Measuring HIV Health Management Efficiency Among Health Insurers in Colombia Using Data Envelopment Analysis

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INTRODUCTION

Efforts towards HIV control and prevention have been set in the public health agenda, leading to international strategies such as 95-95-95 to reduce transmission, continued antiretroviral therapy (ART) and viral suppression for 2030 (1). At a global scale in 2020, 37.7 million people lived with HIV (PLH). However, only 73% accessed treatment and 66% reached viral suppression (2). Internationally, opportunities for improvement in diagnostic and treatment wait times, along with diagnostic testing for early detection and treatment, have been identified (3-5). In Colombia during 2020, 134,636 PLH were reported to Colombia's High Cost Diseases Fund (*Cuenta de Alto Costo – CAC*) with a reduction in reported cases due to the pandemic. Among the CAC's HIV health risk indicators, most presented improvement when compared to 2019. Nonetheless, 12 indicators showed lower performance (6-8). Identifying and correcting the causes of these results could reflect in more efficient resource management and cost-containment (9).

OBJECTIVE

This study evaluates third payer and state regimes health insurer's efficiency in HIV health risk management in Colombia in 2020. A discussion between efficiency and effectiveness is assessed through comparison of specific health indicators levels in efficient insurers against suggested levels in Colombia's HIV health risk indicators consensus.

METHODS

Administrative records of HIV population provided by insurers to the CAC between February 1, 2020, and January 31, 2021, were used to build HIV health risk management indicators for each insurer from third payer and state regimes. Enrolled population to each insurer on January 31, 2021, was calculated from the official unique enrollee database (*Base de Datos Única de Afiliados – BDUA*) of Colombia's Health Ministry (*Ministerio de Salud y Protección Social – MinSalud*). Inputs (*m*) and outputs (*s*) are divided between desirable and discretionary (*dd*), non-controllable (*nc*), undesirable but discretionary (*udd*), and desirable but non-discretionary (*nd*), and selected from a literature review (10-13). Efficiency scores were obtained using Data Envelopment Analysis (14) and efficient insurer's indicators were compared to Colombia's HIV health risk indicators consensus (15,16) to assess effectiveness in therapeutic goals accomplishment. Inputs included treatment wait times (*twt*) and enrolled population, while outputs included proportions of PLH undetectable (*udt*), detected early (*edet*), genotyped (*geno*), with first line treatment (*flt*), receiving ART (*poptar*), proportion of pregnant screened for HIV (*scree*), lethality (*lethal*), mortality (*mortal*) and prevalence (*preval*). Finally a Tobit regression is used to assess the relation between efficiency scores and proportion of population belonging to key population (e.g., sex workers), ethnic population or living in remote areas (14,17,18). All calculations were executed in R (19).

Equation 1 DEA model – first stage (technical efficiency)

$$\max_{\eta_o,\mu} \eta_o$$

$$subject\ to$$

$$x_{o,m,dd} \geq \mu X_{m,dd} \quad \forall m, dd = \{twt\}$$

$$x_{o,m,nc} = \mu X_{m,nc} \quad \forall m, nc = \{\%\ enrolled\ population\}$$

$$\eta_o y_{o,s,dd} \leq \mu Y_{s,dd} \quad \forall s, dd = \{udt.,\ edet,\ scree, geno, flt,\ poptar\}$$

$$\eta_o y_{o,s,idd} \leq \mu Y_{s,udd} \quad \forall s, udd = \{lethal,\ mortal\}$$

$$y_{o,s,dnd} \leq \mu Y_{s,dnd} \quad \forall s, dnd = \{preval\}$$

$$\mu \geq 0$$

$$\forall o = \{Insurer \mid Insurer = 1,\ \ldots,\ 38\}$$

Equation 2 DEA model – second stage (mix efficiency/slacks)

$$\min_{t^-_{o,m,dd}, t^-_{o,m,nc}, t^+_{o,s,dd}, t^+_{o,s,idd}, t^+_{o,s,dnd}, \mu} -t^-_{o,m,dd} - t^-_{o,m,nc} - t^+_{o,s,dd} - t^+_{o,s,udd} - t^+_{o,s,dnd}$$

$$subject\ to$$

$$x_{o,mdd} - \mu X_{mdd} - t^-_{o,mdd} = 0 \quad \forall mdd = \{twt\}$$

$$x_{o,mnc} - \mu X_{mnc} - t^-_{o,mnc} = 0 \quad \forall mnc = \{\%\ enrolled\ population\}$$

$$\eta^*_0 y_{o,sdd} - \mu Y_{sdd} + t^+_{o,sdd} = 0 \quad \forall sdd = \{udt.,\ edet,\ scree, geno, flt,\ poptar\}$$

$$\eta^*_0 y_{o,sidd} - \mu Y_{sidd} + t^+_{o,sidd} = 0 \quad \forall sidd = \{lethal,\ mortal\}$$

$$y_{o,sdnd} - \mu Y_{sdnd} + t^+_{o,sdnd} = 0 \quad \forall sdnd = \{preval\}$$

$$\mu \geq 0,\ t^-_{o,mdd} \geq 0,\ t^-_{o,mnc} \geq 0,\ t^+_{o,sdd} \geq 0,\ t^+_{o,sidd} \geq 0,\ t^+_{o,sdnd} \geq 0$$

$$\forall o = \{Insurer \mid Insurer = 1,\ \ldots,\ 38\}$$

RESULTS

From 38 third payer and state regimes insurers, 30 (79%) were found to be efficient. From the non-efficient insurers 5 belong to the state regime and 3 to the third payer. The indicators with the lowest accomplishment were HIV screening in pregnant women, genotypic resistance testing, proportion of HIV population with undetectable viral loads and HIV early detection. Even among efficient insurers, none fulfilled all of the therapeutic accomplishment goals.

Figure 1 Efficient/Non efficient DMUs and efficiency score distribution

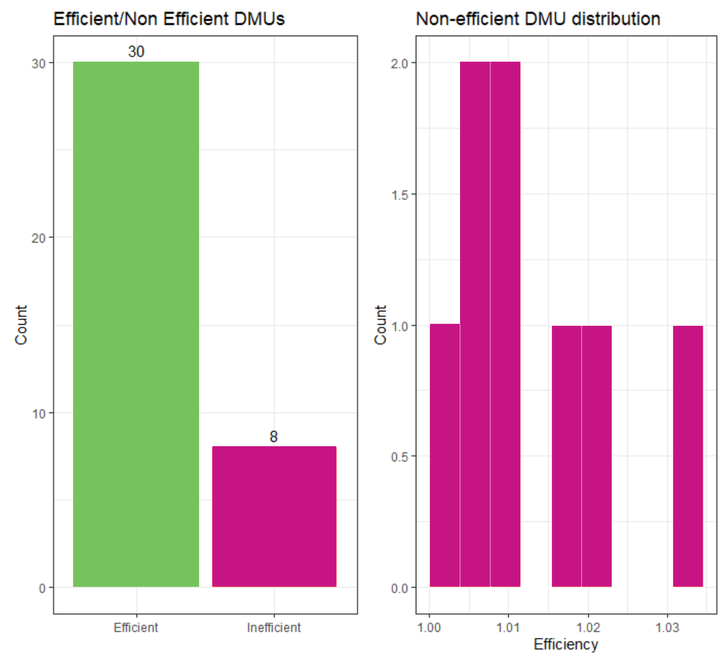
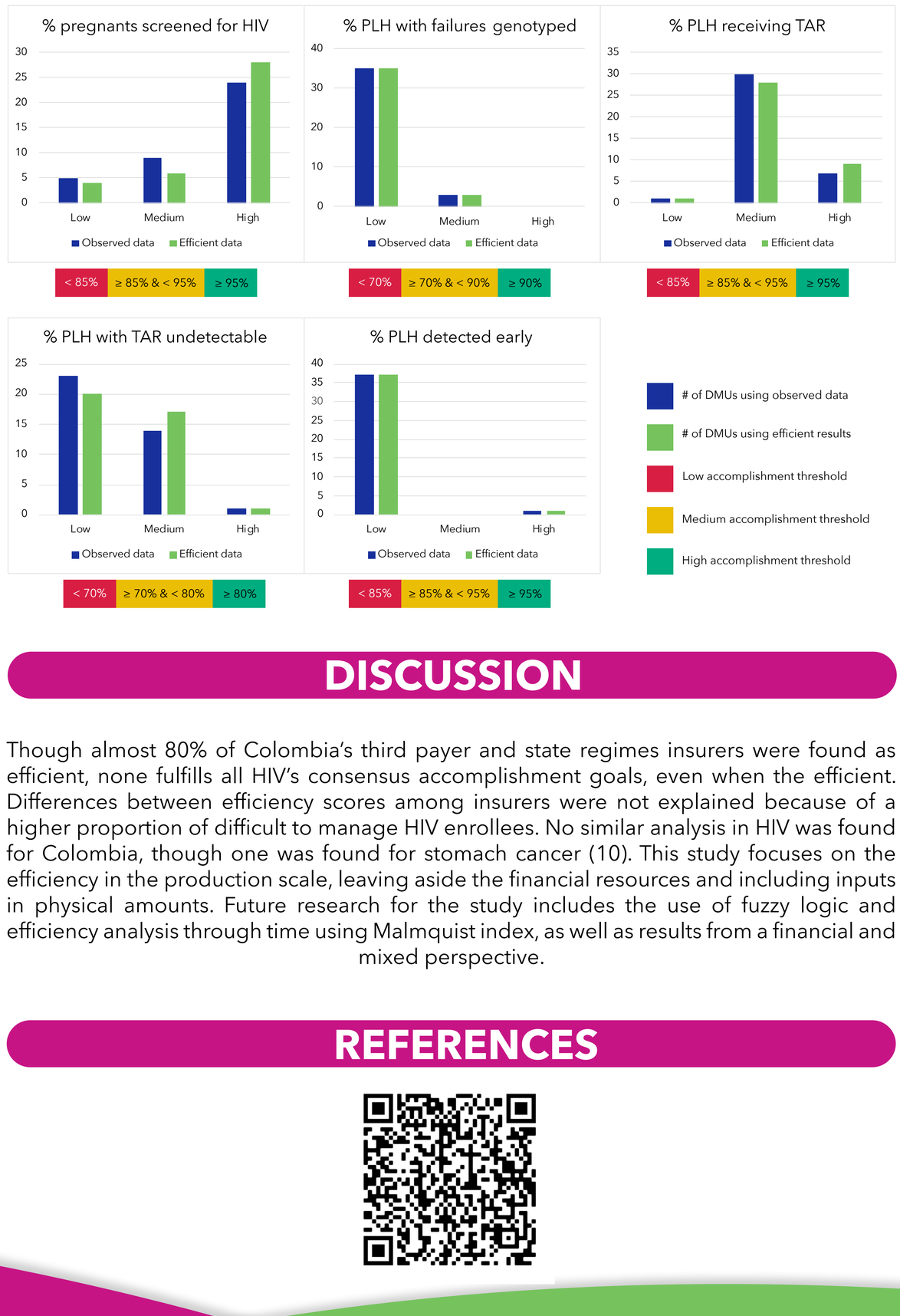


Figure 2 Number of DMUs by indicators accomplishment levels comparing observed data and DEA's efficient results



DISCUSSION

Though almost 80% of Colombia's third payer and state regimes insurers were found as efficient, none fulfills all HIV's consensus accomplishment goals, even when the efficient. Differences between efficiency scores among insurers were not explained because of a higher proportion of difficult to manage HIV enrollees. No similar analysis in HIV was found for Colombia, though one was found for stomach cancer (10). This study focuses on the efficiency in the production scale, leaving aside the financial resources and including inputs in physical amounts. Future research for the study includes the use of fuzzy logic and efficiency analysis through time using Malmquist index, as well as results from a financial and mixed perspective.

REFERENCES