DU90 for the assessment of drug prescribing in primary care

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Master of Public Health

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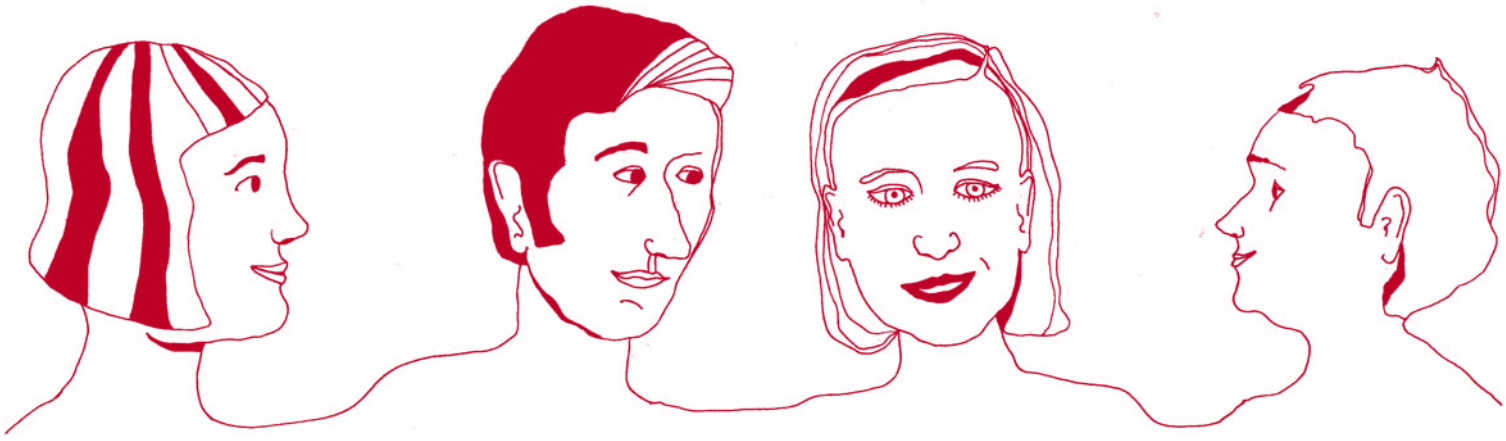

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DU90 for the assessment of drug prescribing in primary care

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Abstract

Prescribing of drugs is an integral component of health care. In ideal situations drug prescribing constitute safe, effective, and inexpensive treatment alternatives for many conditions. However, poor and inappropriate prescribing is associated with illness and increased costs that can have an important impact at population level. Therefore, evaluation of the quality of drug prescribing is an important part of the process to improve quality in health care delivery.

"Drug Utilisation 90%" (DU90) is an innovative approach to assess drug prescribing. Using this approach the drugs that represent 90% of the drug prescription/sales volume are identified. The rationale behind the development of DU90 rests on an assumption that a low number of products prescribed is associated with more rational prescribing practices. Furthermore, the approach can be used to asses what proportion of the drugs that represent 90% of the volume is made up by drugs recommended by local drug committees.

In this essay, a feasibility study of DU90 is presented. Furthermore, the usefulness of DU90 as an indicator for quality assessment is discussed. It is concluded that DU90 does not directly reflect the quality of prescribing but it seems to be an useful tool in the quality assessment process through indicating areas that need to be analysed in more depth. The approach can be used for exploring drug prescribing data in a rapid, effective and inexpensive way.

Key words

Drug prescribing , DU90, quality indicator, rational prescribing

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Master of Public Health
– Uppsats –

Uppsatsens titel och undertitel

DU90 för utvärdering av läkemedelsförskrivningen i primärvården

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Sammanfattning

Läkemedelsförskrivningen är en viktig komponent inom sjukvården. Använd på rätt sätt är den en relativt säker, effektiv och mindre kostsam form av behandling jämförd med andra terapeutiska åtgärder. Utvärderingen av kvaliteten på läkemedelsförskrivningen är en viktig insats eftersom dålig läkemedelsförskrivning kan leda till onödig sjuklighet för patienten och ökade kostnader för samhället.

Drug Utilisation 90 % (DU90) är en ny metod för utvärderingen av läkemedelsförskrivningen. Med hjälp av denna metod identifieras de läkemedel som utgör 90 % av förskrivnings/försäljningsvolymen. Konceptet har utvecklats baserat på antagandet att användning av få produkter är associerat med en mer rationell läkemedelsförskrivning. Baserad på DU90 kan även följsamheten till listan på rekommenderade läkemedel som utfärdas periodvis av Läkemedelskommittéerna, utvärderas inom 90 % av förskrivnings-/försäljningsvolymen.

I denna uppsats presenteras en pilotstudie av användbarheten av DU90. Vidare diskuteras DU90 som indikator för kvalitetsutvärdering. Sammanfattningsvis dras slutsatsen att DU90 inte direkt reflekterar kvaliteten på läkemedelsförskrivningen men verkar vara ett användbart verktyg eftersom det kan ge värdefull indikation på terapiområden som behöver vidare analys. DU90 förefaller vara ett snabbt, effektivt och billigt instrument för utvärdering av förskrivningsdata.

Nyckelord

Läkemedelsförskrivning, DU90, kvalitetsindikator, rationell förskrivning

DU90 FOR THE ASSESSMENT OF DRUG PRESCRIBING IN PRIMARY CARE

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1 INTRODUCTION

Drug therapy is a primary therapeutic intervention for a majority of diseases. More than 80 % of population in Western countries take at least one medication during any given week and many patients are prescribed multiple medications (1).
Appropriate prescription of drugs is probably the most cost-effective technology in all health care. Although drugs only represent a small part of the health care utilisation, the precision with which medications are used can yield substantial influences on the rest of health care utilisation (2).

The costs for medical care and drug therapy are continuously increasing partially because new and expensive drugs are largely used. During 2002, drugs were sold for a total of 27 billions kronor in Sweden which was 8% more than in 2001. Expensive drugs such as lipid-lowering drugs, proton-pump inhibitors and (serotonine selective receptors inhibitors) SSRI drugs were on the top of the list of sales.

Increasingly, it is also recognized that resources available to meet health care needs are limited. This problem is likely to become more acute given new medical technologies and high cost of medical care. It has been recognized for some time that both resource allocation and resource –rationing decisions will become inevitable since not all persons with medical conditions will be able to benefit from medical technology. Therefore, careful assessment of the use of medical technology, including drug therapy, can conceivably increase the efficiency of the health care delivery system (3).

Efficacy and safety has traditionally been the primary focus of health technology assessment and less attention has been paid to how a medical technology, including drug therapy, is used. However, during the past decade the attention for research work in the field of technology assessment, including rational use of drugs has very much increased.

In practice there is a large variation in prescribing between individual general practices in both prescribing frequency and cost per patient and there is little evidence that differences are justified on clinical or demographic grounds (4).

It is recognized that good prescribing is an important issue in terms of quality of care (5). It is also known that poor prescribing is associated with illness and increased costs due to unwanted side effects and interactions, and also costs from using drugs of limited clinical value and possibly inappropriate use of expensive pharmaceutical products.

The aim of this paper was to present a method for assessing drug prescribing. DU90 (Drug Utilization 90%) identifies the drugs frequently prescribed and is intended to formulate a rational base for problem identification and analysis.
The primary objective was to test the feasibility of DU90 approach for evaluation of prescribing of drugs in primary care in Stockholm using register data collected under a specific period of time. The results were summarized and published in the article attached (6).

Another objective was to discuss the usefulness of DU90 as a quality of care indicator from the perspective of rational use of drugs and consequences on the public health. Therefore in the background section, concepts such as drug utilisation, rational prescribing, and also some examples of methods of evaluation of drug prescribing were reviewed.

2 BACKGROUND

2.1 Drug prescribing and rationale use of drugs (RUD)

Drug Utilization Research examines the quantitative and qualitative aspects of drug utilization. These include the medical, social, and psychological factors and consequences of drug use in relation to specific groups and specific population groups, as well as the population in general. Drug utilisation is defined by the WHO as the marketing, distribution, prescription and use of drugs in a society. Drug utilization research examines the relationship between the quality of the treatment process and those involve in it.

A major goal of drug utilization research is the improvement of drug therapy as administered by physicians and pharmacists and the assessment of drug use in the population as a whole. In addition, drug utilization research also fulfills an important public health role in a welfare state by monitoring and controlling drug expenditure, by providing data that serve to answer health policy questions and by contributing to the management and planning of public health politics.

The prescription and utilisation of medication is an important component of medical practice. By comparing drug utilization data for different groups and populations both national and international as well as between medical institutions, socio-demographic groups and diagnostic profiles will help to provide information on the medical, economical and social determinants of drug use and provide a base for health policies. But apart from the monitoring of adverse drug reactions, relatively little effort has been made to integrate drug utilisation into public health practice.

Surveillance of health-related events is an essential component of public health practice. It has traditionally been associated with monitoring of occurrence of specific disease entities, especially tumours and infections. The basic concept underlying the monitoring of drug prescribing and utilisation in public health surveillance is not different from that of any other surveillance activity in public health. That is, it consists of systematic collection, analysis and interpretation and timely dissemination of information regarding prescription and utilisation of pharmaceutical products, in order to increase the quality of drug prescribing.

What is actually rational drug prescribing? Traditional teaching suggests that a prescription for a medicine should be necessary, effective and economic (5). WHO defines rational prescribing as *the application of an appropriate drug by correct route in an adequate dose, over a sufficiently long period of time.* The consumers' perspective may well differ from this definition. What is rational in a medical sense may not be rational for the consumer. For the consumer the rationality of using a drug is based on the interpretation of its value for daily life, influenced by cultural perceptions and economic conditions (7). For understanding of actual drug use both aspects need to be considered. From a public health perspective, rational drug use was defined and accepted at the WHO conference 1985 in Nairobi as *the use of drugs requires that patients receive medications appropriate to their clinical needs, in doses that meet their own requirements, for an adequate period of time and at the lowest cost to them and their community* (8). Taking in consideration theses definitions it may be concluded that rational prescribing and rational use of drug are different concepts though related. *Rational prescribing* reflects the medical perspective and is part of *rational drug use* that encompasses the broad perspective of public health.

Rational prescribing is the *process* that emphasizes how the decisions are to be made. WHOs definition of rational prescribing uses the epistemological *appropriate* (" the drug applied should be appropriate"). Appropriate prescribing and rationale prescribing tend to be used to express the same concept. The concept of appropriateness in health care has emerged from the need of linking different values from evidence based medicine with professional opinion in order to overcome limitations of individual attributes of health care, such as efficacy, effectiveness, indication and cost (9).

The definition of rational prescribing includes the concept of appropriateness. However, prescribing may be rational yet inappropriate when correct reasoning leads to a poor outcome. Prescribing may also be irrational yet fortuity appropriate (may occur when selecting antibiotics in e.g. a sepsis- like condition when bacteriological cultures are negative) (10). The issue of appropriateness has become more and more important, when hundreds of new drugs are brought to market every year. While the rationality of prescribing is viewed from a medical perspective, the appropriateness of prescribing is more related to a public health perspective. The appropriateness has been defined as: *the outcome of a process of decision-making that maximizes net individual gains within society 's available resources* (9).

The types of inappropriate prescribing are at least as varied as their causes (11) and may include:

- use of toxic or addictive drugs when safer agents are available (e.g. barbiturates vs. benzodiazepines)
- use of drug therapy when no therapy is required (antibiotics in viral infections)
- use of ineffective drugs for a given indication (cerebral vasodilators for dementia)
- use of costly drugs when less expensive generics are available
- use of broad-spectrum antibiotics in uncomplicated infections where narrow-spectrum would be just as effective

- under-utilization of preventive therapy (e.g. oral anticoagulant for prevention of stroke in certain groups of patients)
- failure to introduce new and effective therapies into practice (e.g. ACE-inhibitors, lipid-lowering medications)
- failure to discontinue therapy when the drug is no longer needed (e.g. use of H2-blockers longer than recommended)
- repeated prescribing without clinical review/medical consultation (highest for anxiolystics and non-steroid anti-inflammatory drugs) (12).

Inappropriate prescribing may lead to significant related morbidity and increased use of health care resources.
The purpose of the assessment of drug prescribing would therefore be to evaluate the prescribing patterns and prescribing habits and to continuously improve the quality of the prescribing in order to obtain the best value in terms of health outcomes.

2.1.1 Factors influencing prescribing behaviour

Rational prescribing is a complex decision issue based on medical knowledge clinical and laboratory findings, the patients personal needs and the physicians judgment. However, some prescribing habits do not correspond to scientific pharmacology. The prescriber is influenced by the disease, the patient , the working conditions, their own cultural background, including education, the availability to drugs and information about drugs. Factors that transcend logic such as feelings, values, intuition and prior outcomes, can influence both the prescriber and consumer and explain variability in practice. The influences that determine prescribing practices and the consumer behaviour are complex and may be different in different socio-economic environments (13). In modern health care environments the prescribing behaviour is directly influenced by polices that target the prescribers by processes. In this category are included formularies, prescribing restrictions and prescribing guidelines. There are also strong indirect factors, such as advertisements, pharmaceutical representatives and educational programs . Lipton and Bird (14) have classified these factors into factors related to the health care system, factors related to the prescriber' knowledge past experience age and sex, feelings and predispositions, and factors related to the patients needs and demands (Fig 1).

Physicians' prescribing has been explored in connection with programs aiming to improve drug-prescribing behaviour. Two approaches have been used:
-studies evaluating interventions aimed at improving prescribing behavior

-studies explaining the prescribing behavior

In the first type of studies it has been shown that that the credibility of the source of information , the clarity of the message and the motivation of the receiver may explain part of the variation in the results. According to behavioural research theories in the

field of therapeutic decision making (15) the process of elaborating a prescribing follows two steps; the first step is the generation of a small set of possible treatment options, *evoked set*. In the second step is the selection of a specific therapy for the individual patient. Practitioners consider an average of two to five treatment options for a specific diagnose. An unknown or unfamiliar therapy will not belong to an individual set of treatment options. Whether a specific drug will become part of a physician's *evoked set* depends on the education and information received. Generally the perceived risk assigned to a new therapy might influence its adoption.

Rational prescribing should be an active problem-solving act that will lead to good decision if the decision criteria are correctly valued and if the expectations about the treatment outcomes are correct. Sub optimal or undesirable drug-choices can be the result of either using wrong decision criteria or inadequate knowledge. If drug choices are not based on active problem-solving, sub optimal prescribing might be the result. Such poor habits might exist despite correct knowledge of the treatments. Research has demonstrated that only medical knowledge tests did not predict appropriate prescribing (16).

Three mechanisms may lead to sub-optimal or undesirable drug choices (15):

I - Using irrelevant or wrong decision criteria; this usually emerges from the diagnostic decision process and is unintentionally (not perceived by the prescriber). Physicians who act according to this mechanism usually put too much value on the efficacy of the therapy and tend to give too much treatment (over prescribing) in their intention to prevent or decrease illness at all costs.

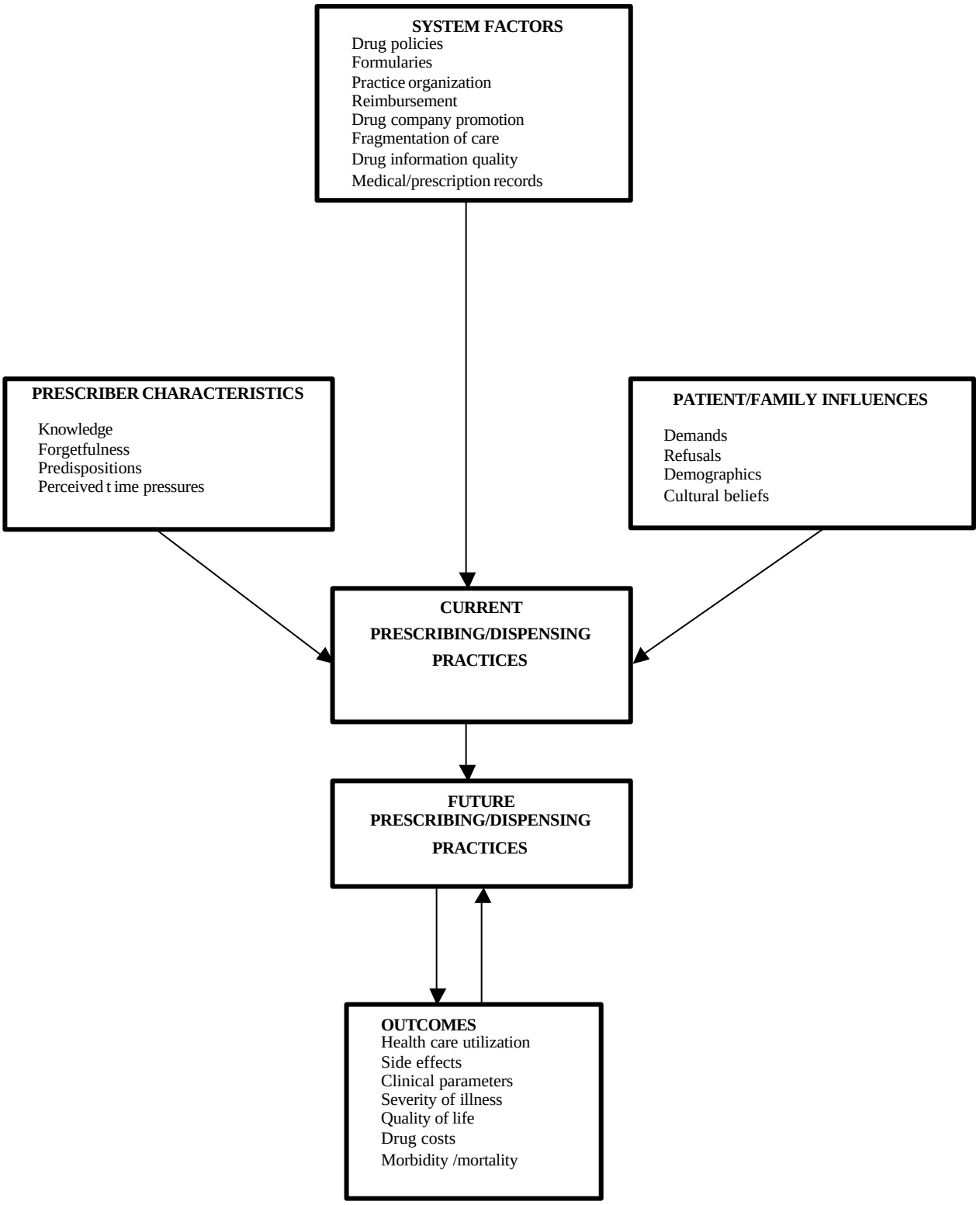
II - Incorrect knowledge and inappropriate expectations about the drug outcomes; the prescriber tends to overestimate the efficacy of a treatment and this is usually related to personal experience bias and to patient demand. The influence of personal experience bias can be related to the amount of experience and age of the physician.

III - Poor prescribing habits; poor prescribing habits are usual habitual practices developed in a specific situation. They can be useful and correct in the given specific situation but inadequate if used in another situation without a second thought. For example using a rule of thumb developed during hospital training, in general practice where the patient population is different.

Past analyses regarding prescribing behaviour have focused primarily on physicians. However in modern health care environment there are other decision-makers who may also influence the medication use, such as the Drug&Therapeutic committees and the clinical pharmacists who often play a role in recommending or even automatically switching drug therapy. These groups are more influenced by polices and cost comparisons while for the prescribers their personal experience and the perception of drug's effectiveness aside from the results of clinical studies play the most important role when choosing a drug. However in terms of medication comparisons the decision

to prescribe a particular drug is strongly influenced by interventions imposed by the hospital or different polices (eg drug formularies) (17).

Figure 1. Factors influencing drug prescribing (Lipton and Bird1933) (14).



2.1.2 The ATC/DDD system

Access to standardized and validated information on drug use is essential to allow audit of patterns of drug utilization, identification of problems, educational or other interventions and monitoring of the outcomes of the interventions. Standardized information over the drug utilization/ consumption is generally acquired using the ATC/DDD system.

At a symposium in Oslo in 1969 entitled The Consumption of Drugs, it was agreed that an internationally accepted classification system for drug consumption studies was needed. At the same symposium the Drug Utilization Research Group (DURG) was established and tasked with the development of internationally applicable methods for drug utilization research. By modifying and extending the European Pharmaceutical Market Research Association (EPhMRA) classification system, Norwegian researchers in collaboration with the Norwegian Medicinal Depot (NMD) developed a system known as the Anatomical Therapeutic Chemical (ATC) classification.

In 1981, the WHO Regional Office for Europe recommended the ATC/DDD system for international drug utilization studies. In connection with this, and to make the methodology more widely used, there was a need for a central body responsible for coordinating the use of the methodology. The WHO Collaborating Centre for Drug Statistics Methodology was accordingly established in Oslo in 1982. The Centre is now located at the Norwegian Institute of Public Health. The Norwegian government funds the Centre.

1996 WHO recognized the need to develop the use of the ATC/DDD system as an international standard for drug utilization studies. The Centre was therefore linked directly to WHO Headquarters in Geneva instead of the WHO Regional Office for Europe in Copenhagen. This was seen as important to allow close integration of international drug utilization studies and WHO's initiatives to achieve universal access to needed drugs and rational use of drugs particularly in developing countries.
The purpose of the ATC/DDD system is to serve as a tool for drug utilization research in order to improve quality of drug use. One component of this is the presentation and comparison of drug consumption statistics at international and other levels.

In order to measure drug use, it is important to have both a classification system and a unit of measurement. To deal with the objections against traditional units of measurement, NMD also developed a technical unit of measurement called the Defined Daily Dose (DDD) to be used in drug utilization studies.

When the decision to globalize the ATC/DDD system was taken, the WHO Division of Drug Management and Policies established the WHO International Working Group for Drug Statistics Methodology. The WHO Collaborating Centre for Drug Statistics Methodology receives expert advice from the Working Group.

2.1.2.1 The ATC classification –Structure and principles

In the Anatomical Therapeutic Chemical (ATC) classification system, the drugs are divided into different groups according to the organ or system on which they act and their chemical, pharmacological and therapeutic properties.
Drugs are classified in groups at five different levels. The drugs are divided into fourteen main anatomical groups (1st level: e.g. A: digestive system, C: cardiovascular system, N: nervous system, R: respiratory system, etc), with one pharmacological/therapeutic subgroup (2nd level). The 3rd and 4th levels are chemical/pharmacological/therapeutic subgroups and the 5th level is the chemical substance. The 2nd, 3rd and 4th levels are often used to identify pharmacological subgroups when that is considered more appropriate than therapeutic or chemical subgroups.

2.1.2.2 The DDD-Definition and principles

The DDD is the assumed average maintenance dose per day for a drug used for its main indication in adults.

A DDD will only be assigned for drugs that already have an ATC code.

It should be emphasized that the defined daily dose is a unit of measurement and does not necessarily reflect the recommended or prescribed daily dose. Doses for individual patients and patient groups will often differ from the DDD and will necessarily have to be based on individual characteristics (e.g. age and weight) and pharmacokinetic considerations.

Drug consumption data presented in DDDs only give a rough estimate of consumption and not an exact picture of actual use. DDDs provide a fixed unit of measurement independent of price and formulation enabling the researcher to assess trends in drug consumption and to perform comparisons between population groups.

DDDs are not established for topical preparations, sera, vaccines, antineoplastic agents, allergen extracts, general and local anaesthetics and contrast media.

The classification of a substance in the ATC/DDD system is not a recommendation for use, nor does it imply any judgments about efficacy or relative efficacy of drugs and groups of drugs.

A major aim of the Centre and Working Group is to maintain stable ATC codes and DDDs over time to allow trends in drug consumption to be studied without the complication of frequent changes to the system. There is a strong reluctance to make changes to classifications or DDDs where such changes are requested for reasons not

directly related to drug consumption studies. For this reason the ATC/DDD system by itself is not suitable for guiding decisions about reimbursement, pricing and therapeutic substitution.

2.1.2.3 Different measures of drug use

Using ATC/DDD system a number of standardized measures that are most often expressed as ratios, have been developed according to the needs in different assessments.
- DDD/1000 inhabitants: indicates the theoretical, average fraction treated in a population.

- DDD using different ATC levels: indicates the volume of specific class of drugs (e. g. beta-blockers) or more specific type of drug (metoprolol) used in a population. The ATC level is chosen depending on the objective of the assessment.

- Cost /DDD in the general consumption and cost/DDD at a specific ATC level: indicates the average cost per daily dose.

- Other, more specific measures can be created depending on the needs and objectives of the study, e.g. disaggregated by age.

These measures only give a theoretical indication over the drug utilization and they should be carefully used when making comparisons. The real consumption is in fact difficult to capture due to differences observed between the volume of prescriptions, the volume of drug sales and the actual patient drug consumption. If the difference between the issued prescriptions and the sold prescriptions can be somewhat evaluated, the actual patient consumption is very difficult to assess. The factors influencing patient compliance, health consequences and studies of improving patient compliance are complex and they constitute the subject of a different area of research.

2.1.3 Assessing the quality of prescribing

2.1.3.1 Indicators, criteria and standards

Drug utilization studies usually use prescribing data whether the objective of the study is to assess the quality of the prescribing in terms of appropriateness.

The key step when measuring quality in any type of research and also in health care, is defining indicators of quality. An indicator is a measurable element of practice performance for which there is evidence or consensus that it can be used to assess the quality and hence change in the quality of care provided (18).

When making quality judgments it is mandatory to have access to priory created *criteria* and *standards* in order to measure the degree of accomplishment. A criterion is *a*

discrete, definable and measurable phenomenon relevant to definition of quality and so clearly defined that one can say whether is present or not.

A standard is *the level of compliance with a criterion.* Standards are required for assessment of a practice or practitioner's overall performance. The standards usually describe the frequency the criteria are or should be attained.

Example: Having agreed that an *indicator* of hypertension management is the diastolic blood pressure, the *criterion* can be diastolic blood pressure ≤ 90 mmHg and the *standard* can be 80% of hypertensive patients in a practice should have a diastolic blood pressure ≤ 90 mmHg.

The standards do usually emerge from an expert consensus upon indicators of quality and guidelines of clinical practice.

Guidelines for any topic of clinical care provide recommendation for action based on the best evidence available. A guideline is *a systematically statement to assist decisions for practitioners and patient about appropriate health care for specific clinical circumstances.* The aim of developing guidelines is to encourage the provision of optimal care by demonstrating and concentrating effort on what is known to be effective and reducing variation between practitioner. Guidelines also include elements of care for which is little or no justification.

An indicator by definition must be *measurable*, implying that it must be quantitative; it must be *reliable* and *valid* to be useful.
Reliability means that the indicator is so precisely defined that it is measured in the same way on different occasions or by different observers.
Validity means that there is an agreement that the indicator really does relate to the outcome of the care being assessed. The validity of any type of indicator is related to its intended purpose. As indicators may be used for various purposes, it is very important for the quality assessment to explicitly specify this purpose.

Further down will be described some examples of sets of indicators of prescribing from the literature. The sets are very different because they are used in different type of assessments.

In 1985 WHO convened a major conference in Nairobi on Rational Use of Drugs during which it was decided to increase the work of improving drug use practices. An important tool of this work was, among other, to describe drug use patterns and prescribing behaviour. A number of five core indicators to quantify the impact of essential drug programs have been developed (19):

1/ Average of drugs per encounter

2/ Percentage of drugs prescribed by generic name

3/ Percentage of encounters with an antibiotic prescribed

4/ Percentage of encounter with an injection prescribed

5/ Percentage of drugs from essential drug list or formulary

The core prescribing indicators are most relevant in developing countries. They do not require collection of clinical data because they are a measure of general prescribing tendencies within a practice independent of specific diagnoses.

A number of 31 indicators of prescribing used in primary care were identified in a study performed in United Kingdom. The purpose of the study was to evaluate the validity of the indicators used in primary care (20). Examples of some of these indicators were:
- Percentage of antibiotic items contained in predefined list (e.g. formulary)

- Generic prescribing rate (%)

- Antibiotic generic prescribing rate (%)

- Ratio of number of items for co-amoxiclav and 4-quinolons to number of all antibiotic items

- Ratio of benzodiazepines to all antidepressants

- Number of items for peripheral and cerebral vasodilators/patient, etc.

Further follow some examples of local indicators of prescribing issued by the local Drug Committee for the Northern of Stockholm in June 2003. These indicators were identified to measure the impact of the therapeutic recommendations released by the same Drug Committee (21). Their rationale is also to emphasize the objectives for the message regarding recommended drugs to be used in relevant therapeutic areas:
- Ratio of citalopram to all selective serotonin release inhibitors (SSRIs) (to decrease)

- Ratio of simvastatin to all statins (to increase)

- Ratio of COX 2 inhibitors to all NSAIDs (to decrease)

- Ratio of angiotensin-receptors- blockers to all ACE- inhibitors (to decrease)

Studies to measure the drug use will vary from setting to setting. The nature and design of such studies will depend on many factors such as: the specific information needs, the type of record keeping systems, the type of providers whose behaviour is to be characterized, resources available, etc. Most of drug utilization studies target specific therapies trying to define causes and consequences of a certain problem related to drug use (22, 23). Other drug utilization studies describe patterns of prescribing (24) and also assess the effects of a new policy or action taken (25). Continuous improvement of drug prescribing needs new methods of research and assessment aiming to approach the drug utilization from new perspectives in order to highlight aspects of clinical relevance (26).

2.1.4 Interventions to improve drug use

Four types of interventions strategies to improve drug use can be distinguished (27):
-Educational

- Managerial

- Financial

- Regulatory

Educational interventions are the most commonly used. Standard treatment guidelines, clinical guidelines, newsletters, bulletins, and printed information such as leaflets are the most common educational materials for prescribers.

A study exploring differences in *adherence to guidelines* for the treatment of uncomplicated urinary tract infections between three European countries was conducted in the Netherlands, Sweden and Norway (28). The indicators used to evaluate the prescribing were *the proportion of the first-choice drug from all prescribed* and *the average duration of the treatment*. The results showed a large variation between countries in both indicators in regard to adherence to treatment guidelines. Only 55% of the prescribers in Sweden chose the first-choice drug according to the guidelines. Knowledge about the length of the therapy according to guidelines were especially low in Norway. In the Netherlands the prescribers had higher knowledge about both the first-drug choice and the length of treatment.

This is one of the many studies showing that passive dissemination of guidelines had little effect and that specific educational interventions are needed to improve the quality of care.

Main methods to introduce educational materials in an active way are: face-to face communication (individual or small group), seminar/work-shop (large group), in service training, feed-back or peer-review and focus-group discussions. The classification is based on how approaches were described in the studies (7).

Following the study described above (28) an educational program based on outreach visits and using feedback as learning tool in peer groups was developed regarding the treatment of non-complicated urinary tract infections (UTI) and asthma in primary care. The message of the educational program was based on national guidelines. It was applied to 204 general practitioners in a randomised controlled trial. The practitioners were randomised to either UTI or asthma, the two study arms being control for each other. The results showed a significant change in the active UTI arm compared to the control arm. Regarding asthma the results showed a positive effect of improving prescribing behaviour in both arms.

Another example of study aiming to evaluate the effectiveness of drug information on the prescribing of lipid-lowering medication using “group-detailing “(face-to-face information) was conducted in Swedish primary care. Groups of general practitioners at 134 community health care centres were randomly allocated to an intervention and a control group. The interventions centres were offered four information sessions on guidelines for management of hypercholesterolemia. The number of prescriptions of lipid-lowering drugs per month increased in the intervention group by 20% compared with the control group showing that academic detailing can be effective in influencing prescribing practices (29).

2.2 DU90 method

DU90 identifies the number of drugs making up 90% of the total volume, measured in Defined Daily Doses (DDD) or number of prescriptions (NP), during a certain period of time.
The theoretical background of this concept is originating in the area of behavioural science and it is in relation with decision-making process in the context of increased task complexity. The basic assumption in the DU90 is that *physicians manage to prescribe only a limited number of drugs in order to achieve a good prescribing*. This has experimentally been supported using analysis of information acquisition to examine the effects of task complexity on physician's decision-making process. Task complexity was manipulated by varying the number of drug alternatives in a choice set (from three to six therapy options for the treatment of urinary infection) (30). The results of the study indicated that physicians shifted from using compensatory to non-compensatory decision-making processes when task complexity increased. This means that the relative importance of drug attributes and the attention given to a specific attribute differs under differing levels of task complexity. Attributes of high value (e.g. duration of treatment) became less important and the choice of drug became "less rationale" when the subject shifted from three drug options to choosing among six drug options. This phenomenon was due to the fact that, increase in task complexity resulted in increase in the amount of cognitive strain and information overload. The subject needed to shorten the time of analysing every option and simplified the decision- making process using a less analytical strategy.

In consequence one important way to maintain and improve rational prescribing is based on choices of drugs among few verified and familiar therapeutic options.

Taking in considerations these results and also the fact that there is a large variability in prescribing between different medical settings which is not explained by demographic and morbidity factors, it had been suggested *that the number of drugs frequently prescribed* found when assessing DU90 could be used to give quality indications upon the drug prescribing. The assumption was that using a low number of different items, the quality of prescribing would be higher than using a large number. The 90% level was chosen after a number of trials at lower levels such as 50, 60 and 75%, where it was observed that lower levels of determination contained few pharmaceutical products. DU90 can be applied on the total prescribing but also in different ATC levels for a more specific assessment of a certain therapeutic area.

Another assumption was that, a rational prescribing would include drugs from the *recommended drug list*, among those frequently prescribed. The *recommended drug lists in Sweden are* similar to drug formularies in other western countries. It mainly contains first –line therapeutic recommendations for common diseases and is updated each year by the *Local Drug Committee* based on a selection of drugs according to the principles of evidence-based medicine. The Pharmacotherapy Task Forces group usually provided this selection. This group includes 13 members from general practice, relevant medical and surgical specialties, pharmacists and clinical pharmacologists. The

list is usually distributed free of charge to all practitioners in the catchments area. By analyzing the DU90 profile of a physician or medical setting in connection with the actual list on recommended drugs, certain information on the quality of prescribing can be obtained; this, assuming that the *recommended drug list* is a recognized quality standard. Currently the DU90 is used in relation to the *recommended drug list*. It is available on a web-based system connected to pharmacies sales data. By choosing the region and the level of analyses (total prescribing or ATC level prescribing) the system offers a DU90 curve where the recommended drugs are identified.

3 OBJECTIVES OF THE ESSAY

The primary objective was to test the feasibility of DU90 approach for evaluation of prescribing of drugs in primary care in Stockholm using register data collected under a specific period of time, 1995 (6).
The secondary objective was to discuss the usefulness of DU90 as a quality indicator of drug prescribing.

4 METHODOLOGY

4.1.1 Data collection

DU90 was tested at the health care centre level using data that had priory been collected during April 1995 through prescription surveys from 24 primary health care centres situated in the South-West region of Stockholm.

Between 1991-1995 this region had a population of about 252 000 people that was served by about 124 general practitioners. The surveys were carried out during the month of April, every second year, since 1991 through 1995. As part of an educational program on improving of quality of drug prescribing in the South –West region of Stockholm it had been agreed that prescriptions issued by the general practitioners and dispensed under a certain time-interval were to be recorded at the community pharmacies (31). This survey referred to drugs prescribed and purchased. It was known from earlier studies that more than 90% of prescriptions issued at a general practitioner centre were dispensed at pharmacies in the neighborhood.

All drug utilization was quantified in terms of *defined daily doses (DDDs)*, and *retail cost*, and classified according to the *Anatomic Therapeutic Chemical (ATC)* system (32) , by a computer program created for this purpose. The ATC level recorded was that of pharmaceutical product (brand name). The number of prescriptions was also recorded but in analyses the standard daily doses were mostly used. The prescribing of individual physician or patient records were not examined. Over- the- counter (OTC) drugs, such as antacids, minor analgesics, vitamins, etc, were included in this study only if the physician prescribed them.

Costs were defined as the total retail price at the pharmacy and included all mark-ups and dispensing fees, regardless of payer.

4.1.2 Analyses

The data sets for 1991, 1993 and 1995 from the 24 health care centres localized in the South-West was analyzed using Excel program. Items containing the pharmaceutical products were ranked according to the volumes prescribed (DDDs) from the highest to the lowest. The total volume of DDDs prescribed during one month, April month, was calculated and by cumulative addition of DDDs the 90% level was established for all the centres. The graphical display of the results using the products in order of volumes prescribed on the X axis and their corresponding volumes prescribed expressed as DDDs on the Y axis. The column's area profile designs a curve to right were two "segments" can be identified; the DU90 segment containing the drugs most frequently prescribed, and the segment representing the remaining 10% of drug utilization containing a larger number of drugs prescribed in small volumes (Figure 2).

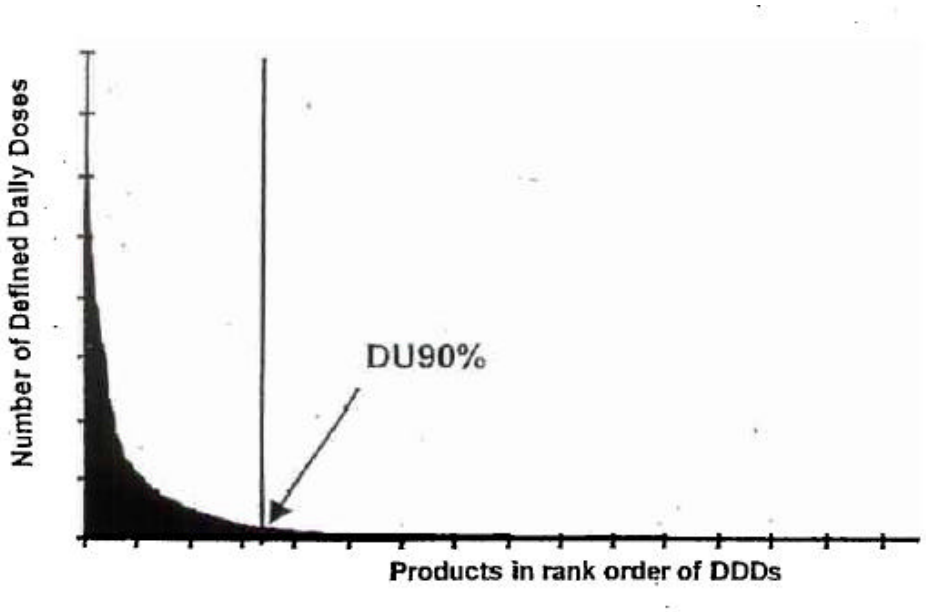


Figure 2. The DU90 segment graphic profile.

The DU90s were calculated for the whole region and for each primary health care centre and the results were than compared. The drugs prescribed within DU90 were also compared with the *list on recommended drugs* and the compliance or adherence to this guideline was defined as *index of adherence*, the proportion of the prescribed drugs in DU90 segment that appear in the list of recommended drugs (Figure 3). A higher index of adherence would suggest a more rational prescribing.

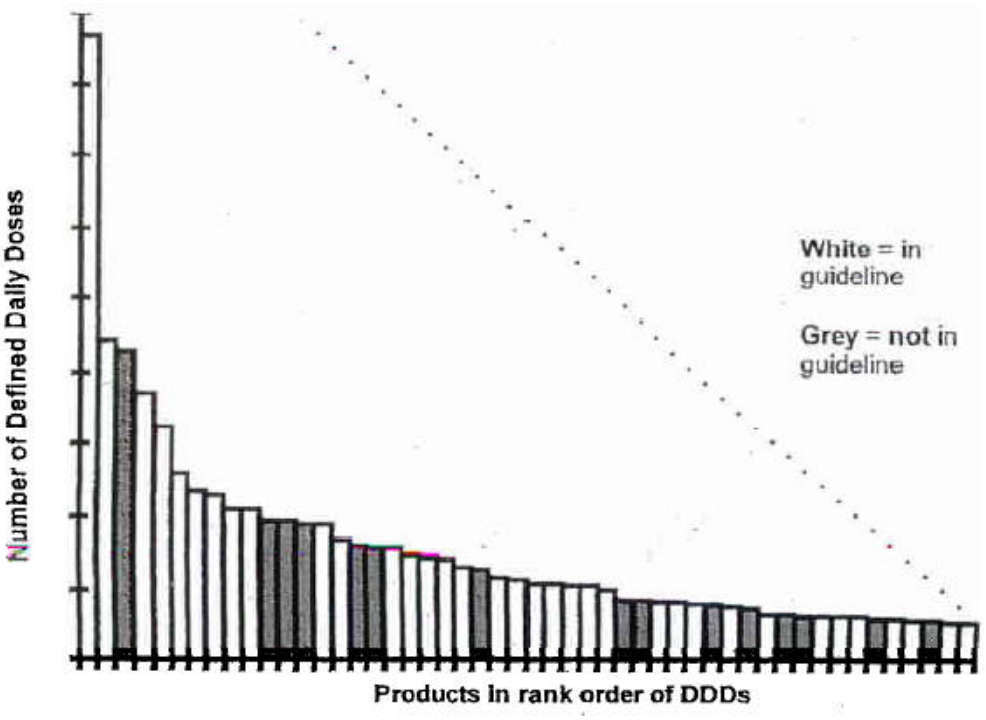


Figure 3. Adherence to *the recommended drug list* within DU90in the South-West region of Stockholm.

In order to highlight the drug costs variation and to compare the drug costs among the primary health care centres, the average *cost/DDD* were calculated in the DU90 segment and in the remaining 10% segment of drug utilization (10).

Descriptive statistics such as mean, SD, median, range, were calculated for the DU90 segments and the indexes of adherence determined at the primary health care centres. Agreement between the different variables was calculated with Spearman´s rank order correlation coefficient. A P value < 0.05 was considered significant.
Only the results from the analyses performed on the 1995 data set were published in the article attached and these results will also be presented below in section 5. In section 6 other type of analyses and comparisons done in all data sets in order to better highlight the usefulness of the DU90 concept will be discussed.

5 RESULTS

During April 1995 a total number of 771 pharmaceutical products (with DDDs assigned) were purchased at the pharmacies in the South–West region of Stockholm. One third of these, 208 products, constituted the DU90 segment.
Including pharmaceutical products without DDDs, mainly ophthalmologic and dermatological products, a total number of 857 products were purchased in the studied period.
When analysed at primary health care centre level, the DU90 varied twofold and ranged from 81 to 164 with a median of 128. There was a positive correlation with the number of general practitioners, ranging from 2 to 9, and the total number of products prescribed.

The rate of adherence to the *list on recommended drugs* in the DU90 segment varied from 54% to 78% among the health care centres with a mean of 67%. There was no correlation between the number of general practitioners and the index of adherence to the guideline.

The average cost / DDD varied from 2.26 SEK to 3.75 SEK in the DU90 segment and from 3.77 SEK to 9.12 SEK in the remaining 10% of the segment.

For further details of the results, please see the attached journal article.

6 DISCUSSION

This was a descriptive study where DU90 approach was used for a rapid assessment of the drug prescribing. This approach focuses on drugs that are frequently prescribed and covers 90% of the volume of prescribing at a certain level (e g overall prescribing, ATC group or subgroup level etc). Theoretically the drugs mostly prescribed have the biggest impact in the health outcome of the patient population. The aspect of the frequently prescribed products also has been emphasized in a Norwegian study where the 20 most frequently prescribed items accounted for 48,5% of all prescriptions (33).We found the level of pharmaceutical product (and not the generic level) more suitable for the purpose of evaluation of prescribing in a limited area of health care with a common *list of recommended drug.* The pharmaceutical product level gives the possibility to distinguish between the different brands and to calculate *the index of adherence* to the *list of recommended drugs*.

The level cut-off 90% of the volume prescribed in DDDs was decided after performing several tests at lower levels such as 50 and 75%. Repeated observations on data sets from individual health care centres showed that approximately 30% of all drug items prescribed during the period corresponded to 90% of the volume prescribed. We have applied DU90 to overall prescribing registered even 1991 and 1993*. The relative size

of the DU90 as ratio of the total number of drugs was rather stable over the five years period (when looking to data from 1991 to 1995) as 1/3. This was a valuable observation that was not clearly shown in the published article. We also applied the DU90 to the ATC level groups* (C cardiovascular, R respiratory an J antibiotics and anti-infective) and the observation that approximately 1/3 of the items corresponded to 90% of the volume prescribed, was consistent through all groups searched.

The objective of the study presented in the attached paper, was to test the DU90 approach for assessing the quality of drug prescribing in primary care in a region of Stockholm during one month, April 1995. It was suggested that the size of DU90 could be used as an overall quality indicator of rational drug prescribing and hence a quality of care indicator.

In order to critically judge the usefulness of DU90 as quality of care indicator it can be relevant to mention three conclusions that were drawn by a Delphi consultation regarding existing indicators of good prescribing used in primary care in Great Britain (34). The statements below may be useful when analysing indicators of quality of care:
1. Indicators are not measures of poor performance, rather they identify potential problems that may require investigations by other methods usually audit.
2. The measure that indicators are intended to measure must be clear in order to define the conclusions that can be claimed from their use.
3. For indicators to be useful, consistent and comparable data must be available across relevant health care organizations.

As described in the methodology section, the DU90 concept was developed based on the assumption that using a large number of drug alternatives in a therapeutic choice set would result in a less rational clinical decision-making process.

Generally, there is a need to improve clinical decision making in order to reduce practice variation, preventable errors and to support the delivery of evidence-based medicine (35). Task complexity affects information use and has been shown to be one of the most important determinants of decision-making efficiency. Any task has three essential components that are:
a/ the information cues
b/ the acts required to accomplish the task
c/ the product of the task (36)

The relationship between the acts required and the informational cues describes the *complexity* of the task. The complexity of the task has three dimensions: the *component complexity*, that refers to the number of acts that are required and information cues that must be processed, *coordinative complexity*, that refers to the relationship between task input and products and *dynamic complexity* that reflects the speed of the changes in

* results unpublished

patient condition or clinical evidence (37). For example, a prescribing task in a case of a patient with multi-organ failure in intensive care has a higher coordinative complexity than the same task for a patient with un-complicated mild infection in general practice. Prescribing is a complex clinical task because it involves:
a/ integration of complex information from a variety of sources
b/ incomplete or imperfect information
c/ the presence of uncertainty and time pressure
d/ a complex interaction between the clinician and the patient with different utilities and values to alternatives in the decision (38).
Such high complexity is a risk factor in clinical decision-making and it has been suggested that clinicians choose less cognitively demanding strategies when making decisions (39) and task complexity has been found to affect information acquisition and prescribing decisions (30).

According to DU90 concept a physician using few, well known and proved drug alternatives in the daily practice, would provide a more rational prescribing and hence a higher quality of care. An optimal number of drugs for DU90 would be difficult to indicate and even inadequate, therefore DU90 was suggested as a purely descriptive indicator. This would be in line with the theory of task complexity, however the process of prescribing appears to be much more complex and a direct relationship between the size of DU90 and the quality of prescribing cannot be considered.

However it has been suggested that the size of the segment could be subject for comparisons in drug prescribing studies. A very large number of drugs in the DU90 assessed in a medical setting and compared with other relatively similar settings could possibly give an indication of less rational prescribing. On the other hand, a small number of drugs in DU90 could suggest a more rational prescribing. The assumption that ”less is better” used in the study has been generalized from one experimental exercise that only used a specific therapeutic decision in non-complicated urinary infection (30). The experiment used the individual prescriber and not a group of prescribers acting in the same health care centre and the rationality of their choice of the therapy was judged against a standard.

In the present work no patient data were available. No linkage between the treatment and the diagnose or pathological condition was possible. The results could not be judged against a standard however they could be run against the *list on recommended drugs* and they could be compared between several primary care centres. Even limited, this information could give an approximation about the average prescribing profile.

As discussed above, drug prescribing is influenced by a number of individual factors such as, age, sex, cultural background, patient demands, etc. However the question in the present study was not related to the appropriateness of the prescribing (by indication, age, sex, etc). The intention was to explore the usefulness of DU90 as a rapid type of assessment meant to give an overall information on the prescribing in a systematic way. In the article it was stated that DU90 could be used as a quality indicator for rational prescribing. It has been shown that there was a positive

relationship between the size of DU90 and the number of physicians at the health care centre, as actually expected. Lower DU90 could in fact reflect the number of prescribers without giving any information about their performance. There was no evidence in the present study that “less is better” at the level of overall prescribing and health care centre. The greatest weakness of this study was that it did not relate DU90 to direct quality measures or health outcomes. Further studies where the size of DU90 would be explored in connection with health and disease outcomes or other measures of performance are needed in order to make quality statements. This view reflects the opinion that measurements of quality of care are most meaningful when applied to individual patients (40). These can be well-defined measurable variables, such as, diastolic hypertension in the management of hypertensive disease or can be related to the adherence of the individual prescribing to the therapeutic guidelines, taking in consideration that therapeutic guidelines are based on clinical evidence and best practice.

DU90 can be useful as an approach when comparing prescribing data from different settings with a standard such as the *list on recommended drugs* or treatment guidelines. The *index of adherence* defined as the ratio of DU90 corresponding to the *list on recommended drugs* can give indications upon the quality of prescribing in general, without being able to distinguish the appropriateness of prescribing in a specific therapeutic area. However a high *index of adherence* would indicate a more rational prescribing or a prescribing in concordance with recommended guidelines or formularies.

A comparison of DU90 with specific treatment guidelines would be a more relevant way of evaluation of drug prescribing. More studies where the relationship between the size of DU90 at therapeutic group level or even at lower ATC group level and specified outcomes, are needed.

At present DU90 method is available as a web application for drug statistics within the Stockholm region. This application gives DU90 profiles of generics or brands together with the *index of adherence* to *the recommended drug list*, as shown in the picture below:

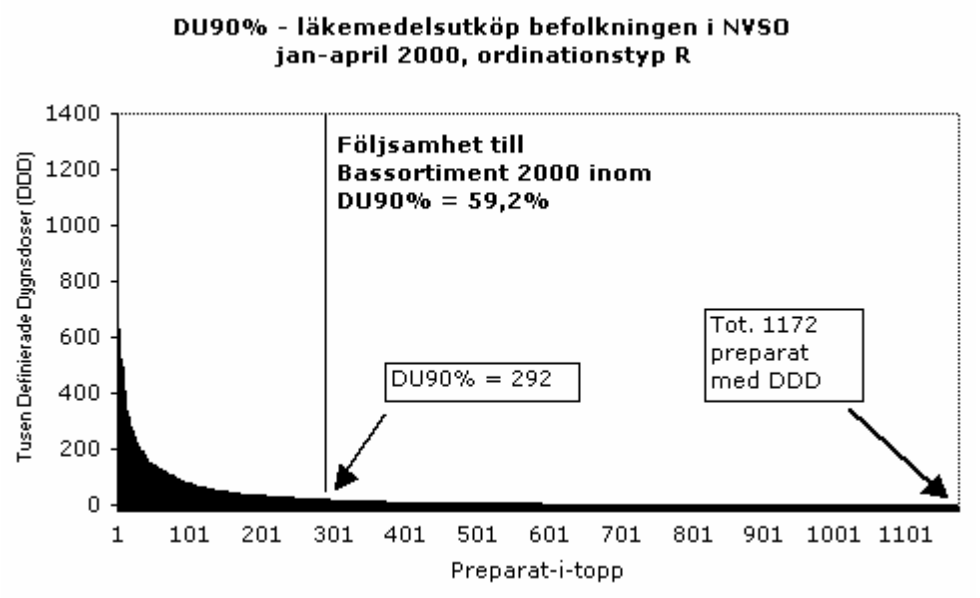


Figure 4. DU90 for the North-West Region of Stockholm during the period January to April 2000. (Läkemedelsstatistik:www.janusinfo.org).

The application also offers the possibility of combining different options on variables such as a specific health care sector, age and sex of patients, and variables related to costs of drugs.

Also options of different ATC levels can be made. The application gives valuable information over the drug prescribing and offers the possibility of comparisons between similar settings. This is an important aspect within the frames of economic constraints that challenge the health care system; however for making quality claims from the size of DU90 and the *index of adherence*, more research is needed.

7 CONCLUSIONS

DU90 does not directly measure quality of prescribing but is a useful tool in quality assessment process, which can indicate potential quality problems that require further investigation.

The approach can be used for exploring prescribed data in a rapid, effective and inexpensive way. It offers a new perspective for studying drug prescribing by highlighting the drugs most used. The pharmaceutical products identified within DU90, should be matter of careful quality assessment by e.g. audit. I suggest that this can be an appropriate base for identifying potential problems, studying trends, making prognosis, etc.

Management of the rational prescribing should focus on this segment in order to be more effective. The size of the DU90 may serve as a descriptive indicator for evaluation of prescribing and can provide valuable information in the context of a rapidly growing drug market. However in order to establish a relationship between the size of DU90 and the quality of rational prescribing further studies are needed.

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