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Introducing the new and improved Danish national patient register: LPR3

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Summary

In Denmark, the Danish Health Data Authority (DHDA, Sundhedsdatastyrelsen in Danish) has implemented a new version of the Danish National Patient Register, the LPR3. The new version allows for more accurate, patient-centric research by including features in the register that makes it possible to follow true patient pathways through the healthcare system. This new feature is centralized around the element patient course which is linked to a specific health condition e.g., disease, injury or pregnancy, and the responsible clinical unit. For each contact with the hospital, one or several contact diagnoses along with procedure codes will be linked to this specific course.

The improved version makes it better than ever for stakeholders to investigate standard of care at hospitals in Denmark. The quality is highly improved which in general will be reflected in all types of epidemiological measures, health economic estimates and different types of epidemiological studies which aims to improve the treatment of patients.


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The latest update of the Danish National Patient Register to LPR3 provides a variety of benefits and applications to real-world data stakeholders

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Introduction

In Denmark, the Danish Health Data Authority (DHDA, Sundhedsdatastyrelsen in Danish) has implemented a new, validated version of the Danish National Patient Register (DNPR), the LPR3 (Landspatientregisteret, version 3 in Danish), an upgrade from the former version LPR2 (Landspatientregisteret, version 2 in Danish). The version is ready to be accessed from the DHDA and is expected to be ready in primo September 2022 at Statistics Denmark. The Danish National Patient Register provides nationwide longitudinal registration of detailed administrative and clinical data and is an essential source of real-world data in the Danish health data ecosystem. The latest update of the Danish National Patient Register to LPR3 provides a variety of benefits and applications to real-world data stakeholders, described below.

Why did DHDA upgrade to LPR3?

The previous version, LPR2, had many applications but was associated with shortcomings such as a lack of direct disease courses descriptions for each patient and only one discharge diagnosis for patients in outpatient courses. Missing the link between all procedures, visits and admissions for a specific health condition usually meant that researchers made their own assumptions when describing disease courses.

The DHDA decided to change the data structure of the register to better reflect the "true patient course" and utilization of Danish hospital services and development over time. These changes are expected to ultimately improve the quality of our health care system and the services provided to patients. For research-

ers, the new version enables linkage between the DNPR and potential new data sources to be added in the future, such as data from primary care or regional data, to enrich real-world evidence studies. Additionally, for statistical and research purposes the data will be easier to work with which will reduce the workload and the resources needed for conducting real-world evidence-studies. Furthermore, results will be derived from data in a more similar way and thereby increasing the reproducibility of findings. This will be further explained below.

Content, coverage, and improvement of LPR3

The DNPR data now also contains all data on hospital contacts from 2019 and onward on a national level. The data includes the same information as in the former LPR2, but the structure has changed and now has an extra level of information to improve the identification and description of the patient's way through the hospital system.

The register includes information about the hospital visit and includes information such as characteristics of the patient, the hospital treating the patient on different organizational levels, the time of treatment, the reason for being treated and referred to the hospital. Furthermore, in this version there is added information making it possible to connect related hospital contacts.

The key improvement with the new version is that it is now possible to follow patients' true courses through the healthcare system where all relevant services regarding the same patient's care are connected. More specifically, the LPR3 provides more in-depth coverage of hospital visits and patient history.

Key differences between LPR2 and LPR3

Table 1 (next page) outlines some of the key differences between LPR2 and LPR3 to explain how the health and disease courses can be better identified in the new version[1,2].

1 LPR-indberetningsvejledning 2022 v. 2.0 (sundhedsdatastyrelsen.dk)

2 Microsoft Word - UDKAST_V3_Datakvalitetsrapport om LPR 2019 - overgangen fra LPR2 til LPR3 (sundhedsdatastyrelsen.dk)

Table 1 Key differences between LPR2 and LPR2

	LPR2	LPR3
Connection of health and disease course	No direct description of health and disease courses exists, instead every contact appears separately. The contact consists of patient identification, diagnoses, procedures, and related information	Additional information level which brings all contacts, diagnoses, and procedures as well as related course markers* and triggered result reports** in a coherent health and disease course, see Figure 1. For each course there is a specific course label which typifies the current independent course e.g., "COPD", "type-2 diabetes", "cancer".
Outpatient visits	All outpatient care contacts (visits) are reported as one main diagnosis code with a start and end date, and each visit in the course is only indicated with a visit date without indication of the actual duration of the visit. This means that LPR2 do not contain information on what the diagnosis is on a given visit date.	Every contact between the patient and the health care system is independent such as diagnostic, observation, treatment, counselling and is registered independently with the exact time of the visit (down to seconds) including visit-specific diagnoses and/or procedure codes (but still with the possibility to link these elements to a specific disease course).
Code lists (different collections of SKS-codes)	Diagnoses, operations, and treatments are reported based on the health care classification system (SKS).	In LPR3, the framework for which SKS codes can be used in reporting is based on code lists. This list is continuously updated with new codes when needed. The code lists place restriction on the use of SKS codes e.g., dates of validity. The list is particularly important for the validation of the reporting, which will be more flexible and easier to maintain.
No differentiation between in-patient and outpatient visit	Type of patient contact is reported as outpatient, emergency or in-patient.	This is not distinguished in LPR3. Instead, the duration of each contact is registered along with information about type of contact (physical, virtual, external contact, death, or diagnosis recording). By use of this information, it is still possible to make the distinction comparable to the LPR2 patient type if needed.
Public and private hospitals	The content of the data is not the same for the public and private hospitals. It depends on whether it is reported directly to LPR2 or via the so called "MiniPas".	The reporting requirements are now identical for the public and the private clinics including data from psychiatry.
Additional mandatory codes	Mandatory to add SKS codes in connection with reporting of supplementary information (e.g., for births and cancer) and various types of markers (e.g., for waiting time and package offers).	The mandatory additional information is generally built in as fixed elements in the reporting (e.g., as results in registration of results or as course markers)**. There is no requirement for additional coding in LPR3, but it is possible to report additional codes for diagnoses and procedures.

* Real time markers based on legislation and political decisions about registration e.g., packages offer in Cancer treatment
** Results reports are triggered by course markers, contacts, diagnoses, and procedures and forwards the mandatory reports and notifications.

LPR3 concept model

Figure 1 (next page) shows the concept model for LPR3 with especially the new key level that includes "courses" as a new central element. The different courses have labels specifying the health condition over time. When a patient is in contact with the hospital (as in- or out-patient) this contact will be created and connected to a course e.g., a disease, injury or pregnancy. The course element is linked to all contacts, diagnoses, procedures, etc. that are related to the parts of a patient's clinical health condition that occur under the responsibility of a given clinical unit.

To the left of the course element is the course markers also referred to as "real time markers" indicating where the patient is in their treatment course. For example, a course maker can be a marker for start of investigation when a patient is referred to examination from another party. Course markers are typically used to monitor patients' legal rights such as their right to urgent referral and urgent diagnosis.

To the right of the course element is the result reporting which is used to report additional results. This reporting is triggered by certain registrations. An example is registration of a birth diagnosis (trigger), which triggers a requirement to report additional information about the pregnancy including gestational age, parity, smoking, number of live born, number of still born, weight and height. This will reduce the number of missing data on relevant information about the mother and the pregnancy. In LPR2, these results had to be reported as additional codes which resulted in missing data, whereas in LPR3, they will automatically pop-up as trigger results.

When applying for data from LPR3, this means that the researcher can choose between a contact-based or course-based data extraction – or both. This was not possible with LPR2 where the researcher instead had to make his/her own interpretation of a certain disease course, which complicated programming of data and hence reduced reproducibility and comparison of studies using the same data source.

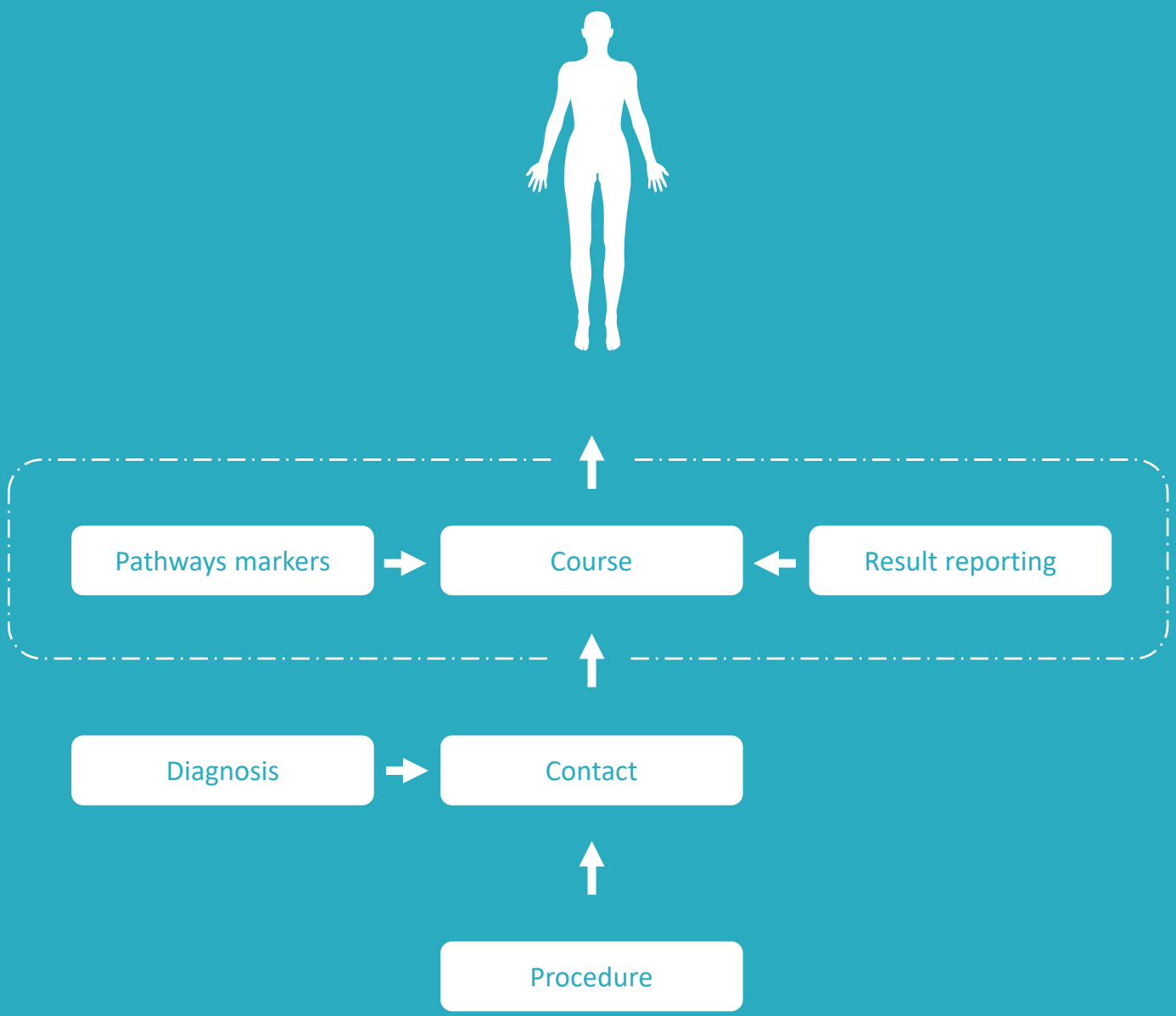
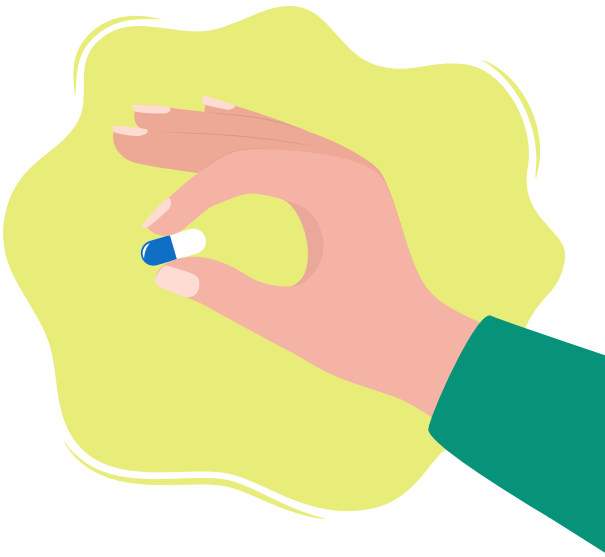


Figure 1 Concept model of LPR3 including the additional level. Recreated from "LPR-indberetningsvejledning 2022 v. 2.0. (Sundhedsdatastyrelsen.dk) Section 1.1. "Begrebsmodel" (in Danish).

How does LPR3 bring value to pharmaceutical and medical device manufacturers?



Denmark and the other Nordic countries offer excellent administrative databases. Individual linkage across registers allows for longitudinal studies of large cohorts including data on all their health care visits, diagnoses and procedures, prescribed treatments, long-term sick-leaves, demographics and causes of death. Furthermore, it allows for parent-offspring linkage to study pregnancy and fetal exposure to drugs and familial hereditary predisposition. The universal coverage essentially eliminates loss to follow-up and makes cohorts representative to the general population. Their completeness and quality are unmatched internationally and make them highly regarded as evidence-base for decision- and policymakers worldwide.

The improved LPR3 increases the quality even more. Below are some examples of how the new and improved LPR in combination with e.g., the prescription register and the upcoming in-hospital register and other databases can bring value to research in different objectives about new and existing medicine.

Incidence and prevalence

In epidemiology, incidence and prevalence are two highly important and fundamental measures when it comes to monitoring diseases and treatment of diseases and illnesses. It is important in all types of studies to reach the true numbers both when calculating the expenses as well as overall studying the impact of the disease on the population.

With the improved version, the numbers will become more accurate for many diseases, especially the chronic diseases, because diagnoses are recorded at each outpatient visit. In LPR2, the diagnoses are given when the patient is discharged from the hospital which can result in an underestimation of the patient numbers, especially for the most recent years for chronic diseases with lengthy outpatient courses such as prostate cancer.

Adherence to guidelines

The core improvement of the new version is the standardization of patient tracking within the hospital healthcare system. This can be used to assess whether the patient is being treated according to clinical guidelines both with medicine treatment and other types of treatment. Better insight into diagnostic and treatment processes can initiate a discussion with clinicians and authorities about clinical practice if clear deviations are observed. These observations and further discussions might change practical and organizational structures and, in the end, improve the patient's health care treatment.

Burden of disease

With the possibility of extracting pure course specific patient information including costs, it is much more efficient, simpler, and precise to evaluate economic burden of a certain health condition. This will improve and ease studies on market access for pharmaceutical companies as well as payers.

Cross-Nordic studies

With LPR3, the structure of the data will be even more similar to registration of out-patient contacts in the other Nordic countries (Sweden, Finland and Norway) as they already have these contacts' specific detailed structure but with the difference that you also can group related visits as per a pre-defined patient course (which is not possible in Sweden, Norway, and Finland). Similar data types across the Nordic countries can even more strengthen the findings, especially when studying small populations or rare events in multi-country studies which is more and more requested with the increasing development of personalized medicines.

Real-world effectiveness and safety

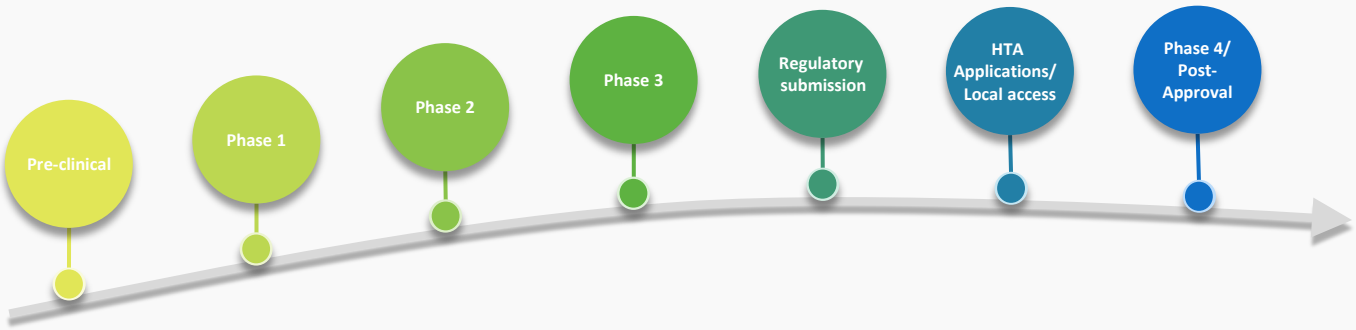
From a regulatory perspective, real-world data can be used to create a variety of evidence relating to the efficacy and safety of medical technologies[1,2,3]. It is crucial, from the perspectives of all stakeholders, to have high quality data when studying the potential benefits and harms of a medicinal product. Supportive real-world data requires detailed information about the patients such as co-morbidities, demographics, and other patient characteristics. With these substantial improvements putting Danish patient data in the forefront of global real world data, Quantify anticipate Danish and Nordic data to be considered regulatory grade RWD in an increasing amount of future regulatory applications.

1 Real-World Evidence | FDA
2 EMAs guideline on registry-based studies, October 22, 2021
3 FDAs Real-World Data: Assessing Registries to Support Regulatory Decision-Making for Drug and Biological Products, Draft guidance for Industry, November 2021.

Quantify's services throughout the product life-cycle

Quantify has extensive experience and expertise using Nordic data to answer our industry partner's most pressing research questions. Many of Quantify's core RWE services within the pharmaceutical product lifecycle are outlined in the figure below.

These services may utilize the Danish LPR3, alone or in combination with other data sources. To get in touch with a Quantify expert, contact info@quantifyresearch.com.



	EVIDENCE & STRATEGY NEEDS	Understanding disease and unmet need	Optimizing trials and regulatory evidence	Launch strategy and HTA evidence	Launch strategy and HTA evidence
RWE		RWE to complement clinical development programme Describe unmet need and natural history	Feasibility of trial protocols using RWE Regulatory grade RWE RWE studies on SOC	Generation of (local) model input Studies to raise awareness and impact policy	PAS studies Treatment patterns and adherence Comparator effectiveness
MAS		Early modelling for price finding	Health economic advice on trial design Global model	Market access and launch strategy Landscape mapping Local HTA submissions incl. local model adaptations	Support in maximizing sales post reimbursement Management of renewal applications Pricing strategy at emergence of generics/biosimilars
ERS		Literature reviews to identify epidemiology and disease burden Collection of information from key stakeholders	Advisory boards Key comparator trials review to advise on clinical outcomes and PROs	Literature reviews and meta-analysis for comparative effectiveness research Indirect treatment comparisons Identify input to economic model	Pharmacovigilance literature reviews to identify reportable AE information

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