCRIPT

Submit your manuscript to Respiratory Care via Manuscript Central (<http://mc.manuscriptcentral.com/rcare>). Carefully follow the Instructions to Authors and Preparing the Manuscript instructions above.

Access Manuscript Central

Log in, or if you are a first-time user, create an account by selecting “Register Here”.

You should have only one account.

Check that your account is up to date using the dropdown menu from your name at the top of the page. Make desired edits to your account, and click “Finish” to save your changes.

You may complete the submission process in one sitting, or save and return later. You can skip from step to step. Make sure you save before logging off. For security reasons, Manuscript Central will log you out if no activity takes place after 75 min.

Submission Process

1. Type, Title, Running Head, & Abstract: Information may be pasted into the fields from a text file.
2. Attributes: Choose 3 categories to aid in the selection of reviewers.
3. Authors & Institutions: Add coauthor names and affiliations. **Be certain that their email address is correct.**
4. Reviewers & Editors: Authors may suggest names reviewers who are not affiliated with the same institution(s). Authors may also indicate who they would prefer not review their manuscript.
5. Cover Letter: Include a cover letter to the Editor. This letter should include any noteworthy information of which you would like him to be aware.
6. File Upload and Submission Checklist: Upload manuscript text file, Figure image files, and Tables files individually.
7. Complete the Manuscript Submission Checklist by indicating the appropriate selections. Failure to complete the Submission Checklist in a manner consistent with the submitted manuscript could lead to rejection.
8. Review & Submit: Carefully review your manuscript and submit.

9. Submission Form: Authors will each be emailed a personalized link to complete the Submission Form. Manuscripts are not considered until **ALL** authors have completed this step. On the form, authors must indicate whether they have any potential conflicts of interest (and if so, list them) and digitally sign the form by typing their name. When finished, click Submit to send the form to the Editorial Office.

Peer Review

Manuscripts undergo peer review on the basis of clarity, scientific accuracy, breadth of appeal, and timeliness. Manuscript reviewers are professionals with expertise in the subject and are selected by the Editor.

You can log into Manuscript Central at any time to check the status of your manuscript. The Editor will inform you via e-mail once a decision has been made; his decision letter may include reviewer comments.

Submission of Revision

Select “Manuscripts with Decision” in your Author Center. You will be prompted to create a revision. Submit your revision retaining the original manuscript ID.

Respond to the Editor’s decision letter and reviewer comments. You must respond *point by point* to the specific comments and suggestions, indicating in each instance whether or how the manuscript has been changed.

You should have ready:

A revised manuscript text file with changes indicated via Microsoft Word’s Track Changes function AND a clean text file where all changes are included (no red text).

Tables or Figures with changes indicated, and clean versions where changes are included.

Any file that you do not revise may remain as is in the list of files. Before uploading a revised file, *delete* the original file.

If there has been any change in authors, author contact information, or other aspect of the research or manuscript about which the Editor should be informed, please highlight these changes in your response.

If there has been a change in conflict of interest status for any of the authors, this must be noted in your response and indicated on the Title Page of the revision.

The Editor may send the revision for peer review and further revision may be requested.

If revision of a submission is not received within 6 months, the Journal will assume the authors have withdrawn the manuscript from further consideration.

Papers in Press

After acceptance, a version of the manuscript will be e-published ahead of print and available online in PubMed and the Respiratory Care website.

Copy Editing

Accepted manuscripts are copy edited for clarity, syntax, grammar, consistency, and conformity with Journal style.

Page Proof

Online page proof will be sent by e-mail to the corresponding author. Authors should pay careful attention to the proof. Authors are responsible for the published manuscript, including any changes made during copy editing. The proof should be corrected by annotations to the online PDF and returned promptly.

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With the proof, a statement transferring copyright to Daedalus Enterprises will be sent to the Corresponding Author for signature.

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ANEXO 4

Normas para publicação – *Respiratory medicine*

We now differentiate between the requirements for new and revised submissions. You may choose to submit your manuscript as a single Word or PDF file to be used in the refereeing process. Only when your paper is at the revision stage, will you be requested to put your paper in to a 'correct format' for acceptance and provide the items required for the publication of your article.

To find out more, please visit the Preparation section below.

Respiratory Medicine is an internationally-renowned, clinically-oriented journal, combining cutting-edge original research with state-of-the-art reviews dealing with all aspects of respiratory diseases and therapeutic interventions, but with a clear clinical relevance. The journal is an established forum for the publication of phased clinical trial work at the forefront of interventional research. As well as full-length original research papers, the journal publishes reviews, correspondence, and short reports. The Journal also publishes regular supplements on areas of special interest.

Submission checklist

You can use this list to carry out a final check of your submission before you send it to the journal for review. Please check the relevant section in this Guide for Authors for more details.

Ensure that the following items are present:

One author has been designated as the corresponding author with contact details:

- E-mail address
- Full postal address

All necessary files have been uploaded:

Manuscript:

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To foster transparency, we encourage you to state the availability of your data in your submission. This may be a requirement of your funding body or institution. If your data is unavailable to access or unsuitable to post, you will have the opportunity to indicate why during the submission process, for example by stating that the research data is confidential. The statement will appear with your published article on ScienceDirect. For more information, visit the [Data Statement page](#).