Cost Effectiveness Analysis of Home-Based Phototherapy Versus Hospital-Based Phototherapy for Treatment of Neonatal Hyperbilirubinemia in shiraz, Iran

Zahra Kavosi
Shiraz University of Medical Sciences
Malallah Mozafari
Shiraz University of Medical Sciences
Mehdi Rezaee
Kerman University of Medical Sciences
Khosro Keshavarz (khkeshavarz2007@gmail.com)
Shiraz University of Medical Sciences

Research Article

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Abstract

Background

Neonatal jaundice is the most common cause of hospitalization of mature and healthy infants. Phototherapy is the most common treatment for the rise in indirect bilirubin. Hospitalization of infants has complications such as hospital infections, separation of the mother from the baby, occupying hospital beds and high cost of hospitalization. Since phototherapy is possible at home and by home care centers, this study was conducted to analyze the cost-effectiveness of phototherapy at home versus phototherapy in hospital in Shiraz in 2021.

Methods

This research is a complete economic evaluation of cost-effectiveness that was conducted cross-sectionally from March to August 2021 in Hafez and Hazrat Zeinab hospitals and Parseh and Ava Gostar home care centers in Shiraz. The study population included all neonates who were admitted to these centers with a diagnosis of jaundice for phototherapy. 180 neonates with jaundice in the two groups of hospital and home care were included in the study. The effectiveness index for this study was the average daily decrease in total bilirubin. We made use of cost and effectiveness forms to collect the required information. The results were presented in the form of incremental cost-effectiveness ratio (ICER) and one-way and probabilistic sensitivity analysis was used to measure the strength of the study results. TreeAge pro2020, Excel 2019 and Spss18 were used to analyze the collected data.

Results

The results showed that the average cost of phototherapy at home and hospital were $ 196.52 and $ 397.85, respectively, and the average effectiveness was 0.39 and 0.36, respectively. Therefore, according to the results, phototherapy at home is more cost-effective than phototherapy in the hospital. In addition, the results of one-way and probabilistic sensitivity analysis showed the strength of the research results.

Conclusion

Phototherapy at home is a more cost-effective option than phototherapy in the hospital. Therefore, it can be suggested to insurance organizations as well as service providers to prioritize phototherapy at home to be included in the basic insurance package.

Introduction

Neonatal jaundice occurs in more than 60% of mature infants in the first week of life, and naturally, total serum bilirubin rises during the third to fifth days of life and then gradually decreases, and this rise in

bilirubin is in the range that does not need any treatment (1). In some cases (2% of mature infants) bilirubin rises to some extent (above 20 mg / dL) which requires treatment and if left untreated, it may cause nerve damage and chrysanthemums (2, 3). Phototherapy is the most common treatment for neonatal jaundice and prevention of its complications (4, 5). It is a safe and healthy method that doctors used for decades in the treatment of this ailment. The main mechanism of bilirubin excretion through phototherapy and the cause of 80% of the efficacy of this method is photo isomerization of insoluble indirect bilirubin on the skin surface and its conversion to polar and soluble form (6). The common treatment for moderate jaundice is the conventional phototherapy with a power of 6 to 12 microwatts per square centimeter per nanometer and for sever jaundice, phototherapy with a high power of 25 microwatts per square centimeter per nanometer for severe jaundice is usually used. Blood transfusions are sometimes required for preventing neurological complications, especially in cases of very high bilirubin (7, 8).

different reports indicate that for healthy and mature infants, phototherapy at home can be safer and more effective than hospitalization of infants for a long time (9, 10). The Regional Agency for Child Health and Human Development, regarding the different results of studies conducted on home phototherapy in 1971, started a comprehensive case-control study on neonatal hyperbilirubinemia from 1974 to 1976. This study raised ambiguities and questions about home phototherapy (11). Along with several studies on term infants receiving phototherapy at home, this study showed that phototherapy at home is a healthier, more effective, and more beneficial way than phototherapy done in hospital, it has no serious side effects, and comparing to hospitalization, it has an average saving of $ 300 for every patient (12, 13).

Also, in a systematic review and meta-analysis conducted in 2020 by Liangliang Chu et, they compared phototherapy in the hospital and at home and concluded that home phototherapy for the treatment of neonatal hyperbilirubinemia appeared to be more effective in reducing bilirubin of total serum. however, there was no significant difference in the duration of phototherapy between the two groups. Therefore, home phototherapy is an effective, feasible, safe and an alternative way to hospital phototherapy for neonatal hyperbilirubinemia (14).

At present, in our country, infants usually receive phototherapy in the hospital after birth if they have jaundice. Hospitalization in the first days of life has complications like nosocomial infections and separation of the mother from the infant, as well as transportation problems, occupation of hospital beds and additional costs (15).

In recent years, in developed countries, considering the high cost of hospitalization, increase in public awareness of diseases and advances in medical technology that has led to the introduction of less risky and more effective methods, families tend to take more advantage of home care (16). Therefore, the health systems of developed countries, considering the mentioned problems, seek to activate the private sector as much as possible in financial procurement and improving the quality of services. So that they often use non-hospital facilities such as home care to treat many ailments (17, 18).

Home care has special benefits such as providing services at home, improving access to services, reducing the risk of nosocomial infections, security, reducing the queue for patients and also greater satisfaction (17). Today, home therapy is very common due to the importance of preventing the separation of mother and baby and the continuation of taking care of the patient at home. The most important feature of home phototherapy is that the mother is not separated from the baby (19, 20).

Studies on estimating the cost-effectiveness of phototherapy are few and such study has not been performed in Iran yet. Since no cost-effectiveness study has been conducted specifically in relation to home phototherapy, this study aimed to analyze the cost-effectiveness of home phototherapy versus in-hospital phototherapy in the treatment of neonates with jaundice in Shiraz in 2021. The aim of this study is to identify the cost of the most effective treatment protocol to help specialists, managers and policy makers in this field to choose the best treatment method and also to use the limited resources correctly.

Methods

Overview

This cost-effectiveness economic evaluation study is a descriptive-analytical, cross-sectional and prospective research conducted in the period from March to August 2021 on newborns and hospitalized infants in Zeinabieh and Hafez hospitals as well as home nursing service centers of Avagostar and parseh. The statistical population of the research included 180 infants with jaundice, 90 of whom received phototherapy at home and another 90 in hospital.

In this research, the neonates who were admitted to the study in accordance with the Phototherapy Instruction at Home approved by the American Fetal and Neonatal Society (21) and the Home Phototherapy Guidance approved by the Iranian Society of Neonatal Physicians (2004) (22) were studied. In the specified period, all the patients in hospitals and home care centers mentioned earlier were included in the study by census. We didn’t do any sampling.

For evaluating the results of the cost and effectiveness, we adopted the Decision Tree Model and we gathered the cost data from a community view, so that the direct and indirect costs could be included in the study. The success amount of clinical testing in each treatment method was defined as a sign of effectiveness. We used a data collection form to gather cost and effectiveness data. The results were presented in the form of Incremental cost Effectiveness ratio (ICER). Furthermore, one-way and probabilistic sensitivity analyzes were conducted to measure the effects of parameter uncertainty in the model. We exploited TreeAge Pro 2020 and Excel 2019 for analyzing the gathered data.

Inclusion and Exclusion Criteria

Inclusion criteria in this study are as follows: term infants with total bilirubin between 10 and 18, infants with normal weight (2500 to 4000 grams) and age more than 24 hours. Exclusion criteria also include

premature infants (weight under 2500 and fetal age under 37 weeks), infants with congenital anomalies, infants with blood disorders and infections, and direct bilirubin above 1.5.

Treatment costs

In this study, the costs were collected from a community perspective. Therefore, the costs considered in our study include direct medical costs (DMC), direct non-medical costs (DNMC) and indirect costs (IC).

The DMC includes the cost of medication, testing, a physician visit, and hospitalization, which will include the cost of side effects from each treatment and subsequent treatment if the initial one fails. We collected the DMC data by checking the patients' medical records as well as interviewing the clinical experts in this field.

DNMC consists of intra-city and intercity transportations, food and accommodation expenditures for the patients and their companions. IC also includes: average days of absence from work of patients and companions and the reduced productivity because of illness, disability and death. DNMC and IC data were gathered through self-reported patients' companions by face-to-face interviews or telephone calls. We used the human capital approach for calculating the IC (23, 24). In addition, all costs were calculated based on the tariffs of 2020 and exchanged into international dollar (purchasing power parity) at the exchange rate of 1 dollar equals 31317 Rials (25).

Effectiveness data

In this study, efficacy indices were adjusted using previous studies and in consultation with clinical specialists, which includes the success rate of treatment. it is the average rate of bilirubin reduction (which is the result of subtracting the average amount of bilirubin when stopping phototherapy from the average bilirubin at the time of admission of the baby at home care center and in the hospital) as well as the average duration of phototherapy treatment.

Model structure

In figure 1, the schematic diagram of the decision tree model shows two strategies of home therapy versus phototherapy in the hospital. For each strategy, we designed treatment success in each situation. Also, costs and effectiveness were entered in the model separately for both strategies.

Cost-effectiveness analysis

We exploited Excel 2019 for collecting data and TreeAge pro 2020 for modelling and analyzing these data. Then, using the following formula, the incremental cost-effectiveness ratio for both treatment strategies was estimated.

$$ICER=\frac{cost\ of\ Home-Based\ Phototherapy-cost\ of\ Hospital-Based\ Phototherapy}{effectivness\ of\ Home-Based\ Phototherapy-effevtivness\ of\ Hospital-Based\ Phototherapy}$$

Due to the lack of cost-effectiveness studies threshold in Iran, according to the World Health Organization (WHO), the threshold of developing countries is one to three times of Gross Domestic Product (GDP) per capita (26). In Iran in 2020, GDP was $ 13,116 (27), using this amount, the threshold for willingness to pay in Iran was set at $ 13,116 (1* GDP)

Sensitivity analysis

Finally, for examining the effects of parameter uncertainty on the results of the study, we used one-way sensitivity analysis and probabilistic sensitivity analysis (PSA). In order to perform one-way sensitivity analysis, some main factors like cost and effectiveness for each drug strategy were changed by 20% and the results were presented in the form of a Tornado Diagram. In addition, because the effectiveness and cost variables in the present study were measurable and probabilistic, PSA was performed and they were regarded as distributions, so that the beta (ß) distribution was used to determine the distribution of effectiveness values, which was between 0 and 1. The gamma distribution was also used to determine the cost distribution. Based on this, Second-order Monte Carlo simulation was done using 5000 trials. We presented PSA results using cost-effectiveness acceptability curve and incremental cost-effectiveness scatter plot. Cost-effectiveness acceptability chart is one of the best curves for planning and policy-making that is highly useful for policy makers and planners of the health system to specify the probability of cost-effectiveness of each intervention in exchange for willingness to different payments. besides, the distribution curves provide more detailed information in individual comparisons. These curves actually indicate what percentage of the points are in the reception area, i.e. below the threshold (28).

Results

In this research, 180 infants in two groups of phototherapy in the hospital (90) and phototherapy at home (90) were studied. Most male infants (66.89%) weighed 2500–3500 (66.6%), had hemoglobin levels less than 14.4 (58.3%) and had hematocrits below 44 (51.6%). Neonates were divided into low-risk (10-1.99) and high-risk (14–18) groups according to primary bilirubin.

Tables 1 and 2 show the average cost and effectiveness in patients with jaundice in the two groups of patients hospitalized and taken care of at home.

According to Table 1, the highest average DMC was in hospitalized patients ($ 292.49). Also, the cost of hospitalization in the phototherapy group at the hospital was the highest type of DMC ($ 129.92). According to Mann-Whitney test, there is a statistically significant difference between direct costs in the two treatment groups (P = 0.03)

Besides, direct non-medical and indirect costs for the two groups of phototherapy in the hospital and at home were 33.74, 71.62 and 39.55, $ 64.01 PPP, respectively, which shows no significant difference in these costs between the two groups.

In addition, the average total cost of phototherapy in a hospital is almost twice the cost of home therapy. According to Mann-Whitney test, there was a significant difference between the total cost in the two groups (P = 0.04).

Table 1
Average annual costs of jaundice treatment with Hospital-based phototherapy versus Home-based phototherapy in Shiraz in 2021:

Costs	Hospital-based phototherapy		Home-based phototherapy		P-value
	PPP $	Percentage	PPP $	Percentage	
Direct Medical Costs					
hospitalization	129.92	44.42	0.00	0.00	-
Physician's Visits	102.93	35.19	26.19	28.18	< 0.001
Laboratory Tests	22.15	7.57	11.38	12.24	< 0.001
Medicine and consumption	29.85	10.21	9.31	10.02	0.95
Home service	0.00	0.00	46.08	49.57	0.59
Nursing services	7.64	2.61	0.00	0.00	-
Total	292.49	73.52	92.96	47.30	0.03
Direct Non-Medical Costs					
Transportation	33.74	8.48	39.55	20.12	< 0.001
Indirect Costs					
Patient's Family Lost Costs	71.62	18.00	64.01	32.58	< 0.001
Total Costs	**397.85**	**100**	**196.52**	**100**	0.04

According to Table 2, in relation to the duration of phototherapy treatment at home and in the hospital, phototherapy in the hospital has a shorter time with 35.6 hours than phototherapy at home with 38.3 hours, although there is no significant difference between the location of phototherapy and the period of treatment.

Table 2 also shows the effect of phototherapy on reducing daily bilirubin levels in the study groups. On average, phototherapy in the hospital reduced 35.56% and phototherapy at home reduced 39.84% of the initial bilirubin, which according to the Mann-Whitney test, there is a statistically significant difference between the effectiveness of phototherapy at home and in the hospital. (P < 0.05).

Table 2
Mean time and rate of reduction of blood bilirubin in patients with jaundice in Hospital-based phototherapy versus Home-based phototherapy in Shiraz in 2021:

Study group	Hospital-based phototherapy	Home-based phototherapy	p-value
Duration of phototherapy (hours)	35.60	38.30	P = 0.06
Decreased bilirubin (percentage)	35.56	39.84	P = 0.02

According to Fig. 2 and Table 3, the results of cost-effectiveness analysis showed that home phototherapy is less costly ($ 196.52 PPP) and more effective (0.39). Therefore, it is a more cost-effective option than phototherapy in the hospital and does not require ICER calculation.

Table 3
Cost-effectiveness analysis table of the effectiveness of Hospital-based phototherapy versus Home-based phototherapy in Shiraz in 2021:

Strategy	cost	Eff	incrCost	incrEff	ICER ((Incremental cost per effectiveness Gained) PPP $)
Hospital-based phototherapy	397.85	0.36	-	-	-
Home-based phototherapy	196.52	0.39	-201.33	0.036	dominant

One-way sensitivity analysis:

According to the tornado diagram in Figure 3, the results showed that ICER was most sensitive to the effectiveness of the second day of home treatment and less sensitive to the costs of home and hospital treatment. Also, according to this diagram, changes in input parameters had little effect on the result and the ICER rate remained negative.

Probabilistic sensitivity analysis (PSA):

The results of uncertainty measurement using cost-effectiveness acceptability curves and ICER distribution curve are presented as follows:

The results of Acceptability curves showed that performing phototherapy at home is the most cost-effective treatment in 95.46% of simulation cases for thresholds less than $ 13,116 (Figure 4).

The results of the distribution curve showed that phototherapy at home was more effective and less costly in 63.72 cases. in 31.74% of cases, although it was less effective, it had a much lower cost and the ICER rate was below the threshold. In total, in 95.46% of cases, it is situated in the admission area and

below the threshold. Therefore, it has defeated the phototherapy in the hospital and is considered to be a more cost-effective strategy. Additionally, phototherapy in the hospital in 4.54% of cases is below the threshold compared to phototherapy at home and is considered as a less cost-effective (inefficient) strategy (Figure 5).

Discussion

Despite the high costs that jaundice put upon the country's health sector every year, no study has been conducted to measure the cost-effectiveness of phototherapy at home compared to phototherapy in hospitals around the world. However, it seems that the economic burden of this disease can lead to high costs, especially in low-income families. The results of studies also show that problems such as frequent visit of laboratories for blood sampling, mental and physical stress imposed on parents and the risk of brain damage due to not getting back to repeat the tests and treatment can be easily reduced by performing phototherapy at home (29). Thus, this study was conducted to assess the cost-effectiveness of phototherapy at home compared to phototherapy in the hospital. We hope that the results of this study can provide guidelines for health specialists and policymakers in allocating financial and human resources and in paying more attention to a more effective control and treatment program for pediatric jaundice.

According to the findings of the present study, phototherapy at home costs an average of $ 196.52, while phototherapy in the hospital costs an average of $ 397.85. Therefore, the average cost of treatment for each patient treated with phototherapy at home is less than the method of treatment with phototherapy in the hospital. One of the reasons for this difference is the very high cost of a hospital bed.

Golshan Tafti and Golzari (2018) showed that despite the same reduction of bilirubin and the same complications of phototherapy in the two groups of phototherapy (home and hospital), the period and the cost of treatment in home-treated phototherapy was significantly lower than in-hospital phototherapy ($ 3121 compared to $ 5192) (29). Peterson et al. (2021) also showed that home phototherapy was less expensive than in-hospital phototherapy ($ 13,491 in home phototherapy versus $ 1101 in hospital phototherapy) (30). In addition, according to Jackson et al. (2000) treatment of patients at home led to an acceptable reduction in serum bilirubin and none of them needed to be readmitted to the hospital for phototherapy. Their families were very satisfied with the phototherapy at home and they had a significant reduction in the cost of phototherapy. So, home phototherapy was affordable and safe for families (31). Findings of all the three studies are consistent with the results of the present study, which makes sense to use phototherapy at home to avoid additional costs associated with hospitalization and the related services.

In this study, the effectiveness was evaluated based on the average bilirubin reduction. According to the results, phototherapy at home has caused a greater reduction in bilirubin in patients than phototherapy in the hospital. Statistical tests showed that there is a statistically significant difference between the effectiveness of phototherapy at home and in the hospital.

In a meta-analysis study, Yangchu et al. (2020) concluded that compared to nosocomial phototherapy, home phototherapy is more effective in treating neonatal hyperbilirubinemia and reducing total serum bilirubin. However, there is no significant difference in duration of phototherapy in the two groups (14), which is similar to the findings of our study.

Also, according to Khatami et al. (2007), home phototherapy, if performed under the supervision of experienced medical and nursing staff, in 92.6 cases can be a suitable and effective alternative method for the treatment of mature and healthy infants with indirect jaundice and has benefits such as lower cost, not separating mother from baby and no feeling of illness in the baby (15), which in this regard is also consistent with the present study.

Barzegar et al. (2005) but showed that there is no significant difference between the two groups in terms of reducing bilirubin levels (22), which is not consistent with our study.

Increased cost-effectiveness ratio (ICER) was used to analyze cost data in two groups of phototherapy at home and in hospital. According to the findings of the study, phototherapy at home is less expensive (196.52 vs. $ 397.85) and more effective (0.39 vs. 0.36) than phototherapy in the hospital, so it is the dominant mode and a more cost-effective option. .

Tiberg et al. (2016) in a study on children with type 1 diabetes concluded that there was a statistically significant difference in relation to health care satisfaction in favor of home care (p = 0.002). Overall, health care costs (direct costs) were significantly lower in the home care group, but there was no statistically significant difference between the two groups in estimating lost production (indirect costs) for the family as a whole. In total, the results showed that home care may be a cost-effective strategy using the perspective of the health care sector, but when using a broader social perspective, no difference was found in cost-effectiveness or cost-desirability (32). The results of this study are also consistent with the present study in terms of cost-effectiveness of home care.

Maru et al. (2015) in research on chronic heart failure (CHF) patients in Australia found that on the verge of willingness to pay a $ 50,000 for each additional QALY, the likelihood of having a better evaluation for home care by heart failure patients was 96% and the increasing net monetary benefit (NMB) was a $ 24,342 (5% off) for home care. They concluded that home care for elderly CHF patients is significantly cost-effective (33). The results of this study are consistent with the present study in terms of cost-effectiveness of home care.

Ghaderi et al. (2013) examined the cost-effectiveness of home care and hospital care for stroke patients and found that the home care system for stroke patients is a suitable substitute for hospitalization of these patients. This issue is more important due to Iran's lack of beds and hospitals and should be considered by policy makers (34).

Moalosi et al. (2003) also found in a study on tuberculosis patients in Botswana that, in general, home care reduced the cost per treated patient by 44% compared to treatment in hospital ($ 1657 vs. $ 2970),

and the cost of the health system fell by 50% ($ 1106 vs. $ 2206). Finally, they concluded that home care is more acceptable and cost effective than hospital care for patients with chronic tuberculosis (35). The results of this study in terms of cost-effectiveness of home care is consistent with the present study.

The results of one-way sensitivity analysis showed that in the cost-effectiveness analysis, the ICER rate was negative, and the highest sensitivity to the effectiveness of the treatment was on the second day. Given that in the cost-effectiveness sensitivity analysis, the ICER value remains negative, so it can be said that the results of the study have the necessary strength. The results of probabilistic sensitivity analysis showed that home phototherapy is the most cost- effective treatment in 95.28% of simulation cases for a threshold of less than $ 13,116. The findings from the distribution curve showed that phototherapy at home was more effective and less costly in 63.04 cases. Although in 32.24% of cases it was less effective, it had a much lower cost, which was finally below the threshold. Therefore, the results revealed that performing sensitivity analysis did not change the status of phototherapy strategy at home as the most effective strategy and this is a sign of the strength of the study results.

One limitation of the present study was the self-reporting of non-medical direct costs and indirect costs by patients or their companions, who were more likely to forget or tell the approximate amount of the costs. Additionally, in this study, intangible costs were not calculated due to the inability to measure them accurately.

Conclusion

According to the findings of this study, phototherapy at home is a more cost-effective option than phototherapy in the hospital. Therefore, it can be recommended to insurance organizations as well as service providers to prioritize phototherapy at home to be included in the basic insurance packages.

List Of Abbreviations

ICER
Incremental cost Effectiveness ratio
DMC
Direct Medical Costs
DNMC
Direct Non-Medical Costs
IC
Indirect Costs
WHO
World Health Organization
PPP
Purchasing Power Parity
GDP

Gross Domestic Product
PSA
Probabilistic Sensitivity Analysis
CHF
Chronic Heart Failure
NMB
Net Monetary Benefit.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with International Declaration of Helsinki. The study protocol was approved by the Ethics Committee of Shiraz University of Medical Sciences under the code IR.SUMS.NUMIMG.REC.1400.014. All participants were informed both verbally and through written information of their right to withdraw from the study at any time. Written Informed consent was obtained from participants and minors parents to the cognitive interviews. All data are collected and handled in accordance with the relevant privacy.

Consent for publication:

Not Applicable.

Availability of data and material:

The datasets generated and analyzed during the current study are available in the Science Data Bank repository, https://www.scidb.cn/s/7riY73. Also, the datasets are available from the corresponding author upon reasonable request.

Competing interests:

The authors declare no competing interests.

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Authors' contributions:

Z.K.: Conceptualization, Data curation, Supervision, Validation, Writing - review & editing

M.M.: Conceptualization, Data curation, Methodology, Validation, Software, Roles/Writing - original draft

M.R.: Conceptualization, Data curation, Methodology, Software, Project administration, Investigation, Supervision, Validation, Writing - review & editing.

Kh.K.: Conceptualization, Data curation, Methodology, Software, Project administration, Investigation, Supervision, Validation, Writing - review & editing.

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References

1. Hulzebos CV, Van't Klooster SJ, Lorenz K, Vreman HJ, Dijk PH. Irradiance levels of phototherapy devices: a national study in Dutch neonatal intensive care units. J Perinatol. 2017;37(7):839–42.
2. Hansen TWR, Maisels MJ, Ebbesen F, Vreman HJ, Stevenson DK, Wong RJ, et al. Sixty years of phototherapy for neonatal jaundice - from serendipitous observation to standardized treatment and rescue for millions. J Perinatol. 2020;40(2):180–93.
3. Porter ML, Dennis BL. Hyperbilirubinemia in the term newborn. Am Fam Physician. 2002;65(4):599–606.
4. Tan KL. The pattern of bilirubin response to phototherapy for neonatal hyperbilirubinaemia. Pediatr Res. 1982;16(8):670–4.
5. McDonagh AF, Lightner DA, editors. Phototherapy and the photobiology of bilirubin. Seminars in liver disease; 1988: © 1988 by Thieme Medical Publishers, Inc.
6. Zainab K, Adlina S. Effectiveness of home versus hospital phototherapy for term infants with uncomplicated hyperbilirubinemia: a pilot study in Pahang, Malaysia. Med J Malaysia. 2004;59(3):395–401.
7. Özkan H, Ören H, Duman N, Duman M. Dermal bilirubin kinetics during phototherapy in term neonates. Acta paediatrica. 2003;92(5):577–81.
8. Kuzniewicz MW, Escobar GJ, Newman TB. Impact of universal bilirubin screening on severe hyperbilirubinemia and phototherapy use. Pediatrics. 2009;124(4):1031–9.
9. Rajpara AN, O'Neill JL, Nolan BV, Yentzer BA, Feldman SR. Review of home phototherapy. Dermatology online journal. 2010;16(12).
10. Slater L, Brewer MF. Home versus hospital phototherapy for term infants with hyperbilirubinemia: a comparative study. Pediatrics. 1984;73(4):515–9.
11. Lapolla W, Yentzer BA, Bagel J, Halvorson CR, Feldman SR. A review of phototherapy protocols for psoriasis treatment. Journal of the American Academy of Dermatology. 2011;64(5):936–49.

12. Nolan BV, Yentzer BA, Feldman SR. A review of home phototherapy for psoriasis. Dermatology online journal. 2010;16(2).
13. Hung R, Ungureanu S, Edwards C, Gambles B, Anstey A. Home phototherapy for psoriasis: a review and update. Clinical and experimental dermatology. 2015;40(8):827–33.
14. Chu L, Qiao J, Xu C. Home-Based Phototherapy Versus Hospital-Based Phototherapy for Treatment of Neonatal Hyperbilirubinemia: A Systematic Review and Meta-Analysis. Clin Pediatr (Phila). 2020;59(6):588–95.
15. Khatami F, Soltani M. Home phototherapy; an alternative method for treatment of jaundice in healthy-term newborns. Iranian Journal of Pediatrics. 2007;17(s2):193–8.
16. Xiong T, Qu Y, Cambier S, Mu D. The side effects of phototherapy for neonatal jaundice: what do we know? What should we do? Eur J Pediatr. 2011;170(10):1247–55.
17. Shahriarpanah S, Haji Ebrahim Tehrani F, Davati A, Ansari I. Effect of Phototherapy on Serum Level of Calcium, Magnesium and Vitamin D in Infants With Hyperbilirubinemia. Iran J Pathol. 2018;13(3):357–62.
18. Ip S, Chung M, Kulig J, O'Brien R, Sege R, Glicken S, et al. An evidence-based review of important issues concerning neonatal hyperbilirubinemia. Pediatrics. 2004;114(1):e130-53.
19. Sardari S, Mohammadizadeh M, Namnabati M. Efficacy of Home Phototherapy in Neonatal Jaundice. Journal of Comprehensive Pediatrics. 2019;10(1).
20. Azami M, Jaafari Z, Rahmati S, Farahani AD, Badfar G. Prevalence and risk factors of retinopathy of prematurity in Iran: a systematic review and meta-analysis. BMC ophthalmology. 2018;18(1):1–14.
21. American Academy of Pediatrics. Committee on Fetus and Newborn. Home phototherapy. Pediatrics. 1985;76(1):136–7.
22. Barzegar M, Valizadeh S, Farshbaaf F, Maaher MHK. Comparison of Impact Home Versus Hospital Phototherapy for Term Healthy Newborns with Hyperbilirubinemia. Med J Tabriz Uni Med Sciences Health Services. 2005;27(3):19–25.
23. Mojahedian MM, Toroski M, Keshavarz K, Aghili M, Zeyghami S, Nikfar S. Estimating the cost of illness of prostate cancer in Iran. Clinical therapeutics. 2019;41(1):50–8.
24. Latio LSY, Nam NH, Shah J, Smith C, Sakai K, Stonewall Shaban K, et al. Economic burden of the persistent morbidity of nodding syndrome on caregivers in affected households in Northern Uganda. PloS one. 2020;15(9):e0238643.
25. World Bank. PPP conversion factor, GDP (LCU per international $) - Iran, Islamic Rep [Available from: https://data.worldbank.org/indicator/PA.NUS.PPP?locations=IR .
26. Kahn J, Marseille E, Larson B, Kazi D, Kahn J, Rosen S. Thresholds for the cost–effectiveness of interventions: Alternative approaches. 2015.
27. Iran – 2020 GDP per capita. Available from: https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD?locations=IR.

28. Keshavarz K, Kebriaeezadeh A, Alavian SM, Sari AA, Hemami MR, Lotfi F, et al. A Cost-Utility and Cost-Effectiveness Analysis of Different Oral Antiviral Medications in Patients With HBeAg-Negative Chronic Hepatitis B in Iran: An Economic Microsimulation Decision Model. Hepat Mon. 2016;16(9):e37435.
29. Golshan Tafti M, Golzari S. Characterization of Phototherapy at Home in Neonatal with Jaundice. Alborz University Medical Journal. 2018;7(4):257–65.
30. Pettersson M, Eriksson M, Albinsson E, Ohlin A. Home phototherapy for hyperbilirubinemia in term neonates-an unblinded multicentre randomized controlled trial. Eur J Pediatr. 2021;180(5):1603–10.
31. Jackson CL, Tudehope D, Willis L, Law T, Venz J. Home phototherapy for neonatal jaundice–technology and teamwork meeting consumer and service need. Aust Health Rev. 2000;23(2):162–8.
32. Tiberg I, Lindgren B, Carlsson A, Hallström I. Cost-effectiveness and cost-utility analyses of hospital-based home care compared to hospital-based care for children diagnosed with type 1 diabetes; a randomised controlled trial; results after two years' follow-up. BMC Pediatr. 2016;16:94.
33. Maru S, Byrnes J, Carrington MJ, Chan YK, Thompson DR, Stewart S, et al. Cost-effectiveness of home versus clinic-based management of chronic heart failure: Extended follow-up of a pragmatic, multicentre randomized trial cohort - The WHICH? study (Which Heart Failure Intervention Is Most Cost-Effective & Consumer Friendly in Reducing Hospital Care). Int J Cardiol. 2015;201:368–75.
34. Ghaderi h, Shafiee h, Amery h, Vafaeinasab mR. The cost - effectiveness analysis of hospital compared to at homecare for cva patients. Journal of healthcare management (journal of health system). 2013;4(3–4 (SERIAL 10)):-.
35. Moalosi G, Floyd K, Phatshwane J, Moeti T, Binkin N, Kenyon T. Cost-effectiveness of home-based care versus hospital care for chronically ill tuberculosis patients, Francistown, Botswana. Int J Tuberc Lung Dis. 2003;7(9 Suppl 1):S80-5.

Figures

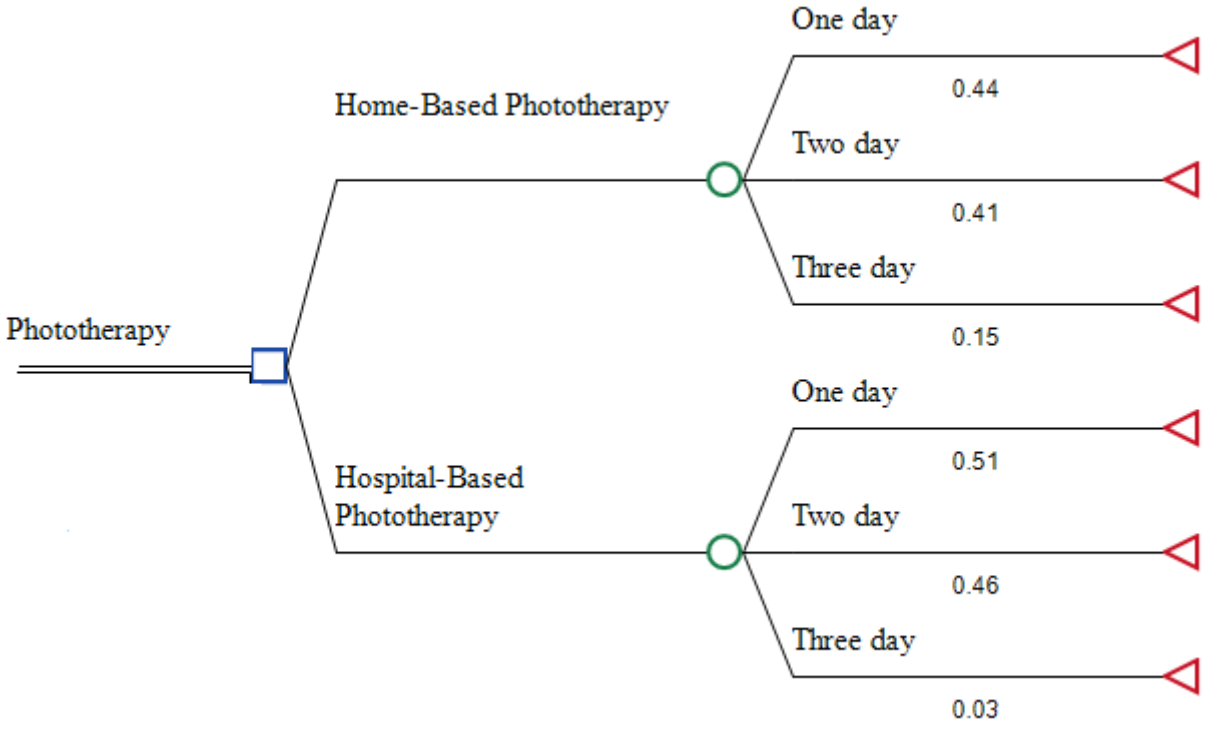

Figure 1

Schematic diagram of a decision tree structure to compare home phototherapy with hospital phototherapy in infants with high bilirubin

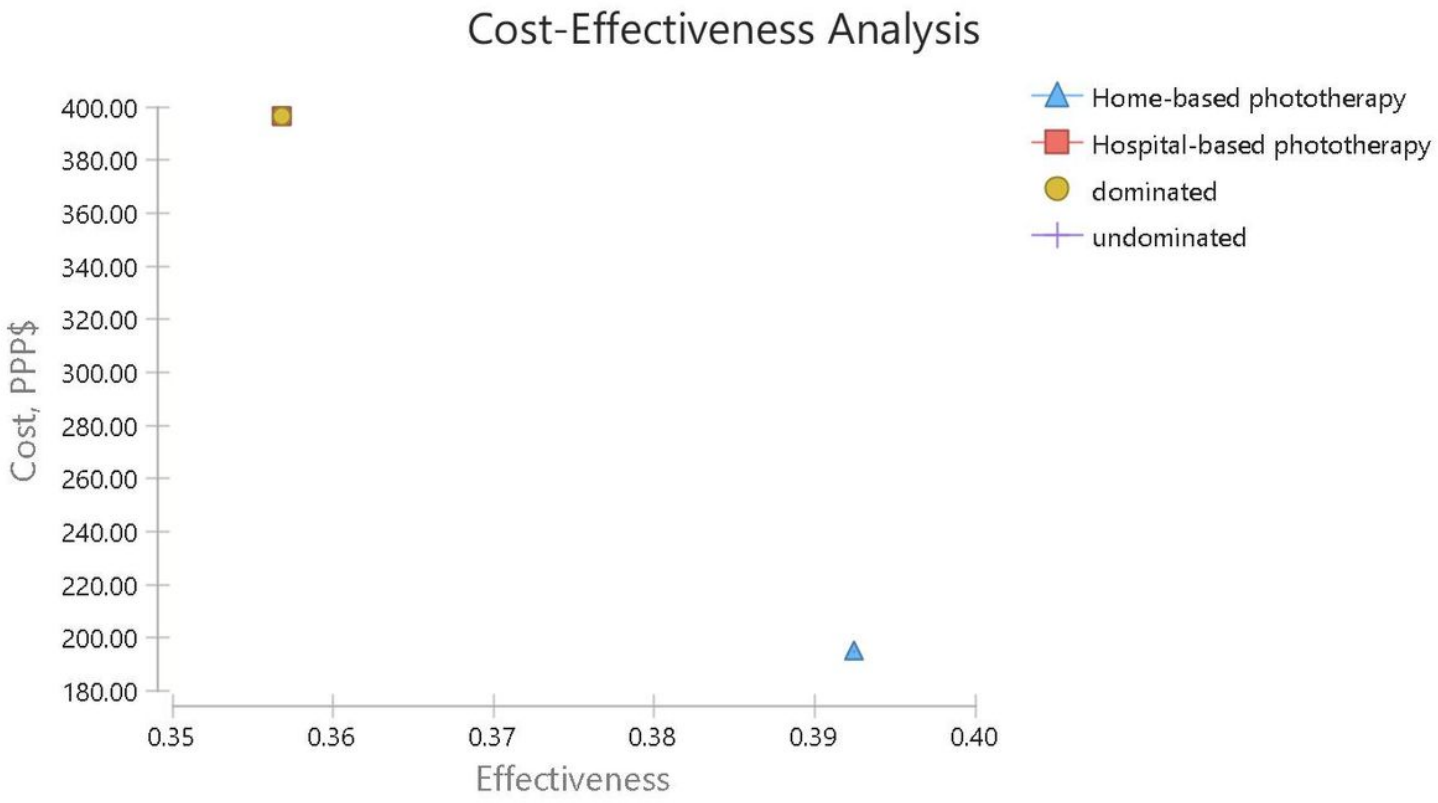

Figure 2

Cost-effectiveness analysis of Hospital-based phototherapy versus Home-based phototherapy in Shiraz in 2021

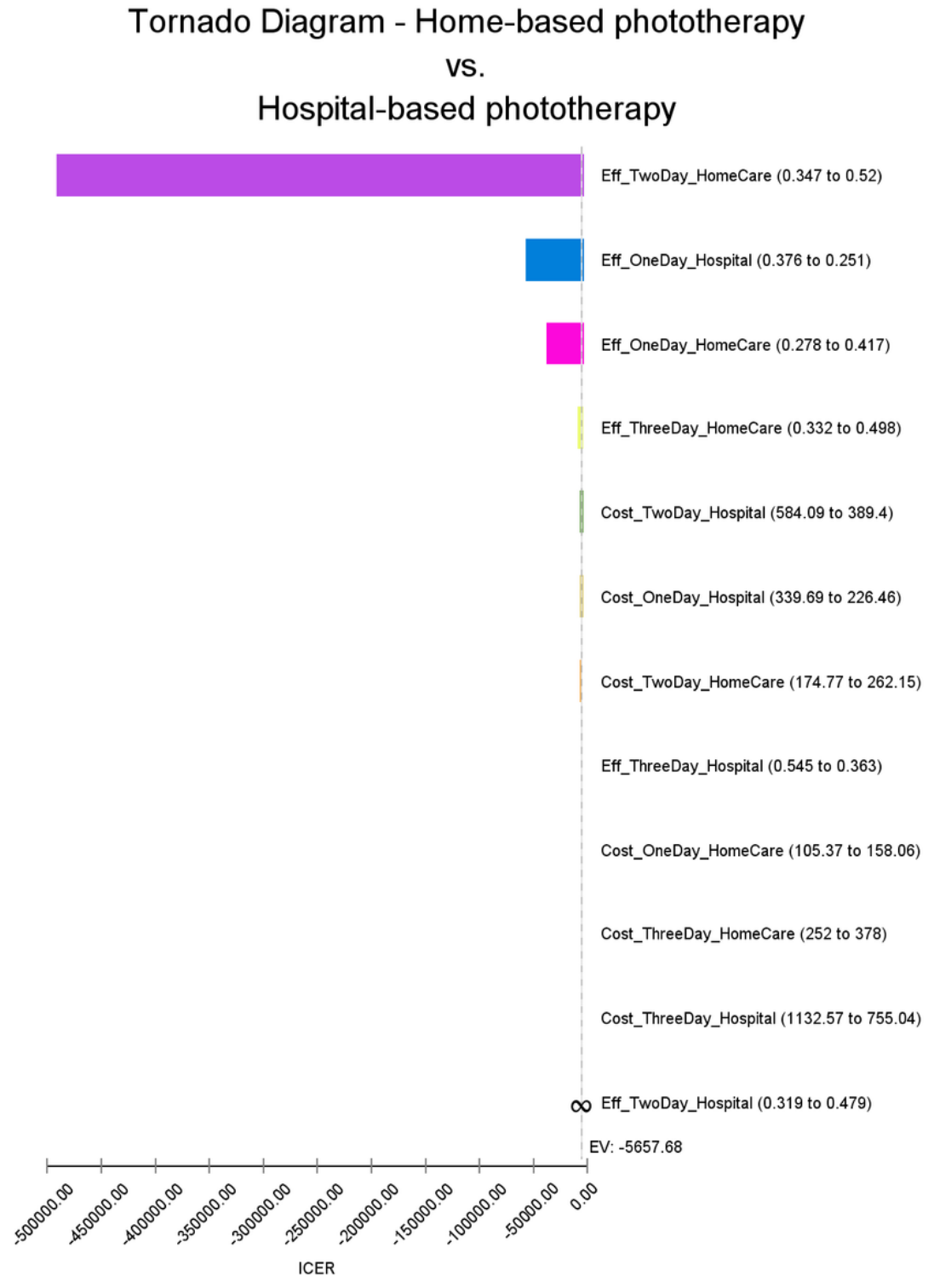

Figure 3

Tornado diagram related to one-way sensitivity analysis for Hospital-based phototherapy versus Home-based phototherapy in Shiraz in 2021

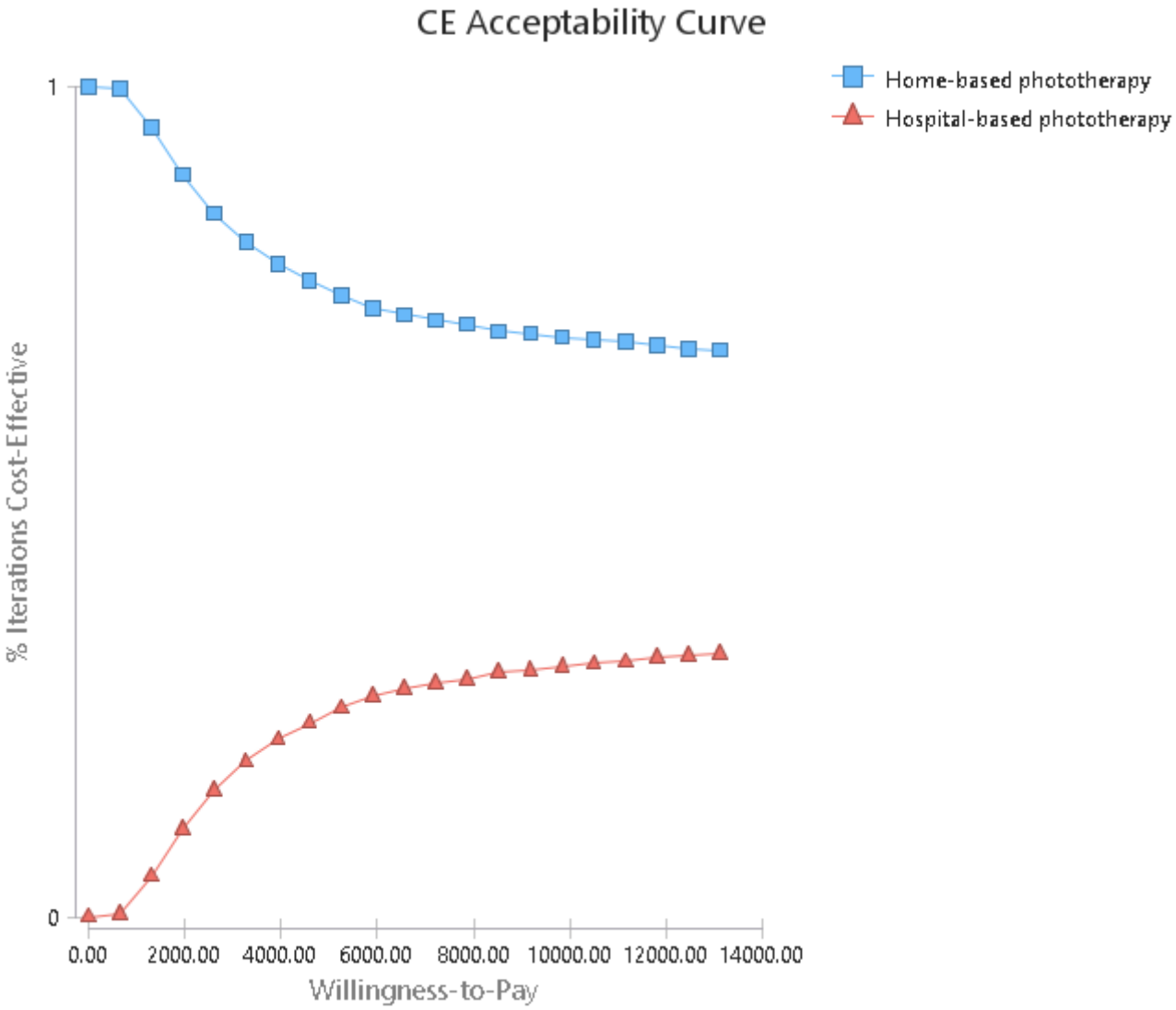

Figure 4

The cost-effectiveness acceptability curves of Hospital-based phototherapy versus Home-based phototherapy based on the Effectiveness obtained through the Monte Carlo simulation

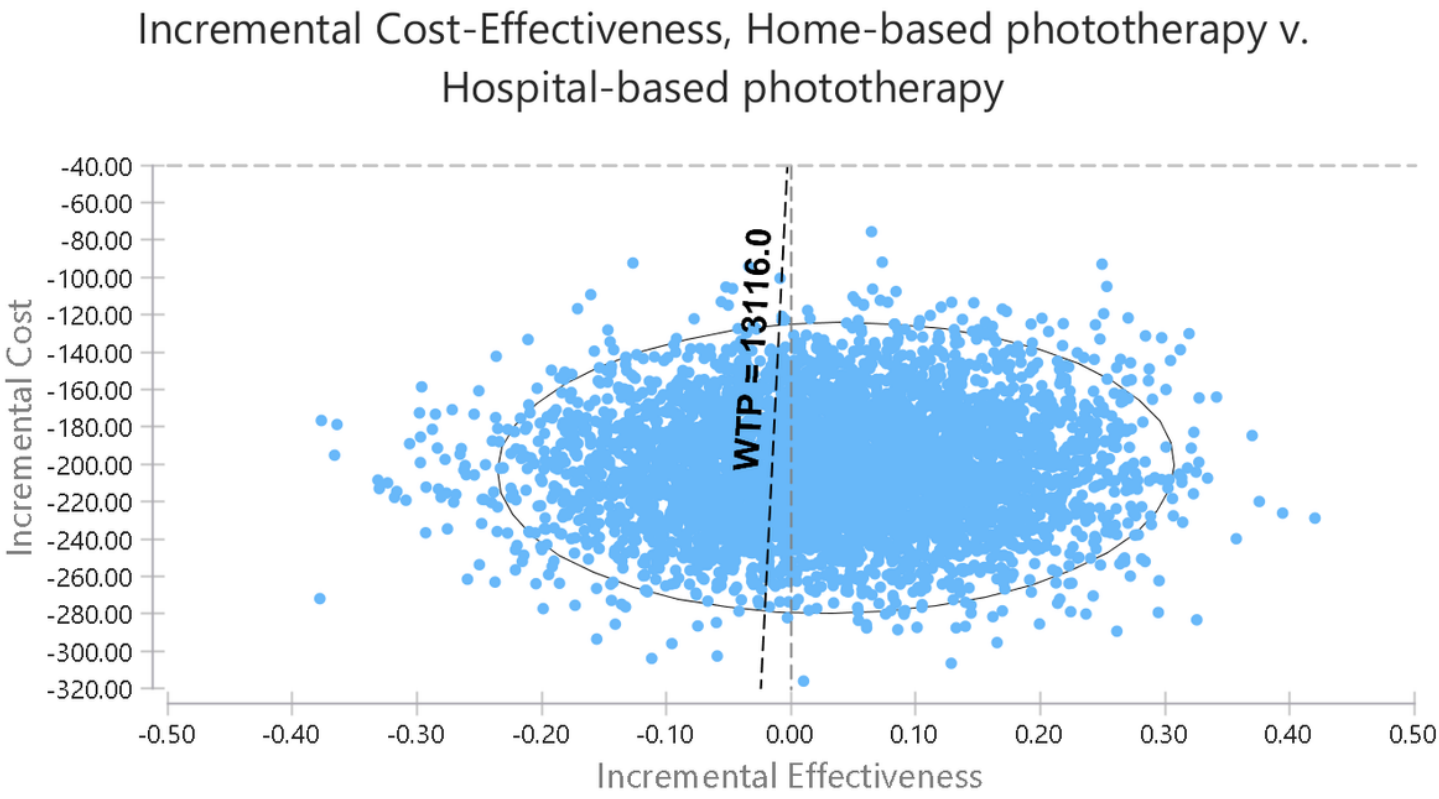

Figure 5

The incremental cost-effectiveness scatter plots of Hospital-based phototherapy versus Home-based phototherapy based on the Effectiveness