12-2018

DCN influencing incentive spriometry use: Summary

Children's Mercy Kansas City

Office of Evidence Based Practice (EBP) – Critically Appraised Topic: Incentive Spirometry

Specific Care Question

How can nurses influence patient's tracking incentive spirometry (IS) use?

Question Originator

Newly Licensed Nurses (NLN) Residency Program

Literature Summary

Background. Incentive spirometry (IS) is used after many thoracic, abdominal, or orthopedic surgeries to promote deep breathing, and prevent post-operative pulmonary complications (PPCs). The spirometer is designed to achieve deep breaths and provide feedback as to how well the patient meets the inhalation goal (IS, 2015). To perform IS, a patient inhales via a tube through a spirometer that measures the volume of air the patient draws in (Clinical Key, 2018). Goals for the volume of air the patient can inspire is pre-determined, usually at $\geq$ 10 ml/kg (Bergin et al., 2014). At CM, the goals of IS are: (a) tidal volume will meet or exceed 10 ml/kg, (b) bilateral breath sounds are clear and/or improved, and (c) if ordered, a chest x-ray is clear (IS, 2015). Patients and caregivers are instructed on IS use, and the patient should continue the treatment independently (IS, 2015). It is noted that children < 5 years of age or those with developmental delays may not be able to perform the maneuverer (IS, 2015).

In the adult literature, PPCs, such as atelectasis and pneumonia, are reasons that increase mortality and morbidity after major thoracic, abdominal or orthopedic surgeries (Freitas, Soares, Cardoso, & Atallah, 2007; Cassidy, Rosenkranz, McCabe, Rosen, & McAneny, 2013; Lawrence, Cornell, Smetana, & American College of, 2006). Few trials compare IS and/or other procedures that promote lung expansion post-op (such as IPPB, DBE, CPAP, BiPAP) to usual care to prevent PPCs. Freitas et al. (2007) showed no difference in atelectasis nor pneumonia in adults post coronary bypass graft (CABG) surgery between those treated with IS and those who were not. Lawrence et al. (2006) also showed no difference in PPC when IS was grouped with other lung expansion procedures compared to no treatment. Finally, Cassidy et al. (2013) showed no difference in PPC when patients had a bundle of cares including IS to decrease PPCs. Although there was no difference between groups treated with lung expansion procedures in general, or IS specifically, the trials are of very low quality (Freitas et al., 2007). All studies reported poor documentation of IS, such as number of times the device was used by the patient, as a barrier to understanding its effect. Cassidy et al. (2013) developed the I COUGH program that included standard order sets for physicians, and nursing documentation requirements to improve understanding the efficacy of IS.

It is perceived that patients are not compliant with performing IS post-operatively. NLNs are inquiring what nursing activities can they employ to increase IS use post-operatively?

Study characteristics. The search for suitable studies was completed on November 6, 2018. Brittney Hunter, RN, BSN, CPN and Andrea Raymond, BA-HCM, RRT-NPS, CPHQ reviewed the 40 titles and abstracts found in the search and identified eight articles believed to answer the question. After an in-depth review, three articles answered the question. One systematic review (Narayanan, Hamid, & Supriyanto, 2016), and two cohort studies (Eltorai et al., 2018; Martin et al., 2018) were identified. Characteristics of included studies are found in Table 1.

Narayanan et al. (2016) set out to report on the role IS therapy plays in the prevention of post-operative pulmonary outcomes. However, they were stymied by the lack of reporting on patient IS compliance. Therefore, they completed a systematic review on IS compliance to highlight the lack of information on this topic. Eltorai et al., (2018) and Martin et al. (2018) report on surveys, one a questionnaire (N = 1681 surveys returned) and the other an observational survey of post-operative patients (n = 42), respectively.

Key results. Overall, compliance to IS therapy in the post-operative period is not well studied. Lack of data is the major barrier to understanding this practice (Narayanan et al., 2016). The included articles do not directly answer the immediate question; the trials will be reported individually.

Summary of Studies

Eltorai et al., (2018). This study is an evaluation of nurses (RNs) and respiratory therapists (RRTs) view on IS adherence by patients. Email surveys were sent to list serve members of American Association of Critical Care Nurses, Academy of Medical Surgical Nurses, American Association for Respiratory Care, and American Society of Peri-Anesthesia Nurses. The number of surveys sent is unknown. The number of surveys completed was 1681. The survey asked for respondents to select reasons they believed patients did not adhere to performing IS. The top perceived factors (reported as aggregated *n*, %) were:

- Forgetting to use IS (1404, 83.5)
- Not using IS effectively (1251, 74.4)
- Not using IS frequently enough (1188, 70.7)
- Not understanding how to use IS (1077, 64.1)
- Having too much pain (994, 59.1)

Martin et al., (2018). In this study, a cross-sectional analysis was performed. A visual survey of post-operative patients' (*N* = 42) bedsides for IS device location and observation of the patient using the device, followed by the investigators performing a 2-minute structured education. After the education, the investigators asked if the patient perceived benefit of IS, and if they were more comfortable using the device. Twenty-six percent (11/42) did not initially use the device correctly as they exhaled into the device, rather than inhale, prior to education. For 24% of the patients (10/42), the device was not located within arm's reach. If the device was within arm's reach, approximately 81% performed the technique correctly, and if the patient had previously used IS about 85% performed the technique correctly. Finally if the patient perceived IS was of benefit to their post-operative recovery, about 79% performed the technique correctly.

Search Strategy and Results (see PRISMA diagram)

PubMed: ("incentive spirometry") AND ("Patient Compliance"[Mesh] OR adherence OR "educational intervention" OR "Patient Education as Topic"[Mesh] OR "Nurse-Patient Relations"[Mesh] OR "patient education" OR "nursing intervention" OR "nurse intervention"), 23 results.

CINAHL:

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#	Query	Limiters/Expanders	Last Run Via	Results
S3	S1 AND S2	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL	17
S2	(MH "Patient Education+") OR "patient education" OR (MH "Nurse-Patient Relations") OR (MH "Patient Compliance+") OR "adherence" OR (MH "Nursing Interventions") OR "educational intervention"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL	168,147
S1	"incentive spirometry"	Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Advanced Search Database - CINAHL	169

Studies Included in this Review (in Alphabetical Order)

Eltorai et al. (2018)
Martin et al. (2018)

Studies <u>Not</u> Included in this Review with Exclusion Rationale (in Alphabetical Order)

Authors (YYYY)	Reason for exclusion
Armstrong, (2017)	Narrative review on how to teach IS
Bergin et al., (2014)	Evaluates education delivered in a pre-operative teaching program, prior to the surgical admission
Jerin & Binutha, (2017)	Evaluate education delivered in a pre-operative teaching program, prior to the surgical admission
Narayanan et al. (2016)	Could not find studies that answered the question
Ong, Miller, Appleby, Allegretto, & Gawlinski, (2009)	Does not answer the question. Addresses patient's pre-operative knowledge and nurses' assessment of patient knowledge and engagement.
Pullen, (2003)	Narrative review on how to teach IS
Restropo, Wettstein, Wittnebel & Tracy, (2011)	Does not answer the question. ARC Guideline on IS

Medical Librarian Responsible for the Search Strategy

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Method Used for Appraisal and Synthesis
The Cochrane Collaborative computer program, Review Manager (Higgins & Green, 2011)[a] was used to synthesize the two included studies. GRADEpro GDT (Guideline Development Tool) is the tool used to create the Summary of Findings Tables for this analysis.

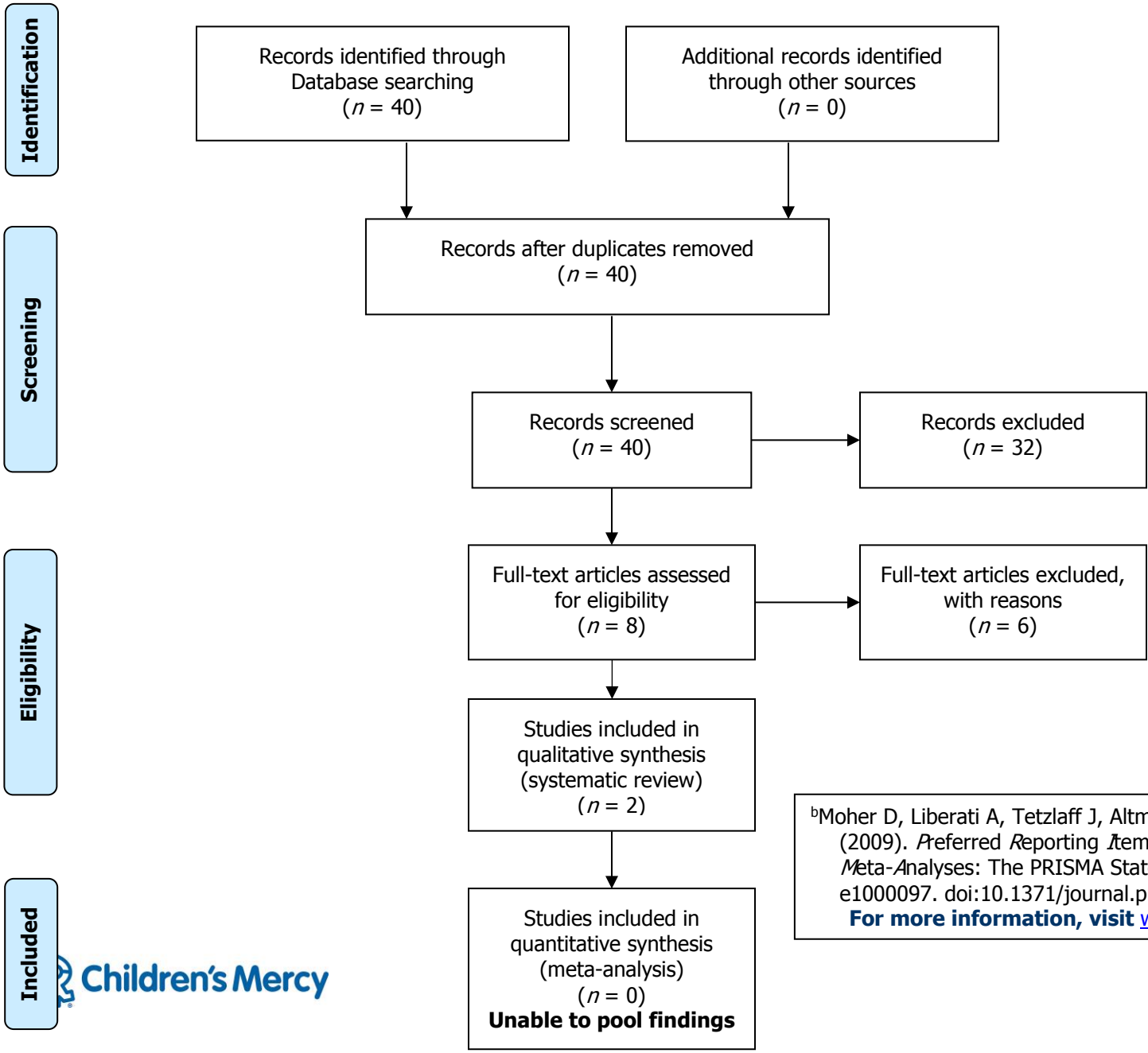
[a]Higgins, J. P. T., & Green, S. e. (2011). *Cochrane Handbook for Systematic Reviews of Interventions [updated March 2011]* (Version 5.1.0 ed.): The Cochrane Collaboration, 2011.

Acronyms Used in this Document

Acronym	Explanation
IS	Incentive spirometry
NLN	Newly Licensed Nurses
RRT	Respiratory Therapists
PPC	Post-operative pulmonary complication
RN	Nurses

Date Developed/Updated December 2018

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRIMSA)[b]



[b]Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

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Table 1
Characteristics of Studies

Eltorai et al. (2018)

Methods	Survey, cross-sectional study
Participants	USA, nurses and respiratory therapists (RRTs) from various professional organizations/societies September 2016-December 2016 • American Association of Critical Care Nurses • Academy of Medical Surgical Nurses • American Association for Respiratory Care • American Society of Peri-Anesthesia Nurses Number of surveys sent out: Unknown, • All members of the professional organization who receive email newsletters were eligible to take the survey • Members who did not receive the emailed survey were excluded • Members who did not respond to the email survey were excluded • It is unclear how many responders were nurses and how many were RRTs Number of surveys completed: *n* = 1681
Interventions	Survey was done via online newsletters and social media regarding patient application and adherence of incentive spirometer (IS) use • Newsletters were sent via email • Social media used listserv to members of professional organization/society Surveys asked "Patient IS adherence is hindered by (mark all that apply)" for the following response options - • Forgetting to use IS • Not knowing when to use IS • Not understanding how to use IS • Not receiving the IS device • Not using IS frequently enough • Not using IS effectively • Not using IS long enough • Not being able to reach the IS device • Having too much pain • Sleep interference • Providers not having enough time to work with the patient on IS use • Providers having inadequate resources to work with patient on IS use • Facility having too few staff to work with the patient on IS use • Patient cognitive status • Patient language barrier

Outcomes	• Top five factors for IS non-compliance
Notes	**Results:** Perceived factor for IS non-adherence, Number of responses, (%) • Forgetting to use IS- 1404, (83.5) • Not using IS effectively- 1251, (74.4) • Not using IS frequently enough- 1188, (70.7) • Not understanding how to use IS- 1077, (64.1) • Having too much pain 994- (59.1)

Martin et al. (2018)

Methods	Prospective, cross sectional study
Participants	**Participants:** Post-operative patients **Setting: Urban hospital** **Number enrolled:** *N* = 42 **Number completed:** *N* = 42 **Gender, males: Not reported** **Age, years/month (mean):** • Not reported **Inclusion Criteria:** • Adult patients on an orthopedic surgery service (including spine, adult, adult reconstruction (upper extremity, foot, ankle) and sports medicine **Exclusion Criteria:** • Not reported **Covariates identified:** None reported

Interventions	• Data was collected on two days from patients in various stages of recovery from their surgeries
	• Variables collected
	  ○ Location of the device, I.S. within arm's reach (1 meter)?
	  ○ Did the patient use the device?
	  ▪ Inhale on first attempt was a successful try
	  ▪ Exhale on first attempt was an unsuccessful try
	  ○ Perform 2-minute standard education and ask the following questions:
	  ▪ Have you every use IS before?
	  ▪ Did the patient think IS would be helpful?
	  ▪ After education by a physician, did they feel more comfortable using the device

Outcomes	**Primary outcome(s):** • Correct use of IS device **Secondary outcome(s):** • Location of device

	• Previous use of IS • Perceived benefit of IS
Results	**Primary outcome(s):** • Correct use of IS device **-** 26.2% did not use the device correctly (11/42) **Secondary outcome(s):** • Location of device- 23.8% the device was located outside of 1 meter (10/42) • Previous use of IS- 61.9% used IS for a previous surgery (26/42) • Perceived benefit of IS- 66.7% perceived benefit of IS (28/42) Relationships (the Bonferrioni-adjusted *p* value was used to address the likelihood of a Type 1 error): • If the device was within reach (*n* = 32) 81.3% performed the technique correctly, *p* < .01 • If the patient had previously used an IS device, (*n* = 26) 84.6 performed the technique correctly, *p* < .01 • If the patient perceived benefit of IS, (n = 28) 78.6 performed the technique correctly, *p* = .022

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