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Qualidade metodológica dos ensaios clínicos randomizados de fisioterapia respiratória em pacientes submetidos a cirurgia de revascularização do miocárdio na unidade de terapia intensiva: uma revisão sistemática.

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Orientador: Dr.Rodrigo Della Méa Plentz

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RESUMO

Objetivo: Avaliar a qualidade metodológica dos ensaios clínicos randomizados de fisioterapia em pacientes pós-operatórios de cirurgia de revascularização do miocárdio no ambiente de terapia intensiva através da ferramenta da Colaboração Cochrane bem como avaliar se os estudos cumprem os critérios para o desenvolvimento desse tipo de estudo de acordo com o CONSORT *Statement* e sua extensão para ensaios clínicos de intervenção não farmacológica. **Métodos:** Foram incluídos nessa revisão os ensaios clínicos randomizados de intervenção fisioterapêutica (respiratória ou respiratória e motora) no período pós-operatório de CRM no ambiente de terapia intensiva, publicados até maio de 2015 nas bases de dados Medline (via Pubmed), Cochrane e PEDro, além de busca manual nas referências de estudos publicados. **Resultados:** Identificou-se 807 estudos sendo 39 incluídos. Os 3 itens mais bem pontuados foram: introdução (100%), intervenções (100%) e resultados (100%). A maioria dos itens do *Consort* apresentaram uma melhor adequação após a publicação do mesmo, exceto os itens Cegamento e Métodos Estatísticos. Estudos com desfechos positivos apresentaram melhor qualidade metodológica. **Conclusão** Pode-se concluir dessa revisão que é crescente o número de publicações referentes a esse tema. A qualidade metodológica dos estudos vem sendo aprimorada ao longo dos anos, principalmente após a criação do Consort. Entretanto, ainda há muitos pontos a serem melhor delineados a fim de que não sejam gerados resultados não fidedignos.

Palavras Chave: exercício, fisioterapia, cirurgia torácica, metodologia, revisão sistemática, unidade de terapia intensiva.

ABSTRACT

Objective: Assess the methodological quality of randomized controlled trials of physiotherapy in postoperative patients of coronary artery bypass surgery in intensive care unit through the Cochrane Collaboration tool and to assess whether the studies meet the criteria for the development of this type of study according to the CONSORT Statement and its extension for clinical trials of non-pharmacological interventions. **Methods:** The randomized clinical trials of (respiratory or respiratory and neuromusculoskeletal) physiotherapy intervention in the postoperative period of CABG in the intensive care unit, published until May 26th, 2015, in MEDLINE (via PubMed), Cochrane and PEDro, as well as papers found through manual searching of references of published studies were included in this review. **Results:** From 807 studies identified, 39 were included. The three highest scoring items were: introduction (100%), interventions (100%), and results (100%). Most Consort items showed a better adequacy after the statement's publication, except for the blinding and the statistical methods items. Studies with positive outcomes presented better methodological quality. **Conclusion:** It can be concluded from this review that there is a growing number of publications regarding this topic. The methodological quality of the studies has been improving over the years, especially after the creation of the Consort. However, many aspects can still be better designed so that unreliable results are not generated.

Keywords: exercise, physiotherapy, thoracic surgery, methodology, systematic review, intensive care unit.

LISTA DE TABELAS E FIGURAS

LISTA DE ABREVIATURAS E SIGLAS

BIPAP	Dois Níveis de Pressão Positiva nas Vias Aéreas
BMJ	*British Medical Journal*
CARE	Case Reports
CONSORT	Consolidated Standards of Reporting Trial Statement
CPAP	Pressão Positiva Contínua nas Vias Aéreas
CRM	Cirurgia de Revascularização do Miocárdio
DAC	Doença Arterial Coronariana
DCV	Doença Cardiovascular
ECR	Ensaio Clínico Randomizado
FRC	Fisioterapia Respiratória Convencional
JAMA	The Journal of American Medical Association
MOOSE	Meta-analysis of Observational Studies in Epidemiology
OMS	Organização Mundial da Saúde
PEDro	The Physiotherapy Evidence Database
PEEP	Pressão Positiva Expiratória Final
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-analysis
QUORUM	Quality of Reporting of Meta-analysis
RATS	Qualitative research review guidelines
STARD	Standards for the Reporting of Diagnostic Accuracy Studies
STROBE	Strengthening the reporting of Observational Studies in Epidemiology
TMR	Treinamento Muscular Respiratório
UTI	Unidade de Terapia Intensiva

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CAPÍTULO I - REVISÃO DA LITERATURA

1 Introdução

O termo "medicina baseada em evidências" foi citado pela primeira vez pelo médico epidemiologista britânico Archie Cochrane, em meados do século XX (GALVÃO, 2004). Tem como conceito o uso consciente, explícito e judicioso da melhor evidência atual na tomada de decisões sobre o cuidado de pacientes de forma individual (SACKETT, 1996), e não somente basear-se na intuição ou experiência clínica.

A enorme quantidade de publicações técnicas na área da saúde faz com que os profissionais tenham dificuldade em se manterem atualizados. Deve-se salientar ainda, que muitas das informações disponíveis não provêm de estudos com adequada qualidade metodológica, o que os torna clinicamente pouco relevantes. A publicação incompleta ou inadequada de informações sobre o planejamento e condução do estudo prejudica a identificação de possíveis erros metodológicos, dificultando também o uso de suas conclusões pelos interessados, uma vez que estes não conseguem avaliar criticamente sua aplicabilidade clínica (ALTMAN, 2001; SCHRIGER, 2006).

Foi a partir dessas questões que em 1996 um grupo de editores e pesquisadores publicaram uma lista de checagem e um diagrama representando o fluxo dos participantes durante cada estágio do estudo. Esse *check-list*, denominado CONSORT (*Consolidated Standards of Reporting Trials*) *Statement* (BEGG, 1996), foi atualizado em 2010 e é composto por 25 itens (MOHER, 2010) que auxiliam os autores a aperfeiçoar a descrição de seus achados proporcionando uma consequente facilitação da interpretação crítica dos resultados. Dessa forma, permite que o leitor conheça detalhes sobre o desenho do estudo, seu modo de condução e o tipo de análise utilizada. Adicionalmente, evita a omissão de possíveis erros sistemáticos que comprometeriam a validade e a confiabilidade dos resultados e, portanto, sua aplicabilidade dentro do contexto da medicina baseada em evidência (MARTINS, 2009). Como resultado, temos um ensaio clínico randomizado (ECR) de qualidade, existindo a probabilidade de um estudo planejado gerar resultados sem tendências e que se aproximem da realidade terapêutica (SANTOS, 2011).

Atualmente, os ensaios clínicos randomizados (ECR's) podem ser divididos em dois grandes grupos, de acordo com o tipo de intervenção aplicada: tratamento farmacológico ou não farmacológico. Estudos de intervenção não farmacológica (cirurgia, psicoterapia, uso de dispositivos, fisioterapia, etc.) possuem algumas peculiaridades, como dificuldade no cegamento,

mais de um componente de intervenção, dificuldade em padronizar e reproduzir o tratamento a todos os pacientes, etc. Todas essas limitações podem ter importante impacto na estimativa de efeito do tratamento proposto. Diante disso, em 2006, foi elaborada uma extensão que viria à acrescentar 11 itens ao já existente *Consort Statement*, especificamente aplicado a ECR's de intervenções não farmacológicas. Da mesma forma, o objetivo foi melhorar a qualidade metodológica desse tipo de estudo para uma maior aplicabilidade clínica de seus resultados.

Apesar do ECR ser padrão ouro para avaliação de intervenções em saúde, esse tipo de estudo é muito propenso a vieses, seja pela arbitrariedade dos investigadores na seleção da amostra e aferição das variáveis analisadas, seja na dificuldade do controle de outros fatores que podem influenciar no desfecho clínico. Viés ou erro sistemático pode ser definido como qualquer tendenciosidade na coleta, análise, interpretação, publicação ou revisão dos dados, o que induz a conclusões que sistematicamente tendem a se distanciar da verdade (CARVALHO, 2013). Diante disso e de forma também a complementar a avaliação da qualidade metodológica dos ECR's, mais especificamente em relação a possíveis vieses, a Colaboração Cochrane desenvolveu a Ferramenta para avaliação do risco de viés de ECR's. Essa ferramenta está incluída no Manual Cochrane para Desenvolvimento de Revisões Sistemáticas de Intervenção (Cochrane Handbook), o qual foi publicado em 2008 e atualizado em 2011 (HIGGINS, 2011).

No caso específico da fisioterapia, durante muitos anos os profissionais atuaram com base em livros de reabilitação, cuja característica marcante eram as "receitas" prontas, que dispensavam a necessidade do raciocínio para a tomada de decisões (MARQUES, 2005). Porém, na atualidade, não se pode pensar em uma prática clínica que não esteja alicerçada na pesquisa e em boas evidências científicas.

Deve-se destacar que não existem evidências quanto a avaliação da qualidade metodológica e um adequado preenchimento dos critérios para realização de ensaios clínicos randomizados de intervenção fisioterapêutica respiratória em pacientes pós-operatórios de CRM no ambiente de Unidade de Terapia Intensiva (UTI). Portanto, essa pesquisa se faz necessária uma vez que o preenchimento ou não dos critérios para um correto desenvolvimento desse delineamento de pesquisa pode influenciar nos resultados encontrados. Também de forma complementar, a divulgação desses dados irá estimular com que pesquisas futuras se façam com uma melhor qualidade metodológica, demonstrando os principais pontos a serem mais bem

delineados e planejados. Dessa forma, poderá obter-se um maior benefício bem como melhores desfechos ao paciente crítico na prática clínica diária.

2 Qualidade Metodológica dos Ensaios Clínicos Randomizados

Em meados do século XX, o médico epidemiologista Archie Cochrane descreveu pela primeira vez o termo medicina baseada em evidência (GALVÃO, 2004). No entanto, foi em 1992 em uma publicação no JAMA (The Journal of American Medical Association), que o Grupo de Trabalho Medicina baseada em evidência trouxe essa expressão para a comunidade médica de forma mais ampla. Conceitualmente, esse novo paradigma não se baseia somente na intuição, experiência clínica e lógica fisiopatológica para a tomada de decisão, salientando também a análise de dados disponíveis através de pesquisa clínica (GUYATT, 1992) . Apesar de suas origens antigas, a medicina baseada em evidências continua a ser um tema relativamente jovem cujos impactos positivos estão apenas começando a serem validados (SACKETT, 1996). Ela significa integrar experiência clínica individual com a melhor evidência disponível de pesquisas sistemáticas.

Atualmente, os meios de comunicação e a globalização nos permitem acessar a qualquer momento e em qualquer lugar, informações provenientes das mais diferentes regiões do mundo. Isso se torna problemático a partir do momento em que é estabelecida uma inversão entre a quantidade e a qualidade dessas informações, principalmente na área da saúde. A cada semana são incluídos em torno de 8.000 novos estudos, sendo cerca de 350 ECR's, na base de dados Medline. Entretanto, somente uma pequena fração desses estudos é válida e relevante o suficiente para promover mudanças na prática clínica diária (GLAZSIOU, 2011). Com essa sobrecarga de dados disponíveis, o grande desafio é selecionar os que realmente são produzidos com metodologia adequada, tornando-se assim fontes confiáveis a serem incorporadas na prática.

A partir dessa questão, foram criadas diversas ferramentas com a finalidade de aprimorar a qualidade de diferentes delineamentos de pesquisa. As revisões sistemáticas e metanálises são extremamente relevantes para a centralização das melhores evidências, indicando um resultado definitivo sobre determinada questão de pesquisa. Para aprimorar e qualificar esse tipo de estudo, foi desenvolvida em 1996 a ferramenta chamada QUORUM (Quality of Reporting of Meta-analysis) que posteriormente, em 2006, foi aprimorada e renomeada de PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (MOHER, 2009). Se tratando de investigação sobre causas de doenças, detecção de efeitos adversos ou tardios de determinados tratamentos e pesquisas de cunho epidemiológico, dentre outros, os estudos de escolha são os de delineamento observacional (coorte, caso-controle ou transversal). A ferramenta STROBE

(Strengthening the Reporting of Observational Studies in Epidemiology), criada em 2004, serve como guia para um adequado e confiável desenvolvimento desse tipo de pesquisa (ELM, 2014). Adicionalmente, as ferramentas STARD (Standards for the Reporting of Diagnostic accuracy studies) (BOSSUYT et al, 2003), RATS (Qualitative research review guidelines) (CLARK, 2003), CARE (case reports) (GAGNIER, 2013) e MOOSE (Meta-analysis of Observational Studies in Epidemiology) (STROUP, 2000) aplicam-se a aprimorar a qualidade metodológica de estudos diagnósticos, revisão de pesquisas qualitativas, relatos de caso e metanálise de estudos observacionais epidemiológicos, respectivamente.

Ensaios clínicos randomizados são padrão ouro para avaliação de intervenções em saúde. Milhares de novos tratamentos, técnicas e intervenções são investigados diariamente para uma vasta gama de condições clínicas. O CONSORT *Statement* e a Ferramenta para avaliação do risco de viés da Colaboração Cochrane são instrumentos que guiam os autores sobre os itens que devem ser seguidos e avaliam a qualidade metodológica de ensaior clínicos randomizados, respectivamente. Na mesma linha, a extensão do CONSORT para ensaios clínicos randomizados de intervenção não farmacológica deve ser consultado no caso de intervenções como técnica cirúrgica, psicoterapia, reabilitação, uso de dispositivos, etc.

2.1 Instrumentos de Avaliação

2.1.1 Consolidated Standards of Reporting Trials (CONSORT *Statement*)

O primeiro ensaio clínico randomizado controlado foi publicado em 1948 no *British Medical Journal* (BMJ) pelo epidemiologista e estatístico Austin Bradford Hill, o qual introduziu uma rigorosa teoria com modelos matemáticos estatísticos no cenário clínico, avaliando o efeito terapêutico da Estreptomicina no tratamento de tuberculose (HILL, 1948). Se bem planejado, executado e avaliado, esse delineamento de pesquisa é considerado padrão-ouro para avaliar a efetividade de intervenções e tratamentos. Caso contrário, podem ser gerados resultados tendenciosos e enviesados por falta de critério metodológico, o que inviabiliza sua aplicação e reprodução (ALTMAN, 2001; SCHRIGER, 2006).

Desde a década de 50, diversas publicações já demonstraram falhas que impossibilitam uma adequada interpretação e análise dos resultados podendo comprometer e colocar em dúvida o real benefício de tratamentos propostos nas mais diversas condições (DERSIMONIAN, 1982; ANDREW, 1994; MOHER, 1998; ZAVITSANOS, 2014; HENSCHKE, 2014; AGHA, 2013; CHIAVETTA, 2014). Frente a esse fato, um grupo denominado "Padrões de registro de ensaios" se reuniu em 1993 e o resultado foi uma proposta de estruturação no relato de ensaios clínicos randomizados. Posteriormente, no ano de 1994, o grupo de trabalho Asilomar sobre as recomendações para notificação de ensaios clínicos na literatura biomédica se reuniu e propôs um check-list com os itens que deveriam constar no registro de ensaios clínicos, bem como sugestão aos editores que adicionassem o mesmo nas instruções aos autores.

Finalmente, de forma a padronizar e consequentemente aperfeiçoar a descrição desses estudos, um grupo formado por editores e cientistas desenvolveu no ano de 1996 um check-list denominado CONSORT (*Consolidated Standards of Reporting Trials*) *Statement*. Embasado nos dois check-list anteriores, o *Consort*, originalmente composto por 21 itens (BEGG, 1996), passou por duas revisões e atualizações, em 2001 e 2010, passando hoje a possuir 25 itens.

Os 25 itens estão dispostos nas sessões de Título e Resumo, Introdução, Métodos, Resultados e Discussão. Trata-se de uma valiosa ferramenta que serve como guia para autores de estudos de intervenção dos principais pontos que devem ser expostos para possibilitar uma interpretação fidedigna dos resultados apresentados (MOHER, 2010). Os itens são classificados em "adequado" ou "inadequado". Os itens do check-list *Consort* está apresentado na tabela a seguir.

Tabela 1. Checklist CONSORT *Statement* (MOHER, 2010).

ITENS	RECOMENDAÇÕES CONSORT
1 TÍTULO E RESUMO	Identificação com o termo ensaio randomizado no título. Resumo estruturado do desenho do estudo, métodos, resultados e conclusões.
2 INTRODUÇÃO	Experiência científica e explicação dos fundamentos, objetivos específicos ou hipóteses.
MÉTODOS	
3 DELINEAMENTO	Descrição do desenho do estudo, incluindo alocação, mudanças importantes nos métodos após o início do estudo (como critérios de elegibilidade), com justificativas.
4 PARTICIPANTES	Critérios de elegibilidade para os participantes, definições e locais onde os dados foram coletados.
5 INTERVENÇÕES	As intervenções para cada grupo, com detalhes suficientes para permitir a replicação, incluindo como e quando eles foram realmente administrados.
6 RESULTADOS	Definir e explicitar as medidas de resultados primárias e secundárias pré-especificados, incluindo como e quando eles foram avaliados . Quaisquer alterações aos resultados do estudo após o seu início, com justificativas.
7 TAMANHO AMOSTRAL	Como o tamanho da amostra foi determinado. Quando aplicável, a explicação de todas as análises intercalares.
8 GERAÇÃO DA SEQUÊNCIA DE ALOCAÇÃO	O método usado para gerar a sequência de atribuição aleatória. Tipo de aleatorização; detalhes de qualquer restrição (tal como o tamanho do impedimento).
9 MASCARAMENTO DA ALOCAÇÃO	Mecanismo utilizado para implementar a sequência de alocação aleatória (como recipientes numerados sequencialmente), descrevendo as providências tomadas para esconder a sequência até que as intervenções forem atribuídas.
10 IMPLEMENTAÇÃO DA ALOCAÇÃO	Quem gerou a sequência aleatória de alocação, os participantes que se inscreveram e quem atribuiu aos participantes as intervenções
11 CEGAMENTO	Quem foi cegado (e como) após atribuição para intervenções (por exemplo, os participantes, prestadores de cuidados, aqueles que avaliam os resultados). Se relevante, descrição das intervenções semelhantes.
12 MÉTODOS ESTATÍSTICOS	Métodos estatísticos utilizados para comparar os grupos. Resultados primários e secundários para análises adicionais, tais como análises de subgrupos e análises ajustadas.
RESULTADOS	
13 DIAGRAMA DE FLUXO	Para cada grupo, o número de participantes que foram

DOS PARTICIPANTES	designados aleatoriamente, receberam tratamento pretendido, e foram analisadas para o resultado primário. Para cada grupo, perdas e exclusões após randomização, juntamente com as razões.
14 RECRUTAMENTO	Datas que definem os períodos de recrutamento e acompanhamento. Justificar porque o estudo terminou ou foi interrompido.
15 CARACTERÍSTICAS BASAIS	Uma tabela mostrando características demográficas e clínicas de base para cada grupo..
16 NÚMEROS ANALISADOS	Para cada grupo, o número de participantes (denominador) incluído em cada análise e se a análise foi atribuída a grupos originais.
17 RESULTADOS E ESTIMATIVAS	Para cada resultado (primário e secundário), para cada grupo, a estimativa do tamanho do efeito e a sua precisão (por exemplo, intervalo de confiança de 95%). Para resultados binários, apresentação de tamanhos de efeitos absolutos e relativos é recomendável.
18 ANÁLISES ADICIONAIS	Resultados de outras análises realizadas, incluindo análises de subgrupos e análises ajustadas.
19 EFEITOS ADVERSOS	Descrever todos os danos importantes ou efeitos não intencionais em cada grupo.
DISCUSSÃO	
20 LIMITAÇÕES	Limitações do estudo, abordando fontes de viés, imprecisão, e, se for o caso, a multiplicidade de análises.
21 GENERALIZAÇÃO	Generalização (validade externa e aplicabilidade) dos resultados do estudo.
22 INTERPRETAÇÃO	Interpretação consistente dos resultados, equilibrando benefícios e malefícios, e considerando outras evidências relevantes.
OUTRAS INFORMAÇÕES	
23 REGISTRO	Número de inscrição e nome do registro do estudo.
24 PROTOCOLO	Quando o protocolo do estudo completo pode ser acessado, se disponível.
25 FINANCIAMENTO	Fontes de financiamento e outros apoios (como fornecimento de medicamentos) e o papel de financiadores.

2.1.1.1 Extensão do CONSORT para ensaios clínicos com terapias não farmacológicas

Dentre as intervenções aplicadas nos estudos com delineamento de ensaio clínico randomizado, estão as de origem não farmacológica, como técnicas cirúrgicas, dispositivos, reabilitação, psicoterapia, etc. Há diversas peculiaridades que tornam a condução desses estudos diferente dos ensaios clínicos "tradicionais", como a dificuldade de cegamento e a não padronização e reprodução da metodologia a todos os sujeitos pesquisados. Da mesma forma, há evidências que mostram a necessidade de melhorar a qualidade desses estudos.

Diante disso, o mesmo grupo de autores que publicou o CONSORT criou uma extensão do mesmo, se aplicando somente a estudos com intervenção não farmacológica. Foram acrescentados 16 itens, sendo 5 novos e os demais somados à itens já existentes, porém com exigências adicionais para estudos de intervenção não farmacológica. Os itens são classificados em "adequado" ou "inadequado" (BOUTRON, 2008).

A extensão do CONSORT se apresenta da seguinte maneira:

Tabela 2. Extensão do CONSORT *Statement* para ensaios clínicos de intervenção não farmacológica.

ITENS	RECOMENDAÇÕES EXTENSÃO CONSORT
1 TÍTULO E RESUMO	No resumo, descriçao do tratamento experimental, comparador, prestadores de cuidados, centros e cegamento
MÉTODOS	
2 PARTICIPANTES	Quando aplicável, critérios de elegibilidade dos centros e como eles realizavam as intervenções
3 INTERVENÇÕES	Detalhes precisos do grupo experimental e comparador
4*	Descrição dos diferentes componentes das intervenções e, quando aplicável, as descrições do procedimento para a adaptação das intervenções para participantes individuais
5*	Detalhes de como as intervenções foram padronizados
6*	Detalhes de como a adesão dos prestadores de cuidados com o protocolo foi avaliada ou melhorados
7 TAMANHO AMOSTRAL	Quando aplicável, detalhes de como e se o agrupamento de prestadores de cuidados ou centros foi abordado.
8 GERAÇÃO DA SEQUÊNCIA DE ALOCAÇÃO	Quando aplicável, como os prestadores de cuidado foram alocados em cada grupo
9 CEGAMENTO	Se aqueles que adminstram co-intervenções foram cegados para atribuição do grupo.
10*	Se cegado, o método de mascaramento e descrição da similaridade das intervenções

11 MÉTODOS ESTATÍSTICOS	Quando aplicável, detalhes de como e se o agrupamento de prestadores de cuidados ou centros foi abordado
RESULTADOS	
12 DIAGRAMA DE FLUXO DOS PARTICIPANTES	O número de prestadores de cuidados ou centros que realizam a intervenção em cada grupo e o número de pacientes tratados por cada prestador de cuidado ou em cada centro.
13* IMPLEMENTAÇÃO DA INTERVENÇÃO	A descrição do tratamento experimental e comparador como eles foram implementados.
14 CARACTERÍSTICAS BASAIS	Quando aplicável, uma descrição dos prestadores de cuidados (qualificação/experiência) e centros (volume) em cada grupo
DISCUSSÃO	
15 INTERPRETAÇÃO	Levar em consideração a escolha do comparador, falta ou cegamento parcial e especialização desigual de prestadores de cuidados ou centros em cada grupo.
16 GENERALIZAÇÃO	Generalização de acordo com a intervenção, grupo comparador, pacientes, prestadores de cuidados e centros envolvidos no estudo.

* - novos itens (BOUTRON, 2008).

2.1.2 Ferramenta da Colaboração Cochrane para o risco de Viés

Atualmente, a tomada de decisão se baseia em evidências consistentes que reduzem incertezas. Ensaios clínicos randomizados são considerados padrão-ouro para avaliação de tratamentos e intervenções, desde que conduzidos de maneira adequada. Inferências causais podem ser prejudicadas por falhas no planejamento, execução, análise e relato, causando uma subestimação ou superestimação do verdadeiro efeito da intervenção. Os vieses possíveis de serem encontrados em ensaios clínicos são classificados em quatro categorias: seleção, performance, detecção e atrito (WOOD, 2008; HIGGINS, 2011; JÜNI, 2001).

A noção de estudo de "qualidade" não está bem definida, mas refere-se a adequada concepção, conduta, análise, e apresentação para responder a sua pergunta da pesquisa. Muitas ferramentas para avaliação da qualidade dos ensaios clínicos randomizados são disponíveis, incluindo escalas e listas de verificação. As próprias revisões da Cochrane utilizaram uma variedade destas ferramentas, principalmente checklists. Porém, em 2005 a Colaboração Cochrane embarcou em uma nova estratégia para a avaliação da qualidade dos ensaios clínicos randomizados. Iniciava-se a criação da Ferramenta para avaliação do risco de viés da Colaboração Cochrane. Reuniram-se, durante 3 dias, 16 membros, dentre eles estatísticos, epidemiologistas e autores de revisão (HIGGINS, 2011).

A ferramenta para avaliação do risco de viés da Colaboração Cochrane foi publicada em fevereiro de 2008 e atualizada em 2011 com o objetivo de avaliar a validade interna de ensaios clínicos randomizados, mais especificamente, o grau em que os resultados "devem ser acreditados" (HARTLING, 2009). A mesma está disponível no Cochrane Handbook (HIGGINS, 2011) e abrange seis domínios de viés: viés de seleção, viés de desempenho, viés de detecção, viés de atrito, viés de informação e outros vieses. Dentro de cada domínio, as avaliações são feitas para um ou mais itens, que podem abranger diferentes aspectos do domínio ou resultados diferentes. Os itens avaliados de acordo com cada domínio são: viés de seleção: a geração de sequência aleatória e ocultação da alocação; viés de desempenho: cegamento de pacientes e profissionais, outras potenciais ameaças à valiadade; viés de detecção: cegamento de avaliadores do desfecho, outras potenciais ameaças à valiadade; viés de atrito:dados incompletos de resultados; viés de informação: registro seletivo; outros vieses: outras fontes de vieses. Dependendo da avaliação, podem ser classificados em "sim", "não" ou "não registrado".

Tabela 3. Ferramenta da Colaboração Cochrane para avaliação do risco de viés (HIGGINS, 2011).

DOMÍNIO	SUPORTE PARA JULGAMENTO	JULGAMENTO DE REVISÃO DOS AUTORES
VIÉS DE SELEÇÃO		
GERAÇÃO DA SEQUÊNCIA ALEATÓRIA	Descrever em detalhe o método utilizado para gerar a sequência aleatória, para permitir avaliar se foi possível produzir grupos comparáveis.	Viés de seleção (tendência de alocação às intervenções) devido à geração insuficiente de uma sequência aleatória
MASCARAMENTO DA ALOCAÇÃO	Descrever em detalhes o método utilizado para ocultar a sequência aleatória, para determinar se a alocação das intervenções pôde ser prevista antes ou durante o recrutamento dos participantes.	Viés de seleção (tendência de alocação de intervenções), devido à ocultação inadequada de alocação antes da atribuição.
VIÉS DE DESEMPENHO		
CEGAMENTO DE PACIENTES E INVESTIGADORES	Descrever todas as medidas utilizadas para cegar participantes e profissionais envolvidos em relação a qual intervenção foi dada ao participante. Fornecer informações se realmente o cegamento foi efetivo.	Viés de desempenho devido ao conhecimento das intervenções atribuídas pelos participantes e pessoal durante o estudo
VIÉS DE DETECÇÃO		
CEGAMENTO DEAVALIADORES DE DESFECHO	Descrever todas as medidas utilizadas para cegar os avaliadores de desfecho em relação ao conhecimento da intervenção fornecida a cada participante. Fornecer informações se o cegamento pretendido foi efetivo.	Viés de detecção devido ao conhecimento das intervenções atribuídas por avaliadores de resultados.
VIÉS DE ATRITO		
DADOS INCOMPLETOS DE RESULTADOS	Descrever a integralidade dos dados de resultados para cada resultado principal, incluindo o atrito e exclusões da	Viés de atrito, devido à quantidade, natureza ou a manipulação de dados de resultados incompletos.

	análise. Informar se o atrito e exclusões foram relatados, os números em cada grupo de intervenção (em comparação com o total de participantes aleatórios), razões de atrito / exclusões caso relatado, e quaisquer novas inclusões em análises realizadas pelos autores da revisão.	
VIÉS DE INFORMAÇÃO		
REGISTRO SELETIVO	Como a possibilidade de registro de resultado seletivo foi examinado pelos autores da revisão, e o que foi encontrado.	Viés de informação devido a relatórios de resultado seletivo.
OUTROS VIESES		
OUTRAS FONTES DE VIÉS	Declaração sobre quaisquer preocupações importantes sobre vieses não abordados nos outros domínios na ferramenta. Se perguntas / regitros particulares foram pré-especificados no protocolo do exame, as respostas devem ser fornecidas para cada pergunta / registro.	Viés devido a problemas não abrangidos em outros lugares na tabela.

3 Doença arterial coronariana e cirurgia de revascularização do miocárdio

As doenças cardiovasculares representam uma das maiores causas de mortalidade no mundo e, segundo a Organização Mundial da Saúde (OMS), nos últimos anos, a taxa de mortalidade por doença cardiovascular (DCV) variou entre 28 a 34 milhões de óbitos na população mundial, com estimativas de atingir valores superiores a 35 milhões em 2030 (MINISTÉRIO DA SAÚDE). Dentre essas doenças, a doença arterial coronariana (DAC) é uma das principais causas de mortalidade e morbidade (SAYOLS-BAIXERAS *et al*, 2014; LLOYD-JONES *et al,* 2010; DATASUS).

A Doença Arterial Coronariana é uma doença inflamatória crônica complexa, caracterizada por remodelação e estreitamento das artérias coronárias as quais fornecem oxigênio ao coração. Isso pode desencadear diversas manifestações clínicas, incluindo angina estável, síndrome coronariana aguda e morte súbita cardíaca. Sua etiopatogenia é complexa e de origem multifatorial relacionada a questões ambientais, dieta, tabagismo, atividade física e fatores genéticos (LLUIS-GANELLA, 2012). Esse processo está ilustrado na Figura 1.

Figura 1. Etiopatogenia da Doença Arterial Coronariana. Adaptado de Sergi, 2014.

O tratamento de DAC pode ser clínico/medicamentoso ou cirúrgico. Apesar dos avanços da terapêutica clínica e das intervenções percutâneas, a cirurgia de revascularização do miocárdio (CRM) é um procedimento seguro realizado em todo o mundo com taxas baixas de mortalidade e morbidade na população geral (SANTOS *et al*, 2014), sendo bastante utilizada no tratamento de

pacientes com insuficiência coronária (PIEGAS, 2009). No entanto, esta cirurgia ainda apresenta altas taxas de complicações pulmonares, as quais representam uma importante causa de morbidade e mortalidade (DRUSS, 1996).

Dentre as complicações respiratórias estão as atelectasias, a pneumonia e o derrame pleural, com consequente hipoxemia e diminuição da pressão parcial de oxigênio no sangue arterial (PaO_2). Esse processo acarreta consequente aumento no tempo de internação hospitalar elevando custos financeiros (BERRY, 2010; SILVA *et al*, 2009; SANTOS *et al*, 2014). A etiologia dessas complicações é complexa. Tanto as condições clínicas do paciente quanto os efeitos sinérgicos da anestesia geral e do procedimento cirúrgico na homeostase do sistema respiratório são responsáveis pela ocorrência das mesmas (JUNIOR *et al*, 2007). Visando agir de forma profilática e também no tratamento dessas complicações, a reabilitação cardíaca é atualmente indicada a pacientes pós operatórios já no ambiente de UTI. Seu início se dá o mais precocemente possível, após estabilização clínica (HERDY, 2014).

4 Reabilitação Cardíaca

Reabilitação cardíaca é definida como a soma de atividades e intervenções necessárias para assegurar as melhores condições físicas, mentais e sociais possíveis para que o paciente com doença cardiovascular crônica ou pós-aguda possa recuperar o seu lugar na sociedade e levar uma vida ativa (WHO, 1993). Abrangendo uma ampla gama de condições, incluindo as cardiológicas (clínicas ou cirúrgicas), a fase I da reabilitação aplica-se ao paciente internado em ambiente hospitalar. Seu início se dá após compensação clínica do paciente, por meio de tratamento clínico e/ou intervencionista. O exercício físico de baixa intensidade, técnicas para o controle do estresse e programas de educação em relação aos fatores de risco devem ser priorizados nessa fase que vem se tornando cada vez mais breve, consequente à internações mais curtas (CARVALHO, T *et al*, 2006).

Em relação aos pacientes pós operatórios de CRM, os protocolos utilizados incluem alongamentos, exercícios respiratórios para a higiene brônquica e reexpansão, além de exercícios aeróbicos por meio de caminhadas nos corredores do hospital e treino em escadas (NÓBREGA *et al,* 2013). O principal objetivo da fisioterapia é contribuir para o retorno do paciente as suas atividades sociais e laborais, nas melhores condições físicas possíveis, e desta forma, melhorando a qualidade de vida (CARVALHO *et al*, 2006).

Especificamente na UTI, a fisioterapia respiratória tem sido largamente requisitada com a finalidade de reverter ou amenizar o quadro de complicações pulmonares pós-operatórias (RENAULT, 2008). São aplicadas técnicas capazes de melhorar a mecânica respiratória, a reexpansão pulmonar e a higiene brônquica, contribuindo para a ventilação adequada do paciente (PADOVANI, 2011). Entre as modalidades terapêuticas mais comumente utilizadas estão: Fisioterapia Respiratória Convencional (FRC), Inspirometria de Incentivo, Pressão Positiva de forma não invasiva com máscara de Pressão Positiva Expiratória Final (PEEP), Pressão Positiva Contínua nas Vias Aéreas (CPAP), Ventilação com dois Níveis de Pressão Positiva nas Vias Aéreas (BiPAP), Treinamento Muscular Respiratório (TMR) (FRANCO *et al*, 2011; BARROS *et al,* 2010), manobras de higiene brônquica e expansão pulmonar.

De uma maneira geral, a reabilitação nessa fase objetiva a melhor condição física e psicológica dos pacientes no momento da alta hospitalar bem como educação em relação ao estilo de vida (WINKELMANN *et al*, 2015). Além dos benefícios da reabilitação o mais precocemente

possível, consequentemente ocorre também uma maior aderência aos programas subsequentes da reabilitação (fases II e III) (HAYKOWSKY *et al*, 2011).

Na fase II, extra-hospitalar, o paciente necessita de vigilância e atendimento de forma individualizada, já que está na fase de convalescença e, com frequência, sem nenhum contato prévio com atividades físicas. A prescrição de exercício deve incluir o tipo, intensidade, duração e frequência. A duração dessa fase é variável, dependendo de cada paciente, mas em média dura de um a três meses. Os exercícios devem ser iniciados com baixa intensidade e com baixo impacto nas primeiras semanas, para adaptação inicial e prevenção de lesões musculoesqueléticas (HERDY, 2014).

As fases III e IV tem duração indefinida. A diferença entre elas está, principalmente, no fato de que na fase IV se consegue controlar a distância, também conhecida como reabilitação sem supervisão. Em essência, a prescrição destas duas fases é muito similar porque os exercícios prescritos são parte da vida cotidiana. A prescrição deve ser atualizada periodicamente para adaptar-se ao perfil e comorbidades de cada paciente. Sugere-se, para iniciar a terceira fase, uma reavaliação, que se pode ser repetida a cada 6 a 12 meses (HERDY, 2014).

5 Qualidade Metodológica e Fisioterapia

Inúmeros estudos na última década têm documentado que os fisioterapeutas são a favor da medicina baseada em evidências e reconhecem a importância do uso de resultados da pesquisa para alcançar uma prática clínica com maior embasamento científico. Logo, tem sido cada vez maior o número de publicações que embasam de forma consistente quais as melhores condutas fisioterapêuticas a serem seguidas (DANNAPFEL, 2013).

A qualidade metodológica de estudos de intervenção fisioterapêutica demonstram uma curva ascendente ao longo das últimas décadas. Porém, de maneira geral, foram publicados somente quatro (MOSELEY, 2000; SCHERRINGTON, 2010; GEHA, 2013, GIMENES, 2005) estudos com esse objetivo, indicando uma escassez e necessidade de mais pesquisas buscando aperfeiçoar e desenvolver cada vez mais essa área do conhecimento.

Moseley (2000) avaliou a qualidade e quantidade de ensaios clínicos randomizados e revisões sistemáticas de fisioterapia para pacientes neurológicos, adultos ou pediátricos. Um total de 238 ensaios clínicos randomizados e 27 revisões sistemáticas foram encontrados na base de dados PEDro (the Physiotherapy Evidence Database). Mais da metade dos estudos (54%) foram classificados com moderada a alta qualidade, tendo média de classificação 5 de 10. A avaliação se deu por meio de instrumento próprio da base de dados. Concluiu-se que há necessidade de realização de mais estudos, para consequentemente viabilizar mais revisões sistemáticas e assim centralizar e determinar as melhores condutas a serem seguidas.

Em 2005 Gimenes avaliou a qualidade metodológica dos ensaios clínicos aleatórios de fisioterapia aquática em pacientes neurológicos. Através da lista de Delphi a autora constatou que nenhum dos 6 estudos incluídos apresentou sigilo na alocação do tratamento e mascaramento dos pacientes em relação a intervenção.

Da mesma forma, em 2010, Sherrington utilizou como referência a base de dados PEDro em investigação na área da fisioterapia esportiva. Dos 717 registros, 615 eram ensaios clínicos randomizados e 102 revisões sistemáticas. A média da classificação pela escala da PEDro foi de 4, sendo 10 a maior pontuação. O cegamento e a randomização foram, respectivamente, os itens de pior e melhor avaliação.

Finalmente, Geha publicou estudo em 2013 avaliando a qualidade metodológica dos ensaios clínicos randomizados na área cardiotorácica. Foram encontrados 2970 registros de ensaios clínicos randomizados na base de dados PEDro. A média de classificação na escala foi

de 4.7, sendo 27% dos estudos de moderada a alta qualidade. O item mais bem pontuado foi a randomização da alocação e o pior a análise por intenção de tratar.

Excetuando-se a revisão de Gimenes (2005), todas demais publicações possuem limitações por terem sido desenvolvidas fundamentando-se em apenas uma base de dados, o que por conseguinte ocasiona um viés por provável não inclusão de todos os artigos publicados. Adicionalmente, em nenhum deles é descrita qual estratégia de busca utilizada, o que inviabiliza a sua corroboração e futura reprodução.

6 Justificativa e Objetivos

Não existem evidências quanto a avaliação da qualidade metodológica dos ensaios clínicos randomizados de intervenção fisioterapêutica em pacientes pós-operatórios de cirurgia de revascularização do miocárdio no ambiente de UTI. Logo, essa pesquisa se faz necessária uma vez que o preenchimento ou não dos critérios para um correto desenvolvimento desse delineamento de pesquisa pode influenciar nos resultados encontrados.

De forma complementar, a divulgação desses dados irá estimular com que pesquisas futuras se façam com uma melhor qualidade metodológica, demonstrando os principais pontos a serem mais bem delineados e planejados. Dessa forma, poderá obter-se um maior benefício bem como melhores desfechos ao paciente na prática clínica diária.

O presente estudo tem como objetivos: avaliar se há um preenchimento adequado dos critérios estabelecidos pelo CONSORT *Statement* e sua extensão para ensaios clínicos randomizados de intervenção não farmacológica e avaliar qualidade metodológica dos ensaios clínicos randomizados de intervenção fisioterapêutica em pacientes pós-operatórios de cirurgia de revascularização do miocárdio no ambiente de UTI através da ferramenta para avaliação do risco de viés da Colaboração Cochrane. São objetivos secundários: comparar os resultados entre os estudos publicados antes e após a criação do CONSORT e se há correlação sobre as conclusões encontradas (positivas ou negativas); citar os itens com maior e menor adequação; descrever os principais vieses encontrados; caracterizar os estudos e mencionar as principais técnicas utilizadas.

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CAPÍTULO II - ARTIGO EM INGLÊS

Methodological quality of randomized clinical trials of respiratory physiotherapy in coronary artery bypass grafting patients in the intensive care unit: a systematic review.

(Artigo escrito seguindo o formato da Revista Respiratory Care, fator de impacto 1.838, Qualis B1)

METHODOLOGICAL QUALITY OF RANDOMIZED CLINICAL TRIALS OF RESPIRATORY PHYSIOTHERAPY IN CORONARY ARTERY BYPASS GRAFTING PATIENTS IN THE INTENSIVE CARE UNIT: A SYSTEMATIC REVIEW.

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Abstract

Objective: To assess whether the randomized controlled trials of physiotherapy in postoperative patients of coronary artery bypass surgery in intensive care unit meet the criteria for the development of this type of study according to the CONSORT Statement and its extension for clinical trials of non-pharmacologic treatment interventions. **Methods:** The randomized clinical trials of (respiratory or respiratory and neuromusculoskeletal) physiotherapy intervention in the postoperative period of CABG in the intensive care unit, published until May 2015, in MEDLINE (via PubMed), Cochrane and PEDro, as well as papers found through manual searching of references of published studies were included in this review. The primary outcome extracted was suitability to the requirements of the CONSORT Statement and its extension, and the secondary outcome extracted was proper filling of the Cochrane Collaboration's tool's items. **Results:** From 807 studies identified, 39 were included. The three items that best suited the CONSORT requirements were: introduction (100%), interventions (100%), and results (100%). Most CONSORT items showed a better adequacy after the statement's publication, except for the blinding and the statistical methods items. Studies with positive outcomes presented better methodological quality. **Conclusion:** It can be concluded from this review that there is a growing number of publications regarding this topic. The methodological quality of the studies has been improving over the years, especially after the creation of the CONSORT. However, many aspects can still be better designed so that unreliable results are not generated.

Keywords: exercise, physiotherapy, thoracic surgery, methodology, systematic review, intensive care unit.

Introduction

The large amount of publications in health care makes professionals have difficulty to stay up to date; moreover, a great part of the available information does not come from studies with adequate methodological quality, what makes them of little clinical relevance. Incomplete or inadequate publication of information on the study planning and conduct affects the identification of possible methodological errors, also hampering the use of its findings by the interested parties, since they cannot critically assess its clinical applicability[1;2].

Even though Randomized Clinical Trials (RCT) are gold standard for the assessment of health interventions, this type of study is also prone to bias whether due to researchers' arbitrariness when selecting the sample and gauging the analyzed variables, or due to the difficulty of controlling other factors that may influence the clinical outcome. Bias or systematic error can be defined as any tendentiousness in the collection, analysis, interpretation, publication or revision of data, which induces conclusions that systematically tend to distance themselves from the truth[3].

In phase I of cardiac rehabilitation, physiotherapy has an increasingly important role in contributing to the patients' return to their social and professional activities in the best possible medical conditions, thus improving the quality of life[4]. In the early postoperative period after a coronary artery bypass grafting (CABG), respiratory physiotherapy has been widely requested in order to reverse or minimize postoperative pulmonary complications[5]. Techniques that can improve respiratory mechanics, lung re-expansion and bronchial hygiene are applied, contributing to the patient's proper ventilation[6].

Numerous studies over the past decade have documented that physiotherapists are in favor of evidence-based medicine and recognize the importance of using research results to achieve a more scientific-based clinical practice. Therefore, the number of publications that consistently

support the best physiotherapy procedures to be followed have been increasing[7]. Assessments of physiotherapy intervention studies demonstrate an upward curve in relation to the enrichment of the methodological quality over the past decades[8-11]. However, there is still great potential for improvement in their elaboration and development.

It should be noted that there is no evidence on the methodological quality of randomized clinical trials of physiotherapy intervention on CABG postoperative patients in the Intensive Care Unit (ICU). Therefore, this research is needed since the fulfillment or not of the criteria for a correct development of this research design can influence the results. Also, complementarily, the dissemination of these data will stimulate further research to be developed with a superior methodological quality, showing the main points that should be better designed and planned. It will then be possible to obtain greater benefits, as well as improved outcomes for critical patients in daily clinical practice. Thus, the aim of this research was to assess whether the studies meet the criteria for the development of this type of study according to the CONSORT Statement and its extension for clinical trials of non-pharmacologic treatment interventions.

Methods

This review was conducted in accordance with the recommendations proposed by the Cochrane Collaboration and the Preferred Reporting Items for Systematic Review and Meta-analyzes: The PRISMA[12;13]. The studies' methodological quality was evaluated using the Cochrane Collaboration's tool for assessing risk of bias[12], and the correct description of the RCTs' items was evaluated using the CONSORT Statement[14] and its extension for clinical trials of non-pharmacologic treatment interventions[15]. When certain items were not applicable to all studies (as in the case of the evaluation of multicenter studies), they were considered as adequate.

Eligibility criteria

Studies designed as randomized clinical trials, with respiratory physiotherapy intervention, associated or not with neuromusculoskeletal physiotherapy, in postoperative patients of coronary artery bypass grafting in the intensive care unit were included. Studies whose intervention also happened in the preoperative period were included as well. The following were ineligible for inclusion in the review: studies whose patients had undergone another associated surgery, and studies that did not contain terms related to physiotherapy and its synonyms (physiotherapy, physical therapy, physiotherapists, physical therapists, and respiratory therapists) anywhere in the paper.

Search strategies

The search was conducted in the following electronic databases (from inception to May 26, 2015): MEDLINE (via PubMed), Central Register of Controlled Trials (Cochrane CENTRAL) and Physiotherapy Evidence Database (PEDro). Additionally, manual search was conducted in the references of published papers. The search terms used were "Coronary Artery Bypass Grafting", terms related to respiratory physiotherapy interventions, such as "breathing exercises" and "respiratory muscle training", and a word sequence with high sensitivity for the search of randomized clinical trials described by Robinson & Dickersin[16]. Papers not published in English were excluded. The full search strategy used for PubMed, which was adjusted for the search in the other databases, is shown in Table 1.

Study selection and data extraction

The selection of studies was carried out by two reviewers (J.L. and C.S.), independently, in two stages: I – selection of studies by reading the titles and abstracts; II – full analysis of

papers selected in Phase I. Papers were included in accordance with the eligibility criteria specified previously. In case of disagreement on the paper's inclusion and with no consensus between the reviewers, a third reviewer (R.P.) was consulted. The primary outcome extracted was suitability to the requirements of the CONSORT Statement and its extension, and the secondary outcome extracted was proper fulfilling of the Cochrane Collaboration's tool's items. The data extraction was performed independently by both reviewers and transferred to three standardized forms, which contained: the 25 items of the CONSORT checklist, the 7 items of the Cochrane Collaboration's tool for assessing risk of bias, and the 16 items of the CONSORT checklist extension for clinical trials of non-pharmacologic treatment interventions. For the CONSORT Statement items, the concept of "adequate" or "inadequate" was assigned, according to the description or not of each item on the checklist. The Cochrane Collaboration's tool's items without a clear description were classified with the word "no" or "not report". Data relating to the studies' characterization were also collected. In the case of missing data, we contacted the authors by e-mail at least twice. The study was excluded if the data were still insufficient after this process.

Data analysis

The results are going to be descriptively displayed (frequency and percentage).

Results

Description of studies

The search strategy identified 807 potentially relevant studies, adding a further 17 studies drawn from the reference lists. Subsequently, 172 duplicates were discarded and 565 irrelevant studies were excluded. Of the 87 resulting records, 2 were excluded for not having been

published in English, 25 had not described a term related to physiotherapy and its synonyms, 3 were not randomized clinical trials, 7 were not with postoperative patients of CABG or had other associated surgery, 2 studies had not been performed in the ICU and 9 studies were not available. Figure 1 shows the review's flowchart.

Of the final 39 studies, 41.02% (16) were conducted in Brazil, 56.41% (22) were published between 2000 and 2010, and only 12.82% (5) were published in journals specialized in physiotherapy. In relation to the sample, in 33.33% (13) of the studies the number of patients was higher than 70, in 58.97% (23) the average age was of over 60, and in 84.61% (33) of the studies more than half of the sample consisted of males. The treatment was provided only in the postoperative period in 69.23% (27) of the studies, and in 51.28% (20) patients were monitored until discharge.

The most widely used techniques were re-expansive ventilatory exercises (56.41%), ventilatory exercises for bronchial hygiene (48.71%) and non-invasive mechanical ventilation (41.02%). There was an association of techniques in 69.23% (27) of the studies.

The most researched outcomes were atelectasis (48.71%), forced expiratory volume in one second (FEV1) (41.02%), invasive mechanical ventilation time (35.89%) and partial pressure of oxygen (PaO_2) (35.89%). The Table 2 shows the characterization studies.

CONSORT *Statement*

According to the CONSORT assessment, the three items that were best and worst described were: introduction (100%), interventions (100%), and outcomes and estimation (100%); allocation concealment (7.69%), ancillary analysis (7.69%), and generalizability (2.56%) (Table 2). The CONSORT extension (Table 3) presented as the best described items: participants (100%), interventions (100%), and components of the interventions (100%). On the other hand,

the lowest scoring items were title and abstract (0%), assessment of adherence with the protocol (0%), and concealment method (5.12%).

Seven studies conducted before the CONSORT publication were identified. When compared to other studies, the items introduction, interventions, results, outcomes and estimation, interpretation, and protocol remained equally adequate. The correct description of the items blinding and statistical methods decreased 41.96% and 6.25% respectively in the studies published after the CONSORT. All of the 17 remaining items were described more frequently after the CONSORT publication, as follows: title and abstract (increase of 10.72%), design (increase of 26.34%), participants (increase of 52.68%), sample size (there was no description of this item in any of the studies published previously to the CONSORT, but it was described in 46.87% of the studies after it), random sequence generation (increase of 30.80%), allocation concealment (there was no description of this item in any of the studies published previously to the CONSORT, but it was described in 9.37% of the studies after it), allocation implementation (there was no description of this item in any of the studies published previously to the CONSORT, but it was described in 12.50% of the studies after it), participant flow diagram (increase of 6.69%), recruitment (increase of 15.18%), characteristics (increase of 1.79%), numbers analyzed (increase of 35.27%), ancillary analyses (there was no description of this item in any of the studies published previously to the CONSORT, but it was described in 9.37% of the studies after it), unintended effects (increase of 4.47%), limitations (there was no description of this item in any of the studies published previously to the CONSORT, but it was described in 50% of the studies after it), generalisability (there was no description of this item in any of the studies published previously to the CONSORT, but it was described in 3.12% of the studies after it), registration (there was no description of this item in any of the studies published previously to the CONSORT, but it was described in 6.25% of the studies after it) and funding (increase of

1.34%). The item "protocol" was not appropriate according to the CONSORT requirements in any of the studies evaluated (Figure 2).

Of the 39 studies, 27 presented its final outcomes as positive and 12 as negative with the proposed treatment. Regarding the CONSORT checklist's Methods section, when evaluated separately in accordance with the outcome, all items showed to have equal or better methodological quality than the studies with positive outcomes, except for the Statistical Methods item (Figure 3).

Risk of Bias

Regarding the assessment of the Cochrane Collaboration's tool for risk of bias, there was description of attrition and exclusions in 66.66% of the studies, proper random sequence generation in 51.28%, blinding of outcome assessors in 46.15%, intention-to-treat analysis in 12.82%, and allocation concealment and blinding of patients and professionals in 7.69% (Table 4).

Discussion

The development of research related to the assessment of the methodological quality of scientific production in health, especially in physiotherapy, is still of little significance. Therefore, this is the first systematic review that has assessed the methodological quality of randomized clinical trials of physiotherapy treatment in postoperative patients of CABG in the ICU based on the instruments CONSORT *Statement*, its extension for non-pharmacologic treatment interventions and the Cochrane Collaboration's tool for assessing risk of bias.

In general, over the years, the methodological quality of studies has increased, especially if we set as a cutoff the year of publication of the CONSORT *Statement* checklist. Of the

checklist's 25 items, 5 have remained with an equal adequacy rate and 17 have been more broadly documented[10] when assessing the quality of cardiorespiratory physiotherapy studies, found similar results, with a rising curve of quality assessed through the PEDro scale. In a study published by Hopewell[56], in which the quality of trials indexed by PubMed published between 2000 and 2006 were evaluated, the results were very similar. While the quality of the studies had improved over time, it was still below an acceptable level (for example, only 45% of the trials had included a calculation of the sample size). This suggests that, despite the release of the CONSORT *Statement* over the last decade, a large proportion of authors, reviewers and journal editors have not yet implemented these recommendations.

The two items that showed an adequacy decline were statistical methods and blinding. The first demonstrated a difference smaller than 7% (2 studies), being therefore irrelevant. In studies published after the CONSORT, there was a reduction of the reporting of blinding in 41.96% of the studies, and only 43.75% informed that blinding was performed in their methodology, with no further elaboration. When the evaluation was directed at who was blinded (patient, professional or outcome assessor), the adequacy was even lower, reaching 7.69%. Our results are similar to the studies[8-11] who assessed the quality of studies in the areas of cardiothoracic, neurological, sports and aquatic physiotherapy, respectively. Research indicates that blinding, or lack thereof, is associated with a greater tendency to maximize the treatment's effect[57-61]. In a study by Boutron[62], in which pharmacologic and non-pharmacologic treatments for hip or knee osteoarthritis were compared, it was found that blinding is less frequent in non-pharmacologic studies, even when there is a possibility to do it. It should be emphasized that an adequate methodological conduct in relation to blinding results in a higher number of professionals involved and often adds costs to the research, which becomes a limiting factor. The lack of blinding interferes directly on the results, making both its internal and external validity

look dubious. Consequently, the use of these studies in systematic reviews becomes limited, generating biased results.

Due to the large number of publications, the standardization of papers to the rules of each journal must be followed, which mainly includes a limit for the number of words, tables and figures. For this reason, very precise details of the research development may end up without space. Given this reality, none of the papers included in this review presented the items title and abstract, assessment of adherence to the protocol, interpretation, and generalizability as required by the CONSORT extension for non-pharmacologic treatment interventions. However, these undescribed data may have been part of the research development, but they were not disclosed. Specifically, there is no available information in the literature for us to corroborate such finding.

A combination of techniques was present in 69.23% of the studies. This result is in accordance with a systematic review published by Stiller[63] on physiotherapy performance in the intensive care unit. It was not possible to evaluate the effectiveness of each technique alone, the same way as the large variation of methodologies and samples made it impossible to carry out a statistical analysis.

Another interesting finding of our research was that the 27 studies with positive outcomes demonstrated a better quality regarding the 10 items of CONSORT Methods section. Except for the statistical methods, in which the difference was of only 7%, all other items were appropriately described more often in studies with positive outcomes. Beckerman[64], when evaluating laser therapy in different musculoskeletal and dermatological conditions, found similar results, with studies with positive outcomes having better quality. A year later, the same author found contrary results when assessing the effectiveness of physiotherapy in musculoskeletal disorders[65]. Studies with negative outcomes tend to be submitted less frequently, and there is also a lower acceptance

by journal reviewers. Therefore, there may be an overestimation of treatment effects, leading to important implications in choosing the best treatment to follow.

The gap between the publication of the results of a scientific research and its actual implementation in the professional routine is still substantial, leading to health care practices of levels lower than expected[66]. However, prior to this, the research planning and development should be improved so that its results are as close as possible to the truth and are legitimized by a methodology of quality.

Conclusion

The description of the necessary items for the correct execution, conduction and publication of studies has increased over the years, but still has great scope for improvement. In general, the methodological quality is below an acceptable level in order to obtain results that are reliable and applicable in the daily practice.

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Table 1. Strategy used for PubMed.

#1 "Coronary Artery Bypass"[Mesh] OR "Coronary Artery Bypass Grafting" OR "Coronary Artery Bypass Surgery" OR "Bypass, Coronary Artery" OR "Artery Bypass, Coronary" OR "Artery Bypasses, Coronary" OR "Bypasses, Coronary Artery" OR "Coronary Artery Bypasses" OR "Aortocoronary Bypass" OR "Aortocoronary Bypasses" OR "Bypass, Aortocoronary" OR "Bypasses, Aortocoronary" OR "Bypass Surgery, Coronary Artery" "Myocardial Revascularization"[Mesh] OR "Myocardial Revascularizations" OR "Revascularization, Myocardial" OR "Revascularizations, Myocardial" OR "Internal Mammary Artery Implantation"
#2 "breathing exercises" OR "intermittent positive-pressure breathing" OR "continuous positive airway pressure" OR "weaning of mechanical ventilation" OR "mechanical ventilation" OR "noninvasive ventilation" OR "breathing exercises" OR "Exercise, Breathing" OR "Respiratory Muscle Training" OR "Muscle Training, Respiratory" OR "Training, Respiratory Muscle" OR "Breathing, Intermittent Positive-Pressure" OR "Intermittent Positive Pressure Breathing" OR "Positive-Pressure Breathing, Intermittent" OR "Intermittent Positive Pressure Breathing (IPPB) " OR "Inspiratory Positive-Pressure Breathing" OR "Breathing, Inspiratory Positive-Pressure" OR "Inspiratory Positive Pressure Breathing" OR "Positive-Pressure Breathing" OR "Inspiratory" OR "IPPB" OR "CPAP Ventilation" OR "Ventilation, CPAP" OR "Biphasic Continuous Positive Airway Pressure" OR "Bilevel Continuous Positive Airway Pressure" OR "Nasal Continuous Positive Airway Pressure" OR "nCPAP Ventilation" OR "Ventilation, nCPAP" OR "Airway Pressure Release Ventilation" OR "APRV Ventilation Mode" OR "APRV Ventilation Modes" OR "Ventilation Mode, APRV" OR "Ventilation Modes, APRV" OR "Respiration, artificial" OR "Artificial Respiration" OR "Artificial Respirations" OR "Respirations, Artificial" OR "Ventilation, Mechanical" OR "Mechanical Ventilations" OR "Ventilations, Mechanical" OR "Mechanical Ventilation" OR "Noninvasive Ventilations" OR "Ventilation, Noninvasive" OR "Ventilations, Noninvasive" OR "Non-Invasive Ventilation" OR "Non-Invasive Ventilations" OR "Ventilation, Non-Invasive" OR "Ventilations, Non-Invasive" OR "Non Invasive Ventilation" OR "Non Invasive Ventilations" OR "Ventilation, Non Invasive" OR "Ventilations, Non Invasive"

#3 randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized controlled trials[mh] OR random allocation[mh] OR double-blind method[mh] OR single-blind method[mh] OR clinical trial[pt] OR clinical trials[mh] OR ("clinical trial"[tw]) OR ((singl*[tw] OR doubl*[tw] OR trebl*[tw] OR tripl*[tw]) AND (mask*[tw] OR blind*[tw])) OR ("latinsquare"[tw]) OR placebos[mh] OR placebo*[tw] ORrandom*[tw] OR research design[mh:noexp] OR follow-up studies[mh] OR prospective studies[mh] OR cross-over studies[mh] OR control*[tw] OR prospectiv*[tw] OR volunteer*[tw]) NOT (animal[mh] NOT human[mh]).
1 AND #2 AND #3

Table 2. Characteristics of Studies Included in Systematic Review.

Author, Year	Intervention	Comparator	N (IG/CG)	Mean Age ± SD (IG/CG)	Masculine (IG/CG)	Protocol	Conclusion
Al Jaaly et al, 2013[17]	BIPAP, RVE, VEBH, EM, IS, NBL	RVE, VEBH, EM, IS, NBL	66 / 63	65.7±10.7 / 69.4±8.86	Not reported	IG: Usual care and BIPAP during the first 24 hours after extubation. CG: usual care alone twice per day for the first 2 to 3 days after surgery. Outcomes: atelectasis, FEV1, ICU days, days of hospitalization, $PaCO_2$	Among patients undergoing elective coronary artery bypass grafting, the use of BIPAP at extubation reduced the recovery time. Supported by trained staff, more than 75% of all patients allocated to BIPAP tolerated it for more than 10 hours.
Barros et al, 2010[18]	IMT, TM, PD, AT	TM, PD, TS	23 / 15	62.1±8.1 / 67±7.1	19 / 6	IG: conventional physiotherapy and IMT, with three sets of ten repetitions, once a day, with 40% of the MIP. CG: Conventional physiotherapy with four sets of six cycles of vibrocompression associated with postural drainage and aspiration where necessary, twice a day. Outcomes: MIP, MEP, Dyspnea, pain, PEF, CV	There is loss of respiratory muscle strength in patients undergoing coronary revascularization. The IMT, realized in the postoperative period, was effective in restore the following parameters: MIP, MEP, PEF and CV in this population.
Blattner et al, 2008[19]	MH, TS	TS	28 / 27	55.6±8.7 / 57.6±4.9	16 / 17	IG : Twenty minutes MH with flow of 15l / m and expiratory pressure 10cmH2O, often 18 to 30 rpm and TS. CG: TS Outcomes: atelectasis, pleural effusion, consolidation, PaO_2, Cstat, IMV time, days of hospitalization.	The group that received early MH had markedly better oxygenation and static compliance as well as shorter mechanical ventilation times than the control group. The length of hospital stay and incidence of postoperative pulmonary complications were similar in the two groups.
Borges et al, 2013[20]	WP com PEEP ($5cmH_2O$)	WP com PEEP ($8cmH_2O$) / WP com PEEP ($10cmH_2O$)	44 / 47 / 45	20<60>24 / 22<60>25 / 19<60>26	29 / 32 / 35	IG: PEEP 5cmH2O after ICU admission and extubation when met clinical conditions. CG: PEEP 8cmH2O after ICU admission and extubation when met clinical conditions. CG: PEEP 10cmH2O after ICU admission and extubation when met clinical conditions. Outcomes: ventilatory mechanics, pulmonary shunt, oxygenation index	Higher levels of positive end-expiratory pressure in immediate postoperative period of coronary artery bypass grafting improved pulmonary compliance values and increased oxygenation indexes, resulting in lower frequency of hypoxemia.

Borghi-silva et al, 2005[21]	PEP, TM, TS,VEBH, RVE, EULL, AM, LA	TM, TS, VEBH, RVE, EE, EULL, AM, LA	8 / 16	59.9±9.8 / 55.9±11.9	Not reported	IG: two daily sessions of about 40 minutes. TM, TS, VEBH, EE, AM, LA. PEP through facial mask with PEEP 10cmH2O. CG: two daily sessions of about 40 minutes. TM, TS, VEBH, EE, AM, LA. Outcomes: VC, FVC, length of stay, MIP, MEP.	These data suggest that cardiac surgery produces a reduction in inspiratory muscle strength, pulmonary volume, and flow. The association of positive expiratory pressure with physiotherapy intervention was more efficent in minimizing these changes, in comparison to the physiotherapy intervention alone. However, in both groups, the pulmonary volumes were not completely reestablished by the fifth postoperative day, and it was necessary to continue the treatment after hospital convalescence.
Castellana et al, 2003[22]	WP with VCV	WP with PCV	32 / 29	65±7 / 64±11	Not reported	IG: IMV in the VCV mode with volume of 7 ml / kg respiratory rate of 12 and PEEP 5cmH2O, inspiratory time of 33% and 60% FiO2. CG: IMV in the PCV mode with volume of 7 ml / kg respiratory rate of 12 and PEEP 5cmH2O, inspiratory time of 33% and 60% FiO2. Outcomes: Shunt, oxygenation index	Ventilatory modes controlled the volume and pressure were equally effective in treating hypoxemia observed in patients in the postoperative immediate coronary artery bypass surgery, showing that the pattern of administration of inspiratory flow It is of little relevance for the treatment of postoperative hypoxemia.
Celebi et al, 2008[23]	AR, NIV, VEBH, EM, IS	NIV, VEBH, EM, IS / AR, VEBH, EM, IS / VEBH, EM, IS	25 / 25 / 25 / 25	52±9 / 57±8 / 58±6 / 57±7	20 / 18 / 21 / 22	IG: NIV through facial mask for periods of one hour, starting 6hs after extubation in the first 24 hours, in the SP mode around 10cmH2O, PEEP 5cmH2O and FiO2 40%. VEBH, EM and IS after extubation IG: AR in CPAP mode with peak pressure 40cmH2O (20cm H2O inspiratory pressure and 20cmH2O PEEP) sustained for 30 seconds and FiO2 by 40%. VEBH, EM and IS after extubation. IG: application of NIV and AR as the two previously described protocols. VEBH, EM and IS after extubation CG: maintenance of 5cmH2O PEEP during the IMV and VEBH, EM and IS after extubation Outcomes: Pleural effusion, atelectasis, VC, FEV1	NIV associated with AR provided better oxygenation both during and after the mechanical ventilation period. NIV either alone or in combination with AR provided lower atelectasis scores and better early pulmonary function tests compared to the control group, without a significant difference regarding the duration of mechanical ventilation, intensive care unit stay, and the length of hospitalization. NIV combined with AR is recommended after open heart surgery to prevent postoperative atelectasis and hypoxemia.

Crowe and Bradley, 1997[24]	IS, RVE, VEBH, TM, EM, TS, EULL, AM, PE	RVE, VEBH, TM, EM, TS, EULL, AM, PE	90 / 95	64±8.9 / 64.8±8.6	74 / 79	IG: PE, RVE, TM, VEBH and TS once or twice a day. After extubation, EULL and AM. Spirometry incentive driven volume used every hour by the patient. GC: PE, RVE, TM, VEBH and TS once or twice a day. After extubation, EULL and AM. Outcomes: atelectasis, pulmonary congestion, pneumothorax, pleural effusion, FEV1, FVC, respiratory infection, SpO2, days of hospitalization	Incentive spirometry combined with physical therapy is no more effective than postoperative physical therapy alone in reducing atelectasis for this population. Use of the spirometer, however, was not monitored, and although the study mimicked practice as it often occurs, the effeciveness of the spirometer cannot be fully evaluated
Dongelmans et al, 2009[25]	WP with SA	WP with PCV and SP	64 / 64	65±9 / 67±8	56 / 51	IG: ventilation adapted support, minute volume of 100% of the predicted weight, FiO2 50%, PEEP 10cmH2O, trigger the 2L / s. CG: PCV, CV 6-8ml / kg, respiratory rate of 12-15 rpm, FiO2 50%, PEEP 10cmH2O, 2L / s trigger. After spontaneous ventilation with SP 10cmH2O, trigger 2L / s, expiratory sensitivity 25% and rise time 50ms. Outcomes: Days of ICU, length of stay, PaO2, PaCO2, IMV Time	Weaning automation with SA is feasible and safe in non–fast-track coronary artery bypass grafting patients. Time until tracheal extubation with SA equals time until tracheal extubation with standard weaning and allows for frequent (automatic) switches between controlled and assisted ventilation.
El-kader, 20112[6]	RVE, VEBH, TM, IS	RVE, VEBH, TM, CPAP / RVE, VEBH, TM, RPPI	12 / 12 / 12	48.7±6.8 / 47.4±6 / 49.6±7.1	Not reported	IG: 3-5 RVE followed 2-3 VEBH at least 10 times in 15 minutes. If necessary, positioning and thoracic maneuvers. IS volume for five minutes, five times a day. CG: 3-5 RVE followed 2-3 VEBH at least 10 times in 15 minutes. If necessary, positioning and thoracic maneuvers. CPAP 10cmH2O for 15 minutes daily. CG: 3-5 RVE followed 2-3 VEBH at least 10 times in 15 minutes. If necessary, positioning and thoracic maneuvers. RPPI with inspiratory phase of 20%, peak inspiratory pressure of 15 cm H2O for 15 minutes. Outcomes: $PaCo_2$, PaO_2	Incentive spirometry in addition to the usual respiratory physical therapy is recommended for patients in phase I of cardiac rehabilitation program after CABG.
Ferreira et al, 2010[27]	IS, PEP	RVE, VEBH, EM	8 / 8	61±2 / 60±3	6 / 6	IG: IS volume coupled to a PEP valve after extubation, with increased expiratory pressure progressively to 5cmH2O to 15cmH2O twice a day with supervision and twice a day without supervision, lasting 15 minutes. CG: guidance on VEBH, EM and RVE. Outcomes: FVC, FEV1, PEF, MIP, MEP, SMWT, Evaluation level of physical activity, evaluation of quality of life	Patients undergoing IS + PEP presented less dyspnea and lower sensation of effort after SMWT and also better quality of life 18 months after CABG.

Franco et al, 2011[28]	BIPAP, RVE, VEBH, TM, EULL, PE	RVE, VEBH, TM, EULL, PE	13 / 13	Not reported	10 / 7	IG: RVE, VEBH, TM, EULL, PE for two days after surgery. BIPAP in the spontaneous mode with inspiratory pressure of 8-12cmH2O and expiratcry of 6cmH2O, twice daily for 30 minutes. CG: RVE, VEBH, TM, EULL, PE for two days after surgery. Outcomes: CV, MV, VC, MIP, MEP, PEF	Coronary artery bypass surgery leads to deterioration of respiratory function postoperatively, and the application the BIIPAP may be beneficial to restore lung function more quickly, especially vital capacity, safely, and well accepted by patients due to greater comfort with the feeling of pain during the execution of respiratory therapy .
Garcia and Costa, 2002[29]	IMT (twice a day)	IMT (once a day) / VEBH	20 / 20 / 20	56±11 / 58±7.5 / 63±9	13 / 16 / 11	IG: three sets of 10 repetitions, twice a day. Efforts inspiratory in a free load manometer for at least five seconds. IG: three sets of 10 repetitions daily. Efforts inspiratory in a free load manometer for at least five seconds. CG: conventional treatment, especially VEBH. Outcomes MIP, MEP, PEF, cirtometry	It was found that through a specific IMT was increased respiratory muscle strength both the group that trained two as in trained once a day, compared to the control group which had no change.
Gust et al, 1996[30]	RCP	CPAP / BIPAP	25 / 25 / 25	60.5±7.5 / 63±7 / 62.6±7.5	23 / 21 / 23	IG: oxygen therapy by NC 6l m and RCP. IG: CPAP with 7.5 cmH2O and FiO2 of 50%. CG: BIPAP with 10cmH2O and PEEP 5cmH2O, getting oxygen to 10l / m. Outcomes: cardiac index, pulmonary blood volume index, extravascular water content	Mask CPAP and nasal BIPAP after extubation of the trachea prevent the increase in extravascular lung water during weaning from mechanical ventilation. This effect is seen for at least 1 h after the discontinuation of CPAP or BIPAP treatment.
Haefener et al, 2008[31]	IS, PEP	RVE, VEBH, EM	17 / 17	62±6 / 60±7	14 / 14	IG: IS volume associated with PEP twice a day 15-20 minutes with expiratory pressure increased progressively 2.5cmH2O the 15cmH2O CG: patients were educated about VEBH, EM and RVE Outcomes: plethysmography, SMWT, atelectasis, pleural effusion, consolidation, FVC, FEV1, IMV time	In patients undergoing CABG, IS + PEP results in improved pulmonary function and 6-minute walk distance as well as a reduction in postoperative pulmonary complications

Hendrix et al, 2006[32]	WP with PRVC, VSV	WP with PRVC, SIMV, CPAP	10 / 10	54±9 / 66±4	10 / 10	IG: WP with PRVC and activated automatic mode function triggered when the patient's ventilatory cycle the mode automatically changed to VSV CG: WP with PRVC when the patient triggered a ventilation cycle, the team modified to SIMV mode with frequency of 5 and PS 10cmH2O. When patients become fully alert, they were changed to the mode CPAP 10cmH2O Outcomes: VC, FEV1, PaO2, PaCO2, IMV time	Automode ventilator weaning trended toward more rapid extubation than did conventional protocol driven ventilation in conjunction with a standardized weaning protocol. Physiologic and hemodynamic factors were better in patients using automode ventilation compared to patients using conventional ventilation. Automode ventilation was well tolerated and did not induce significant adverse effects.
Herdy et al, 2008[33]	RPPI, RVE, IS, AM, LA	NPI	29 / 27	61±10 58±9	20 / 20	IG: RPPI, RVE, IS, AM, LA five days before surgery and continuing after extubation to discharge. Energy expenditure was 2 METS, progressing up to 4 METS CG: NIP Outcomes: Pleural effusion, atelectasis, ICU days, hospital days, PEF, IMV time, SMWT	Pre- and postoperative cardiopulmonary rehabilitation in patients who await CABG in the hospital is superior to standard care and leads to a reduced rate of postoperative complications and shorter hospital stay.
Hirschhorn et al, 2008[34]	VEBH, PD, AM, LA, PE	PWC / IS, EULL, AM	31 / 31 / 30	63.6±8.5 / 63.2±10.8 / 61.8±7.2	26 / 27 / 27	IG: five sets of 4 repetitions of IS during the service and guidance to perform every hour. RVE and EMSI IG: PWC CG: PE, PD, RVE, VEBH, LA. AM starting at 10m up to 30m in the morning and night. Outcomes: SMWT, VC, quality of life, atelectasis, injury, failure or pulmonary consolidation	A physiotherapy-supervised, moderate intensity walking program in the inpatient phase following CABG improves walking capacity at discharge from hospital. The performance of respiratory and musculoskeletal exercises confers no additional benefit to the measured outcomes.
Jenkins et al, 1989[35]	RVE, VEBH, EULL, AM, LA, PE, TM	VEBH, EULL, AM, LA, PE / VEBH, EULL, AM, LA, PE, IS	35 / 38 / 37	55±8.5 / 56±6.9 /54±7.6	35 / 38 / 37	IG: Guidance on VEBH, EULL, AM, LA, PE. Three to five repetitions of RVE and if necessary were carried TM. At least 10 RVE every hour until the fifth day after surgery. IG: Guidance on VEBH, EULL, AM, LA, PE. Three to five repetitions of IS. At least 10 reps every hour until the fifth day after surgery. CG: Guidance on VEBH, EULL, AM, LA, PE. Outcomes: FEV1, PEF, FVC, consolidation, PaCO2, PaO2, pain	It is concluded that the addition of breathing exercises or incentive spirometry to a regimen of early mobilisation and huffing and coughing confers no extra benefit after uncomplicated coronary artery bypass grafting

Johnson et al, 1995[36]	RVE, EM	RVE, SMI, EM (group with minimal atelectasis)/ RVE, SMI, EM (group marked atelectasis)) / RVE, SMI, TM, EM	48 / 49 / 64 / 63	60±10 / 64±11 / 66±8 / 64±11	39 / 40 / 52 / 53	IG: EM and five repetitions of RVE every hour. IG: group with minimal atelectasis. EM and five repetitions of SMI starting from the residual functional capacity to total lung capacity. IG: group marked atelectasis. EM and five repetitions of SMI starting from the residual functional capacity to total lung capacity. CG: During the operation of SMI, application TM with frequency of 1-2 per second and EM. Three daily sessions. Outcomes: . Atelectasis, VC, FVC, FEV1, days of hospitalization, MIP, MEP, pain	We concluded that postoperative respiratory dysfunction is common but does not commonly cause significant morbidity or prolong hospital stay. Adding SMI ti patients with minimal atelectasis at extubation does not improve clinical outcomes. Similarly, adding TM to patients with marked atelectasis does not improve outcomes over those obtained with SMI and early ambulation.
Marvel et al, 1986[37]	WP with ambient pressure	WP with PEEP of 5cmH_2O, CPAP of 5cmH_2O / WP with PEEP 10 cmH_2O	17 / 15 / 12	62.7±1.7 / 60.9±2.9 / 55.8±2.7	Not reported	IG: WP pressure environment IG: WP with 5cmH2O and CPAP 5cmH2O for an hour and a half before extubation CG: WP with 10cmH2O and CPAP 5cmH2O for half an hour before extubation Outcomes: atelectasis, days of hospitalization, PaO2	We conclude that routine PEEP improves pulmonary oxygen transfer but, once discontinued, PEEP offers no sustained beneficial effect upon impaired oxygen transfer or roentgenographic evidence of atelectasis following CABG.
Matheus et al, 2012[38]	IMT, RVE, IS, AM, PE	RVE, IS, AM, PE	23 / 24	61.8±13.5 / 63.3±10.2	18 / 16	IG: RVE, IS, AM, PE and IMT twice a day with three sets of 10 repetitions with 40% of MIP. CG: RVE, IS, AM, PE Outcomes: MIP, MEP, CV, VC, PEF, pleural effusion, atelectasis, ICU days, hospital days, IMV time	Patients undergoing cardiac surgery suffer reduction of VC and respiratory muscle strength after the surgery. The muscle training performed was effective in recover the CV and VC in PO3, the trained group.
Matte et al, 2000[39]	VEBH, EM, IS, NBL	RVE, EM, IS, NBL, CPAP / VEBH, EM, IS, NBL, BIPAP	30 / 33 / 33	63±8 / 65±8 / 64±9	25 / 30 / 30	IG: Routine physiotherapy (VEBH, NBL, EM and IS) IG: Routine physiotherapy, CPAP 5cmH2O CG: Routine physiotherapy, BIPAP with the inspiratory pressure 12cmH2O and expiratory pressure 5cmH2O Outcomes: VC, FEV1, PaO2, PaCO2, atelectasis, days of ICU	We conclude that preventive use of NIV can be considered as an effective means to decrease the negative effect of coronary surgery on pulmonary function
Mendes et al, 2010[40]	RVE, VEBH, PD, TM, EM, PE, EE, EULL, AM, LA	RVE, VEBH, PD, TM, EM, PE	24 / 23	60±8 / 58±9	16 / 20	GI: Four sets of 10 repetitions of RVE and VEBH once daily. If necessary, PD and TM. GC: Four sets of 10 repetitions of RVE and VEBH once daily. If necessary, PD and TM. EE with five sets of 10 repetitions, EULL with two sets of 15 reps, 10 minutes AM, LA-four steps. Outcomes: ICU days, hospital days, IMV time, heart rate and RR interval	Short-term supervised physiotherapy exercise protocol during inpatient cardiac rehabilitation improves cardiac autonomous regulation at the time of discharge. Thus, exercise-based inpatient cardiac rehabilitation might be an effective non-pharmacological tool to improve autonomic cardiac tone in patient's post-CABG.

Michalopoulos et al, 1998[41]	WP with ZEEP	WP with PEEP of 5cmH_2O / WP with PEEP of 10 cmH_2O	22 / 24 / 21	61.1±6.1 / 60.9±6.2 / 61.9±6.6	18 / 20 / 16	IG: ZEEP during IMV postoperatively until extubation IG: PEEP 5cmH2O during IMV postoperatively until extubation CG: PEEP 10cmH2O during IMV postoperatively until extubation Outcomes: atelectasis, IMV time, oxygenation index, cardiac index	We concluded that low levels of PEEP have no advantage over zero PEEP in improving gás Exchange in the early postoperative course of patients following open heart surgery.
Muller et al, 2006[42]	CPAP	RPPI	20 / 20	61±5.8 / 62.1±7.3	16 / 17	IG: CPAP to 5cmH2O and 31 / m oxygen within 3 hours for 15 minutes every hour, on the 24th and 48th postoperative for 30 minutes in two 15-minute sets. CG: RPPI 20cmH2O the 30cmH2O with serum as diluent in the micronebulizer. Within 3 hours for 15 minutes every hour, on the 24th and 48th postoperative for 30 minutes in two 15-minute sets. Outcomes: PaO2, PaCO2, dyspnea, ventilometry	Both devices were shown to be able to keep pO2, pCO2, and SPO2 values within normal limits. However, when the objective was pulmonary reexpansion with less imposed workload, the Müller Resuscitator was more effective because of its prompter action and consequently lower levels of dyspnea, respiratory rate (RR) and use of accessory muscle were observed.
Oikkonen et al, 1991[43]	IS, PE	RPPI, PE	26 / 26	55±1 / 55±1	22 / 22	IG: PE with guidance on RVE, VEBH. IS volume with 3 seconds support at least 5 times per training CG: PE with guidance on RVE, VEBH. RPPI with a peak pressure of 10 to 15cmH2O pressure for not less than 4 daily sessions. Outcomes: atelectasis, congestion, pleural effusion, diaphragm elevation, VC, PEF, PaO2, PaCO2	Based on the three variables studied, we consider both devices equal in efficiency after coronary surgery.
Renault et al, 2009[44]	RVE, VEBH, EM, NIV	VEBH, EM, IS, NIV	18 / 18	54.8±7.4 / 58.7±9.2	13 / 16	IG: EM, VEBH, NIV with two pressure levels for 30 minutes twice a day in the ICU and once in the inpatient unit. RVE three sets of ten repetitions. CG: EM, VEBH, NIV with two pressure levels for 30 minutes twice a day in the ICU and once in the	No significant differences were observed in maximal respiratory pressures, spirometric
Richter Larsen et al, 1995[45]	RVE, VEBH, EM, AM, PE, PEP	RVE, VEBH, EM, AM, PE, IR, PEP / RVE, VEBH, EM, AM, PE	Not reported	Not reported	Not reported	IG: Twice a day RVE, VEBH and EM. PEP with 10-15cmH_2O. IG: Twice a day RVE, VEBH and EM. IR around 20cmH_2O and PEP of 10-15cmH_2O. CG: twice a day RVE, VEBH and EM Outcomes: Atelectasis, FVC, PaO_2	We did not find any Significant difference between the three groups; however, a tendency to decreased risk of having post operative complications was observed in the groups having positive expiratory pressure and inspiratory resistance-positive expiratory pressure

Romanini et al, 2007[46]	RPPI	IS	20 / 20	56.4±8.8 / 57.1±9.8	12 / 16	GI: RPPI for ten minutes, five minutes interval and again applied for ten minutes. GC: IS volume for ten minutes, five minutes interval and again applied for ten minutes. Outcomes: FEV1, Tiffenau index, MIP, MEP, ventilometry	In order to reverse hypoxemia earlier, the RPPI was more efficient compared to IS; however, to improve the strength of respiratory muscles, it was more effective.
Savci et al, 2011[47]	IMT, RVE, VEBH, EM, EULL, AM, LA	RVE, VEBH, EM, EULL, AM, LA	22 / 21	62.8±8.6 / 57.4±1.4	19 / 19	IG: IMT twice a day for ten days (five before and five postoperatively), EM, EULL, RVE, VEBH, AM, LA CG: EM, EULL, RVE, VEBH, AM, LA Outcomes: atelectasis, pleural effusion, consolidation, FVC, FEV1, Tifennau index, MIP, MEP, SMWT, quality of life	IMT results in faster recovery of inspiratory muscle strength, functional capacity, intensive care unit stay, quality of life and psychosocial status after CABG.
Savci et al, 2006[48]	RVE, VEBH, EM, EULL, AM, CAR	RVE, VEBH, EM, EULL, AM, IS	30 / 30	55.2±8.5 / 57.2±8.9	30 / 30	IG: RVE, VEBH, EM, EULL. AM 30 and 80m in the morning and late in the first postoperative day. On the second day, AM for five minutes. On the third day, the walk was free in the hallway. CAR consisted of 1-2 controlled breaths, followed 3 RVE inspiratory pause of 3 seconds, controlled breaths 1-2 VEBH. CG: RVE, VEBH, EM, EULL. AM 30 and 80m in the morning and late in the first postoperative day. On the second day, AM for five minutes. On the third day, the walk was free in the hallway. IS was applied followed by 3 repetitions inspiratory pause of 3 seconds. VEBH 1-2 controlled breaths. By the second day after surgery, two daily sessions and after, 1time a day, 15 minutes session Outcomes: VC, FVC, FEV1, PEF, SMWT, atelectasis, congestion, infiltration, pneumothorax, pleural effusion, pulmonary edema, pain	Both treatments improved arterial oxygenation from the first day post-operatively. After a 5-day treatment, functional capacity was well preserved with the usage of CAR or IS. Both physiotherapy methods had similar effects on the rate of atelectasis, pulmonary function, and pain perception.
Stein et al, 2009[49]	Medical consultation and nursing, RVE, VEBH, EE, EULL, AM, LA, PE, PEP	PE, Medical consultation and nursing	10 / 10	64±7 / 63±6	6 / 5	IG: Medical consultation and nursing, PE, VEBH, RVE, EE, EULL, AM, LA, PEP with progressive pressure 3-8cmH2O for 3-12 minutes. CG: PE, medical visits and nursing. Outcomes: FVC, FEV1, MIP, MEP, SMWT, dyspnea, IMV time	A 6-day rehabilitation program attenuated the postoperative reduction in respiratory muscle strength and also improved the recovery of functional capacity after CABG. The correlation between MIP and VO2peak during the late postoperative period suggests that inspiratory muscle strength is an important determinant of functional capacity after CABG.
Stiller et al, 1994[50]	PE and RVE, VEBH, TM, PD (twice a day)	PE and RVE, VEBH, TM, PD (four times a day) / NPI	40 / 40 / 40	61±9 / 63±8 / 62±11	33 / 32 / 33	GI: PE, RVE, VEBH (2x / day for the first 2 days of PO and e1x / day 3 and 4 po. 3-5 EVR followed 2-3 HB (also independently every hour). If necessary TM and PD. GI: PE, RVE, VEBH (4x / day for the first 2 days of PO and 2x / day 3 and 4 PO. 3-5 RVE followed 2-3 VEBH (also independently every hour) if necessary TM and PD. CG: No physical therapy intervention in pre- or postoperative Outcomes: FVC, days of hospitalization, IMV time, PaO2, PaCO2, oxygenation index	The necessity for prophylactic chest physiotherapy after routine coronary artery surgery should be reviewed

Sulzer et al, 2001[51]	WP with SA	WP with SIMV	16 / 20	59.2±8.7 / 59.7±8.1	12 / 14	GI: WP with SA 100% of minute ventilation, 100% FiO2, 4cmH2O PEEP, peak pressure 25cmH2O and sensitivity 21 / min. GC: WP with SIMV, tidal volume of 7 ml / kg, decelerating flow, respiratory rate of 12, 100% FiO2, PEEP 4cmH2O, sensitivity 21 / min. Outcomes: Days of ICU, IMV time, PaO2, oxygenation index	A respiratory weaning protocol based on SA is practicable; it may accelerate tracheal extubation and simplify ventilatory management in fast-track patients after cardiac surgery. The evaluation of potential advantages of the use of such technology on patient outcome and resource utilization deserves further studies.
Thomas et al, 1992[52]	nasal CPAP	Oxygen by mask	14 / 14	59±4 / 55±10	14 / 14	IG: on the first day after surgery, 60 minutes of nasal CPAP with 5cmH2O pressure. CG: use of facial mask for oxygen therapy. Outcomes: pain, pulmonary shunt, cardiac index	We conclude that the use of nasal CPAP is a simple, tolerable and effective method of treating hypoxemia in adult patients after coronary artery bypass surgery and warrants further study.
Westerdahl et al, 2001[53]	RVE, VEBH, EM, EULL, AM, blow bottle	RVE, VEBH, EM, EULL, AM, RI and PEP / RVE, VEBH, EM, EULL, AM	36 / 30 / 32	66±9.4 / 65.9±8.8 / 63.5±9.2	36 / 30 / 32	IG: EM, EULL, VEBH, AM. RVE in blow bottle , with 10 cm of water and plastic tube with 40 cm long and 1 cm in diameter, generating an expiratory resistance of 10 (± 1) cm H2O. 30 replicates were performed for RVE every hour during the day. IG: EM, EULL, VEBH, AM. RVE through a face mask connected to a T tube with PEP 10cmH2O and RI -5cmH2O. 30 replicates were performed for RVE every hour during the day. CG: EM, EULL, VEBH, AM and RVE without any device. 30 replicates were performed for RVE every hour during the day. Outcomes: VC, inspiratcry capacity, FEV1, RV, TLC, diffusing capacity , pain, atelectasis, pleural effusion	No major differences between the treatment groups were found, but the impairment in pulmonary function tended to be less marked using the blow bottle technique. The Blow bottle group had signi. cantly less reduction in total lung capacity compared to the Deep breathing group, while the IR-PEP group did not signi. cantly differ from the other two groups
Westerdahl et al, 2005[54]	VEBH, EM, AM, PE	RVE, VEBH, EM, AM, PE, blow bottle	48 / 42	66±9 / 65±9	36 / 31	IG: care given once or twice daily for the first four days. EM, VEBH, PE and AM. IG: PE, EM, VEBH, AM. 3 sets of 10 repetitions of RVE were carried through every hour during the day, in the first 4 days. RVE in the blow bottle, with 10 cm of water and plastic tube with 50 cm long and 1 cm in diameter, generating an expiratory resistance 10cmH2O Outcomes: VC, FVC, FEV1, inspiratory capacity, residual functional capacity, TLC, atelectasis, PaO2, PaCO2, pain, IMV time	Patients performing deep-breathing exercises after CABG surgery had significantly smaller atelectatic areas and better pulmonary function on the fourth postoperative day compared to a control group performing no exercises

Westerdahl et al, 2003[55]	RVE	RVE, blow bottle / RVE, RI e PEP	21 / 20 / 20	66±9 / 64±8 / 64±10	18 / 16 / 15	IG: three sets of 10 repetitions of RVE without any device. IG: three sets of 10 repetitions of RVE in the blow bottle, with 10 cm of water and plastic tube with 50 cm long and 1 cm in diameter, generating an expiratory resistance 10cmH2O CG: three sets of 10 repetitions of RVE through a face mask connected to a T tube with PEP 15cmH2O and IR -5cmH2O. Outcomes: atelectasis, PaO2, PaCO2, IMV time	A significant decrease of atelectatic area, increase in aerated lung area and a small increase in PaO2 were found after performance of 30 deep breaths. No difference between the three breathing techniques was found.

AR - alveolar recruitment; AM - ambulation; BIPAP - Bilevel Positive Pressure Airway; CAR - Active cycle of breathing; CPAP - Continuous positive airway pressure; Cstat - static compliance; CV - current volume; EE - ends exercises; EM - early mobilization; EULL - exercise upper and lower limbs; FEV1 -forced expiratory volume in one second FiO_2 - inspiratory oxygen fraction; FVC - forced vital capacity; ICU - intensive care unit; IMV - invasive mechanical ventilation; IMT - inspiratory muscle training; IS - incentive spirometry; LA -ladder; MEP - maximal expiratory pressure; MIP - maximal inspiratory pressure; MH - manual hyperinflation; MV - minute volume; NBL - nebulization; NC - nasal catheter; NIV - non-invasive ventilation; NPI - none physiotherapy intervention; PaCO2- partial pressure of carbon dioxide; PaO2 - partial pressure of oxygen; PCV - pressure-controlled ventilation; PD - postural drainage; PE - preoperative education; PEEP - positive end-expiratory pressure; PEF - peak expiratory flow; PEP - positive expiratory pressure; PRVC - pressure regulated volume control; PWC - progressive walking circuit; RI -inspiratory resistance; RCP - routine chest physiotherapy; RPPI - intermittent positive pressure breathing; RV - residual volume; RVE - re-expansive ventilatory exercises; SA - support adapted; SIMV - Synchronized Intermittent Mandatory Ventilation; SMI - sustained maximal inspirations; SMWT - six minutes walk test; SP - suport pressure; SpO2 - peripheral oxygen saturation; TLC - total lung capacity; TM - thoracic maneuvers; TS - tracheal suctioning; TV - tidal volume; VCV - volume-controlled ventilation; VEBH - ventilatory exercises for bronchial hygiene;; VC - vital capacity; VIPP - ventilation with intermittent positive pressure; VSV - volume support ventilation; ZEEP - zero end expiratory pressure; WP - weaning protocol.

Table 3. CONSORT *Statement*.

Author, Year	TITLE AND INTRODUCTION		METHODS										RESULTS							DISCUSSION			OTHER INFORMATIONS		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Al Jaaly et al, 2013[17]	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	I	A	A	I	I
Barros et al, 2010[18]	I	A	A	A	A	A	A	A	I	A	I	A	I	I	I	I	A	I	I	A	I	A	I	I	I
Blattner et al, 2008[19]	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	I	I	A	I	A	I	I	I
Borges et al, 2013[20]	I	A	A	A	A	A	I	A	I	I	I	A	I	A	A	A	A	I	I	I	I	A	I	I	I
Borghi-silva et al, 2005[21]	I	A	A	A	A	A	A	A	I	I	I	A	I	I	A	A	A	I	I	A	I	A	I	I	I
Castellana et al, 2003[22]	I	A	I	A	A	A	I	I	I	I	I	A	I	I	A	I	A	A	I	I	I	A	I	I	I
Celebi et al, 2008[23]	I	A	I	A	A	A	A	A	I	I	A	A	I	I	A	A	A	I	I	A	I	A	I	I	I
Crowe and Bradley, 1997[24]	I	A	I	A	A	A	I	A	I	I	A	A	I	A	A	A	A	A	I	I	I	A	I	I	I
Dongelmans et al, 2009[25]	A	A	A	A	A	A	A	A	I	I	A	A	I	A	A	A	A	I	I	A	I	A	I	I	I
El-kader, 2011[26]	I	A	I	A	A	A	I	I	I	I	I	A	I	I	A	I	A	I	A	I	I	A	I	I	I
Ferreira et al, 2010[27]	I	A	A	A	A	A	I	I	I	I	I	A	I	I	A	A	A	I	I	A	A	A	I	I	A
Franco et al, 2011[28]	I	A	I	A	A	A	I	I	I	I	I	I	I	I	I	A	A	I	I	I	I	A	I	I	I
Garcia and Costa, 2002[29]	I	A	I	A	A	A	I	A	I	I	I	I	I	A	I	I	A	I	I	I	I	A	I	I	I
Gust et al, 1996[30]	I	A	I	I	A	A	I	I	I	I	I	A	I	I	A	A	A	I	I	I	I	A	I	I	I
Haefener et al, 2008[31]	I	A	A	A	A	A	A	A	I	I	A	A	A	I	A	A	A	I	A	A	I	A	I	I	A
Hendrix et al, 2006[32]	A	A	I	I	A	A	A	A	I	I	I	A	I	A	A	A	A	I	I	A	I	A	I	I	I
Herdy et al, 2008[33]	A	A	I	A	A	A	A	I	I	I	A	A	I	A	A	A	A	I	I	I	I	A	I	I	I
Hirschhorn et al, 2008[34]	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	I	A	A	I	A	I	I	I
Jenkins et al, 1989[35]	I	A	A	I	A	A	I	I	I	I	A	A	I	I	A	A	A	I	I	I	I	A	I	I	A
Johnson et al, 1995[36]	I	A	I	A	A	A	I	I	I	I	A	A	A	A	A	I	A	I	I	I	I	A	I	I	I
Marvel et al, 1986[37]	I	A	I	I	A	A	I	A	I	I	A	A	I	A	A	I	A	I	I	I	I	A	I	I	I
Matheus et al, 2012[38]	I	A	I	A	A	A	I	A	I	I	I	A	I	A	A	A	A	I	I	A	I	A	I	I	I
Matte et al, 2000[39]	I	A	I	I	A	A	I	I	I	I	A	A	I	I	A	I	A	I	I	I	I	A	I	I	I
Mendes et al, 2010[40]	A	A	A	I	A	A	A	A	I	I	I	A	A	I	A	A	A	I	A	A	I	A	I	I	I
Michalopoulos et al, 1998[41]	I	A	I	A	A	A	A	I	I	I	I	A	I	I	A	I	A	I	I	I	I	A	I	I	I
Muller et al, 2006[42]	I	A	A	A	A	A	I	I	I	I	I	A	I	A	A	A	A	I	I	I	I	A	I	I	I
Oikkonen et al, 1991[43]	I	A	I	I	A	A	I	I	I	I	A	A	I	I	A	A	A	I	I	I	I	A	I	I	I
Renault et al, 2009[44]	I	A	A	A	A	A	I	A	I	I	I	A	I	I	A	A	A	I	I	I	I	A	I	I	I
Richter Larsen et al, 1995[45]	A	A	I	I	A	A	I	I	I	I	A	A	I	I	I	I	A	I	A	I	I	A	I	I	I
Romanini et al, 2007[46]	I	A	I	A	A	A	I	A	I	I	I	A	I	A	I	I	A	I	I	A	I	A	I	I	A
Savci et al, 2011[47]	A	A	I	I	A	A	A	A	I	I	I	A	A	I	A	A	A	I	I	A	I	A	I	I	I
Savci et al, 2006[48]	I	A	I	A	A	A	I	I	I	I	A	A	I	A	A	A	A	I	I	I	I	A	I	I	I
Stein et al, 2009[49]	I	A	A	A	A	A	A	A	I	I	A	A	A	I	A	A	A	I	A	A	I	A	A	I	A
Stiller et al, 1994[50]	I	A	I	A	A	A	I	A	I	I	A	A	I	I	A	A	A	I	I	I	I	A	I	I	I
Sulzer et al, 2001[51]	I	A	I	A	A	A	I	I	I	I	I	A	I	A	A	A	A	I	I	A	I	A	I	I	I
Thomas et al, 1992[52]	I	A	I	I	A	A	I	I	I	I	I	A	I	I	A	I	A	I	I	I	I	A	I	I	I
Westerdahl et al, 2001[53]	I	A	I	I	A	A	I	A	I	I	A	A	I	I	A	A	A	I	I	I	I	A	I	I	I
Westerdahl et al, 2005[54]	I	A	I	A	A	A	A	I	I	I	A	A	I	I	A	A	A	I	I	I	I	A	I	I	A
Westerdahl et al, 2003[55]	I	A	I	A	A	A	I	I	I	I	A	A	I	I	A	A	A	I	I	I	I	A	I	I	I

A - adequate; I - inadequate.

Table 4. Extension CONSORT *Statement*.

Author, Year	TITLE AND ABSTRACT	METHODS										RESULTS			DISCUSSION	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Al Jaaly et al, 2013[17]	I	A	A	A	A	I	A	A	I	I	A	A	A	A	I	I
Barros et al, 2010[18]	I	A	A	A	I	I	A	A	I	I	A	I	A	I	I	I
Blattner et al, 2008[19]	I	A	A	A	A	I	A	A	A	A	A	A	A	A	I	I
Borges et al, 2013[20]	I	A	A	A	I	I	I	A	I	I	A	I	A	A	I	I
Borghi-silva et al, 2005[21]	I	A	A	A	A	I	I	A	I	I	A	I	A	A	I	I
Castellana et al, 2003[22]	I	A	A	A	I	I	I	I	I	I	A	I	A	A	I	I
Celebi et al, 2008[23]	I	A	A	A	I	I	A	A	A	I	A	I	A	A	I	I
Crowe and Bradley, 1997[24]	I	A	A	A	A	I	I	A	A	I	A	I	A	A	I	I
Dongelmans et al, 2009[25]	I	A	A	A	A	I	A	A	A	I	A	I	A	A	I	I
El-kader, 2011[26]	I	A	A	A	I	I	I	I	I	I	A	I	A	A	I	I
Ferreira et al, 2010[27]	I	A	A	A	I	I	I	I	I	I	A	I	A	A	I	I
Franco et al, 2011[28]	I	A	A	A	I	I	I	I	I	I	I	I	A	I	I	I
Garcia and Costa, 2002[29]	I	A	A	A	I	I	I	A	I	I	A	I	A	I	I	I
Gust et al, 1996[30]	I	A	A	A	A	I	I	I	I	I	A	I	A	A	I	I
Haefener et al, 2008[31]	I	A	A	A	A	I	A	A	A	I	A	A	A	A	I	I
Hendrix et al, 2006[32]	I	A	A	A	A	I	A	A	I	I	A	I	A	A	I	I
Herdy et al, 2008[33]	I	A	A	A	A	I	A	I	A	I	A	I	A	A	I	I
Hirschhorn et al, 2008[34]	I	A	A	A	A	I	A	A	A	A	A	A	A	A	I	I
Jenkins et al, 1989[35]	I	A	A	A	I	I	I	I	A	I	A	I	A	A	I	I
Johnson et al, 1995[36]	I	A	A	A	I	I	I	I	A	I	A	A	A	A	I	I
Marvel et al, 1986[37]	I	A	A	A	A	I	I	A	A	I	A	I	A	A	I	I
Matheus et al, 2012[38]	I	A	A	A	I	I	I	A	I	I	A	I	A	A	I	I
Matte et al, 2000[39]	I	A	A	A	I	I	I	I	A	I	A	I	A	A	I	I
Mendes et al, 2010[40]	I	A	A	A	I	I	A	A	I	I	A	A	A	A	I	I
Michalopoulos et al, 1998[41]	I	A	A	A	A	I	A	I	I	I	A	I	A	A	I	I
Muller et al, 2006[42]	I	A	A	A	I	I	I	I	I	I	A	I	A	A	I	I
Oikkonen et al, 1991[43]	I	A	A	A	I	I	I	I	A	I	A	I	A	A	I	I
Renault et al, 2009[44]	I	A	A	A	I	I	I	A	I	I	A	I	A	A	I	I
Richter Larsen et al, 1995[45]	I	A	A	A	I	I	I	I	A	I	A	I	A	I	I	I
Romanini et al, 2007[46]	I	A	A	A	I	I	I	A	I	I	A	I	A	I	I	I
Savci et al, 2011[47]	I	A	A	A	A	I	A	A	I	I	A	A	A	A	I	I
Savci et al, 2006[48]	I	A	A	A	A	I	I	I	A	I	A	I	A	A	I	I
Stein et al, 2009[49]	I	A	A	A	I	I	A	A	A	I	A	A	A	A	I	I
Stiller et al, 1994[50]	I	A	A	A	I	I	I	A	A	I	A	I	A	A	I	I
Sulzer et al, 2001[51]	I	A	A	A	A	I	I	I	I	I	A	I	A	A	I	I
Thomas et al, 1992[52]	I	A	A	A	I	I	I	I	I	I	A	I	A	A	I	I
Westerdahl et al, 2001[25]	I	A	A	A	I	I	I	A	A	I	A	I	A	A	I	I
Westerdahl et al, 2005[54]	I	A	A	A	I	I	A	I	A	I	A	I	A	A	I	I
Westerdahl et al, 2003[55]	I	A	A	A	A	I	I	I	A	I	A	I	A	A	I	I

A - adequate; I - inadequate.

Table 5. Risk of Bias.

Author, Year	Adequate sequence generation	Allocation concealment	Blinding of patients and investigators	Blinding of outcome assessors	Description of losses and exclusions	Intention-to-treat analysis
Al Jaaly et al, 2013[17]	Yes	Yes	No	Yes	Yes	Yes
Barros et al, 2010[18]	Yes	No	No	No	Yes	No
Blattner et al, 2008[19]	Yes	Yes	No	Yes	Yes	Yes
Borges et al, 2013[20]	Yes	No	No	No	Yes	No
Borghi-silva et al, 2005[21]	Yes	No	No	No	Yes	No
Castellana et al, 2003[22]	No	No	No	No	No	Not report
Celebi et al, 2008[23]	Yes	No	No	Yes	No	Not report
Crowe and Bradley, 1997[24]	Yes	No	No	Yes	No	Not report
Dongelmans et al, 2009[25]	Yes	No	Yes	No	Yes	No
El-kader, 2011[26]	No	No	No	No	No	Not report
Ferreira et al, 2010[27]	No	No	No	No	No	Not report
Franco et al, 2011[28]	No	No	No	No	No	Not report
Garcia and Costa, 2002[29]	No	No	No	No	Yes	No
Gust et al, 1996[30]	No	No	No	No	No	Not report
Haefener et al, 2008[31]	Yes	No	No	Yes	Yes	Yes
Hendrix et al, 2006[32]	Yes	No	No	No	No	Not report
Herdy et al, 2008[33]	No	No	No	Yes	Yes	Yes
Hirschhorn et al, 2008[34]	Yes	Yes	Yes	Yes	Yes	Yes
Jenkins et al, 1989[35]	No	No	Yes	No	Yes	No
Johnson et al, 1995[36]	No	No	No	Yes	Yes	No
Marvel et al, 1986[37]	Yes	No	No	Yes	Yes	No
Matheus et al, 2012[38]	Yes	No	No	No	No	Not report
Matte et al, 2000[39]	No	No	No	Yes	Yes	No
Mendes et al, 2010[40]	Yes	No	No	No	Yes	No
Michalopoulos et al, 1998[41]	No	No	No	No	Yes	No
Müller et al, 2006[42]	No	No	No	No	No	Not report
Oikkonen et al, 1991[43]	No	No	No	Yes	Yes	No
Renault et al, 2009[44]	Yes	No	No	No	Yes	No
Richter Larsen et al, 1995[45]	No	No	No	Yes	Yes	No
Romanini et al, 2007[46]	Yes	No	No	No	No	Not report
Savci et al, 2011[47]	Yes	No	No	No	Yes	No
Savci et al, 2006[48]	No	No	No	Yes	No	Not report
Stein et al, 2009[49]	Yes	No	No	Yes	Yes	No
Stiller et al, 1994[50]	Yes	No	No	Yes	Yes	No
Sulzer et al, 2001[51]	No	No	No	No	Yes	No
Thomas et al, 1992[52]	No	No	No	No	No	Not report
Westerdahl et al, 2001[53]	Yes	No	No	Yes	Yes	No
Westerdahl et al, 2005[54]	No	No	No	Yes	Yes	No
Westerdahl et al, 2003[55]	No	No	No	Yes	Yes	No

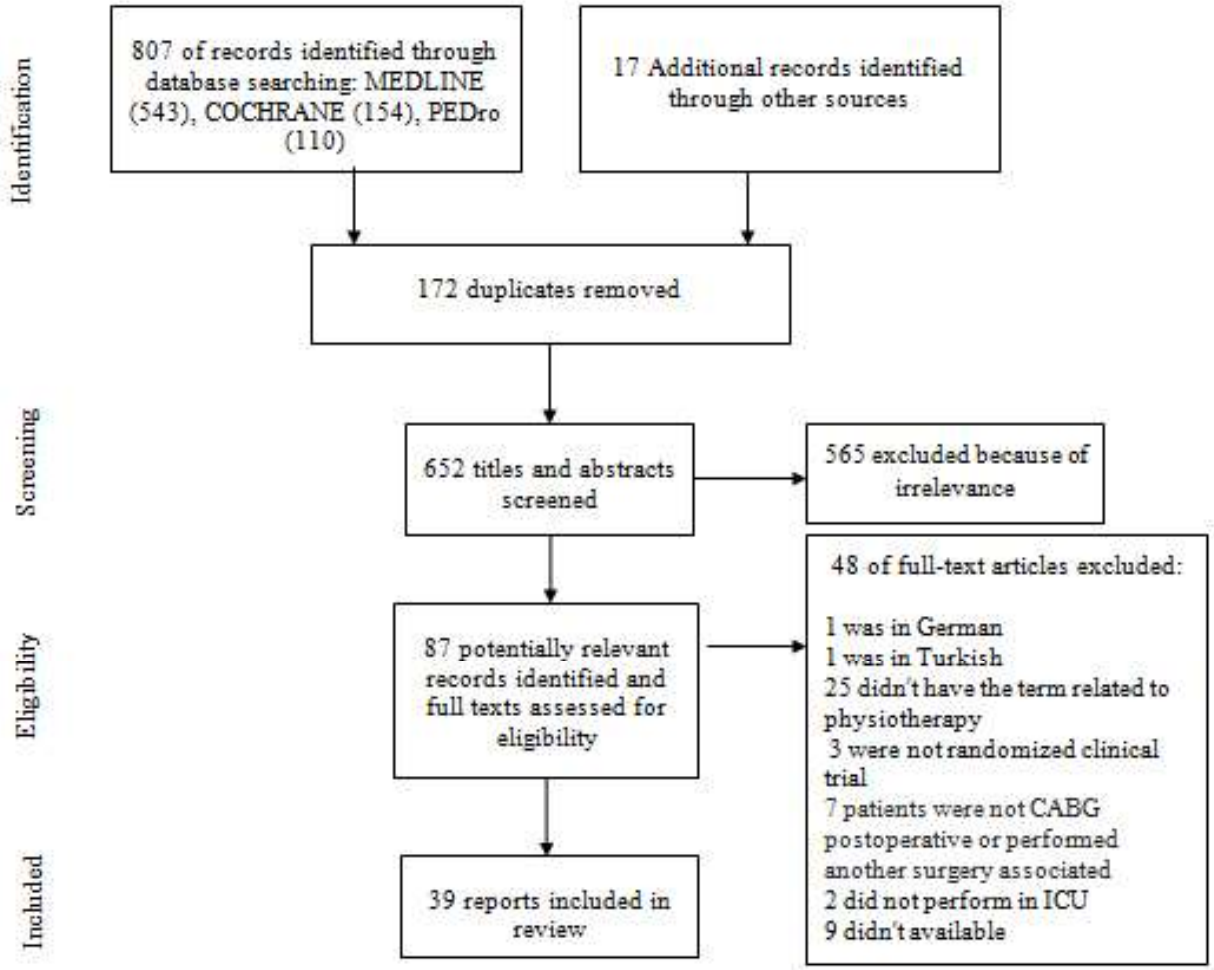

Figure 1. Review's flowchart.

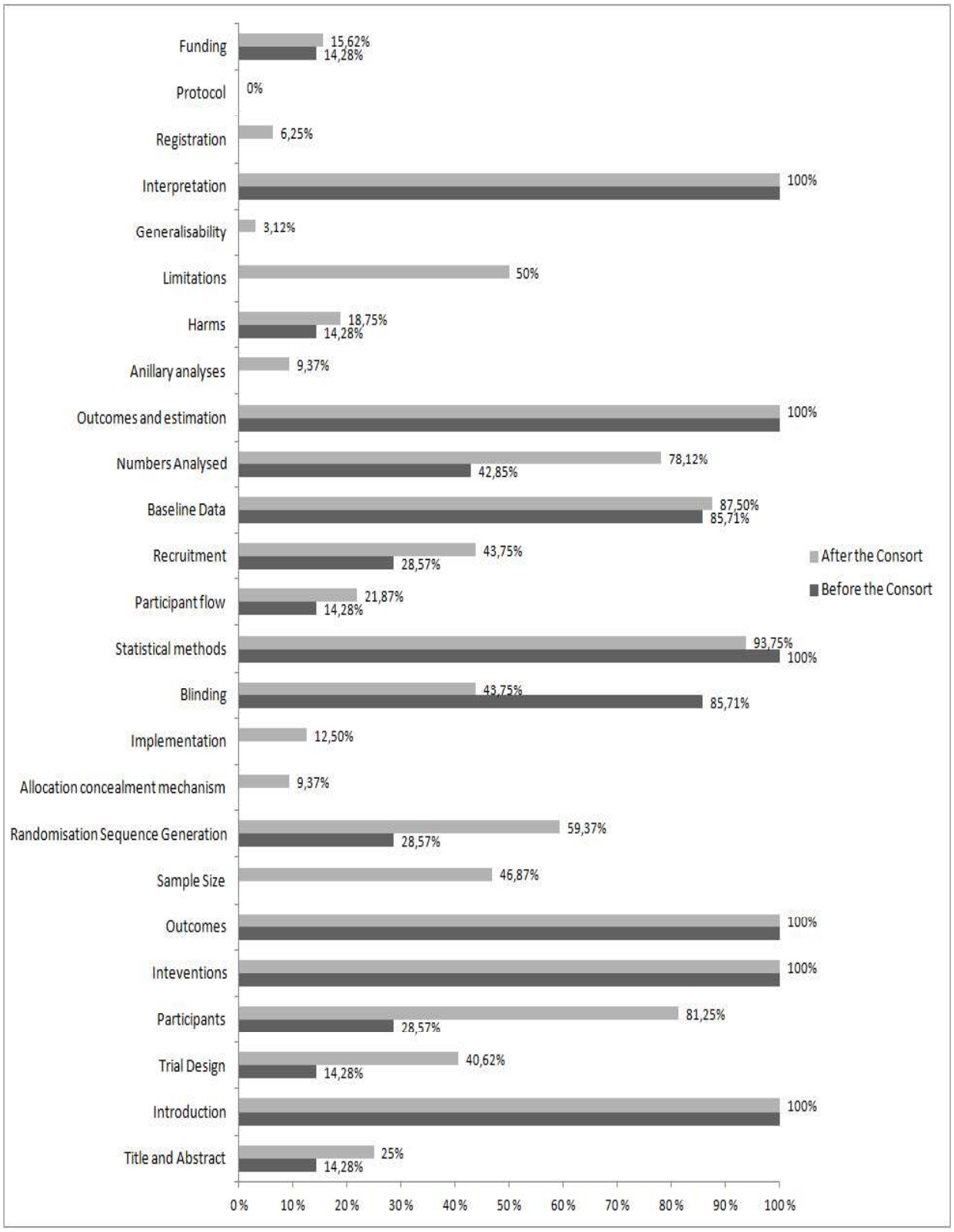

Figure 2. Comparison studies published before and after the CONSORT *Statement*.

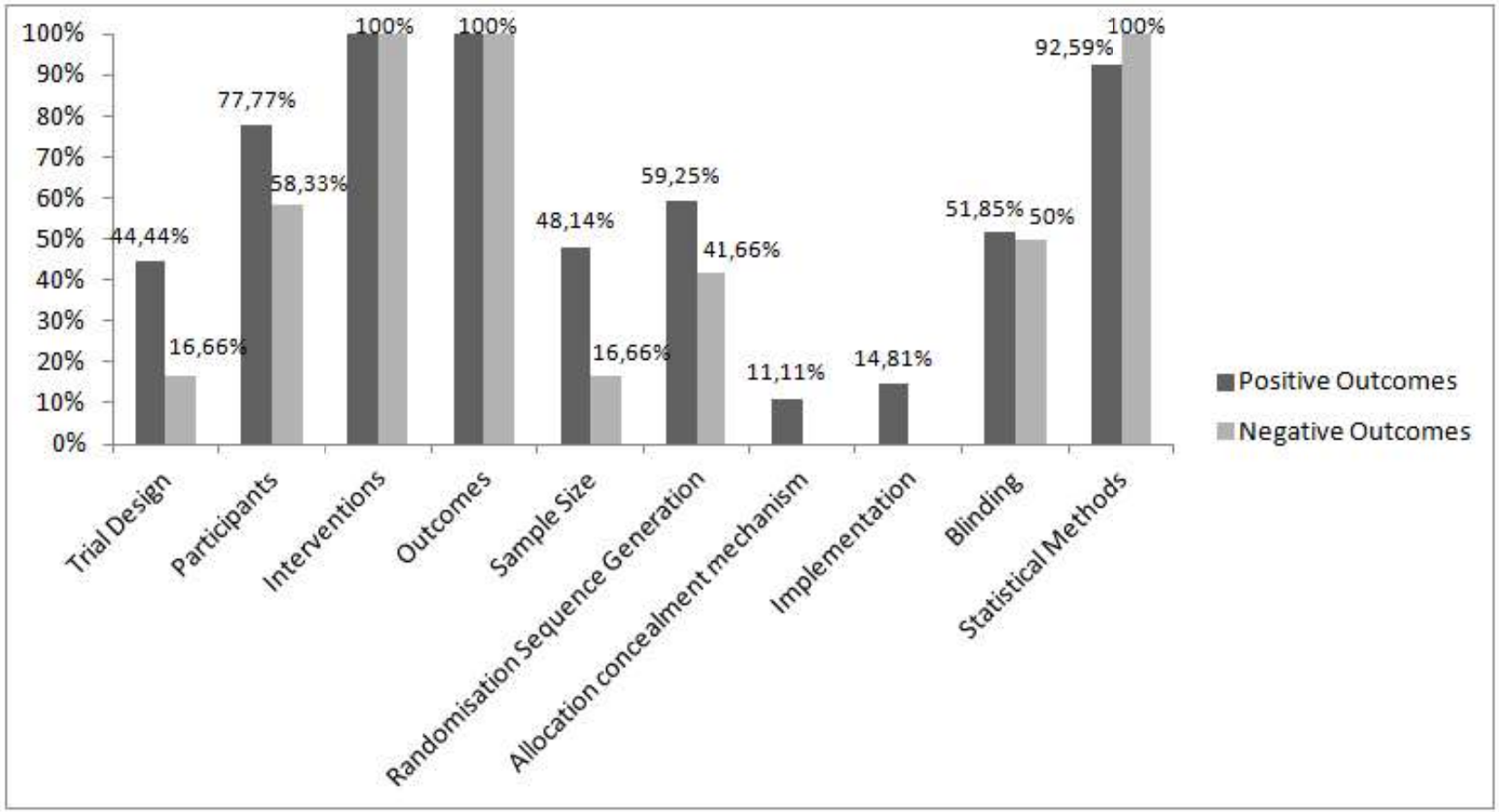

Figure 3. Methods section of CONSORT: comparison studies with positive and negative outcomes.

ANEXO I - NORMAS PARA PUBLICAÇÃO

RESPIRATORY CARE

RESPIRATORY CARE

RESPIRATORY CARE welcomes original manuscripts related to the science of respiratory care. The Journal is published in both print and electronic formats and appears online at www.rcjournal.com.
Manuscripts must be submitted electronically using Manuscript Central. Prepare your manuscript according to these instructions. For queries about the submission process, contact the editorial office at rcjournal@aarc.org.

GUIDELINES FOR AUTHORS

GENERAL GUIDELINES
- Ethics of Publication
- Duplicate Publication and Plagiarism
- Conflict of Interest
- Industry Relationships
- Registration of Clinical Studies
- Ethics of Investigation

MANUSCRIPT TYPES
- Original Research
- Review
- Editorial
- Correspondence

PREPARING THE MANUSCRIPT
- Title Page
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- Figure Legends
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- Borrowed Figures and Tables
- Acknowledgements
- Equations
- Statistical Analysis
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- Pulmonary Terms and Symbols
- Drugs and Commercial Products
- Subjects versus Patients
- Ventilator Modes
- Language Editing Services

SUBMITTING THE MANUSCRIPT

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

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.

Registration of Clinical Studies

RESPIRATORY CARE will only consider clinical trials that are registered, as appropriate, at 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 both retrospective and prospective studies.

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

A report of an original investigation. Must include: Title Page, Structured Abstract, Key Words, Introduction, Methods, Results, Discussion, Conclusions, References, and Quick Look. 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.

Review

A comprehensive review of the literature. Must include: Title Page, Outline, Narrative Abstract, Key Words, Introduction, Review of the Literature, Summary, and References. May also include Tables, Figures, Acknowledgments, and Supplementary Material for online publication only. Review articles are generally written by persons with established expertise in the subject area. Narrative reviews are acceptable, but systematic reviews are preferred. A systematic review and meta-analysis may be prepared as an original research paper.

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:

- 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

Structured Abstracts include these sections: Introduction, Methods (how the study was performed, including the number of subjects), Results (brief summary of the data), and Conclusions. Abstracts must not contain any facts or conclusions that do not also appear in the text.

Narrative Abstracts are written as a narrative paragraph and fewer than 300

words. 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, Rodriquez 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, Kuschner 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 in the text using the URL and access date. Do not include in 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 uploaded:

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 H_2O 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 H_2O. 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, O_2). 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 H_2O rather than millibars.

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, FEV_1, F_{IO_2}, FVC, ICU, P_{aO_2}, P_{aCO_2}, P_{O_2}, P_{CO_2}, PEEP, SD, S_{pO_2}. 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).

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Appendix 1. Preferred Terms and Symbols

Primary Symbols	
S	Saturation
C	content
F	Fractional concentration
T	Temperature
P	Pressure
V	Volume
Qualifying symbols are denoted by subscripted character; uppercase for values in the lungs and lowercase for values in the blood	
A	Alveolar
I	Inspired
B	Barometric
L	Lung
D	Dead space
T	Tidal
E	Expired
E	Mixed expired
A	Arterial
B	Blood
C	Capillary
V	Venous
c′	Pulmonary end-capillary
V	Mixed venous
T	Time
Pulmonary Function testing	
D/V_A	
DLCOsb	Lung diffusing capacity determined by the single-breath technique
ERV	Expiratory reserve volume
$FEF_{25-75\%}$	Forced expiratory flow over the middle half of the FVC
FEV_1	Forced expiratory volume in the first second

FEV_t	Forced expiratory volume in the first *t* seconds
FRC	Functional residual capacity
FVC	Forced vital capacity
IC	Inspiratory capacity
IRV	Inspiratory reserve volume
IVC	Inspiratory vital capacity
MVV	Maximal voluntary ventilation
PEF	Peak expiratory flow
RV	Residual volume
RV/TLC%	Residual volume expressed as percent of TLC

TGV	thoracic gas volume
TLC	Total lung capacity
V_A	Alveolar gas volume
VC	Vital capacity
Ventilation	
F	Breathing frequency
V_T	Tidal volume
V_A	Alveolar ventilation
V_D	Dead space ventilation
V_{CO_2}	Carbon dioxide production
V_{O_2}	Oxygen consumption
V/Q	ventilation-perfusion ratio
Pulmonary mechanics	
C	Compliance
E	Elastance
Gaw	Airway conductance
$P_{0.1}$	Airway occlusion pressure at 0.1 s
P_A	Alveolar pressure
Paw	Pressure in the airway
P̄aw	Mean pressure
PE_{max}	Maximal expiratory pressure
P_{es}	Esophageal pressure
PI_{max}	Maximal inspiratory pressure
PIP	Peak inspiratory pressure
P_L	Transpulmonary pressure
P_{pl}	Intrapleural pressure
Pplat	Plateau pressure
R	Resistance
Raw	Airway resistance
R_E	Expiratory resistance
R_I	Inspiratory resistance
sGaw	Specific airway conductance
WOB	Work of breathing

Blood gases	
P	Mean pressure
P_{O_2}	Partial pressure of oxygen
P_{aO_2}	Arterial partial pressure of oxygen
P_{AO_2}	Alveolar partial pressure of oxygen
P_{aCO_2}	Arterial partial pressure of carbon dioxide

P_{ACO_2}	Alveolar partial pressure of carbon dioxide
P_{ETCO_2}	End-tidal partial pressure of carbon dioxide
P_{ECO_2}	Mixed exhaled partial pressure of carbon dioxide
P_{vCO_2}	Mixed venous partial pressure of oxygen
P_{tcO_2}	tcPO2 transcutaneous partial pressure of oxygen
P_{tcCO_2}	tcPO2 transcutaneous partial pressure of carbon dioxide
$P(A\text{-}a)O_2$	Alveolar-arterial PO_2 difference
$P(a/A)O_2$	Arterial to alveolar PO_2 ratio
C_{aO_2}	Arterial oxygen content
C_{vCO_2}	Mixed venous oxygen content
$C_{c'O_2}$	Pulmonary capillary oxygen content
S_{aO_2}	Arterial oxygen saturation
S_{pO_2}	Oxygen saturation as measured by pulse oximetry
S_{vCO_2}	Mixed venous oxygen saturation
$C(a - v)O_2$	Arterial-venous oxygen content difference
pH	
Q	Blood flow
Q_T	Cardiac output
Q	Blood volume
Q_S/Q_T	Shunt fraction
R	Respiratory quotient
Ventilator Nomenclature	
APRV	Airway pressure release ventilation
AVAPS	Average volume assured pressure support
CMV	Continuous mandatory ventilation (rather than assist-control)
CPAP	Continuous positive airway pressure
EPAP	Expiratory positive airway pressure
F_{IO_2}	Fraction of inspired oxygen (expressed as a fraction, not percent)
HFJV	High frequency jet ventilation
HFOV	High frequency oscillatory ventilation
I:E	Inspiratory time to expiratory time ratio
IPAP	Inspiratory positive airway pressure
NAVA	Neurally adjusted ventilatory assist
NIV	Noninvasive ventilation (rather than NPPV)

PAV	Proportional assist ventilation
PC-CMV	Pressure-control continuous mandatory ventilation (rather than pressure assist-control)
PC-IMV	Pressure-control intermittent mandatory ventilation
PCIRV	Pressure control inverse ration ventilation
PEEP	Positive end-expiratory pressure

PRVC	Pressure regulated volume control
PSV	Pressure support ventilation
T_E	Expiratory time
T_I	Inspiratory time
VC-CMV	Volume-control continuous mandatory ventilation (preferred rather than volume assist-control)
VC-IMV	Volume-control intermittent mandatory ventilation
VDR	Volumetric diffusion respiration
VS	Volume support
Other preferred terms	
6MWD	Six-minute walk distance
6MWT	Six-minute walk test
AARC	American Association for Respiratory Care
ABG	Arterial blood gas
ALS	Amyotrophic lateral sclerosis
ARDS	Acute respiratory distress syndrome
ARF	Acute respiratory failure
ATPS	Ambient temperature and pressure saturated
BMI	Body mass index
BPAP	Bilevel positive airway pressure (rather than BiPAP)
BTPS	Body temperature and pressure saturated
CCI	Chronic critical illness
CDC	Centers for Disease and Prevention
CF	Cystic fibrosis
CI	Confidence interval
CMS	Centers for Medicare and Medicaid services
CO	Carbon monoxide
COPD	Chronic obstructive pulmonary disease
CPR	Cardiopulmonary resuscitation
CPT	Chest physical therapy
CT	Computed tomography
DNR	Do not resuscitate
DPI	Dry powder inhaler
EAdi	Electrical activity of the diaphragm
EBUS	Endobronchial ultrasound
ECLS	Extracorporeal life support
ECMO	Extracorporeal membrane oxygenation
EIB	Exercise-induced bronchospasm

FDA	US Food and Drug Administration
HFNC	High flow nasal cannula
HME	Heat and moisture exchanger
HMEF	Heat and moisture exchanging filter

HRCT	High resolution computed tomography
Hz	Hertz
IBW	Ideal body weight
IBW	Ideal body weight
ICP	Intracranial pressure
ICU	Intensive care unit
ICU	Intensive care unit
ILD	Interstitial lung disease
IQR	Interquartile range
MDI	Metered dose inhaler
MRI	Magnetic resonance imaging
NG	Nasogastric (tube)
NIH	National Institutes of Health
NO	Nitric oxide
OSA	Obstructive sleep apnea
PAP	Positive airway pressure
PEP	Positive expiratory pressure
PFT	Pulmonary function test or testing
PMV	Prolonged mechanical ventilation
PSG	Polysomnography
R	Correlation coefficient
RSBI	Rapid shallow breathing index
RT	Respiratory therapist
SBT	Spontaneous breathing trial
SD	Standard deviation
SE	Standard error
STPD	Standard temperature and pressure dry
TBLB	Transbronchial lung biopsy
TBNA	Transbronchial needle aspiration
VA	Veterans Administration
VAE	Ventilator-associated event
VAC	Ventilator-associated condition
VAP	Ventilator-associated pneumonia
VILI	Ventilator induced lung injury

Appendix 2. Preferred Ventilator Mode Nomenclature

Preferred Term	**Preferred Symbol**	**Intended Meaning**	**Similar Terms to be Avoided**

Volume Control Continuous Mandatory Ventilation	VC-CMV	Mechanical ventilation with preset tidal volume and inspiratory flow. Every breath is mandatory (ie, inspiration is patient or machine trigged and machine cycled).	Assist/Control, A/C, CMV, Volume Assist/Control, Volume Control, Volume Limited Ventilation, Volume Control Ventilation, Controlled Ventilation, Volume Targeted Ventilation
Volume Control Intermittent Mandatory Ventilation	VC-IMV	Mechanical ventilation with preset tidal volume and inspiratory flow. Spontaneous breaths (ie, inspiration is patient triggered and patient cycled) can exist between mandatory breaths.	Synchronized Intermittent Mandatory Ventilation, SIMV
Pressure Control Continuous Mandatory Ventilation	PC-CMV	Mechanical ventilation with preset inspiratory pressure and inspiratory time. Every breath is mandatory (ie, patient or machine trigged and machine cycled).	Assist/Control, A/C, CMV, Pressure Assist/Control, Pressure Control, Pressure Limited Ventilation, Pressure Control Ventilation, Pressure Targeted Ventilation

Pressure Control Intermittent Mandatory Ventilation	PC-IMV	Mechanical ventilation with preset inspiratory pressure and inspiratory time. Spontaneous breaths (ie, inspiration is patient triggered and patient cycled) can exist between mandatory breaths.	Synchronized Intermittent Mandatory Ventilation, SIMV
Continuous Spontaneous Ventilation	CSV	Any mode of mechanical ventilation where every breath is spontaneous (ie, patient triggered and patient cycled)	Spont
Mandatory Breath	None	A breath type during mechanical ventilation for which inspiration is machine triggered and/or machine cycled.	Machine breath, mechanical breath
Spontaneous Breath	None	A breath type for which inspiration is both patient-triggered and patient cycled. Applies to assisted or unassisted breathing.	N/A
Assisted Ventilation or Breath	None	Ventilation or breath for which a machine provides some or all of the work of breathing.	Patient triggered ventilation or breath

Patient Triggered Breath	None	A breath that is initiated by the patient, independent of ventilator settings for frequency.	Patient assisted breath, assisted breath
Auto-triggering	None	Unintended initiation of breath delivery by the ventilator, eg, by an external disturbance such as movement of the breathing tube or an inappropriate trigger sensitivity setting.	Auto-cycling