

AN EXPLORATION OF THE CLINICAL APPROPRIATENESS OF NURSE PRESCRIBING: A CASE-STUDY

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Dutch summary

Titel Een exploratie naar de klinische juistheid van voorschrijven van medicatie door verpleegkundigen: een case-study.

Inleiding In Nederland geldt sinds januari 2012 een tijdelijke aanvulling op de wet Beroepen in de Individuele Gezondheidszorg, wat verpleegkundig specialisten toestaat medicatie voor te schrijven. Er is echter nog weinig bewijs over de kwaliteit en veiligheid van voorschrijven door verpleegkundigen. Het beoordelen van de klinische juistheid kan een eerste stap zijn in de evaluatie hiervan.

Doel en onderzoeksvraag Het doel van de studie is het exploreren van voorschrijven door verpleegkundig specialisten, door de onderzoeksvraag: wat is de klinische juistheid van het voorschrijven van medicatie door verpleegkundig specialisten in de klinische praktijk van een academisch ziekenhuis? Hierbij kunnen aanbevelingen worden gedaan voor verder onderzoek naar voorschrijven door verpleegkundigen in de klinische praktijk.

Methode In deze mixed-methods case-study zijn elf case-reports opgesteld van cases waarin werd voorgeschreven door verpleegkundig specialisten. Deze zijn gebruikt door een onafhankelijke arts om de klinische juistheid van het voorschrijven te beoordelen, middels de aangepaste Medication Appropriateness Index. Van de scores van verschillende items zijn beschrijvende statistieken weergegeven. Uitleg op de scores van de items is kwalitatief weergegeven. Waar mogelijk is naar patronen gezocht.

Resultaten Alle cases bevatten een indicatie voor de medicatie, geen significante interacties tussen medicaties en geen onnodige duplicatie. In tien cases was de medicatie effectief voor de aandoening, de dosis was correct in zeven cases, in negen cases waren er geen significante interacties tussen medicatie en aandoening en de duur van de behandeling was acceptabel in zes cases. Slechts in twee cases waren de gegeven aanwijzingen correct en in één case praktisch.

Conclusie In het merendeel van de cases was het voorschrijven van medicatie door verpleegkundig specialisten juist. De gegeven aanwijzingen bij het voorschrijven waren in het merendeel van de cases niet correct en praktisch.

Aanbevelingen Meer onderzoek is nodig met tenminste twee beoordelaars en multi-level analyses, om deze resultaten te kunnen onderschrijven.

Trefwoorden Nurse prescribing, medication appropriateness index

English abstract

Title An exploration of the clinical appropriateness of nurse prescribing: a case-study.

Background In the Netherlands, a temporary amendment to the Individual Healthcare Professions Act which applies from January 2012, has allowed nurse specialists to prescribe medications. However, there is insufficient evidence on the quality and safety of nurse prescribing. This can be evaluated, firstly by assessing the clinical appropriateness.

Aim and research question The aim of the study is to explore clinical appropriateness of nurse prescribing, by the research question: What is the clinical appropriateness of nurse prescribing of medications by nurse specialists in the university hospital setting? Hereby recommendations can be made regarding further research on nurse prescribing in the clinical setting.

Method In this mixed-methods case-study, eleven case-reports were composed of cases where nurse specialists did prescribe medication. These were used by an independent physician to assess the clinical appropriateness of nurse prescribing, by using the adapted Medication Appropriateness Index. Descriptive statistics are presented of the scores on different items of this index. Explanations of these scores are presented qualitatively. Whenever possible, patterns in the results were sought.

Results All cases presented an indication for the medication, there were no clinically significant medication interactions and there was no unnecessary duplication apparent. In ten cases, the medication was effective for the condition, the dosage prescribed was correct in seven cases, there were no clinically significant medication-disease interactions in nine cases and in six cases the duration of the therapy was acceptable. However, only in two cases the directions given were correct and in one case practical.

Conclusion The prescribing of medications by nurse specialists in the clinical setting can be considered appropriate in most cases. Inappropriate ratings are given to the topics of correct directions given and practicality of given directions.

Recommendations More research is needed with at least two raters and multi-level analysis, to underpin these findings.

Key words Nurse prescribing, medication appropriateness index

Background

The number of countries in which nurses can prescribe medication has grown substantially over the past few decades and will grow further¹. In Australia, Canada, Ireland, the Netherlands, New Zealand, Spain, Sweden, the United Kingdom and the United States of America a change in the law or new legislation was made to enable nurses to prescribe medication². Nurse prescribing is introduced in these countries to improve quality of care, solve the workforce shortage within the health care service, make better use of nurses' skills thereby increasing autonomy and job satisfaction and offer patients better access to medications, especially patients living in remote geographical areas¹⁻⁴. In Ireland nurse prescribing was already evaluated, but risk of inappropriate prescribing was detected⁵. Medications can have undesirable aspects like being unnecessary, ineffective, impractical, harmful or costly, which can lead to morbidity, hospitalization and costs⁶. Further evaluation of nurse prescribing is therefore needed.

Previously, nurses did not have the right to prescribe medication independently in the Netherlands. However, in the clinical setting nurses did prescribe medication. Therefore, it was necessary to set up legislation, so that boundaries are set and the government has more influence on the safety of nurse prescribing⁷. In the Netherlands, an amendment to the Individual Healthcare Professions act, section 36a, which applies from January 1st 2012, has allowed nurse specialists for a period of five years to prescribe medications which are only available by prescription⁸. A nurse specialist is a nurse who completed a master in advanced nursing practice. Most nurse specialists are working in a clinical setting⁹. Because this amendment to the law is experimental for a period of five years, an evaluation of safety of practices is desirable. For this evaluation, processes in which nurses prescribe medications and the considerations they keep in mind in doing so are crucial.

One quality indicator to assess the safety of nurse prescribing is the clinical appropriateness of the prescribed medications. Different definitions of appropriateness are found in the literature. Latter et al. (2007) defined clinical appropriateness as both pharmacological appropriateness and patients' evaluations of the appropriateness of the prescribing of medications¹⁰. This study will keep this definition as a focus, because these two aspects of appropriateness can be assessed by using the Medication Appropriateness Index (MAI), because it both assesses the effectiveness of the medication and the dosage, as well as the directions given of the prescribed medication⁶. This tool is already used in Ireland and the United Kingdom to assess safety of nurse prescribing^{5:10}, and was shown a reliable and valid tool in different studies¹¹⁻¹³. A modified version of the MAI will be used in this study, which is also shown valid and reliable¹⁰.

Problem statement

Insufficient evidence on the quality of nurse prescribing in the Netherlands is available, since nurse specialists are only recently allowed to prescribe medications. The safety and effectiveness of nurse prescribing is therefore unclear and has to be evaluated, firstly by assessing the clinical appropriateness of nurse prescribing.

Aim

The primary aim of this study was to explore the clinical appropriateness of nurse prescribing of medications by nurse specialists in the clinical setting. With these understandings more knowledge is gained in the practice of nurse prescribing of medications, which can be the foundation of recommendations regarding further research.

Research question

The research question is: What is the clinical appropriateness of nurse prescribing of medications by nurse specialists in the university hospital setting?

Methods

Embedding

This study is part of a larger study, conducted by the Netherlands institute for health services research (NIVEL). The aim of the NIVEL study is to explore the considerations made by nurse specialists in prescribing medications, the way in which the nurse specialists consult physicians and the clinical appropriateness of the prescribed medications.

Research design

The design of this study was a case-study. This design was chosen so that a deeper understanding of the different cases could be sought¹⁴. The case-study had a mixed-methods design because of the quantitative analysis of the modified MAI and the qualitative description of the case-reports. Consults in which nurse specialists prescribed medications were observed, patient records were studied and interviews with nurse specialists were held to gain the information needed to assess the clinical appropriateness of nurse prescribing by using the modified MAI (figure 1).

[Insert figure 1 here.]

Setting

The study was conducted in two university hospitals in the Netherlands because of the exploratory nature of this study.

Population

The target population consisted of nurse specialists in the Netherlands who completed the master program “Master of Advanced Nursing Practice”. The nurse specialists in the target population were working in different hospitals in the Netherlands. Of this target population, a convenience sample was taken.

Overall, 13 nurse specialists of one university hospital were approached and assessed for eligibility. In order to be eligible to participate in this study, the nurse specialists had to be registered in the register of nurse specialists in the Netherlands. The process of assessing eligibility of nurse specialists is clarified in figure 2. One nurse specialist did not prescribe medication during the patient consults observed. Because the amount of prescriptions per month appeared to be low and the nurse specialist stated that it was not known in advance if she would prescribe medications, this nurse specialist was excluded. A third nurse specialist employed in another university hospital was assessed for eligibility, because there were no remaining eligible nurse specialists in the first hospital of inclusion.

[Insert figure 2]

Nurse specialists were recruited by sending an information letter by e-mail. When the nurse specialist was willing to participate, more information about the study was given by the researcher.

Completeness was not the aim of this study, because of the initiating, exploratory nature. Therefore, a minimum of nine consults of prescribing of medications by nurse specialists were observed. This small amount was chosen so the exploration of the cases could be in-depth, yet there was variation in cases¹⁴.

Before the consult between the nurse specialist and the patient started, information about the study was given to the patient by the researcher. Then, informed consent was asked. Subjects could withdraw their informed consent and leave the study at any time and for any reason without any consequences. Whenever a subject was withdrawn, another consult of the nurse specialist was observed after gaining informed consent of the patient.

Study procedures

Medication Appropriateness Index

The original MAI developed by Hanlon et al. (1992) consists of ten items; indication, effectiveness, dosage, directions, practicality, drug-drug interaction, drug-disease interaction, unnecessary duplication, duration and expensiveness. Each item of the MAI is rated on appropriateness on a three-point Likert scale⁶. The MAI was shown a valid, reliable tool (ICC 0.74) to assess appropriateness of prescribing^{11;12}.

In the present study, the item of expensiveness was held out, because the independent physician was not familiar with different medications used in the different specialties. Also, nurse specialists were not able to choose between different types/brands of medications. This item was held out of the MAI in earlier research in which validation was determined⁵.

A modified version of the MAI (appendix A) was defined in an earlier study and has been shown to be a valid and feasible tool to evaluate prescribing by nurses by using transcripts of prescribing consults, therefore this modified version was used in this study¹⁰. In this modified MAI used in this study, every item was represented as a question. The rater could answer with a rating referring to whether the prescribing was appropriate or inappropriate instead of the three-point Likert scale used in the original MAI, because the option 'marginally appropriate' was considered ambiguous¹⁰. Also, inter-rater agreement was best when the 'marginally appropriate' ratings were considered similar to 'appropriate' ratings¹⁵. The rater could also choose between 'don't know' and 'not applicable'. Per item, there was a space for comments from the rater.

For each item, a list of operational definitions was supplied to the rater, which also provided examples of appropriate and inappropriate ratings.

To be able to use the MAI, the rater should be familiar with diagnoses of patients treated by the nurse specialists and medication used by these patients. Also, for every patient a problem list, medication history, physician notes and laboratory and test results are needed, depending on the medication prescribed⁶. This information was collected with observations of patient consults, extraction of patient records and interviews with nurse specialists prescribing.

Observations

Observations were performed of consults of nurse specialists with patients in which medications were prescribed. The observations were performed guided by a topic-list based on the modified MAI (Appendix B). Items of the modified MAI which can only be assessed by observing the nurse specialists are the directions they gave to patients when medications were prescribed, and the way in which these directions were practical. Also observations were performed on the actions nurse specialists performed during the consults, for example searching for medication history in the (electronic) patient records.

Extraction of patient records

Additional information was extracted out of the record of the patient who was prescribed medications, to fill-up the case-report. A topic-list which was also used in the observations was guiding in extracting the information. Also, demographic data of the patients was extracted, in which the focus was on gender, age, diagnosis, comorbidity, medication history and prescribed medications.

Interviews

After the data was collected by observing the consults and extracting patient records, a semi-structured interview between the researcher and the nurse specialist was held, in which information left to complete the case-report was asked. The modified MAI was guiding in this process, and the topic-list used by the observations was used. The interviews were audio-taped and transcribed verbatim.

Writing of case-report

A case-report was written which described the total case of nurse prescribing of medications, consisting of information gathered by the previous mentioned observations, extraction of patient records and interviews. An example of a case-report is added in appendix C.

Analysis of modified MAI

One independent physician was recruited to assess the clinical appropriateness of the prescribing of medications by using the case-reports and the modified MAI. The physician who rated the prescriptions had to be familiar with the specialization of the nurse specialist and had to be independent of the nurse specialist (not the supervisor).

For this position, a physician specialized in general medicine was chosen, because a general practitioner has knowledge about a broad range of diseases.

Analyses

Data was analyzed using SPSS version 20.0. Frequency tables were made for every item of the MAI. For every item, total frequency was analyzed, as well as differences in frequency between nurse specialists. With the analysis of these scores, patterns in appropriateness of the different items were sought.

A qualitative explanation was given of the scores on the different items of the MAI and the comments given by the independent physician. This data was analyzed by searching for patterns and the meaning of these patterns. Together with data of the NIVEL study, naturalistic generalizations will be made from the case, so it can be transported to other cases¹⁴.

Ethical considerations

Data was handled confidentially and anonymously, in accordance with the Dutch Personal Data Protection Act. In each case-report, a subject identification code was presented. With this code, the data could be traced to the individual nurse specialist and patient. The key to the code was safeguarded by the researchers of the NIVEL. This study was not WMO-compliant. Codes and data were destroyed whenever the stage of the research allowed so, according to the NIVEL study. The study protocol was reviewed by the Medical Ethical Review Board of the VU medical center.

Results

Participants

Two of the three nurse specialists included, working in different university hospitals, had hematology as their specialization, but the range of patients they prescribed for differed. The other nurse specialist was working in the nephrology department. The nurse specialists were graduated three to seven years ago. The range of medications which they can prescribe differed as their focus was different, the precise range can be found in table 1.

[Insert table 1]

Of the three nurse specialists included, patient consults were observed. For nurse specialist 1 and 3, three patient consults were analyzed, for nurse specialist 4, five consults were analyzed. The age of patients who were prescribed medications ranged from 18 to 69. Patients had a range of 2 to 17 co-medications. The type of medications prescribed in the consults and the diagnoses patients had are mentioned in table 2.

[Insert table 2]

Items of the MAI

All results are presented in table 3. In table 4, results are presented per nurse specialist. The rater also gave comments when assessing the clinical appropriateness by using the MAI.

[Insert table 3 and 4]

Indication for the medication

In every case where medication was prescribed, the medication was rated 'indicated'.

Medication effective for the condition

In ten of all cases, the rater assigned the judgment 'effective' on the question whether or not the medication was effective for the condition. Only in one case of nurse specialist 1, the rater could not assess the effectiveness of the medication for the condition. The comments of the rater explicated that in this case the nurse specialist did not question the patient whether he or she still had complaints, to determine if the drug still would be effective.

Correct dosage

The rater indicated that the dosage was correct in seven out of eleven cases, in the other cases the rater indicated that he could not determine if the dosage was correct or not. In both

nurse specialist 2 and 3, most cases were assessed as having the correct dosage, while in only one of three cases of nurse specialist 1 the correct dosage was prescribed. When the dosage was determined as being incorrect, the rater indicated that it was unclear what the dosage was.

Correct directions

In only two out of eleven cases, the directions given were correct according to the rater. Both cases were cases of nurse specialist 3. The comments of the rater revealed that the rater rated the directions incorrect in six cases because the directions were incomplete in three cases, and in the other cases the patient received no actual prescription. In three other cases he did not know if the directions given were correct.

Practicality directions

The directions given were rated impractical in eight out of eleven cases. These judgments were equally distributed over the nurse specialists.

Clinically significant medication interactions

The rater indicated that in none of the cases the prescribed medication had significant interactions with other used medications.

Clinically significant medication-disease interactions

In two out of eleven cases, there were significant medication-disease interactions, according to the rater. Comments of the rater revealed that these were cases in which the nurse specialist did not mention that the patient could get a hypersensitive response to the medications, or did not question why the patient stopped a similar medicine.

Unnecessary duplication

The rater did not indicate cases where unnecessary duplication appeared. In nine cases there was no apparent unnecessary duplication, in two cases the rater indicated that he did not know if there was unnecessary duplication.

Duration of the therapy

The duration of the therapy was not mentioned in three cases of nurse specialist 3. In six cases the duration of the therapy was assessed as acceptable. In one case of nurse specialist 1 and one case of nurse specialist 3 the rater could not determine if the duration of the therapy was acceptable.

Discussion

This study indicates that in all cases where nurse specialists did prescribe medication, there was an indication for the medication, there were no clinically significant medication interactions and there was no unnecessary duplication apparent. In ten cases where nurse specialists did prescribe medication, the medication was effective for the condition, in seven cases the dosage prescribed was correct, there were no clinically significant medication-disease interactions in nine cases and the duration of the therapy was acceptable in six cases. However, only in two cases the directions given were correct and in one case practical.

The MAI as an instrument is usable for assessing the clinical appropriateness of prescribing of medications, but the rater has to be trained in using it, so validity of the results can be guaranteed. A second rater is preferable, to test the inter-rater agreement, thereby contributing to the validity. Also, the case-reports have to be complete, so no incorrect judgments will be given to the items of the MAI.

In the study of Bregnhøj et al. (2007), where the appropriateness of prescribing of general practitioners was evaluated, most inappropriate ratings were given to the topics of indication and duration of the therapy¹⁶. This is contradictory to the results of our study, where these issues scored appropriate in six to eleven of the cases. Differences between these results can be due to actual prescribing differences between the practice of the nurse specialist and the general practitioner, or due to the small sample size of this study. The differences in the results can also be due to the differences between the patients seen by general practitioners, compared to nurse specialists.

In the study of Latter et al. (2007), where nurse prescribing of medications was evaluated, most inappropriate ratings were on the topics of correct directions, practicality of directions and duration of the therapy¹⁰. In our study the topics of correct directions and practicality of directions did also score appropriate in few of the cases, therefore more training for nurse specialists may be needed on the aspect of directions given when prescribing medications.

There are a few limitations of this study. First, generalizability was not the aim of this study, and with the small sample including only nurse specialists of academic hospitals the generalizability of the results is limited to this subpopulation. Due to the small sample size, no firm conclusions can be made because of the weak statistical power of the results.

Selection bias could have occurred because nurse specialists voluntarily could participate to this study, thereby selecting themselves when they found that their prescribing practice was

of good quality. Prescribing inappropriateness could be underestimated by this selection bias.

Also, selection bias could have occurred because two of the three included nurse specialists were working in the same specialism. However, the category of patients they prescribed medication for was different. Hereby, enough differentiation took place to include both nurse specialists of the hematology specialism.

To make statements about whether or not nurse prescribing is clinical appropriate, the assessment of clinical appropriateness has to be correct and unadulterated. However, only one rater rated the case-reports, hereby inter-rater agreement could not be determined. The independent physician was provided with a clear explanation of the MAI as well as instructions on how to use it. Also, an example on how to complete the MAI was provided, but the independent physician was not trained in using the MAI as an instrument.

The independent physician was a general practitioner, not used to the cases of patients whose consultations were observed. Thereby, it was difficult to assess the appropriateness of prescribing in these cases.

An important limitation of this study is that in some cases, not every assessment of the nurse specialist during a consultation or thereafter, is visible and verbalized for the researcher. Hereby, gaps in the case-reports can occur, and an incorrect judgment can be assigned to different items of the MAI. As a result, the validity of the results of this study is under discussion. Also, in some cases the medication was not initiated, but the dosage was adjusted. The patient could already be informed about the directions of importance in the medication. When the nurse specialist does not mention the directions during the consultation in which the medication is adjusted, this item will get the incorrect judgment of 'incorrect' or 'don't know'.

Last, the method of analyzing the results of the MAI. The MAI which is used in this study is derived from the MAI described by Latter et al. (2007). For this adjusted MAI, there is no method for analyzing the summated scores described. Hereby, the scores cannot be compared with other studies which assess the appropriateness of nurse prescribing of medications by summated scores.

Conclusion

The prescribing of medications by nurse specialists in the university hospital setting can be considered appropriate in most cases. Inappropriate ratings are given to the topics of correct directions given and practicality of given directions. Considering the small sample size and the limitations mentioned in the discussion, the results can only be seen as *indications* of clinical appropriateness in the hospital setting.

Recommendations

More research is needed to underpin the findings that nurse prescribing of medications is appropriate in most cases. Studies using at least two raters are recommended. Also, multilevel analysis is expedient, on the level of patients, nurse specialists, specialisms and hospitals. When our findings can be endorsed by further research, recommendations can be made about future training of nurse specialists and it can help evaluate the process of nurse prescribing in the Netherlands.

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Tables and figures



Figure 1 Activities of the study

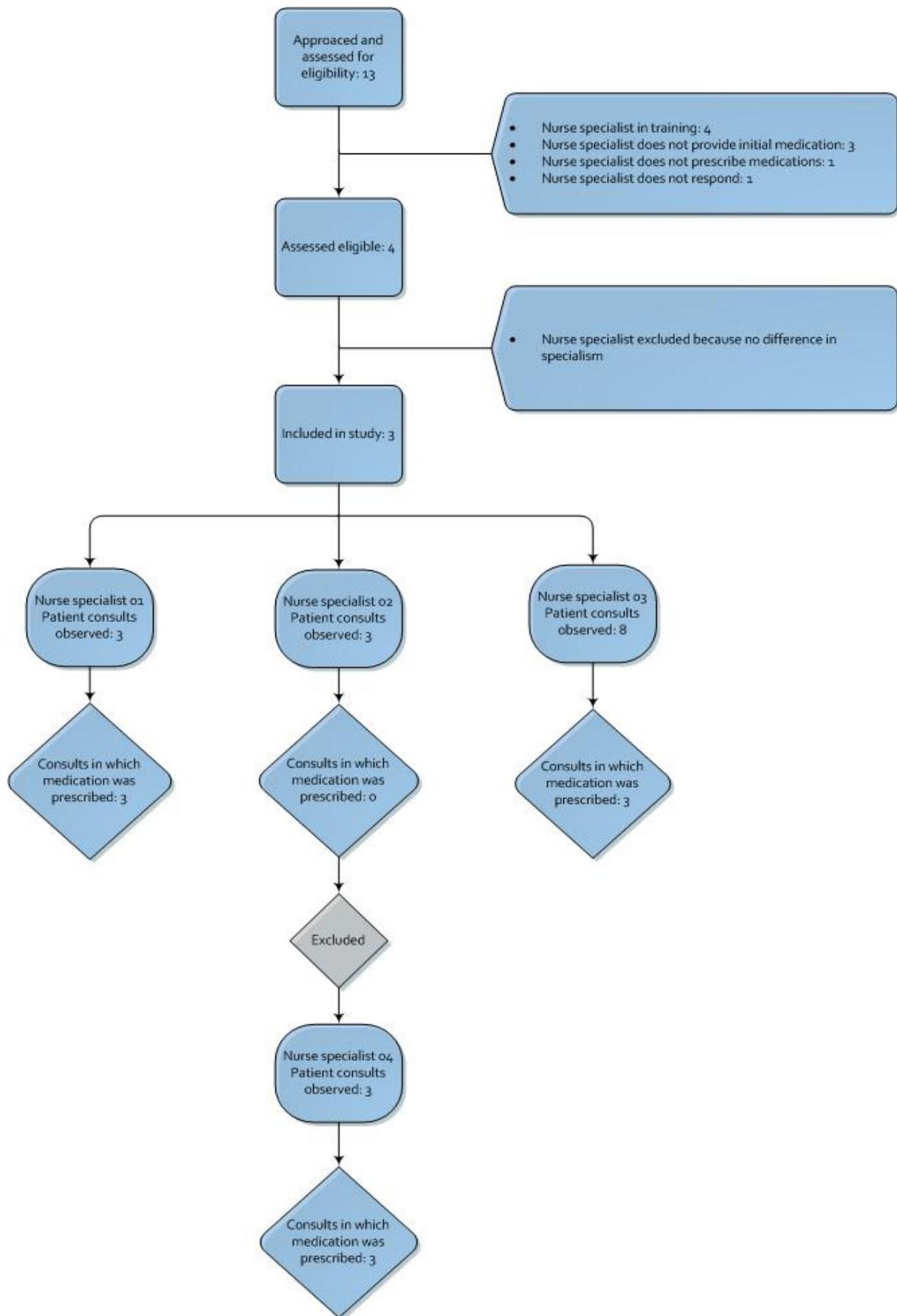


Figure 2 Flow diagram

Table 1 Demographical data nurse specialists

Participants	Sexe	Specialization	Year of graduation	Range of medication	Number of prescriptions per day
Nurse Specialist 01 (NS01)	Male	Haematology, within three months after stem cell transplantation	2010	Anti-emetics, corticosteroid creams. Repeated prescriptions for immunosuppressive medications and antibiotics	+/- 8-10
Nurse specialist 03 (NS03)	Female	Nefrology, patients prior to dialysis or kidney transplantation	2008	Medications in renal anemia, statins, anti-hypertensive medications, tolbutamide, medications in hyperkalemia, medications in metabolic acidosis, medications in proteinuria, hypercalcaemia, hyperuricaemia, secondary hyperparathyroidia.	Not mentioned
Nurse specialist 04 (NS04)	Female	Haematology, patients with graft versus host disease	Not mentioned	Immunosuppressive medications, hormonal suppletion, anti-bacterial medication, anti-viral medication, antimycotica, medication in diabetes, medication for the skin	In about half of the patients seen on a consult, medication is prescribed

Table 2 Demographical data patients included

Participants	Year of birth	Sex	Diagnosis	Number of (co)-medications	Type of medication prescribed/rated
<i>NS01</i>					
Patient 01 (NS01P01)	1952	Female	Acute myeloid leukemia (2012), allogeneic stem cell transplantation (02-2013)	7	Amphotericin B
Patient 02 (NS01P02)	1963	Male	Acute myeloid leukemia (08-2012), myeloablative unrelated stem cell transplantation (01-2013)	5	Triamcinolonacetonide salve and cetomacrogol/vaseline 20% cream
Patient 03 (NS01P03)	1972	Male	Non Hodgkin lymphoma (12-2006), allogeneic stem cell transplantation (2009), multiple infections, chronic pain after radiation	10	Temazepam
<i>NS03</i>					
Patient 01 (NS03P01)	1957	Female	Diabetic nephropathy (2012), chronic renal failure, myocardial infarction (2012)	17	Epoetine theta
Patient 03 (NS03P02)	1944	Male	Chronic renal failure after nephrectomy, coronary artery disease, aortic valve stenosis and diabetes	10	Sevelamer
Patient 08 (NS03P03)	1994	Male	Henoch-Schonlein (1999), IgA-nephropathy	2	Hepatitis B vaccin
<i>NS04</i>					
Patient 01 (NS04P01)	1947	Male	Acute myeloid leukemia, allogeneic stem cell transplantation (2010), cutaneous graft versus host disease	5	Atorvastatin
Patient 02 (NS04P02)	1959	Male	Myelodysplastic syndrome, allogeneic stem cell transplantation (2011), cutaneous/oral/optical graft versus host disease	14	Prednisone
Patient 03 (NS04P03)	1952	Female	Chronic lymphatic leukemia, allogeneic stem cell transplantation (2011), cutaneous graft versus host disease	13	Prednisone

Participants	Year of birth	Sex	Diagnosis	Number of (co)-medications	Type of medication prescribed/rated
<i>NS04</i>					
Patient 04 (NS04P04)	1943	Male	Acute myeloid leukemia, allogeneic stem cell transplantation, cutaneous/oral/bronchiolytic obliterans graft versus host disease, diabetes (induced by prednisone)	9	Prednisone
Patient 05 (NS04P05)	1962	Female	Non-Hodgkin lymphoma, stem cell transplantation, cutaneous/oral/optical graft versus host disease	8	Prednisone

Table 3 Results, total

Item of MAI	Appropriate prescribing, n	Inappropriate prescribing, n	Don't know, n	Not applicable, n
Is there an indication for the medication?	Indicated: 11	Not indicated: -	-	-
Is the medication effective for the condition?	Effective: 10	Ineffective: -	1	-
Is the dosage correct?	Correct: 7	Incorrect: -	4	-
Are the directions correct?	Correct: 2	Incorrect: 6	3	-
Are the directions practical?	Practical: 1	Impractical: 8	2	-
Are there clinically significant medication interactions to be expected?	Insignificant: 11	Significant: -	-	-
Are there clinically significant medication-disease/condition interactions to be expected?	Insignificant: 9	Significant: 2	-	-
Is the unnecessary duplication with other medication(s)?	None apparent: 9	Unnecessary duplication: -	2	-
Is the duration of the therapy acceptable?	Acceptable: 6	Unacceptable: -	2	3

Table 4 Results, per nurse specialist

Variable	Judgment	Frequency
Indication		
<i>Nurse specialist 1</i>	Indicated	3
<i>Nurse specialist 2</i>	Indicated	3
<i>Nurse specialist 3</i>	Indicated	5
Effectiveness		
<i>Nurse specialist 1</i>	Effective	2
	Don't know	1
	Total	3
<i>Nurse specialist 2</i>	Effective	3
<i>Nurse specialist 3</i>	Effective	5
Correct Dosage		
<i>Nurse specialist 1</i>	Correct	1
	Don't know	2
	Total	3
<i>Nurse specialist 2</i>	Correct	2
	Don't know	1
	Total	3
<i>Nurse specialist 3</i>	Correct	4
	Don't know	1
	Total	5
Correct Directions		
<i>Nurse specialist 1</i>	Incorrect	1
	Don't know	2
	Total	3
<i>Nurse specialist 2</i>	Incorrect	2
	Don't know	1
	Total	3
<i>Nurse specialist 3</i>	Correct	2
	Incorrect	3
	Total	5
Practicality Directions		
<i>Nurse specialist 1</i>	Impractical	2
	Don't know	1
	Total	3
<i>Nurse specialist 2</i>	Impractical	2
	Don't know	1
	Total	3
<i>Nurse specialist 3</i>	Practical	1
	Impractical	4
	Total	5
Medication Interactions		
<i>Nurse specialist 1</i>	Insignificant	3

<i>Nurse specialist 2</i>	Insignificant	3
<i>Nurse specialist 3</i>	Insignificant	5
Medication Disease Interactions		
<i>Nurse specialist 1</i>	Insignificant	3
<i>Nurse specialist 2</i>	Insignificant	2
	Significant	1
	Total	3
<i>Nurse specialist 3</i>	Insignificant	4
	Significant	1
	Total	5
Duplication		
<i>Nurse specialist 1</i>	None apparent	2
	Don't know	1
	Total	3
<i>Nurse specialist 2</i>	None apparent	3
<i>Nurse specialist 3</i>	None apparent	4
	Don't know	1
	Total	5
Duration		
<i>Nurse specialist 1</i>	Acceptable	2
	Don't know	1
	Total	3
<i>Nurse specialist 2</i>	Acceptable	3
<i>Nurse specialist 3</i>	Acceptable	1
	Don't know	1
	Not applicable	3
	Total	5

Appendix A: Medication Appropriateness Index

1. Is there an indication for the medication?	<input type="checkbox"/> Indicated	<input type="checkbox"/> Not indicated	<input type="checkbox"/> Don't know	<input type="checkbox"/> N/A
<i>Comments:</i>				
2. Is the medication effective for the condition?	<input type="checkbox"/> Effective	<input type="checkbox"/> Ineffective	<input type="checkbox"/> Don't know	<input type="checkbox"/> N/A
<i>Comments:</i>				
3. Is the dosage correct?	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect	<input type="checkbox"/> Don't know	<input type="checkbox"/> N/A
<i>Comments:</i>				
4. Are the directions correct?	<input type="checkbox"/> Correct	<input type="checkbox"/> Incorrect	<input type="checkbox"/> Don't know	<input type="checkbox"/> N/A
<i>Comments:</i>				
5. Are the directions practical?	<input type="checkbox"/> Practical	<input type="checkbox"/> Impractical	<input type="checkbox"/> Don't know	<input type="checkbox"/> N/A
<i>Comments:</i>				
6. Are there clinically significant medication interactions to be expected?	<input type="checkbox"/> Insignificant	<input type="checkbox"/> Significant	<input type="checkbox"/> Don't know	<input type="checkbox"/> N/A
<i>Comments:</i>				
7. Are there clinically significant medication- disease/condition Interactions to be expected?	<input type="checkbox"/> Insignificant	<input type="checkbox"/> Significant	<input type="checkbox"/> Don't know	<input type="checkbox"/> N/A
<i>Comments:</i>				
8. Is there unnecessary duplication with other medication(s)?	<input type="checkbox"/> None apparent	<input type="checkbox"/> Unnecessary duplication	<input type="checkbox"/> Don't know	<input type="checkbox"/> N/A
<i>Comments:</i>				
9. Is the duration of therapy acceptable?	<input type="checkbox"/> Acceptable	<input type="checkbox"/> Unacceptable	<input type="checkbox"/> Don't know	<input type="checkbox"/> N/A
<i>Comments:</i>				

Overall comments on safety and effectiveness of the prescribing episode:

Appendix B; Topic-list observations

Topic list observations

Algemene informatie

Code verpleegkundig specialist:

Ziekenhuis/afdeling:

Consultnummer:

Code patiënt:

Aantal aanwezigen tijdens consult:

Naam observant:

Datum:

Topics met betrekking tot voorschrijven van medicijnen:

- Wordt een diagnose gesteld door de verpleegkundig specialist? Zo ja, welke?
- Hoeveel aandacht besteedt de verpleegkundig specialist aan het voorschrijven van medicatie?
- Worden alternatieve behandelkeuzes met de patiënt besproken (bijv. het besluit om eventueel geen medicatie voor te schrijven)? Zo ja, welke? Welke keuze wordt uiteindelijk gemaakt?
- Wordt de patiënt betrokken bij de keuze over te gaan tot het voorschrijven van een medicijn en/of de keuze van medicatie? Op welke manier?
- Vindt (tussentijds) overleg met een arts plaats over het voorschrijven van een medicijn?
- Werkt de verpleegkundig specialist zichtbaar met protocollen of volgens richtlijnen die (deels of geheel) betrekking hebben op het medicatie voorschrijven?
- Als de verpleegkundig specialist een medicijn voorschrijft, welk medicijn wordt voorgeschreven? In welke dosering? Hoeveel daags gebruik? Voor welke periode?
- Voor welke aandoening schrijft de verpleegkundig specialist voor?
- Welke instructies worden meegegeven aan de patiënt?
- Of en in welke mate zijn organisatorische voorwaarden geregeld? Bijvoorbeeld, beschikt de verpleegkundig specialist over een AGB code, eigen receptpapier, toegang tot elektronisch voorschrijfsysteem, protocollen, formele samenwerkingsovereenkomsten en/of afspraken, et cetera.

Appendix C; Example of case-report

Case report VS08P01

Code patiënt:	VS08P01
Geslacht:	Vrouw
Geboortjaar:	1952
Voorgeschreven medicijn (waar MAI op toegepast zal worden)	Fungizone
Reden voor voorschrift:	Witte plekjes op verhemelte, lijkend op een schimmel. Hiervan is tevens een kweek genomen.
Voorgeschiedenis:	De patiënt is een vrouw, geboren in 1952. De patiënt is gediagnosticeerd met acute myeloïde leukemie in 2012. In februari 2013 heeft zij een allogene stamceltransplantatie ondergaan. Patiënt is nu acht weken na transplantatie. In de tussentijd is zij ook nog eens opgenomen in verband met algehele malaise.
Overige gebruikte medicijnen:	Cotrimoxazol 1xdgs 480 mg Thyrax 1xdgs 100 mcg Foliumzuur 1xdgs 5mg Amlodipine 1xdgs 5mg Valaciclovir 2xdgs 500mg Pantozol 1xdgs 40mg Duratears zo nodig

Recente status

Het probleem wat patiënt nu nog heeft is een anemie, wat mogelijk veroorzaakt wordt door een trage repopulatie. Eén week geleden kwam de patiënt op controle, waarbij zij een laag Hb bleek te hebben, waarbij zij ook symptomen liet zien (onder andere vermoeidheid). Ze heeft toen twee zakjes erythrocyten gekregen.

Consult

De verpleegkundig specialist bekijkt voorafgaand aan het consult het bloedbeeld.

De verpleegkundig specialist vraagt na hoe het met de patiënt gaat. De patiënt geeft aan voldoende energie te hebben, maar erg verkouden te zijn. De verpleegkundig specialist gaat hierop in en vraagt sinds wanneer de patiënt de klachten heeft en of de klachten toenemen. Dit is niet het geval, de klachten blijven gelijk. De patiënt geeft aan ook te hoesten. De

verpleegkundig specialist vraagt na of de patiënt hoofdpijn/spierpijn/pijn bij het slikken heeft, dit is niet het geval. De verpleegkundig specialist noteert de gegevens in het dossier. De verpleegkundig specialist vraagt naar eetgewoonten van de patiënt, de patiënt geeft aan voldoende te kunnen eten. De verpleegkundig specialist vraagt ook hoe de vermoeidheid zich heeft ontwikkeld na het krijgen van erythrocyten één week geleden. De patiënt geeft aan meteen verbetering te hebben gemerkt (de patiënt kon lopend het ziekenhuis verlaten na transfusie), en nog steeds verbetering merkt. De verpleegkundig specialist vraagt aan de patiënt of zij huiduitslag heeft en of zij problemen heeft met haar slijmvliezen, de patiënt geeft aan geen problemen te hebben.

De verpleegkundig specialist vraagt lab aan: een neusspoelsel in verband met de verkoudheid, om uit te sluiten dat er iets anders aan de hand is.

De verpleegkundig specialist doet lichamelijk onderzoek: gewicht 77kg, temperatuur 36.3 graden Celcius. De verpleegkundig specialist bekijkt de slijmvliezen in de mond en merkt aanslag op het verhemelte op, wat lijkt op een schimmel. De verpleegkundig specialist neemt hier een kweek van af. De verpleegkundig specialist vraagt de patiënt nog diep in en uit te ademen, de patiënt ervaart hierbij geen pijn. De verpleegkundig specialist noteert de bevindingen en het aanvullende onderzoek in het elektronisch patiënten dossier.

De verpleegkundig specialist loopt even weg om de bloeduitslagen op te halen, gezien de patiënt eerder die ochtend bloed heeft laten prikken. Hb 6.4 (gestegen na de erytransfusie), leuco's waren eerder 1 tot 2, nu 6.5. De trombo's zijn nu 46, dit is stabiel ten opzichte van eerdere metingen.

De verpleegkundig specialist vraagt ook een X-thorax aan.

De verpleegkundig specialist schrijft een antischimmelmiddel voor in verband met de plekjes op het verhemelte van de patiënt. De verpleegkundig specialist vraagt na of de patiënt thuis nog fungizone heeft, dit is het geval. De verpleegkundig specialist geeft aan dat de patiënt dit vier keer daags gedurende één week moet gebruiken, tot de volgende controle op de polikliniek. Afhankelijk van het effect zal de verpleegkundig specialist dan bepalen of de patiënt hier nog mee door moet gaan of kan stoppen. De verpleegkundig specialist legt uit dat de patiënt het kunstgebit uit moet doen, de fungizone in de mond moet doen en goed door de mond moet laten gaan. De patiënt kan hierna het middel uitspugen of doorslikken. Hierna mag de patiënt tien minuten niets eten of drinken, het kunstgebit mag wel weer in. De verpleegkundig specialist noteert het voorgeschreven middel in het elektronisch patiënten dossier. De verpleegkundig specialist vraagt of de patiënt nog herhaalrecepten nodig heeft, dit is niet het geval.

De verpleegkundig specialist sluit het consult af door aan te geven dat de patiënt echt contact op moet nemen bij verergering van de klachten.