

Online Supplement

Original Research

Inhalation Innovation: Optimizing COPD Care Through Clinical Pharmacist Integration in a Rehabilitation Hospital's Multidisciplinary Team – A Quality Improvement Study

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Appendix 1

Part 1: Admission of a patient with COPD to the HfR (Patient contact 1)

Evaluation current inhalation technique, medication adherence (if necessary through contact with the family pharmacist), the mMRC (Modified Medical Research Council) Dyspnea Scale, the COPD Assessment Test and the Beliefs About Medicines Questionnaire (BMQ).
→ Discussion of smoking behaviour
Evaluation of influenza, pneumococcal and COVID19-vaccination status
Measure of airflow (in case no spirometry is available)

Part 2: First validation of inhalation therapy to a patient with COPD (no patient contact)

Pharmacists' evaluation of pharmacotherapy (GOLD guidelines for pharmacotherapy are followed)
Pharmacists' evaluation of inhalation device is appropriate
→ Discussion with prescribing physician if changes are necessary
→ Discussion of points of attention with nursing staff

Part 3: First administration of optimized inhalation therapy (Patient contact 2)

Structured patient education about
COPD pathophysiology (if required)
COPD medication
 dosing instructions
 inhalation technique (including physical demonstration with demo inhaler unit and in-check dial)
 importance of adherence to maintenance therapy and current problems with adherence
 possible side effects

Short intervention on smoking cessation and referral to smoking cessation counselling (if required)
Provision of a personalized patient information leaflets or medication information sources about COPD or inhalation therapy

Part 4: Follow-up counselling of inhalation medication use for patients with COPD (Patient contact 3)

Evaluation current inhalation technique, medication adherence (if necessary through contact with the family pharmacist), the mMRC (Modified Medical Research Council) Dyspnea Scale, the COPD Assessment Test and the Beliefs About Medicines Questionnaire (BMQ).

Part 5: Second validation of inhalation therapy to a patient with COPD (no patient contact)

Pharmacists' evaluation of inhalation device is appropriate
→ Discussion with prescribing physician if changes are necessary
→ Discussion of points of attention with nursing staff

Part 6: Second validation of inhalation therapy to a patient with COPD (Patient contact 4)

Structured patient education about (if required)
COPD medication
 inhalation technique (including physical demonstration with demo inhaler unit)
 adherence to maintenance therapy
Short intervention on smoking cessation and referral to smoking cessation counselling (if required)

Part 7: Discharge counselling by clinical pharmacist (Patient contact 5)

Evaluation current inhalation technique, medication adherence (if necessary through contact with the family pharmacist), the mMRC (Modified Medical Research Council) Dyspnea Scale, the COPD Assessment Test and the Beliefs About Medicines Questionnaire (BMQ).

Structured patient education about (if required)
COPD pathophysiology
COPD medication
 inhalation technique (including physical demonstration with demo inhaler unit)
 adherence to maintenance therapy
Self-management (e.g. lifestyle advice, exacerbation recognition, etc)
Short intervention on smoking cessation and referral to smoking cessation counselling (if required)
Provision of information about the need for vaccination (influenza, pneumococcal, COVID19)
Provision of a patient information leaflet about COPD in the home setting
Provision of a discharge letter about inhalation medication to general practitioner and community pharmacist

Part 8: Follow-up counselling of inhalation medication use for patients with COPD after discharge (Patient contact 6)

Evaluation current inhalation technique, medication adherence (if necessary through contact with the family pharmacist), the mMRC (Modified Medical Research Council) Dyspnea Scale, the COPD Assessment Test and the Beliefs About Medicines Questionnaire (BMQ).
Evaluation of smoking behaviour
Evaluation of influenza, pneumococcal and COVID19-vaccination status

Appendix 2 ¹⁵

PRESSURIZED METERED DOSE INHALER	Score
1. Remove cap*.
2. Shake inhaler*.
3. Hold inhaler upright with mouthpiece down.
4. Breathe out.
5. Put mouthpiece between lips and seal lips tightly around it.
6. Take a slow deep breath at the same time as pressing the canister down.
7. Hold breath for 10 sec.
8. If corticosteroids: rinse mouth with water.

Total score = / 8

(If step 1 or 2 are not executed, the patients receives a total score of 0.

PRESSURIZED METERED DOSE INHALER + LARGE-VOLUME SPACER:	Score
1. Remove cap*.
2. Shake inhaler*.
3. Hold inhaler upright with mouthpiece down and place mouthpiece into the spacer.
4. Breathe out.
5. Put spacer between lips and seal lips tightly around it.
6. Press the canister down.
7. Breathe in slowly within 5 sec after pressing down the canister ⁽³³⁾
8. Hold breath for 10 sec.
9. Breathe 5 times in and out in the spacer.
10. If corticosteroids: rinse mouth with water.

Total score = / 10

(If step 1 or 2 are not executed, the patients receives a total score of 0.

DRY POWDER INHALER	Score
1. Load dry powder inhaler correctly (depending on the type) *.
2. Breathe out.
3. Put mouthpiece between lips and seal lips tightly around it.
4. Inhale forcefully and deeply*.
5. Remove dry powder inhaler from the mouth.
6. Hold breath for 10 sec.
7. If corticosteroids: rinse mouth with water.

Total score = / 7

(If step 1 or 4 are not executed, the patients receives a total score of 0.

Appendix 3

Interview guide for health care provider

For each part of the advanced pharmaceutical care program as provided in Appendix 1 of the protocol, the following aspects will be discussed with the involved health care providers.

- To what extent do you consider this part of the advanced pharmaceutical care program feasible in your daily routine?
- How much extra effort did this part of the advanced pharmaceutical care program take in comparison to the current protocols?
- To what extent do you feel this part of the advanced pharmaceutical care program is an additional value to the care for patients with COPD?
- Which aspects of this part of the advanced pharmaceutical care program do you consider redundant and why?
- Would you need additional training to provide this part of the advanced pharmaceutical care program in a routine matter? If yes: in which way would you prefer this training?

Appendix 4

Theme	Subtheme	Participant	Quote
Multidisciplinary teamwork for patients with COPD		Head nurse	<i>Last year with corona that [the education] wasn't even possible. It could have been once every 18 days, once every 20 days, or even once every 12 days. It really depended.</i>
	Addition of a clinical pharmacist to the multidisciplinary team	Head of the hospital pharmacy	<i>I think, indeed, that the full protocol will only be achievable if there is sort of a collaboration with the pharmacy. ... It could be a solution to expand our team, so we could execute the full protocol as described.</i>
		Reference nurse	<i>The preparatory work, that was performed by the pharmacist in the protocol before the first visit, such as searching information about inhalation medication, vaccination status, weight, smoking status, etc. We don't need to do that since we already have knowledge on the patient.</i>
		Reference nurse	<i>Indeed. We know how to prioritize for each patient. We really know the patient and what he/she lacks or needs concerning education.</i>
		Physician	<i>The community pharmacists get paid to do an education interview on inhalation medication when a physician prescribes one. Why have we only included nurses in our current practice and not the pharmacists? [rhetoric]</i>
	Defining the role of the clinical pharmacist	Reference nurse	<i>I thought that the evaluation of the inhalation device's appropriateness [by the pharmacist] was really good. When the patient used three devices and a switch to one or two could be made, the patient was very happy. This was very well perceived by the patients.</i>
Necessary adjustments to the pharmaceutical protocol for implementation in daily practice.	Individualization of the protocol	ICT coordinator	<i>An evaluation of all the patients with COPD with inhalation therapy should happen for every patient. Based on the results [of the evaluation], we need to establish some inclusion and exclusion criteria to determine if the</i>

			<i>patient will follow the entire education process or maybe requires just one consult from the pharmacy.</i>
	Expanding patient education	Reference nurse	<i>We should let the patient know in advance when we will visit. This way we can make sure that they [the family] are present in their room. We can even check if family will visit to include them in the process.</i>
		Head of paramedics department	<i>And I think you need to see the bigger picture. I think that every patient on our ward with a respiratory comorbidity can have a need for education concerning their inhaler use.</i>
	Supplementary training	Nurse	<i>Everything we do now is actually self-taught. We have never been trained for this particular part. It was all done based on our own checklists and self-study. And yes, I find that a bit unfortunate.</i>
Labor intensity of the pharmaceutical care protocol		Hospital pharmacist	<i>I had expected a lot worse. I thought it would have taken a lot longer.</i>
		ICT coordinator	<i>It can be implemented in the EHR. You can put everything in the EHR. It is just a matter of in what way, what you need,... We first need to look what is going to be the flow and define the content. We need to have a finished protocol and then we can look further into it.</i>
Follow-up after discharge		Head nurse	<i>I also think the ambulatory consultations could [help to] maintain the knowledge of the inhalation medication. Patients come back every so much time, for a consultation. If it [the educational training] would be repeated there, that could make a difference.</i>