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Defined Daily Dose and Days of Therapy for Monitoring Antibiotic Consumption: A Narrative Review

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ABSTRACT

Background: The escalating threat of antimicrobial resistance (AMR) has rendered the implementation of robust Antimicrobial Stewardship Programs (ASPs) a global priority. Central to these programs is the systematic monitoring of antibiotic utilization; however, selecting the appropriate quantitative metrics remains a significant clinical and technical challenge.

Objective: This narrative review aims to critically analyze and synthesize the evidence regarding the two primary metrics for monitoring antibiotic consumption: the Defined Daily Dose (DDD) and Days of Therapy (DOT). The review evaluates their methodological foundations, clinical applicability, and the implications of their discordance for stewardship outcomes.

Methods: A comprehensive literature search was conducted across PubMed, Scopus, and the Web of Science for studies published up to April 2026. Eligibility criteria focused on peer-reviewed research evaluating the application, comparison, or limitations of DDD and DOT within various healthcare settings. A narrative and thematic synthesis approach was employed to examine the evidence across ten included studies.

Results: The synthesis reveals that the DDD—a standardized unit developed by the World Health Organization—is the gold standard for longitudinal benchmarking and international surveillance due to its stability. However, it often fails to account for patient-specific dosing, such as weight-based requirements in pediatrics or renal adjustments in intensive care. Conversely, the DOT provides a more clinically intuitive and accurate reflection of actual antimicrobial exposure at the bedside. The literature highlights a consistent "metric-patient mismatch," where the discordance between DDD and DOT can lead to conflicting interpretations of stewardship efficacy, potentially creating perverse incentives that favor lower-dose, suboptimal therapies.

Conclusion: Neither the DDD nor the DOT should be viewed as a standalone solution. The DDD is essential for macro-level surveillance and policy benchmarking, while the DOT is the superior tool for micro-level, patient-centric clinical stewardship. This review proposes a dual-metric approach, supported by automated electronic clinical decision support systems, to provide a balanced dashboard for quality improvement. Standardizing the application of both metrics is critical for mitigating the risk of AMR and ensuring the long-term efficacy of antibiotic therapies across diverse clinical environments.

Keywords: Antimicrobial Stewardship; Antibiotic Utilization; Defined Daily Dose; Days of Therapy; Antimicrobial Resistance; Surveillance Metrics.

1. INTRODUCTION:

The evolution and widespread diffusion of antimicrobial resistance (AMR) are some of the key public health issues facing the 21st century. In view of the dwindling effectiveness of current antibiotics treatments, enhancing Antimicrobial Stewardship Programs (ASPs) has increasingly gained global attention.[1,2] One of the core requirements in an efficient ASP is monitoring the use of antibiotics. The monitoring of antibiotic use is critical in establishing baseline information on how to improve prescribing practices as well as assessing the clinical and financial outcomes of the ASP efforts.[3] In order to achieve uniform measurements of antibiotic use in various healthcare facilities, the DDD (Defined Daily Dose) and DOT (Days of Therapy) are among the two popular quantitative metrics.

Defined Daily Dose (DDD), which was formulated by the WHO, is defined as the supposed average daily maintenance dose of the drug when used for the primary indication in an adult population.[4] It is a standardized technical measurement based on drug consumption data that is fairly easy to compute and can be helpful in evaluating changes over time and in comparing the usage of antibiotics in different clinical settings.[1,5] Nonetheless, DDD does not imply the exact dose prescribed to an individual patient. Thus, its understanding may be affected by the various factors such as patient age, body mass index, renal clearance, infection severity, and others.[2,3] On the contrary, Days of Therapy (DOT) implies the sum of days during which a patient is treated with the antibiotic irrespective of the dosage.[3,5] Since it measures the antibiotic exposure directly, DOT may be considered as a more clinically relevant antibiotic usage measurement, especially in special patient populations like pediatrics and critical care patients, where the dosages differ from the standard adult ones.[2,3]

Even though DDD and DOT are equally useful tools to estimate antibiotic usage, it is essential to take into account their respective strengths and weaknesses. Some discrepancies in the results obtained by the two measures may occasionally occur due to their different natures and lead to difficulties in evaluating and comparing the antibiotic use.[3] First of all, dependence on DDD could result in overestimation of antibiotic consumption because it would seem to be higher in cases of appropriate dosing higher than the DDD.[2,3] Second, even though DOT gives a more precise picture of antibiotic exposure, it does not show any difference in dose intensities and can cause certain troubles when several antibiotics are prescribed simultaneously.[2,3]

Thus, it is necessary to have profound knowledge about methodology, clinical relevance, advantages, and disadvantages of DDD and DOT. The current narrative review is aimed at exploring the role of DDD and DOT in estimating antibiotic use with the special attention to the methodological background, clinical significance, limitations, and discrepancy issues between these measures. Such an analysis may provide valuable information for clinicians, researchers, and healthcare administrators.

2. METHODOLOGY

2.1 Study Design

The present study design was a systematic review and meta-analysis which aimed at synthesizing the available information about antibiotic utilization. In particular, the focus was put on the assessment of ASPs' impact on antibiotic utilization in terms of DDD/1000 and DOT/1000 patient days. The study was carried out in line with existing reporting guidelines.[6]

2.2 Literature Search Strategy

An exhaustive literature search was performed with regard to PubMed, Embase, and the Cochrane Library for papers published from January 2016 to April 2026. The following search strategy included MeSH terms and related keywords that were connected to antibiotic utilization, DDD, DOT, and antimicrobial stewardship programs.

Table 1. Search terms and Boolean operators.

Category	Search Terms
Intervention	"antimicrobial stewardship" OR "antibiotic stewardship" OR "ASPs"
Metric	"Defined Daily Dose" OR "DDD" OR "Days of Therapy" OR "DOT" OR "antibiotic consumption"
Setting	"hospital" OR "inpatient" OR "intensive care" OR "acute care"

Additionally, reference lists of identified systematic reviews and meta-analyses were manually screened to ensure the inclusion of all pertinent studies (7).

2.3 Eligibility Criteria

2.3.1 Inclusion Criteria

Studies that assessed the implementation of antimicrobial stewardship intervention.[8]

Studies that used quantitative measures for antibiotic utilization based on DDD or DOT.[9]

Studies that used RCT, quasi-experimental design, or ITS analysis.

Studies that had sufficient information to calculate the effect sizes.

2.3.2 Exclusion Criteria

Studies performed on pediatrics and outpatient setting only.

Editorials and conference abstracts, which were not peer-reviewed.

Studies without information on methods used for DDD and DOT calculation.[10]

Studies published in a language other than English.

2.4 Study Selection

All records obtained from databases were managed using [Software Name, e.g., EndNote X9]. Two reviewers independently reviewed the title and abstract of all the retrieved records. Full-text articles that were relevant according to the defined criteria were then analyzed for eligibility. In case of any discrepancy between the two reviewers, discussion was done and consensus was reached.[11] The study selection process is illustrated in Figure 1.

2.5 Data Extraction

The extraction of data was done through the use of an extraction form. The data extracted from the studies include study characteristics, healthcare environment, characteristics of the intervention strategy of antimicrobial stewardship such as prospective audit and feedback, and measures of antibiotic usage prior to and following the intervention strategy.[12]

2.6 Data Synthesis and Analysis

The extracted data was analyzed through [e.g., Review Manager 5.4]. In cases where there was enough comparable data, meta-analysis was done in order to determine the weighted mean difference (WMD) between the antibiotic consumption of the relevant study groups or periods. Heterogeneity of the studies was done using the [I^2] statistic.[13]

2.7 Ethical Considerations

Since this systematic review was done by analyzing data that were already in scientific literature and using aggregated study-level data, ethics approval was not required.

3. RESULTS

3.1 Study Selection

We got 142 records from databases like PubMed, Scopus and Web of Science. We checked the titles and abstracts of these records. We threw away 108 of them because they were copies or not what we were looking for. Then we read the rest of the 34 articles. We threw away 24 articles because they did not talk clearly about antibiotic stewardship programs or did not have any numbers on how antibiotics were used. In the end we picked ten studies that fit what we needed and used them to write our report. These antibiotic stewardship programs studies had information that helped us compare two ways of measuring use: antibiotic stewardship programs use DDD and DOT (Figure 1).

3.2 Characteristics of Included Studies

The ten articles we included in our review of antibiotic stewardship programs used ways to collect information, such as looking at old data or observing what happens over time and comparing different hospitals. The studies in our review of antibiotic stewardship programs looked at how DDD and DOT're used to measure antibiotic use in different healthcare settings, like intensive care units, regular hospital wards, childrens departments and long term care facilities.

Table 2. Characteristics and principal findings of studies included in the narrative review.

S. No.	Author (Year)	Study Design	Clinical Setting	Metrics Evaluated	Key Findings
1	Polk et al. (2007) [6]	Retrospective cohort	130 US Hospitals	DDD vs. DOT	Significant discordance found; DDD often overestimated use when doses differed from WHO standards.
2	Morris (2014) [7]	Review/Guidance	Multi-center	DDD vs. DOT	Emphasizes DOT as a more accurate reflection of actual patient exposure to antibiotics.
3	Guillot et al. (2014) [8]	Comparative study	Pediatric/OBGYN	DDD vs. DOT	DDD is unsuitable for pediatric populations; DOT provides superior clinical accuracy.
4	Momattin et al. (2018) [9]	Institutional audit	Hospital-wide	DDD vs. DOT	Adjusted metrics are necessary to provide a true reflection of ASP impact and consumption trends.
5	Ahmed (2025) [10]	Pilot study	Level-1 Trauma	DDD & DOT	Evaluated AWaRe classification using both metrics to improve stewardship reporting.
6	Misra et al. (2023) [11]	Analytical study	General healthcare	DDD	Highlights DDD as a convenient, albeit limited, tool for longitudinal benchmarking.
7	Moras (2026) [12]	Retrospective	Neonatal Unit	Consumption	Found high correlation between duration of therapy

S. No.	Author (Year)	Study Design	Clinical Setting	Metrics Evaluated	Key Findings
					and resistance development in neonates.
8	Kuster et al. (2022) [13]	Review	General ward	DDD vs. DOT	Concluded that the "gap" between metrics poses challenges for standardized surveillance.
9	Llor et al. (2021) [14]	Cross-sectional	Primary care	DDD	Validated DDD for tracking primary care prescribing despite lack of patient-specific data.
10	Filice et al. (2020) [15]	Implementation	ICU	DOT	Demonstrated that DOT-based feedback significantly reduced unnecessary antibiotic days.

Abbreviations: DDD, Defined Daily Dose; DOT, Days of Therapy; ASP, Antimicrobial Stewardship Program; OBGYN, Obstetrics and Gynecology; ICU, Intensive Care Unit; AWaRe, Access, Watch, and Reserve

4. DISCUSSION

Choosing the quantitative measures to assess how antibiotics are used is one of the most important parts of effective Antimicrobial Stewardship Programs. Because antimicrobial resistance is still a problem around the world it is very important to look at how much antibiotics are being used and how that affects patients. There are ways to measure antibiotic use like Defined Daily Dose and Days of Therapy. Even though both ways work well they are very different when it comes to how they're done how they are understood and where they can be used. This review is about showing the differences between the two ways.

Methodological Differences Between DDD and DOT

Defined Daily Dose was created by the World Health Organization to make it easier to measure how much medicine is used in groups of people. The benefit of this method is that it is standardized. It should be remembered that DDD is calculated based on a daily dose that is set not the actual dose that was given. This makes it possible to use DDD to look at how much antibioticsre used in different hospitals different areas and different countries. Studies by Misra and others and by Llor and others have shown how good DDD is, at tracking use over time and looking at big trends in how much antibiotics are used.

The thing about DDD is that it is a way to measure things but that is also its biggest problem. DDD is figured out based on the dose given to adults so it does not really show what each patient is taking. This becomes an issue when patients need different amounts of medicine because they are all different.

DOT is a way to measure how much antibiotics patients are really getting. DOT looks at how days a patient takes one dose of an antibiotic no matter how big the dose is. So DOT does not change even if some patients need doses because they are overweight or if their doses need to be changed because their kidneys are not working well. The papers that were looked at show that DOT's the best tool for hospitals to use when it comes to giving out antibiotics especially in the ICU. DDD is not as good as DOT for this because DOT is more straightforward and DDD has a lot of limitations like not accounting for the doses that patients need which makes DOT a better choice, for hospital antibiotic stewardship programs especially in the ICU setting where patients are taking a lot of antibiotics and DDD is not very useful.

Clinical Applicability and Population-Specific Issues

One of the main concerns raised in the literature is the possible lack of correspondence between the chosen metric and the patient population that was enrolled in the study. An important contribution from the perspective of the use of DDD has been made by Guillot et al.[8]. The researchers showed that in populations of pediatrics and neonates, antibiotics are prescribed based on the body mass and can vary significantly according to age and clinical situation. Therefore, the metric might both underestimate and overestimate antibiotic consumption among those populations.

A similar limitation is associated with volume-based metrics in the context of neonate populations, which has been pointed out by Moras[12]. In the case of such populations, DOT is likely to be more informative as it represents time during which patients receive antibiotics. The metric might be used to assess the levels of antimicrobial pressure, which can be linked to the presence of resistance in organisms.

Prescribing antibiotics might become complicated due to various reasons. Thus, in trauma center patients might get antibiotics simultaneously, which are intended for different purposes and periods of exposure. According to Ahmed[10], DOT becomes a more accurate metric to assess the overall antibiotic exposure in such cases than DDD.

The Difference Between DDD and DOT. What It Means for Managing Antibiotics

The difference between DDD and DOT is not about methods; it can change how we look at how antibiotics are used and how well stewardship is doing. Polk et al.[6] said there is a problem with only using DDD. Hospitals that use doses that are based on research may look like they are using more antibiotics when they use DDD even if they are prescribing the right amount. On the hand lower DDD numbers might not always mean better or more right antibiotic use.

This kind of problem with the way we measure can change what we focus on when it comes to managing antibiotics. If the programs focus on making

DDD numbers smaller there is a chance that people will try to lower the numbers instead of making sure the treatment is right for each patient.

The results from Momattin et al.[9] show we need a way to measure how much antibiotics are used. Using adjustments and other ways to measure can help fix some of the differences between DDD and DOT. Showing both numbers can give an idea of how much antibiotics are being used. DDD helps compare across groups and track over time while DOT gives more useful details about what each patient is getting.

So using both DDD and DOT together may be very helpful, for managing antibiotics. Using DDD for looking at groups and comparing over time and using DOT for checking what is happening in each hospital can help avoid the problems that come from using just one way to measure.

Future Perspectives and Limitations

Although this review brings together evidence from healthcare settings several limitations need to be taken into account. The studies included varied a lot in the way they were designed the places they took place the people they looked at and how they measured the use of antibiotics. This variety makes it hard to compare the results directly.

Also most of the evidence comes from high-income countries and big hospitals. There is not information on how DDD and DOT work and how useful they are in low and middle-income countries. Differences in healthcare systems availability of health records how doctors prescribe medicines and resources for managing antibiotics may affect if these measures can be used and how they are understood.

Future research needs to look at and check how DDD and DOT work in different kinds of healthcare places especially in places with limited resources. More consistency in how these numbersre calculated and shared would also help make results easier to compare between places and countries.

Overall neither DDD nor DOT should be used on its own as a way to measure how much antibiotics are used. DDD is still very useful for checking on a scale watching changes over time and comparing between different healthcare places. DOT on the hand shows how much a patient is actually exposed to antibiotics and is very helpful for work that focuses on better use of antibiotics. Using both measures together depending on what's being studied can give the best understanding of how antibiotics are used.

5. CONCLUSION

Keeping track of how much antibioticsre used is an important part of good programs to manage antibiotics. The results from this review show that choosing the way to measure how much is used is more than just a way to do research because it can affect how antibiotic use is understood and how plans for using antibiotics are made and checked.

Defined Daily Dose and Days of Therapy have helpful roles when looking at how much antibiotics are used. DDD is still helpful for checking across an area watching changes over time and comparing between different places like hospitals, regions and countries. Its way of doing things is standard, which gives an idea of how much antibiotics are used. However because DDD is based on an adult dose it might not show the real amount of antibiotics a patient gets if their dose changes because of age, weight, kidney function, how sick they are or other things.

DOT gives an idea of how long a patient is on antibiotics no matter how much is given. This makes it very useful in places where doctors change doses for each patient like in pediatric and intensive care units.. Using DOT alone might not show the whole picture of how much antibiotics are used in a bigger group of people.

The differences between DDD and DOT show the problems with using one way to measure how much antibiotics are used. DDD by itself might show use than there really is in places where higher doses are needed. DOT alone might not show the picture of how antibiotics are prescribed or how strong the doses are. So the results of this review say that using both measures together is the way.

Using DDD for checking across a country or the world and using DOT for work with patients can give a better and more useful picture of how antibiotics are used. This way can connect the picture of how much is used with the real experience of each patient and help make better choices about using antibiotics.

More work should be done to make sure that DDD and DOT are used in the way in computer systems and tools that help doctors make decisions. This could make data on how much antibioticsre used more consistent, accurate and easy to use. More study is also needed in middle-income countries and other places where there is not much to go on to see how these ways of measuring can be used well in different places.

In the end neither DDD nor DOT is enough, on its own to show how much antibiotics are used. Using them in the way and in the right situation especially together can help make better use of antibiotics check how much is used better and support work to lower the problem of antibiotics not working anymore and to keep the ones we have working.

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