Improvement of hospital care for patients with non-Hodgkin’s lymphoma: protocol for a cluster randomized controlled trial (PEARL study)

Stienen et al.
Improvement of hospital care for patients with non-Hodgkin’s lymphoma: protocol for a cluster randomized controlled trial (PEARL study)

Jozette JC Stienen1*, Rosella PMG Hermens1, Lianne Wennekes1, Saskia AM van de Schans8, Helena M Dekker2, Nicole MA Blijlevens3, Richard WM van der Maazen4, Eddy MM Adang5, Johan HJM van Krieken6 and Petronella B Ottevanger7

Abstract

**Background:** Malignant lymphomas constitute a diverse group of cancers of lymphocytes. One well-known disease is Hodgkin’s lymphoma; the others are classified as non-Hodgkin’s lymphoma (NHL). NHLs are the most common hematologic neoplasms in adults worldwide, and in 2012 over 170,000 new cases were estimated in the United States and Europe.

In previous studies, several practice gaps in hospital care for patients with NHL have been identified. To decrease this variation in care, the present study aims to perform a problem analysis in which barriers to and facilitators for optimal NHL care will be identified and, based on these findings, to develop (tailored) improvement strategies. Subsequently, we will assess the effectiveness, feasibility and costs of the improvement strategies.

**Methods/design:** Barriers and facilitators will be explored using the literature, using interviews and questionnaires among physicians involved in NHL care, and patients diagnosed with NHL. The results will be used to develop a tailored improvement strategy. A cluster randomized controlled trial involving 19 Dutch hospitals will be conducted. Hospitals will be randomized to receive either an improvement strategy tailored to the barriers and facilitators found or, a standard strategy of audit and feedback.

The effects of both strategies will be evaluated using previously developed quality indicators. Adherence to the indicators will be measured before and after the intervention period based on medical records from newly diagnosed NHL patients. To study the feasibility of both strategies, a process evaluation will be additionally performed. Data about exposure to the different elements of the strategies will be collected using questionnaires. Economic evaluation from a healthcare perspective will compare the two implementation strategies, where the costs of the implementation strategy and changes in healthcare consumption will be assessed.

**Discussion:** The presence of variation in the use of diagnostic tests, treatment, and follow-up between different physicians in different hospitals in the Netherlands is important for patients. To reduce the existing variation in care, implementation of tailored interventions to improve NHL care is necessary.

**Trial registration:** This trial is registered at ClinicalTrial.gov as the PEARL study, registration number NCT01562509.

**Keywords:** non-Hodgkin’s lymphoma, Quality of healthcare, Guidelines, Oncology, Implementation, Interventions
Background
Malignant lymphomas represent a heterogeneous group of malignant lymphocyte proliferations, which can be classified as either Hodgkin’s lymphoma (HL) or non-Hodgkin’s lymphoma (NHL). NHLs are the sixth most common malignant neoplasm in the United States [1] and the most common hematologic neoplasm in adults worldwide [2]. In 2012, the estimated number of new cases was 79,000 for the United States [1] and over 93,000 for Europe [3]. NHL constitute of more than 40 disease entities. The most prevalent are diffuse large B-cell lymphoma, follicular lymphoma, marginal zone cell lymphoma, small lymphocytic lymphoma and mantle cell lymphoma, together accounting for 80% of all NHL [4].

Evidence-based guidelines on diagnosis, treatment, and follow-up of patients with NHL have been developed during the past years and provide recommendations for high quality NHL care [5-11]. These national and international guidelines support physicians as well as patients in their decisions about diagnosis, therapy, and follow-up. In general, publication and distribution of these guidelines is not sufficient to maximize their effect on the quality of care [12], hence active implementation is needed. Several studies demonstrated suboptimal care for patients with NHL [13-15]. They described large gaps between daily practice and high-quality NHL care as recommended in the guideline. This lack of guideline adherence concerned, among others, diagnostics, therapy, and prognostic parameters. For example, in 22 Dutch hospitals, adherence was lowest for assessment of International Prognostic Index (IPI), documentation of indicator lesions found on CT-scans during diagnostics and after therapy, adequate pathology reporting, and discussing patients during multidisciplinary consultations [15]. The clinical relevance of guideline adherence is shown in several cancer studies [16-20]. These studies showed that better adherence to guidelines is associated with better overall survival or progression-free survival.

To improve quality of NHL care, it is important to know what the barriers to and facilitators for high-quality NHL care are. Based on this, tailored interventions can be developed to improve the quality of care. Most theories on implementation of evidence in healthcare emphasize assessment of influencing factors first, in order to acquire a tailor-made improvement strategy [21,22]. Several models have shown to be effective in structuring the experienced barriers and facilitators [23-25]. In the final steps, the strategies can be tested and evaluated.

Aim and objectives
This study aims to perform a problem analysis in which barriers and facilitators for optimal NHL care will be identified. Based on these findings, we intend to develop (tailored) improvement strategies, and assess their effectiveness, feasibility and costs.

Main objectives that will be investigated are:

1. To explore barriers and facilitators according to patients and physicians, that influence optimal NHL care as described in evidence based NHL guidelines,
2. To gain insight into the current NHL care based on previously developed quality indicators.
3. To develop, test, and evaluate the improvement strategies, tailored to the barriers found and current practice.

Methods
The objectives of this study will be examined in a cluster randomized controlled trial (cRCT), preceded by a problem analysis.

Problem analysis
Design and methods
Barriers and facilitators for delivering optimal care will be investigated at different levels. For the classification of the influencing factors a framework developed by Cabana [23] and Grol [25] will be used. This framework includes features of the guidelines; features of the target group of physicians; features of patients; features of the social context (e.g., colleagues of the involved physicians and geographic distance to hospital); and features of the organizational context.

To detect possible barriers and facilitators regarding optimal NHL care, a literature study will be performed. Second, a qualitative study will be conducted on the basis of (small group) interviews among physicians involved in NHL care and on individual interviews with NHL patients. The interviewer will follow the framework as described above during the semi-structured interviews to explore influencing factors. This method will provide us with barriers and facilitators at different levels (e.g., patient, physician, as well as the organization). Finally, a questionnaire survey will be performed to quantify the features mentioned in the (small group) interviews. All participants will receive a web-based questionnaire by email and asked to fill in this questionnaire. The data will be gathered in an electronic database.

Study population and setting
Four small group interviews with seven to 10 physicians will be conducted. Physicians, including hematologists, pathologists, radiation oncologists, radiologists, and nuclear medicine physicians, from 22 hospitals involved in a previous NHL study [15] will be invited to participate in the interviews. These hospitals include university, teaching, and non-teaching hospitals. Patients will be invited to take part in the individual interviews by the
Dutch Lymphoma Organization (LVN) and their attending physician. The interviews will be held with 15 to 20 patients until saturation has been reached. The questionnaire survey will be performed among 200 physicians and patients. To select the participants, we will contact the national professional associations of all professions involved and request e-mail addresses. Additionally, the LVN will be asked to invite patients via their website.

**Outcome measures**
Barriers and facilitators regarding optimal NHL care based on evidence-based multidisciplinary NHL guidelines. They will be classified within the framework developed by Cabana and Grol [23,25].

**Data analysis**
The barriers and facilitators mentioned in the interviews with physicians and patients will be qualitatively analyzed using the software Atlas.ti® (version 6.2.23, Atlas.ti Scientific Software Development GmbH; Berlin, Germany) and will be descriptive. Potential barriers and facilitators will be identified independently by two members of the project team, and any discrepancies will be discussed until consensus is reached.

The influencing factors from these interviews are quantified on the basis of questionnaire surveys conducted among physicians and patients to assess the most frequently mentioned barriers and facilitators. Analysis of the questionnaires will be descriptive (i.e., frequencies and means).

**Cluster randomized controlled trial**

**Design and methods**
Based on the results of the problem analysis and the care measurements of Wennekes et al. [15], tailored interventions will be developed in order to increase indicator adherence. Current care will be assessed before start of the intervention period and the tailored interventions will be adjusted if necessary.

The interventions will be tested in a cRCT in 19 Dutch hospitals. The hospitals will be the level of randomization which includes two arms: centers receiving a standard strategy of audit and feedback, and centers receiving the standard strategy followed by an improvement strategy tailored to the barriers and facilitators found. Both strategies will be evaluated with an effect-, process-, and cost-evaluation. In the effect evaluation, the previously developed quality indicators will be used as effect measures: before and after implementing the strategies, quality indicator adherence will be assessed by retrospective searches in medical records by the Comprehensive Cancer Centre the Netherlands (CCC). After the intervention period, patients as well as physicians will be asked to fill out a questionnaire concerning the use and experiences with the interventions tested. Semi-structured interviews in each hospital will give insight into the processes concerning implementation of the interventions and local initiatives to improve NHL care during the intervention period. Costs of the interventions and the accompanied changes in consumption of care will be assessed as well.

**Study population and setting**
Nineteen hospitals, including university, teaching, and non-teaching hospitals, and their physicians involved in NHL care will participate in this study. Hospitals that participated in a previous NHL study [15] will be invited to take part in the current cRCT. An invitation letter will be send by email to the contact persons, accompanied by an informed consent.

Randomization will take place after formal agreement of all hospitals to participate in the trial and will be based on randomly generated numbers (computer based) stratified by hospital size (small, medium, and large). The contact persons of all participating hospitals will be informed of the allocation after collection of the baseline measurement. In all participating hospitals, the trial will be conducted between November 2012 and June 2014.

Per hospital, approximately 22 newly diagnosed NHL patients will be selected for data collection regarding adherence to the quality indicators. Selection of patients will take place using the cancer registry, with support of the CCC. The CCC will use the cancer registry to make a list of potentially eligible patients in the participating hospitals. From each list, the first 25 to 30 patients will be selected, and listed according to day of birth. This cancer registry is based on the pathology coding system of the World Health Organization (WHO) and patients with mature B-, T- and NK-cell neoplasms will be selected for inclusion. Patients diagnosed with cutaneous or leukemia-type neoplasms will be excluded, as well as patients younger than 18 years old.

During the intervention period, physicians of the intervention hospitals will hand out patient information and an informed consent to all newly diagnosed NHL patients. Physicians are asked to use the different developed elements to improve quality of care. Patients will return their informed consent with permission (or prohibition) for sending them a questionnaire at the end of the intervention period. Patients as well as physicians will be stimulated to actively apply the interventions of our improvement strategy (when applicable).

**Outcome measures**

**Effect measures**
The effect evaluation aims to determine the effectiveness of the standard audit and feedback strategy versus the tailored improvement strategy using the previously
developed quality indicators. Percentage of adherence to these indicators will be used as a primary measure for quality of NHL care. The effect measurement will be done by two assessments, one before and one after implementation of the improvement strategies. The data for these indicators will be collected on patient level from medical records. Additionally, morbidity in the patient groups, patient-related outcome measures, and potential confounders of the effects will be evaluated.

**Process measures**
To study the feasibility of both strategies, the process evaluation has to give insight into the mechanisms and processes responsible for the result (i.e., extent of adherence to the indicator set for optimal NHL care). The actual exposure of the patients and physicians to the interventions, together with their experience with these elements may have influenced the final result (success or failure of indicator adherence).

Data about exposure to the different interventions will be collected using a combination of data collection methods (e.g., user data of developed tools and questionnaires for physicians and patients). This information will be related to effectiveness of the strategy to assess which interventions were particularly associated with successful implementation. At the end of the intervention period, experiences of patients and physicians with the implementation elements will be measured with questionnaires and/or interviews. This information will be used to, if necessary, adapt the interventions to make them more acceptable and effective for implementation on a national level.

**Cost measures**
The economic evaluation will compare the two strategies in a healthcare perspective. Both the costs of the implementation strategy and changes in healthcare consumption will be assessed. Although the underlying technologies might be evaluated well on a national level, the aim of this analysis is to detect which strategy is the most cost-effective strategy to optimal care in common practice.

The input of resources in the improvement strategies will be assessed by collecting volumes of consumed resources and multiplying these by the price of each resource unit (market prices, guideline prices, or self-determined prices based on costing methods, i.e., full costing) [26,27]. The decision criterion on which the efficient implementation strategy will be selected is the incremental cost per gained percentage adherence.

**Sample size considerations**
We hope to detect a difference in adherence to the indicators between the two strategies of at least 20%. In a previous study, the mean adherence rate was 40%. To detect a difference of 20% (40% versus 60%), with alpha = 0.05, a two-sided testing and power = 0.80, at least 194 NHL patients are required.

However, considering an intra-cluster correlation coefficient of 0.09 (mean ICC in previous study [15]) and a hospital cluster correlation of 0.8, in 19 hospitals, 22 patients per hospital are needed (n = 418 patients).

**Data analysis**

**Effect evaluation**
Multilevel regression analyses will be performed to evaluate the effectiveness of both improvement strategies. Patient characteristics as gender, age, tumor type, and co-morbidity will be collected and included in the analysis as possible confounders for differences in actual care between the different hospitals and for differences in effectiveness between the two strategies.

**Process evaluation**
Exposure to and experiences with the improvement strategy elements will be analyzed descriptively. Possible local initiatives to improve NHL care during the intervention period will also be considered descriptively.

**Cost evaluation**
The implementation process and consequently (full) costs of both strategies will be estimated by an Activity Based Costing (ABC) approach focusing on activities performed with costs accumulated at the activity level(s) of the healthcare implementation processes. The incremental costs will be determined by the difference in resource consumption between the two strategies. Next, the underlying activities (personnel, material, and overhead costs) associated with these sub-processes are identified. Use of ABC concepts facilitates the identification of non-value-added activities.

The output or consequences of the implementation strategies will be determined by the level of adherence to the quality indicators, measured before and after the intervention period. Adherence will be determined by using the repeated measures method over the two different time intervals. The decision criterion on which the efficient implementation strategy will be selected is the incremental cost per gained percentage adherence. The impact of variable(s) uncertainty on the decision criterion will be evaluated by sensitivity analyses.

**Ethical considerations**
In the Netherlands, studies involving human subjects need to undergo a medical ethics review if they are subject to the Medical Research Involving Human Subjects Act (WMO). The Medical Ethics Committee (CMO) of district Arnhem/Nijmegen assessed the study protocol and declared that no further ethical approval was required.
NHL: non-Hodgkin. will optimize NHL care and might be applicable on a
that the interventions tailored to the barriers found

to define a preferred improvement strategy. We believe
strategies on the quality of NHL care, which enables us
evaluation.

tions will be additionally inquired during the process
fore, information on local, non-study-related interven-
tervention period might bias our study results. There-
different interventions.
entendents is supposed to be effective, directed at
professional, patient, and organizational level. This strat-
y accompanites the disadvantage of measuring the effect
of the entire package of interventions, which makes it
able to distinguish which intervention was most effective
regarding improved NHL care (with indicator adherence
as effect measure). During the process evaluation, we will
try to get insight into the effectiveness of each separate
intervention by acquiring information from participants
concerning the exposure to, use of, and experiences with the
different interventions.

Local initiatives to optimize NHL care during the
intervention period might bias our study results. There-
therefore, information on local, non-study-related interven-
tions will be additionally inquired during the process
evaluation.

The results of this study will contribute to a better
knowledge of barriers and facilitators of optimal NHL
care and thus improvement opportunities. Next to this,
insight will be obtained in the effects of different
strategies on the quality of NHL care, which enables us
to define a preferred improvement strategy. We believe
that the interventions tailored to the barriers found
will optimize NHL care and might be applicable on a
national level in the future.

Discussion
This paper describes the protocol of an improvement
study, consisting of a problem analysis and a cRCT,
to assess barriers and facilitators for optimal NHL care
to develop, test, and evaluate (tailed) improvement
strategies, based on these findings.

The strength of this study is the use of multifaceted
tailored interventions, which may be more effective
than single ones [22,28,29]. Therefore, a strategy with differ-
ten interventions is supposed to be effective, directed at
professional, patient, and organizational level. This strat-
y accommodates the disadvantage of measuring the effect
of the entire package of interventions, which makes it
un
egendering improved NHL care (with indicator adherence
as effect measure). During the process evaluation, we will
try to get insight into the effectiveness of each separate
intervention by acquiring information from participants
concerning the exposure to, use of, and experiences with the
different interventions.

Local initiatives to optimize NHL care during the
intervention period might bias our study results. There-
therefore, information on local, non-study-related interven-
tions will be additionally inquired during the process
evaluation.

The results of this study will contribute to a better
knowledge of barriers and facilitators of optimal NHL
care and thus improvement opportunities. Next to this,
insight will be obtained in the effects of different
strategies on the quality of NHL care, which enables us
to define a preferred improvement strategy. We believe
that the interventions tailored to the barriers found
will optimize NHL care and might be applicable on a
national level in the future.

Abbreviations
NHL: non-Hodgkin’s lymphoma; ZonMw: Netherlands organization for health
research and development; LLN: Dutch lymphoma organization; cRCT: cluster
randomized controlled trial; CCC: Comprehensive cancer centre the Netherlands;
WHO: World health organization; B-T- and NK-cell: B-lymphocyte, T-lymphocyte
and natural killer cell; ICC: intra-cluster correlation coefficient; ABC: Activity based
costing; WMO: Medical research involving human subjects act; CMO: Medical
ethics committee.

Competing interests
The authors declare that they have no competing interests.

Authors’ contributions
RH and PO had the basic idea for this study. RH, PO, and JvK were
responsible for the research questions and designed the study. LW, RvdM,
EA commented on the design of the problem analysis and all authors
commented on the design of the cRCT. EA is the team’s expert in economic
valuations. JS wrote the first draft of this manuscript and was responsible
for the revisions. All authors critically reviewed the drafts and approved the
final manuscript before submission.

Acknowledgements
This study is funded by the Netherlands Organization for Health Research
and Development (ZonMw), grant number 171103002. We would like to
thank Reiner Akkermans for his help with performing the power calculations
and John Raemaekers for thinking along with the setup of this study.

Furthermore, we would like to express thanks to Katja Aben for her
contribution in realizing the collaboration between CCC and IQ healthcare
for this study.

Author details
1Scientific Institute for Quality of Healthcare (IQ healthcare), Radboud
University Nijmegen Medical Centre, PO box 9101, 6500 HB Nijmegen
the Netherlands. 2Department of Radiology, Radboud University Nijmegen
Medical Centre, PO box 9101, 6500 HB Nijmegen, the Netherlands.
3Department of Radiology, Radboud University Nijmegen Medical Centre,
PO box 9101, 6500 HB Nijmegen, the Netherlands.
4Department of Radiotherapy, Radboud University Nijmegen Medical Centre, PO box 9101,
6500 HB Nijmegen, the Netherlands. 5Department of Health Evidence,
Radboud University Nijmegen Medical Centre, PO box 9101, 6500 HB
Nijmegen, the Netherlands. 6Department of Pathology, Radboud University
Nijmegen Medical Centre, PO box 9101, 6500 HB Nijmegen, the Netherlands.
7Department of Medical Oncology, Radboud University Nijmegen Medical
Centre, PO box 9101, 6500 HB Nijmegen, the Netherlands. 8Department of
Registry and Research, Comprehensive Cancer Centre the Netherlands (CCC),
PO box 19079, 3501 DB Utrecht, the Netherlands.

Received: 28 April 2013 Accepted: 5 July 2013
Published: 9 July 2013

References
according to the human development index (2008–2030): a population-
H, Forman D, Bray F: Cancer incidence and mortality patterns in Europe:
35:160–164.
5. Australian cancer network diagnosis and management of lymphoma
guidelines working party: the cancer council Australia and Australian cancer
network: clinical practice guidelines for the diagnosis and management of
synopases/cp107/cp107.pdf.
diagnosed and relapsed follicular lymphoma: ESMO clinical practice
guidelines for diagnosis, treatment and follow-up. Ann Oncol 2011,
22(Suppl 6):v605–v663.
8. Hallek M, Stahel RA, Greil R: ESMO minimum clinical recommendations for
diagnosis, treatment and follow-up of chronic lymphocytic leukemia.
lymphoma: ESMO clinical practice guidelines for diagnosis, treatment
11. Zucca E, Dreyling M, Group EGW: Gastric marginal zone lymphoma of
MALT type: ESMO clinical practice guidelines for diagnosis, treatment

doi:10.1186/1748-5908-8-77