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COST-EFFECTIVENESS OF HIV/AIDS MANAGEMENT: A PHARMACOECONOMIC PERSPECTIVE

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Abstract

Background: Managing HIV/AIDS requires long-term treatment plans, which frequently call for lifetime antiretroviral medication (ART). These therapies can be quite expensive, which has an effect on healthcare systems, especially in places with little resources. Pharmacoeconomic studies aid in determining the cost-effectiveness of various treatment approaches, assisting in the management of HIV/AIDS.

This study's goal was to evaluate the cost-effectiveness of different HIV/AIDS care approaches from a pharmacoeconomic standpoint, taking into account both direct medical expenses and health results.

Methods: Information from clinical research, medical reports, and treatment guidelines was used to do a cost-effectiveness analysis. The costs, effectiveness, and gains in patients' quality of life of various ART regimens, including first-line and second-line therapy, were compared. Indirect expenses (patient productivity loss, caregiving) and direct costs (drugs, doctor visits, hospitalisation) were included in the analysis. Health outcomes were measured using quality-adjusted life years (QALYs). Sensitivity analyses were used to assess the effects of different data uncertainties and assumptions.

The findings showed that although first-line ART regimens are initially less costly, individuals who experience treatment failure may benefit from second-line medicines in the long run, which might enhance their quality of life. The cost-effectiveness ratio differed greatly throughout healthcare settings, and because of the high cost of therapy, low-income nations had a harder time putting the best HIV/AIDS management plans into practice.

In summary, pharmacoeconomic analysis of HIV/AIDS care is essential for enhancing patient outcomes, guaranteeing the effective use of medical resources, and refining treatment plans. In order to make the best judgements about HIV/AIDS care, economic evaluations must take into account the patient population, healthcare infrastructure, and local economic realities, even if ART is a very cost-effective treatment.

Keywords: quality-adjusted life years (QALYs), antiretroviral therapy, pharmacoeconomics, cost-effectiveness, HIV/AIDS, and treatment approaches.

1. Introduction

Around 37.7 million persons worldwide are estimated to be infected with HIV/AIDS as of 2020 [1]. Over half of these originate from LMICs (low- and middle-income countries) [2]. The considerable stress and expense experienced by individuals living with HIV/AIDS (PLWHA), their family members, and the community makes the socioeconomic burden of HIV/AIDS noteworthy [3]. $562.6 billion was spent on HIV/AIDS between 2000 and 2015, with $48.9 billion spent globally on HIV/AIDS prevention, care, and treatment in 2015 alone [4]. Additionally, funding for HIV/AIDS prevention rose 519.6% from $596 million to $3 billion between 2000 and 2016 [5]. However, the advent of highly active antiretroviral treatment (HAART) in the early 2000s is largely responsible for the 39% drop in AIDS-related mortality since 2010. [1]. The success of the current antiretroviral medication (ART), which will help to suppress the virus, slow its transmission, and reduce AIDS-related deaths, will be crucial to ending the AIDS threat by 2030 and meeting the UNAIDS 95-95-95 objectives [6–8].

In HIV prevention and treatment, antiretroviral therapy (ART) is essential [9, 10], and chemists are vital in ensuring the safety and continuation of its use [11, 12]. Pharmacist treatments might reduce medication mistakes, enhance medication literacy, and increase adherence [15, 16]. Pharmacists provide PLWHA with high-quality, patient-oriented medication therapy management services [13, 14]. PLWHA might improve their health and manage their illness with proper care [14, 17]. In turn, this might reduce increasing health expenditure by reducing the utilisation of healthcare services and facilities, including clinic and ER visits [16, 18]. The availability of pharmaceutical services to PLWHA was linked to statistically significant increases in medication adherence and had a positive impact on viral suppression, according to a 2021 meta-analysis by Ahmed et al. that included data from the beginning to June 2020 [12]. The beneficial benefits of chemists on patients' viral loads, CD4 T lymphocyte counts, and ART adherence have also been shown in other trials [11, 15, 19, 20]. Pharmacy services are currently regarded by the American Society of HealthSystem Pharmacists (ASHP) as a crucial part of HIV treatment [12, 21, 22]. Nevertheless, economic effects and specifically PLWHA health outcomes were not the focus of earlier systematic evaluations of pharmacist treatments [11, 12, 23]. Therefore, in order to evaluate the financial effects of chemist treatment for PLWHA, we want to carry out a comprehensive study of the research.

2. Methods

In order to submit the results, we adhered to the PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analysis) standards and registered the systematic review on PROSPERO (CRD42020173057) [24].

2.1. Eligibility criteria

The following criteria have to be met for the studies to be included: (1) original research publications; (2) analyses of pharmacist-managed services in PLWHA; (3) economic assessments; (4) English-language writing; and (5) full-text accessibility. However, if they were not accessible in full-text format, workshop materials, case reports, editorials, views, letters to editors, comments, correspondences, news items, qualitative

research, and conference abstracts were not included.

2.2. Information sources

The Cochrane Library, PubMed, EMBASE, Scopus, international pharmaceutical abstracts (IPA) via ProQuest, and CINAHL Plus were among the electronic resources that were searched. From the beginning until February 23, 2021, three types of keywords—pharmacist managed services (e.g., "pharmacists"), HIV (e.g., "AIDS"), and economic evaluation (e.g., "economics")—that describe the main elements of the study topic were utilised, although with modifications. Both database-specific headings (such as MESH and EMTREE) and freetext keywords were employed (Supplementary Table S1).

To find any more records not uncovered by the computerised searches, the bibliographies of pertinent papers were manually examined. All of the listed papers' titles and abstracts were independently vetted by two writers. Two independent reviewers obtained the full-text of possibly acceptable titles and abstracts for a thorough examination. Discussion and agreement were used to settle any disagreements between the two reviewers. When a consensus could not be achieved, a third independent reviewer was contacted.

2.3. Data extraction and synthesis

The information derived from the included studies encompasses author(s), study objectives, study design, type of comparison, research setting, country of study, inclusion and exclusion criteria, study duration, sample size, intervention (i.e., chemist services), control group(s), perspective(s), cost year, program costs, economic outcomes, significant statistical results, benefit-to-cost ratio, currency, and type of economic assessment. The comparative methodologies included pre-post and inter-group analyses. Control groups were classified as parallel control for inter-group comparisons and historical self-control for pre-post comparisons. The study settings were categorised as hospital-based outpatient facilities or community pharmacies. The study viewpoints were classified as patient, provider, or social [25]. Ultimately, equivalents were supplied for all currency values in 2021 USD, accounting for inflation and currency fluctuations for each research.

The present systematic study encompasses program expenditures associated with the implementation and maintenance of pharmacy-managed projects or programs, including pharmacist salaries, incentives, office supplies, equipment, facility space, and utilities expenses. Conversely, economic consequences include expenses associated with services, such as prescription prices, cost reductions, savings per case, and more factors. The benefits-to-cost ratio, representing economic advantages per dollar spent on pharmacist-managed services, was determined by dividing the economic benefits of the service by the corresponding delivery costs for the same timeframe. If the cost year was not expressly indicated in the research, the year of study completion was used.

2.4. Quality assessment

The economic evaluation was categorised according to the criteria proposed by Drummond et al. [25], including the number of options and the analysis of costs and intervention results. Studies with two or more alternatives (e.g., intervention group vs control group or historical control group) were classified as 'analysis,' while

those lacking a control group were categorised as 'description.' A partial economic assessment may include a cost description, a cost analysis, a result description, and an outcome evaluation. The comprehensive economic assessment encompasses all cost and result elements, with studies further categorised as cost-effectiveness, cost-benefit, and cost-utility analyses. The assessment of the economic studies' quality was conducted using the 24-item Consolidated Health Economic Evaluation Reporting Standards (CHEERS) checklist [27].

3. Results

We identified 4,204 articles using database searches and two items via bibliographic searches. Following the elimination of duplicate articles, 3,409 surviving articles were evaluated based on their titles and abstracts. A total of 48 publications were selected for full-text examination; 44 articles were discarded for the reasons specified in Figure 1, and four papers were included for qualitative evaluation.

Table 1 encapsulates the characteristics of the studies covered. A study was performed in the United States, Mexico, Spain, and Brazil [15, 28-30]. Three investigations were performed in a hospital-based outpatient facility [15, 28, 29], while one research was executed in a community pharmacy environment [30]. Furthermore, three studies were prospective, single-group, pre-post trials [15, 29, 30], and one research was a prospective, parallel-controlled experiment [28]. The lowest sample size was 28, while the highest sample size was 279. Two studies possess a sample size of less than 50 [10, 19], whilst two research exceed a sample size of 100 [28, 30]. The two investigations lasted six months [15, 29], while the others were done over a period of 12 months [28, 30]. The pharmacist-managed interventions employed in the studies can be categorised into five types: targeted education for adherence (n=4) [15, 28-30]; pharmaceutical care (including medication review, modification, and recommendations for other healthcare providers) (n=4) [15, 28-30]; health screening and laboratory services (n=2) [15, 30]; referral to specialists (n=2) [15, 30]; and motivational interviewing for adherence (n=1) [15].

Table 2 encapsulates the economic attributes and other results of the research considered. Two research provided partial economic assessments, namely result and cost descriptions [15, 29], while two investigations conducted comprehensive economic evaluations, namely cost-benefit analysis [28] and cost-effectiveness analysis [30]. A research was conducted from a provider viewpoint [28], another from a patient perspective [29], a third from a societal perspective [15], and a fourth from both provider and society perspectives [30]. Pre-proof Manuscript Pre-proof of the Journal The program's expenses include labour costs and other expenditures, such as office utilities (lighting, rent), pharmacist training, and maintenance costs for pharmacist-managed services [15, 28-30]. Carnevale et al. indicated that an additional daily investment of US$1.45, 1.09, 2.13, 4.35, 1.09, and 0.87, equating to 2.30, 1.73, 3.38, 6.90, and 1.38 in 2021 US dollars, would be necessary for each incremental outcome of viral load at 200, 350, and 500 cells/mm3, as well as for optimal immune response, respectively. The intervention group produced yearly savings of US$ 32.33 per patient, equivalent to US$ 51.29 in 2021, related to visits, laboratory testing, and hospitalisations. The

intervention group indicated a benefit-to-cost ratio of 2.51:1 relative to normal care [28].

Dilworth et al. report that the actual mean cost of the 5-visit intervention was $819.74, equivalent to $1,028.85 in 2021 US dollars per patient. The total comprises $139.24, equivalent to 174.4 in 2021 US dollars for patient expenses, and $680.50, equivalent to 853.19 in 2021 US dollars for clinic expenses. Remuneration for chemists' time ($528.86, equivalent to $663.73 in 2021 US dollars per patient on average) was 78% of the clinic's total expenditure for each patient who underwent the adherence intervention. According to transmission rate modelling study, the adherence intervention averted about 0.134 secondary HIV infections among sexual partners of PLWHA who completed the whole six-month evaluation intervention. The avoidance of future HIV-related medical expenses resulted in savings of $49,702, equivalent to $62,360.68 in 2021 dollars, while incurring a loss of 0.772 QALYs. The intervention was very cost-effective, with a return on investment of $2.96, or $3.63 in 2021, in future medical savings for each dollar spent [15].

Individuals living with HIV/AIDS (PLWHA) travel monthly or bi-monthly to the clinic for in-person consultations and medication distribution, incurring significant expenses and resulting in a notable decline in productivity throughout the year. The research findings indicate a distinct advantage for patients. The study by Margusino et al. indicated that chemist teleconsultation resulted in a savings of 137 23 Euros per patient annually, equivalent to 165.74 US dollars in 2021, and an increase of 18.5 7.2 hours per patient per year.

Shrestha et al. indicated that treatments like the patient-centered HIV care model (PCHCM), which generally promotes viral suppression and thus inhibits HIV transmission, are essential to eradicate the HIV pandemic in the United States. The average cost per patient visit was $813, the incremental cost per patient achieving viral suppression was $48, and the total cost per patient virally suppressed was $5,039, equivalent to 887.76, 52.41, and 5,502.34 in 2021 US dollars, respectively. According to the results, interventions by HIV specialised clinical chemists prevented 2.75 HIV transmissions, resulted in a savings of 12.22 QALYs, and over $1.28 million, equivalent to 1.40 million in 2021 US dollars, in living expenditures for HIV care [30]. Moreover, research indicates that chemist treatments have elevated intervention costs while simultaneously decreasing future medical expenses (such as laboratory testing, consultations, hospitalisations, and emergency visits), so offsetting the heightened prices of medications.

According to the CHEERS checklist (Table 3), all four economic evaluations have satisfied item 1, since the names indicate that the research are economic assessments. All reviews have fulfilled criteria 2, except for Carnevale et al., which was partly finished due to the lack of a summary of the research viewpoint [28]. No discounts were used in any of the experiments, since their length did not exceed one year. In item 19 of the CHEERS checklist, Dilworth et al. and Margusino et al. failed to provide any incremental analysis or the implications of alternatives [15, 29]. Carnevale et al. provided a comprehensive explanation of model-based structural uncertainties and input parameter delays, whereas Shrestha et al. offered a partial elucidation [28, 30].

Carnevale et al. partly documented the disparities in baseline subgroup differences and heterogeneity in intervention effects [28].

4. Discussion

This systematic review analysed research assessing the economic effects of pharmacist-managed care for people living with HIV/AIDS. Despite the increased costs associated with chemist therapies, their total benefit on enhancing the well-being of PLWHA is far more substantial, either directly or indirectly, than the expenses incurred for the treatments. Interventions positively influenced adherence to ART, viral load suppression, immune system enhancement, prevention of opportunistic infections, laboratory expenses, hospitalisations, and emergency hospital visits within the intervention groups. Moreover, these strategies significantly decreased HIV transmission to HIV-negative partners and enhanced QALYs. This outcome may be associated with enhanced HIV management via better medication monitoring, leading to a reduction in total healthcare expenditures. Research indicates that pharmacist-managed initiatives provide cost savings, highlighting the significant role of chemists in the treatment of HIV/AIDS.

The role of chemists in healthcare has evolved from only dispensing and distributing medications to providing individualised, patient-centered care, including pharmacotherapy management and tailored education [31-34]. The inclusion of pharmacists in HIV/AIDS healthcare management teams is expected to be maintained and progressively expanded, particularly in light of the recommendations from the World Health Organisation (WHO) and the American Society of Health-System Pharmacists (ASHP), both advocating for the integration of pharmacists into multidisciplinary teams to enhance health outcomes for people living with HIV/AIDS (PLWHA) [6, 22].

This review included one research performed in a community pharmacy environment and three investigations executed in hospital outpatient contexts. This aligned with the pertinent evaluations of pharmacist-managed services for diabetes and hypertension, which acknowledged that pharmacists have enhanced pharmacotherapy services in outpatient environments [18, 31]. One hypothesis is that chemists are easily accessible and eager to provide immediate counsel on drugs in outpatient environments, especially for those undergoing outpatient treatment for chronic conditions like HIV/AIDS. The findings from these research will allow pharmacist managers to substantiate the financial advantages of pharmacist-managed programs and to enhance such services in outpatient settings, in light of the growing acknowledgement of pharmacists' role in the effective utilisation of medications for chronic illnesses. The findings from research undertaken in the USA, Mexico, Spain, and Brazil cannot be generalised to other nations because to discrepancies in chemist competencies and services provided.

Several restrictions need attention. Initially, fifty percent of the research considered were comprehensive economic analyses akin to a study of the cost assessment of chemist services for patients with diabetes [31]. To motivate decision-makers to optimise the distribution of scarce healthcare resources, comprehensive economic assessments should be performed and documented

based on established criteria, taking into account both costs and results. Secondly, the majority of research is conducted from a provider's viewpoint, while just one study used a patient's standpoint. In contrast, none of the research determined the insurance status of participants, since uninsured persons seem to have low incomes. Non-insured people get fewer prescriptions and have fewer doctor's appointments, but have higher emergency department visits, indicating insufficient HIV treatment that results in a significant cost burden. Consequently, research may be conducted to investigate the economic impact of such measures on uninsured persons.

Third, two studies have examined indirect costs, which constitute a substantial fraction of the total expenses associated with HIV therapy [15, 29]. Bam et al. indicated that the cumulative sum of days missed in a monthly cycle owing to HIV/AIDS was 3.5 days lost [35]. While pharmacist-managed programs may enhance individual health outcomes and productivity, the current studies may not fully comprehend the economic implications of these services. Fourth, the uncertainty inherent in the key point calculations and the expectations about costs and outcomes must be acknowledged, since variations in parameter values may not result in divergent findings and conclusions. Economic estimations of chemist interventions may use one-way, multi-way, and probabilistic sensitivity analyses, together with non-parametric bootstrapping, to assess variations in estimates. Ultimately, establishing a causal relationship between pharmacist-managed services and their economic impacts might benefit from a research design that include a contemporaneous control group and use randomisation to mitigate bias. Policymakers may get more robust and compelling data from future randomised controlled trials with greater sample sizes.

4.1. Constraints

The current research has many drawbacks. Although a systematic search method has been used to identify eligible research, it is probable that not all publications meeting the inclusion criteria have been included. Secondly, this study is compromised by publication bias, since only select reports that have been published may accurately represent the findings, while non-significant results may remain unpublished. Thirdly, there was no effort to reach out to the authors of the analysed papers to get unreported information; hence, reporting bias may have existed. Ultimately, we excluded conference abstracts and dissertations without full-text availability, which may have introduced publishing bias.

5. Conclusion

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