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The utility of the Infantile Hemangioma Referral Score (IHReS) as a decision-making tool for referral to treatment

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Title

The utility of the Infantile Hemangioma Referral Score (IHReS) as a decision-making tool for referral to treatment

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Abstract

Background The general pediatricians and primary physicians sometimes face immense difficulty in referral judgments regarding which infantile hemangiomas (IHs) require referrals and when is the appropriate time to refer IHs for treatment. This resulted in the treatment being delayed beyond IHs' critical timeframe. The Infantile

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Hemangioma Referral Scores (IHReS) have been recently developed, with the aim to solve this problem.

Objectives The objective of the present study is to evaluate the reliability of IHReS and to assess the possibility of using this instrument in our country where a similar problem of delaying treatment of IHs is currently existing.

Methods The present study was a prospective, cross-sectional study. Thirteen selected clinical cases were used to assess the reliability of IHReS among physicians who may have had the chance to deal with IHs patients. The target physicians across the country were asked to participate in the study via an online platform (google forms) to decide whether to refer IHs patients for treatment or observe. There were 3 steps of assessment; step 1) Usual practice evaluation, step 2) Using IHReS, and step 3) Retesting by using IHReS.

Results Substantial agreement was observed after using IHReS (step2) for interrater reliability, with Fleiss' Kappa values of 0.80 and 0.78 among IHs experts and non-expert physicians, respectively. Regarding repeatability, in the test-retest assessments, Cohen's Kappa coefficient values revealed almost perfect agreement in intrarater repeatability for both experts and non-expert physicians (1.00).

Conclusion IHReS is a simple, easy to assess tool for non-expert physicians. The benefit in the increase of interrater agreement was found in both IHs experts and non-expert physicians. It has had the reliability to be used in making referral decisions regarding IHs patients for treatment among Thai physicians. Using IHReS can improve clinical outcomes by identifying which patient needs early intervention to minimize the possible complications.

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What is Known?

- IHs is a disease with a window of opportunity in which physicians can make timely intervention and prevent poorer outcome. This critical time frame for optimizing outcomes can be missed if there are delays in referral or treatment.
- The heterogeneous presentation of IHs poses a clinical challenge for physicians in determining the need for treatment and subspecialty referral.

What is New?

- IHReS is a simple, easy to assess tool that has reliability to be used to make decisions regarding referral of IHs patients for treatment in both IHs experts and non-expert Thai physicians.
- Using IHReS can improve clinical outcomes by identifying the patients that need early intervention to minimize the possibility of complications.

Key words:

Infantile hemangioma, treatment, refer, score, physician

Abbreviations:

IHs	Infantile Hemangiomas
IHReS	The Infantile Hemangioma Referral Score
HAS	Hemangioma Activity Score
HSS	Hemangioma Severity Scale
HASI	Hemangioma Activity and Severity Index
HDCS	Hemangioma Dynamic Complication Scale

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Introduction

Infantile hemangiomas (IHs) is a disease with a window of opportunity that allows timely intervention and prevent poorer outcomes.[1] This critical time frame for optimizing outcomes can be missed if there are delays in referral or treatment. A judgment of whether to refer for treatment or observe IHs is sometimes a difficult decision especially among non-expert physicians. This is due to the unique characteristic of IHs that has its own spontaneous regression over a period of time[2], thus, most non-expert primary physicians usually provide a main leading advice for those IHs patients to be observed without intervention or treatment. However, some IHs became problematic ones later when they start to have a rapid progression during proliferative phase. Most primary physicians may not able to identify problematic IHs at the time of examination that resulted in the treatment delays.

A similar problem of delayed referral of IHs for treatment is also in occurrence in our country. Most of the general pediatricians and primary physicians face a difficulty in referral judgment to decide which IHs and when is the appropriate time to refer IHs for treatment to avoid the consequence of delayed treatment beyond the critical time frame.

Léaute-Labrèze et al. recently proposed Infantile Hemangioma Referral Score (IHReS) as an initial tool for primary physicians to make their decisions to refer patients to expert centers.[3] This tool was developed by the experts from 7 different countries across the European countries. It had a high sensitivity of 96.9% which is suited for screening purposes. After IHReS has been published, we all agree that this may be a useful instrument to solve the problem of delayed treatment among IHs patients. Therefore, this became the objective of the present study to evaluate reliability of IHReS and to assess the possibility of using this instrument among Thai physicians.

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Methods

Data collections

This was a prospective, cross-sectional study conducted in Thailand. Thirteen selected clinical cases were used to assess reliability of IHReS among physicians who may have had the chance to deal with IHs patients. The target population; pediatric dermatologists, general pediatricians and primary physicians across the country were asked to participate the study via online platform (google forms). Individual participant gave consent to the study by replying back the online questionnaire.

The participants were asked to make a decision whether to refer for treatment or observe individual 13 selected clinical cases provided with a clear high-quality image with essential history and physical examination. Three steps of the study intervention were designed; step 1) Usual practice assessment of the selected clinical cases without reference to the IHReS, step 2) Completion of the IHReS questionnaires of the same selected clinical cases, and step 3) Completion of the IHReS questionnaires for a second time (test-retest) one week after. The authors attached IHReS together with selected clinical cases via the google forms, thus, all participants were able to make a decision and submit their answer in one step. We used a personal code that was created individually by each participant to match the answer in step 3 which were made a week later, with the previous answers in step 1 and 2.

The number of the target population in the study were calculated from the determination of sample size for estimating proportions with expected agreement of 0.8 with the margin of error of 0.1. For a confidence level of 95%, α was set at 0.05 and the critical value was 1.96. This resulted in a total calculated participant requirement of at least 62 participants.

Statistical methods

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At the end of the study, the collected data were analyzed using STATA software version 10 (StataCorp LP). Descriptive statistical methods - means, standard deviations (SDs), medians, and frequencies were used to analyze the demographic data. Internal consistency was calculated by using Cronbach's alpha. The Fleiss' Kappa was used to test interrater agreement, while the Cohen's Kappa coefficient was used to analyzed agreement of the repeatability decisions (intrarater agreement). Statistical significance was set at $P < 0.05$.

Patient and public involvement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

Results

A total of 94 questionnaires were sent out to the target population; pediatric dermatologists, general pediatricians and primary physicians across the country via online platform (google forms), and with 68 (72.34%) were returned. There were 28 primary physicians, 36 general pediatricians, and 4 pediatric dermatologists participated. The majority of participants (56 physicians, 82.36%) were experienced in treating IHs patients, eight physicians (11.76%) have never had the experience in treating this condition, and four pediatric dermatologists (5.88%) were the IHs experts. Sixty-four (94.12%) participants have not known IHReS before participating in the study.

There were 13 selected clinical cases of IHs in the present study. Internal consistency tested by Cronbach's alpha revealed a value of 0.88. The participants were classified into two groups, the IHs expert group (4 pediatric dermatologists) and the non-expert group (64 participants: 28 primary physicians and 36 general pediatricians). Sixty-eight participants completed the step 1 and 2 questionnaires. The decision made at

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step 1 (usual practice assessment without IHReS) revealed moderate agreement for interrater reliability in IHs experts, while the fair agreement was observed in non-expert physicians, Fleiss' Kappa values = 0.42 and 0.23 respectively, Table 1.

For both expert and non-expert physicians, there were substantial agreement for interrater reliability at step 2 (completion of the IHReS questionnaires); Fleiss' Kappa values = 0.80 and 0.78, and almost perfect agreement was observed for interrater reliability in both groups, with Fleiss' Kappa values for step 3 (IHReS retesting) of 0.87 and 0.81, respectively. Table 1 shows the steps of the study interventions and the agreement results in IHs experts and non-expert physicians.

Regarding repeatability, in the test-retest assessment, Cohen's Kappa coefficient values revealed almost perfect agreement in intrarater repeatability for both IHs experts and non-expert physicians (1.00).

The average time needed to complete IHReS per each case was 12.59 seconds (SD 3.55). A satisfaction survey was sent to all 68 participants. The survey consisted of 4 questions and the value of Cronbach's Alpha for the satisfaction was acceptable, α = 0.72. Percentage of participants' satisfactions in 4 different aspects of IHReS are represented in Fig. 2.

Discussion

IHs are commonly encountered in primary care and most often remain asymptomatic, resolving without sequelae. Even though certain characteristics are associated with a greater risk of complications, associated anomalies, and disfigurement, most of non-expert physicians usually provide the main leading advice for those IHs patients to be observed instead of early intervention or treatment. The updated consensus guidelines[1,2,4–6] had provided a suggestion of early treatment and timely intervention, however, the heterogeneous presentation poses a clinical challenge

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for physicians in determining the need for treatment and subspecialty referral. The heterogeneous presentation included patient age[7], IHs type, different sizes of IHs, numbers of IHs, characteristics, locations, anatomical patterns[8], revealing of complications, timing of the IHs' growth, and parental preferences. The choice of active non-intervention as the primary approach to uncomplicated lesions were usually made. Life- and function-threatening IHs, as well as IHs associated with a high risk for disfigurement and scarring, necessitate systemic treatment. The major problem for non-expert primary physician is that when is the appropriate time for treatment of each individual case. This problem had become more evident, thus, the development of many IHs scoring systems which aimed to provide an objective and standard measurement for early detection of problematic IHs and as a follow-up tool during the treatment have been developed.

Scoring IHs is challenging because of the heterogeneity of their morphology, behavior, and response to treatment. Many IHs scoring systems have been developed during the past decade. Each scoring system has its own advantages for a variety of purposes. The Hemangioma Activity Score (HAS) was developed to measure proliferative activity of IHs.[9] This instrument has been used to monitor IHs responses during the treatment.[9–11] The Hemangioma Severity Scale (HSS) and Hemangioma Dynamic Complication Scale (HDCS) were developed shortly after with an objective to measure severity of IHs and the complications of IHs for longitudinal usage.[12] The Hemangioma Activity and Severity Index (HASI) was recently developed with a purpose to combine the proliferative activity score together with the severity index in one unified scoring system.[13]

All mentioned instruments are valid and used to measure disease severity that are needed to substantiate the benefit of therapies for IHs.[11] As a utility of triage

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purpose, the cutoff values of the HSS of 6 or lower and 11 or higher could be used as a triage tool for propranolol treatment.[14] Another study also revealed the cutoff values of IHs with total HSS scores of 6 or greater should be referred for subspecialty evaluation.[15] As a triage purpose, the HSS may be a useful tool for primary care physicians in identifying high-risk IHs that may benefit from therapy. The HSS is a one-page scale with scoring items that require thorough information to complete the total score. The process is somehow needed to be refined to get to the standard results.

Léaute-Labrèze et al. recently developed IHReS as an initial tool for primary physicians to make their decision to refer patients to expert centers.[3] This is a two-step easy-to-use tool for non-expert physicians, provided with some drawing pictures indicating striking location and practical notice points in making decisions. This tool is free to use and is available to be downloaded from www.ihscoring.com (Fig.1). After IHReS efficacies had been published, we all agree that this may be a useful instrument to solve the delayed treatment among IHs patients. Thus, initiation of the present study was set to evaluate reliability of IHReS and to assess the possibility of using this instrument among Thai physicians.

Our study was conducted in Thailand among the target physicians who deal with IHs patients in their real practices that includes primary physicians, general pediatricians, and pediatric dermatologists. The present study revealed that non-expert physicians had fair agreement interrater (Fleiss' Kappa= 0.23) at step 1 (usual practice assessment), while moderate agreement was observed in IHs experts, Fleiss' Kappa= 0.42. This finding reflected that a problem of timely decision making in treating IHs occurred more often in the nonexpert physicians by the usual assessment without the assisting instruments. However, interrater reliability increased to substantial agreement at step 2 (use of IHReS) in the both groups. The result correlated to the findings in the

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validation study of IHReS in 2020 [3], and also reflected that the use of assisting instrument (IHReS) can help physicians in making their decision to refer IHs patients for treatment. Our findings revealed that there was an increased in mutual agreement and acceptance after using IHReS not only among non-expert physicians, the IHs experts also had benefited by the use of this score with an increased interrater reliability, Fleiss' Kappa in IHs experts were 0.42 at step 1, and 0.80 at step 2, respectively. The IHReS also provided a consistent result after retesting at one week later with almost perfect interrater and intrarater repeatability in both groups, Table 1.

The average time needed to complete IHReS per each case was 12.59 seconds (SD 3.55). A satisfaction survey was sent to all 68 participants. The survey consisted of 4 questions and the value for Cronbach's Alpha for the satisfaction was acceptable, $\alpha = 0.72$. Percentage of participants' satisfactions in 4 different aspects of IHReS are shown in Fig. 1.

The study design that was done via the online platform made the authors concerned of the returned questionnaires compliance, thus we decided to limit number of the selected clinical cases in the present study to shorten the time to complete the questionnaires. Therefore, there might be some selection bias of some difficult or controversial clinical cases that affected the decision by usual assessment without IHReS. However, the findings of discriminate decisions between usual assessments vs. using IHReS supported the evidence that the triage screening tool for IHs as a decision to refer for treatment is essential.

In summary, IHReS was a simple, easy to assess tool for non-expert physicians. However, the present study also revealed that this tool is beneficial for IHs experts as well. It took a short duration less than a minute to complete the score and had the reliability to be used to make a decision to refer IHs patients for treatment among Thai

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physicians. Using IHReS can improve clinical outcomes by identifying which patient needs early intervention to minimize the possibility of complications.

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Declarations

Funding

None

Conflict of interest

The authors declare that they have no conflict of interest.

Availability of data and material

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Code availability: N/A

Authors' Contribution

K. Chitpiromsak contributed to study conception, design of the study, and data collection. L.Techasatian contributed to the conception and design of the study, data analysis, interpretation of findings, drafting the article, revising the article, and final approval of the version submitted. C. Jetsrisuparb contributed to study conception and supervised the study process.

Ethical approval

This study was approved by the institutional review board of Faculty of Medicine, Khon Kaen University, Thailand (IRB no. #HE641280) before enrolling any participants.

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Consent to participate

All participants gave individual consent to the study by replying back the online questionnaire. The study was approved by the institutional review board of Faculty of Medicine, Khon Kaen University, Thailand (IRB no. #HE641280) before data collection.

Consent for publication

Written parental consent for the patients' photographs for publication was obtained in all subjects.

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Table and Figure legends

Table. 1 The steps of the study interventions and the agreement results in IHs experts and non-expert physicians.

Fig. 1 The Infantile Hemangioma Referral Score (IHReS). This tool is free to use and is available to be downloaded from www.ihscoring.com.

Fig. 2 The participants' satisfaction of the Infantile Hemangioma Referral Score (IHReS). The figures provide percentages of physicians who agreed that; A) IHReS helps in making decision to refer IHs patients for treatment, B) IHReS is an easy-to-use tool, C) IHReS shortens the duration in decision making process, and D) they will use IHReS to make decisions to refer IHs patients in the future.

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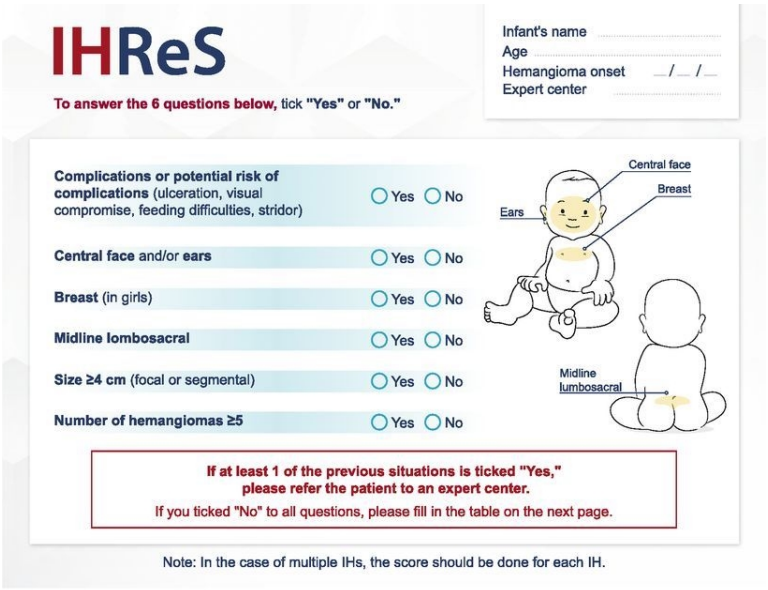

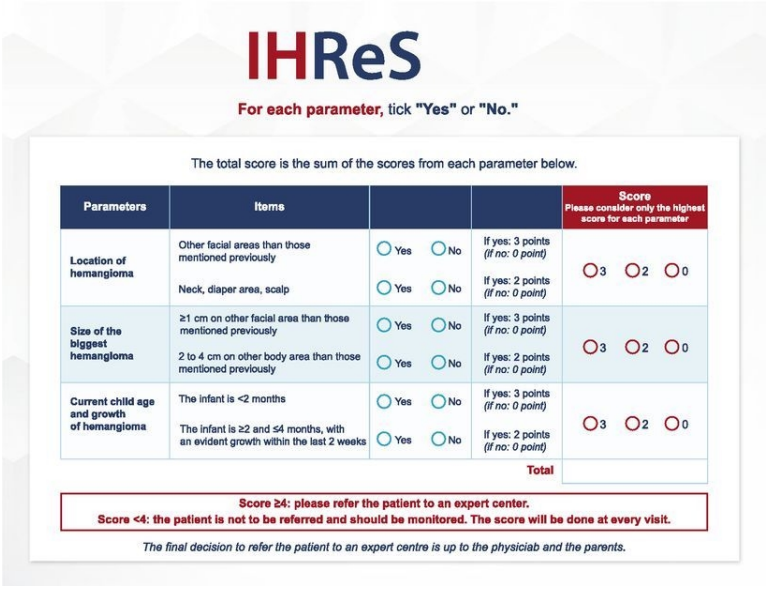

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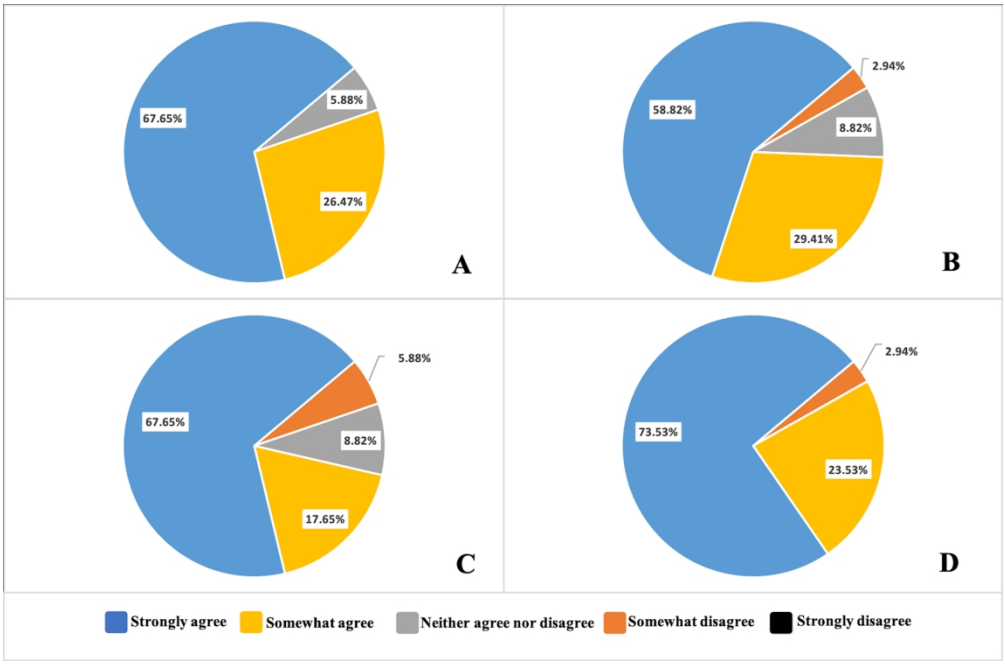

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Table 1. The steps of the study interventions and the agreement results in IHs experts and non-expert physicians.

	Step 1 Usual practice assessment	**Step 2** Completion of the IHReS questionnaire	**Step 3** Completion of the IHReS questionnaire a second time (Test-Retest)	
Statistical measurement	Interrater agreement (Fleiss' Kappa)	Interrater agreement (Fleiss' Kappa)	Interrater agreement (Fleiss' Kappa)	Intrarater agreement (Cohen's Kappa)
IHs Experts	0.42	0.80	0.87	1
Nonexpert physicians	0.23	0.78	0.81	1

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The utility of the Infantile Hemangioma Referral Score (IHReS) as a decision-making tool for referral to treatment

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Abstract

Background The general pediatricians and primary physicians sometimes face immense difficulty in referral judgments regarding which infantile hemangiomas (IHs) require referrals and when is the appropriate time to refer IHs for treatment. This resulted in the treatment being delayed beyond IHs' critical timeframe. The Infantile

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Hemangioma Referral Scores (IHReS) have been recently developed, with the aim to solve this problem.

Objectives The objective of the present study is to evaluate the reliability of IHReS and to assess the possibility of using this instrument in our country where a similar problem of delaying treatment of IHs is currently existing.

Methods The present study was a prospective, cross-sectional study. Thirteen selected clinical cases were used to assess the reliability of IHReS among physicians who may have had the chance to deal with IHs patients. The target physicians across the country were asked to participate in the study via an online platform (google forms) to decide whether to refer IHs patients for treatment or observe. There were 3 steps of assessment; step 1) Usual practice evaluation, step 2) Using IHReS, and step 3) Retesting by using IHReS.

Results Substantial agreement was observed after using IHReS (step2) for interrater reliability, with Fleiss' Kappa values of 0.80 and 0.78 among IHs experts and non-expert physicians, respectively. Regarding repeatability, in the test-retest assessments, Cohen's Kappa coefficient values revealed almost perfect agreement in intrarater repeatability for both experts and non-expert physicians (1.00).

Conclusion IHReS is a simple, easy to assess tool for non-expert physicians. The benefit in the increase of interrater agreement was found in both IHs experts and non-expert physicians. It has had the reliability to be used in making referral decisions regarding IHs patients for treatment among Thai physicians. Using IHReS can improve clinical outcomes by identifying which patient needs early intervention to minimize the possible complications.

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What is Known?

- IHs is a disease with a window of opportunity in which physicians can make timely intervention and prevent poorer outcome. This critical time frame for optimizing outcomes can be missed if there are delays in referral or treatment.
- The heterogeneous presentation of IHs poses a clinical challenge for physicians in determining the need for treatment and subspecialty referral.

What is New?

- IHReS is a simple, easy to assess tool that has reliability to be used to make decisions regarding referral of IHs patients for treatment in both IHs experts and non-expert Thai physicians.
- Using IHReS can improve clinical outcomes by identifying the patients that need early intervention to minimize the possibility of complications.

Key words:

Infantile hemangioma, treatment, refer, score, physician

Abbreviations:

IHs	Infantile Hemangiomas
IHReS	The Infantile Hemangioma Referral Score
HAS	Hemangioma Activity Score
HSS	Hemangioma Severity Scale
HASI	Hemangioma Activity and Severity Index
HDCS	Hemangioma Dynamic Complication Scale

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Introduction

Infantile hemangiomas (IHs) is a disease with a window of opportunity that allows timely intervention and prevent poorer outcomes.[1] This critical time frame for optimizing outcomes can be missed if there are delays in referral or treatment. A judgment of whether to refer for treatment or observe IHs is sometimes a difficult decision especially among non-expert physicians. This is due to the unique characteristic of IHs that has its own spontaneous regression over a period of time[2], thus, most non-expert primary physicians usually provide a main leading advice for those IHs patients to be observed without intervention or treatment. However, some IHs became problematic ones later when they start to have a rapid progression during proliferative phase. Most primary physicians may not able to identify problematic IHs at the time of examination that resulted in the treatment delays.

A similar problem of delayed referral of IHs for treatment is also in occurrence in our country. Most of the general pediatricians and primary physicians face a difficulty in referral judgment to decide which IHs and when is the appropriate time to refer IHs for treatment to avoid the consequence of delayed treatment beyond the critical time frame.

Léaute-Labrèze et al. recently proposed Infantile Hemangioma Referral Score (IHReS) as an initial tool for primary physicians to make their decisions to refer patients to expert centers.[3] This tool was developed by the experts from 7 different countries across the European countries. It had a high sensitivity of 96.9% which is suited for screening purposes. After IHReS has been published, we all agree that this may be a useful instrument to solve the problem of delayed treatment among IHs patients. Therefore, this became the objective of the present study to evaluate reliability of IHReS and to assess the possibility of using this instrument among Thai physicians.

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Methods

Data collections

This was a prospective, cross-sectional study conducted in Thailand. Thirteen selected clinical cases were used to assess reliability of IHReS among physicians who may have had the chance to deal with IHs patients. The target population; pediatric dermatologists, general pediatricians and primary physicians across the country were asked to participate the study via online platform (google forms). Individual participant gave consent to the study by replying back the online questionnaire.

The participants were asked to make a decision whether to refer for treatment or observe individual 13 selected clinical cases provided with a clear high-quality image with essential history and physical examination. Three steps of the study intervention were designed; step 1) Usual practice assessment of the selected clinical cases without reference to the IHReS, step 2) Completion of the IHReS questionnaires of the same selected clinical cases, and step 3) Completion of the IHReS questionnaires for a second time (test-retest) one week after. The authors attached IHReS together with selected clinical cases via the google forms, thus, all participants were able to make a decision and submit their answer in one step. We used a personal code that was created individually by each participant to match the answer in step 3 which were made a week later, with the previous answers in step 1 and 2.

The number of the target population in the study were calculated from the determination of sample size for estimating proportions with expected agreement of 0.8 with the margin of error of 0.1. For a confidence level of 95%, α was set at 0.05 and the critical value was 1.96. This resulted in a total calculated participant requirement of at least 62 participants.

Statistical methods

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At the end of the study, the collected data were analyzed using STATA software version 10 (StataCorp LP). Descriptive statistical methods - means, standard deviations (SDs), medians, and frequencies were used to analyze the demographic data. Internal consistency was calculated by using Cronbach's alpha. The Fleiss' Kappa was used to test interrater agreement, while the Cohen's Kappa coefficient was used to analyzed agreement of the repeatability decisions (intrarater agreement). Statistical significance was set at $P < 0.05$.

Patient and public involvement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

Results

A total of 94 questionnaires were sent out to the target population; pediatric dermatologists, general pediatricians and primary physicians across the country via online platform (google forms), and with 68 were returned. There were 28 primary physicians, 36 general pediatricians, and 4 pediatric dermatologists participated. The majority of participants (56 physicians) were experienced in treating IHs patients, eight physicians have never had the experience in treating this condition, and four pediatric dermatologists were the IHs experts. Sixty-four participants have not known IHReS before participating in the study.

There were 13 selected clinical cases of IHs in the present study. Internal consistency tested by Cronbach's alpha revealed a value of 0.88. The participants were classified into two groups, the IHs expert group (4 pediatric dermatologists) and the non-expert group (64 participants: 28 primary physicians and 36 general pediatricians). Sixty-eight participants completed the step 1 and 2 questionnaires. The decision made at step 1 (usual practice assessment without IHReS) revealed moderate agreement for

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interrater reliability in IHs experts, while the fair agreement was observed in non-expert physicians, Fleiss' Kappa values = 0.42 and 0.23 respectively, Table 1.

For both expert and non-expert physicians, there were substantial agreement for interrater reliability at step 2 (completion of the IHReS questionnaires); Fleiss' Kappa values = 0.80 and 0.78, and almost perfect agreement was observed for interrater reliability in both groups, with Fleiss' Kappa values for step 3 (IHReS retesting) of 0.87 and 0.81, respectively. Table 1 shows the steps of the study interventions and the agreement results in IHs experts and non-expert physicians.

Table 1. The steps of the study interventions and the agreement results in IHs experts and non-expert physicians.

	Step 1 Usual practice assessment	**Step 2** Completion of the IHReS questionnaire	**Step 3** Completion of the IHReS questionnaire a second time (Test-Retest)	
Statistical measurement	Interrater agreement (Fleiss' Kappa)	Interrater agreement (Fleiss' Kappa)	Interrater agreement (Fleiss' Kappa)	Intrarater agreement (Cohen's Kappa)
IHs Experts	0.42	0.80	0.87	1
Nonexpert physicians	0.23	0.78	0.81	1

Regarding repeatability, in the test-retest assessment, Cohen's Kappa coefficient values revealed almost perfect agreement in intrarater repeatability for both IHs experts and non-expert physicians (1.00).

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Table 2. The participants' satisfaction of IHReS in different aspects

The participants' satisfaction of IHReS in different aspects	Number of participants (N)					Total
	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree	
• IHReS helps in making decision to refer IHs patients for treatment	46	18	4	0	0	68
• IHReS is an easy-to-use tool	40	20	6	2	0	68
• IHReS shortens the duration in decision making process	46	12	6	4	0	68
• Phycisians will use IHReS to make decisions to refer IHs patients in the future	50	16	0	2	0	68
Total	182	66	16	8	0	272

The average time needed to complete IHReS per each case was 12.59 seconds (SD 3.55). A satisfaction survey was sent to all 68 participants. The survey consisted of 4 questions and the value of Cronbach's Alpha for the satisfaction was acceptable, $\alpha = 0.72$. Percentage of participants' satisfactions in 4 different aspects of IHReS are represented in Table 2.

Discussion

IHs are commonly encountered in primary care and most often remain asymptomatic, resolving without sequelae. Even though certain characteristics are associated with a greater risk of complications, associated anomalies, and disfigurement, most of non-expert physicians usually provide the main leading advice for those IHs patients to be observed instead of early intervention or treatment. The updated consensus guidelines[1,2,4–6] had provided a suggestion of early treatment and timely intervention, however, the heterogeneous presentation poses a clinical challenge for physicians in determining the need for treatment and subspecialty referral. The

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heterogeneous presentation included patient age[7], IHs type, different sizes of IHs, numbers of IHs, characteristics, locations, anatomical patterns[8], revealing of complications, timing of the IHs' growth, and parental preferences. The choice of active non-intervention as the primary approach to uncomplicated lesions were usually made. Life- and function-threatening IHs, as well as IHs associated with a high risk for disfigurement and scarring, necessitate systemic treatment. The major problem for non-expert primary physician is that when is the appropriate time for treatment of each individual case. This problem had become more evident, thus, the development of many IHs scoring systems which aimed to provide an objective and standard measurement for early detection of problematic IHs and as a follow-up tool during the treatment have been developed.

Scoring IHs is challenging because of the heterogeneity of their morphology, behavior, and response to treatment. Many IHs scoring systems have been developed during the past decade. Each scoring system has its own advantages for a variety of purposes. The Hemangioma Activity Score (HAS) was developed to measure proliferative activity of IHs.[9] This instrument has been used to monitor IHs responses during the treatment.[9–11] The Hemangioma Severity Scale (HSS) and Hemangioma Dynamic Complication Scale (HDCS) were developed shortly after with an objective to measure severity of IHs and the complications of IHs for longitudinal usage.[12] The Hemangioma Activity and Severity Index (HASI) was recently developed with a purpose to combine the proliferative activity score together with the severity index in one unified scoring system.[13]

All mentioned instruments are valid and used to measure disease severity that are needed to substantiate the benefit of therapies for IHs.[11] As a utility of triage purpose, the cutoff values of the HSS of 6 or lower and 11 or higher could be used as a

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triage tool for propranolol treatment.[14] Another study also revealed the cutoff values of IHs with total HSS scores of 6 or greater should be referred for subspecialty evaluation.[15] As a triage purpose, the HSS may be a useful tool for primary care physicians in identifying high-risk IHs that may benefit from therapy. The HSS is a one-page scale with scoring items that require thorough information to complete the total score. The process is somehow needed to be refined to get to the standard results.

Léaute-Labrèze et al. recently developed IHReS as an initial tool for primary physicians to make their decision to refer patients to expert centers.[3] This is a two-step easy-to-use tool for non-expert physicians, provided with some drawing pictures indicating striking location and practical notice points in making decisions. This tool is free to use and is available to be downloaded from www.ihscoring.com (Fig.1). After IHReS efficacies had been published, we all agree that this may be a useful instrument to solve the delayed treatment among IHs patients. Thus, initiation of the present study was set to evaluate reliability of IHReS and to assess the possibility of using this instrument among Thai physicians.

Our study was conducted in Thailand among the target physicians who deal with IHs patients in their real practices that includes primary physicians, general pediatricians, and pediatric dermatologists. The present study revealed that non-expert physicians had fair agreement interrater (Fleiss' Kappa= 0.23) at step 1 (usual practice assessment), while moderate agreement was observed in IHs experts, Fleiss' Kappa= 0.42. This finding reflected that a problem of timely decision making in treating IHs occurred more often in the nonexpert physicians by the usual assessment without the assisting instruments. However, interrater reliability increased to substantial agreement at step 2 (use of IHReS) in the both groups. The result correlated to the findings in the validation study of IHReS in 2020[3], and also reflected that the use of assisting

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instrument (IHReS) can help physicians in making their decision to refer IHs patients for treatment. Our findings revealed that there was an increased in mutual agreement and acceptance after using IHReS not only among non-expert physicians, the IHs experts also had benefited by the use of this score with an increased interrater reliability, Fleiss' Kappa in IHs experts were 0.42 at step 1, and 0.80 at step 2, respectively. The IHReS also provided a consistent result after retesting at one week later with almost perfect interrater and intrarater repeatability in both groups, Table 1.

The study design that was done via the online platform made the authors concerned of the returned questionnaires compliance, thus we decided to limit number of the selected clinical cases in the present study to shorten the time to complete the questionnaires. Therefore, there might be some selection bias of some difficult or controversial clinical cases that affected the decision by usual assessment without IHReS. However, the findings of discriminate decisions between usual assessments vs. using IHReS supported the evidence that the triage screening tool for IHs as a decision to refer for treatment is essential.

In summary, IHReS was a simple, easy to assess tool for non-expert physicians. However, the present study also revealed that this tool is beneficial for IHs experts as well. It took a short duration less than a minute to complete the score and had the reliability to be used to make a decision to refer IHs patients for treatment among Thai physicians. Using IHReS can improve clinical outcomes by identifying which patient needs early intervention to minimize the possibility of complications.

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Declarations

Funding

None

Conflict of interest

The authors declare that they have no conflict of interest.

Availability of data and material

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Code availability: N/A

Authors' Contribution

K. Chitpiromsak contributed to the study conception, design of the study, and data collection. L.Techasatian contributed to the conception and design of the study, data analysis, interpretation of findings, drafting the article, revising the article, and final approval of the version submitted. C. Jetsrisuparb contributed to study conception and supervised the study process.

Ethical approval

This study was approved by the institutional review board of Faculty of Medicine, Khon Kaen University, Thailand (IRB no. #HE641280) before enrolling any participants.

Consent to participate

All participants gave individual consent to the study by replying back the online questionnaire. The study was approved by the institutional review board of Faculty of Medicine, Khon Kaen University, Thailand (IRB no. #HE641280) before data collection.

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Consent for publication

Written parental consent for the patients' photographs for publication was obtained in all subjects.

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Table and Figure legends

Table. 1 The steps of the study interventions and the agreement results in IHs experts and non-expert physicians.

Table. 2 The participants' satisfaction of the Infantile Hemangioma Referral Score (IHReS) in different aspects.

Fig. 1 The Infantile Hemangioma Referral Score (IHReS). This tool is free to use and is available to be downloaded from www.ihscoring.com.

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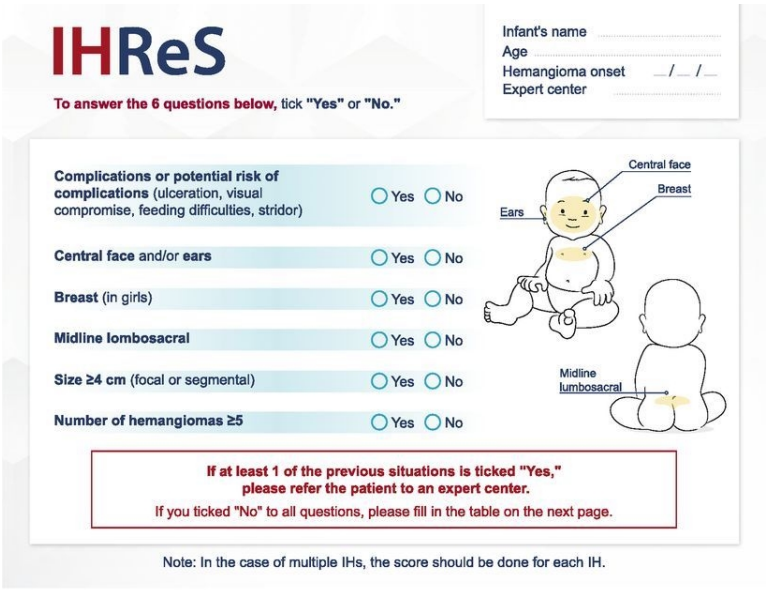

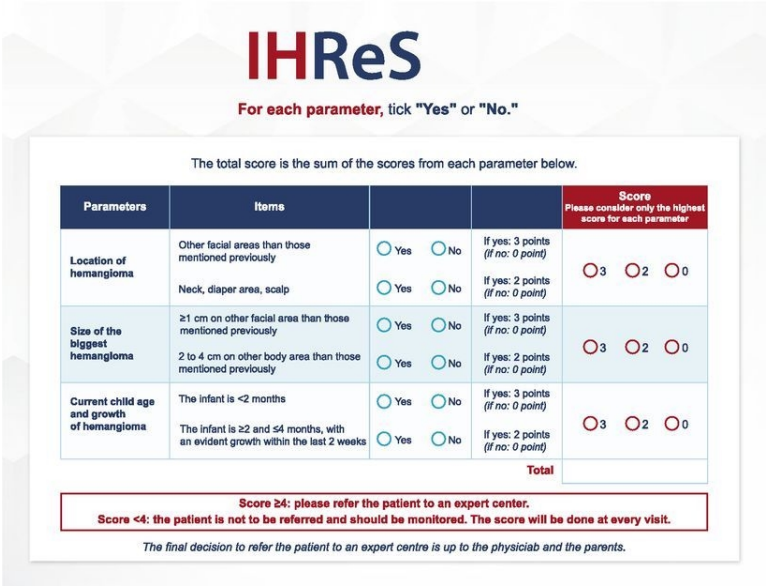

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