Benchmarking Current Practices in Data Visualisation in HEOR, Identifying Gaps and Suggesting Improvements

Kunal Hriday¹, Tushar Srivastava^{1*}

¹ConnectHEOR, London, UK

*tushar.srivastava@connectheor.com

BACKGROUND

Data visualisation is a graphical depiction of data analysis using common graphics such as plots, charts, and infographics. In health economics and outcomes research (HEOR) studies, it is vital to interpret and communicate the study findings to multiple stakeholders. Data visualisation has the potential to express complicated data relationships and data-driven insights in an understandable manner. The standard data visualisation graphs in HEOR studies include scatter plot, efficiency frontier, tornado chart, cost-effectiveness acceptability curve (CEAC), etc. The study aims to understand the trend of usage of **non-standard data visualisation** in HEOR and suggest improvements within that.

METHODS

A targeted literature review was conducted using the PubMed database

RESULTS

Distribution of various plots used in the studies

Following screening of 173 records, 60 relevant articles were included. Of these, we observed occurrence of several unique nonstandard HEOR charts, including relative density plot, horizontal tornado, stepwise tornado, spider plots, rankogram, enhanced Kaplan-Meir (KM) plot, price acceptability curves, panel plots, contour plot, funnel plots, error bands, and Sankey plot. Furthermore, MS-Excel was utilised 60% of the time to develop these graphs, followed by Prism (15%) and R (13%).



Distribution of various software used in the studies





to identify original articles published in the last 10 years (between 1/1/2012 and 1/1/2022). Only studies with 'non-standard data visualisation' were included.

DISCUSSION

Further understanding the literature, we observed that as more visualisation software come into play a degree of advancement can be seen in popular HEOR graphs. However, this advancement was still limited to only a few research papers. We present a few of these advancements and our understanding of their advantage below. Data visualisation in HEOR remains an interesting area of further future research.

Example Use Case	Traditional Approach	Recent Approach	Advantage	Software
Incremental cost effectiveness ratio (ICER) distribution for various intervention strategies or various scenarios for the same intervention strategy	Box plot	Bean/ Violin Plot	Alongside dispersion, bean plots allow for weight of dispersion. E.g. can be used to show ICER variation under different scenarios of a particular input. A Violin or bean plot will be more accurate if various scenarios have different weights.	Power Bl/ Graph pad Prism
Kaplan-Meier estimates	Line plot	Error BandsImage: Stress of the second	Error bands plot uncertainty along with trend. They are recommended to depict confidence level bands around KM estimates. They make it easier to understand till what threshold KM metric is robust.	MS Excel
Probabilistic Sensitivity Analysis (PSA)	Scatter plot	Relative Density plot 	It plots a bivariate normal distribution to the X-Y coordinates with mean of 0 and standard deviation of 1. It smoothens the surface of scatter plot. It helps to know the density of simulated Costs Vs quality-adjusted life years (QALYs) comparison points and gives a cleaner picture of points away from the mean. It gives higher information relevant for decision making to the modeller . It also makes comparison of two different PSAs much easier.	R
To show changes in treatment patterns or choices over a period of time Or, to show cycles of a transition matrix where patients move in and out of various states to eventually converge in one final stage	State Proportion Cycle (Months) State 1 State 2 State 2 0	Sankey Plot <caption></caption>	Sankey plot is useful when there are multiple stages (time stages, treatment stages, intervention stages etc) and there is a shift in distribution of a category at each stage. It simplifies a stage related diagram or model and helps visually assess the movement along with respective proportion of individuals. It is also helpful to visualise effect of intervention on population.	Tableau/ SankeyM ATIC/ R (Treatme ntPattern s Package)
Meta-Analysis	Forest Plot 0 000 10 000 10 000 10 000 10 000 10 000 10 000 10 000 10 000 10 000 10 000 10 000 10 000 10 000 10 000	<section-header>Rainforest Plot</section-header>	In conventional forest plots, subgroups are visually overemphasized by long confidence interval lines. The point estimates of large subgroups are difficult to discern because of the large box representing the precision of the estimate within subgroups. Moreover, confidence intervals depicted by lines might incorrectly convey the impression that all points within the interval are equally likely. Rainforest plots have been proposed to overcome these potentially misleading aspects of conventional	R



CONCLUSION

Recently, there has been a substantial advancement in HEOR visualisation, however, our scope has been limited to improvements over traditional graphs only. Storytelling through data visualisation is a profound research area in itself where any data table or matrix can be systematically classified into comparison, correlation, distribution, concept, geospatial or trend and each of these category supports plenty of charts for visualisation. New visualisations like bean charts, horizontal tornados, cycle plots, jitter plots along with traditional charts like Lorenz curve, box plots, bullet charts can have potential applications in HEOR studies. The advanced visualisation tools like Power BI, Tableau, R and python libraries like ggplot2, Plotly, Lattice, Matplotlib, Pandas open up options for creating whole new visualisations in HEOR that could be explored further.



