

A Five-Year Evaluation of Surgical Aid in Vietnam

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Abstract: In low- to middle-income countries, long-term documentation following medical grants remains limited. This study surveyed the outcomes of Vietnamese recipients who received financial aid for congenital surgery in 2020. In 2025, 197 of the original 687 recipients were interviewed by telephone. This study used predefined coding criteria to measure outcomes in child health, education or labor participation, and household livelihood. Wald and Clopper-Pearson methods were used to analyze proportions with two-sided 95% confidence intervals. Findings showed 75.1% of the assisted children displayed favorable health outcomes. Meanwhile, health deteriorated for 14.7%, and the remaining 10.2% had passed away, while 73.4% of the surviving children showed consistent education or labor participation. Of the households with sufficient livelihood information, 57.8% were classified as having favorable or stable livelihood outcomes. Favorable health and education or labor outcomes were more common than stable livelihood outcomes. These findings indicate that long-term outcomes among surgical financial-aid beneficiaries are heterogeneous across health, education, and household livelihood. The study supports the value of multidimensional follow-up beyond immediate surgical outcomes and provides five-year household-level evidence for evaluating charitable pediatric cardiac surgical assistance in Vietnam.

Keywords: congenital heart surgery, financial assistance, charitable care, long-term outcomes, household livelihood, Vietnam.

1. Introduction

A. Motivation

Surgery in low and lower-middle-income countries (LMICs) carries a financial burden for recipients, whose income is often insufficient to cover medical costs. Some developing countries establish medical support programs, such as insurance, to mitigate this. The portions of medical costs that insurance doesn't cover and that the recipient is unable to finance are typically paid for by financial assistance programs. These programs largely come from charity work and donations, which aim to finance surgery for patients lacking the required funds. Despite the expansion of medical insurance and health charities in LMICs in recent years, few studies have examined the long-term outcomes of patient families receiving surgical financial aid. While assistance programs focus on funding for the patient, they do not typically comprise long-term monitoring. Consequently, extended effects of financial medical aid remain under-documented.

This study thus examines the long-term outcomes of families

recipients of one-time financial aid. In 2020, the children of these households were diagnosed with congenital heart disease (CHD) and were granted the funds that insurance didn't cover for surgery. Using follow-up interviews conducted approximately five years after treatment, the paper measures patient recovery alongside educational participation and overall family livelihood. The findings henceforth give evidence of whether one-time financial aid for surgery contributes to lasting household recovery, while informing future designs of medical assistance and postoperative follow-up programs.

B. Literature Review

Illness is both a medical shock to the patient and a financial shock to the household. Healthcare fees, such as medicine, treatment, check-ups, and transportation, affect families beyond physical wellbeing. Indirect opportunity costs, including foregone productivity, lost caregiver time, and depletion of long-term assets, also constitute the financial consequences of healthcare in LMICs [1]. The chain reaction from illness pushes households into financial debt and poverty. While these effects are common throughout healthcare, surgical intervention is especially risky financially because treatment requires exacting and specialized procedures.

Around the world, 81 million people face catastrophic medical expenditures annually, while 3.7 billion are endangered [2]. A Ugandan case study further discovered that 46% of sampled surgical patients lived in extreme poverty, while 53% borrowed money to cover fees and 17% lost their jobs; another portion pulled their children out of school [3]. This demonstrates how LMIC households cope with financial consequences: debt, asset liquidation, and loss of productivity. Beyond LMICs, 37.9% of US surgical patients suffered economic hardship in the years following intervention; surgery was also associated with a 16% relative increase in financial struggles compared to matched non-surgical controls [4]. Though the United States is not categorized as an LMIC, the discussion shows that catastrophic medical expenditures are not unique to an economy's resource constraints.

The resulting hardship persists after discharge. The coping strategies damage household resilience and suggest that financial toxicity is multivariable. Financial toxicity is described as the sum of the economic, psychological, and social hardship experienced by households [5]. Health expenditure and toxicity affect households across all healthcare and income

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structures, despite higher-income contexts or care initiatives. Essue *et al.* argued that medical treatment severely destabilizes the household economy through the financial toxicity framework [6]. While there are structural consequences of OOP spending among LMICs, Pisu & Martin were able to use financial toxicity to show that this phenomenon occurs irrespective of the nation's wealth and income landscape. Medical procedures thus put multiple domains at risk and damage the household economy as well as future productivity.

Efforts have been made to expand medical care and health insurance to curb patient spending. A 2025 WHO report established two main components of healthcare coverage: access to needed healthcare, as well as protection from financial hardship [7]. Despite meaningful progress in healthcare coverage, growth has stalled in recent years, and gaps remain in financial protection. Because healthcare expenditure contributes to financial toxicity, insurance should be the primary tool for policymakers to combat that process. Yet, Hooley *et al.* found across 100 LMICs that although coverage has considerably expanded, higher percentages do not correspond to similar relief in financial burden [8]. While alleviating a portion of medical costs, insurance leaves patients responsible for the remaining substantial OOP spending. Since insurance schemes also face high price sensitivity and administrative barriers, establishing the program is not enough for effective healthcare expansion [9]. These sources distinguish nominal coverage from effective protection: for households, enrollment may not be sufficient in avoiding financial toxicity without meaningful cost reductions from healthcare.

These limitations nonetheless do not invalidate the value of health insurance. Fan *et al.*, in a meta-analysis of independent research samples, found a generally positive association between health insurance and economic performance [10]. Yet, Osei *et al.* discovered a mixed association between insurance and improvement, with significant developments in health outcomes but inconclusive results in the process of care and mortality [11]. While insurance may provide a meaningful financial buffer, coverage proportions do not necessitate better care or improved results. Therefore, the efficacy of insurance programs depends not only on nominal coverage but also on how program enrollment translates into tangible household protection in the long run.

Vietnam illustrates the difference between insurance coverage and protection efficacy. In 2025, health insurance has reached 95% of the country's population [12]. Bales & Dao discovered that, although approximately 91% of Vietnamese were insured in 2022, OOP spending still accounted for 40% of the national health expenditure [13]. The paper concluded that the nation's insurance expansion helps reduce catastrophic expenditure but has not curbed OOP spending. Park & Pak discovered that 18% of participants in rural and suburban Vietnam still face unmet healthcare needs, providing evidence that certain groups remain geographically or economically secluded despite the extension of healthcare [14]. Wijiya & Sulistiadi studied several reasons why patients in Asia continue paying OOP expenditure, such as public service availability,

perceived private quality, and healthcare accessibility [15]. These findings suggest that the global pattern identified by Hooley *et al.* is observable in Vietnam: coverage expands while still leaving obstacles to household financial protection.

External financial assistance allows treatment for families who cannot afford necessary care. Non-governmental organizations (NGO) can address the gap left behind by insurance coverage and healthcare costs. NGO assistance is especially prevalent in surgical care due to its costly nature and thus is necessary to improve the immediate accessibility of treatment. It does not, however, guarantee that the resulting welfare persists. Charity programs typically aim to create sustained humanitarian impact for recipients: the VinaCapital Foundation, for instance, states that the organization seeks long-term improvement among the disadvantaged children who received aid [16]. Yet, a cross-analysis of cardiac patients found only a 14.7% follow-up rate across nine LMICs and 43.2% in Vietnam [17]. Long-term monitoring is a crucial but missing factor to assess beneficiary outcomes after treatment.

CHD outcomes thus is not simply procedural success. Sood *et al.* found that cognitive consequences of congenital patients last throughout childhood, adolescence, and adulthood, affecting learning, behavior, and psychosocial functioning [18]. Because CHD has consequences in various these domains, long-run measurements should consider multiple improvement dimensions as well. Wilkinson *et al.* advocate using Patient-Reported Outcome Measures (PROMs) to evaluate these dimensions from the patient's perspective beyond clinical research [19]. By arguing that survival sometimes masks poor quality of life, the paper concludes that livelihood- and patient-centered outcomes should supplement clinical results. While Sood *et al.* argue for evaluation across multiple substantive domains, Wilkinson *et al.* support that these functional dimensions require centered measurement through appropriately designed PROMs, in favor of pure clinical status.

Post-surgery financial hardship and the limitations of insurance protection are well-documented. Charity programs, such as the VinaCapital Foundation, can fill this access gap by financing treatment for recipient families. However, access to treatment is not sufficient for benefits to persist after discharge. The existing literature documents a knowledge gap in long-term follow-up of surgical programs; evidence is especially limited for multidimensional outcomes of Vietnamese pediatric patients receiving charity assistance. In light of this missing evaluation of sustained outcome, this study examines the five-year progress of households whose children received financial aid for congenital cardiac surgery. We evaluate health, education, and livelihood outcomes among contacted families.

C. Rationale

This study examines children who received charitable financial assistance for pediatric heart surgery in 2020. Follow-up interviews were conducted in August 2025 to assess household outcomes based on the child's current health, educational or workforce participation, and overall livelihood of the family. Of the 687 families that constituted the original recipient cohort in 2020, 197 provided complete responses. All

687 families required financial assistance and were supported by the VinaCapital Foundation five years prior to the study.

A major limitation of this study is the 28.7% response rate. Because of the five-year period since financial assistance, many households could not be reached. This introduces non-response bias. Households that did not respond may systematically differ from respondents in their socioeconomic outcomes; this difference affects the ability to respond. Furthermore, findings are specific to one charity program. They should not be generalized to different demographics or all pediatric surgery patients. Still, the study sample provides evidence regarding the long-term experiences of beneficiaries who were successfully contacted. The findings should be interpreted as a statistic of a respondent cohort rather than the parameter of all families who received financial assistance.

This study is based on the Sustainable Livelihoods Framework (SLF), developed by the UK Department for International Development [20]. The SLF defines socioeconomic wellbeing as influenced by an interconnected multivariable system. Specifically, it posits that livelihood is shaped by the interaction between assets and other sources of vulnerability, not just income. Instead of defining poverty by wealth or earnings, the framework incorporates a combination of human, social, financial, physical, and natural factors. Together, these areas determine a household's ability to maintain livelihood and recover from adverse events.

For low-income households, CHD is a major livelihood shock. Surgery, and its impending costs, affects many factors of household at once. Because multiple domains were influenced, fluctuations extend beyond income. The SLF thus informs the measures used in this study. Child health represents the financial aid's most immediate interest: the child's recovery from the original condition. Educational or workforce participation reflects the family's long-term ability to create and maintain long-term productive opportunities following a medical shock. Household livelihood was measured multidimensionally to assess socioeconomic stability. A household's true sustenance in the long run is the central question of targeted financial assistance.

Rather than evaluating these indicators separately, the SLF treats them as interconnected and mutually essential for recovery. Likewise, this study interprets long-term outcomes through health, education, and livelihood, not clinical recovery alone. The interviews thus used several informed guidelines to ensure consistency and precision of the responses. The methodology is holistically transcribed in the Appendix sections.

2. Methods

A. Design

This study was designed using structured phone interviews to reach out to patient families. These families were recipients of the VinaCapital Foundation's Heartbeat Vietnam financial assistance program in 2020, and the survey was conducted in August 2025. The interview measured three domains: the child's current health, current education or employment, and

the family's overall livelihood.

All interview protocols were standardized beforehand to measure these areas as consistently as possible. The Appendix sections present those protocols.

The study population comprised 687 recipient families of the VinaCapital Foundation's Heartbeat Vietnam program. These families requested financial assistance for surgery and were aided in 2020. The households came from diverse demographics and contexts. The interview team successfully contacted 197 families, who responded and provided the sample base for this study. However, 16 households among the 197 did not give enough information for an accurate livelihood assessment and thus were excluded from that domain specifically.

Since one of the main goals was to survey the child's situation, 13 families whose children have been marked by the VinaCapital Foundation as deceased since 2020 were not contacted, but were included in the 687 population regardless.

To measure long-term post-surgery household improvement, we thus define the three outcome variables: the child's current health, their educational or labor participation (if applicable), and overall family livelihood. These metrics were chosen based on the Sustainable Livelihoods Framework and qualified by interview criteria.

Appendix B features the coding guidance to specify responses for each section.

B. Health

This domain measures the child's current medical condition five years after their surgery.

Information was collected on their number of recurrence surgeries after the original one (both surgeries up to this point and surgeries required in the future), the volume and expense of medications currently consumed, the frequency of routine medical check-ups the child has to undergo, the doctor's diagnosis in recent check-ups, as well as the child's daily life and activities (whether there are symptoms of unwellness); some examples of deterioration symptoms include dyspnea and cyanosis. These health variables are often interconnected and correlated.

The overall health condition of the child was evaluated by considering these indicators together. Cases showing signs of persistent medical struggle, such as repeated surgeries and/or requiring further operations in the future, dependence on prescribed medication (not supplements), frequent need for physician check-ups and/or abnormal findings, or ongoing functional limitations that inhibit daily life, were classified as deteriorated. Children without these symptoms and demonstrating normal health were counted as a long-term health improvement case.

C. Education/Labor

This variable measures whether the child is maintaining education or, if applicable, employed and working. Lag is expected (for instance, an 8-year-old entering 2nd grade) since surgery and medical treatment have taken time off from school.

Interview questions track school enrollment, grade level and

attendance, and learning ability. If the child is unable to continue or has already finished school, corresponding questions were asked to assess their employment status, including earnings and work hours. Interviewers also followed up on the child's social adjustment, such as their ability to communicate with others and participate in everyday social activities. These criteria surveyed long-term surgical recovery beyond school attendance to gauge the child's ability to reintegrate into a normal social environment.

D. Livelihood

This criterion assesses the household's overall livelihood following the child's surgery.

Questions surveyed stability in the family's income stream (explicit income was not inquired due to privacy), the number and wellness of their children, the availability of caretakers in the home, food and sustenance security, the presence and volume of monetary debt, and whether there have been any major adverse events. The respondent was also asked to qualitatively judge the general situation of the household.

Because livelihood is multidimensional, no single indicator determined the final assessment. To mitigate variability and subjectivity, responses were interpreted collectively according to the coding criteria.

E. Data

The data were collected using phone interviews during two weeks in August 2025. A team of five trained interviewers contacted patient families by the phone numbers provided at the time of the financial aid. A rigid question guide, designed to gauge the household outcome most accurately, was standardized to collect responses on the child's health, educational or labor participation, and household livelihood, while respondents had room to provide contextual details as comfortable. Interviewers contemporaneously recorded responses on standardized data sheets.

Before collecting data, all interviewers received training on interview procedures, conversational techniques, and consistent application of the survey guide. Calls were conducted from a dedicated office environment, thus allowing supervisors and team members to provide immediate guidance during difficult calls as well as guidance and feedback after calls. Each phone number provided was contacted two times before being classified as a nonresponse. When multiple numbers were provided for the same family, each number was contacted three times. The complete interview guide is available in Appendix A and Appendix B.

At the start of each call, team members obtained verbal informed consent from the respondent before interviewing. Participation was voluntary, and respondents were informed that they could decline to answer any question or stop the interview at any point if they were uncomfortable. This would not affect their eligibility for future assistance. All data and answers were anonymized before analysis to protect family privacy.

All steps, including the structured interview questionnaires and the verbal informed consent process, were reviewed and

approved by the VinaCapital Foundation¹³ before the field survey.

F. Analysis

The findings measure percentages of children with a positive health outcome, consistent educational or labor force participation, and families with a stable household livelihood. These statistics were quantified using descriptive statistics. Two-sided 95% confidence intervals for binomial data were computed to quantify sampling uncertainty for this population (in other words, the methodology is 95% confident that the true population proportion is captured by the interval).

Because the study relied on a moderate-sized respondent sample, confidence intervals were calculated with both the approximate Wald and the precise Clopper-Pearson methods. Computing both methods allowed for the contrast between a common but less precise interval and a more conservative one, letting the methodology compare the accuracy of the estimated proportions. All confidence intervals utilized a significance level $\alpha = 0.05$.

Since the main objective of this survey is purely descriptive rather than comparative, no formal hypothesis testing was implemented. Detailed formulas and precise computational procedures are available in Appendix D.

3. Results

A. Response Rate

The sample consisted of 197 families, representing 28.7% of the 687 households in the population. Based on those statistics, the calculations yielded a standard deviation of 0.4528 and a standard error of 0.0173. 95% confidence intervals can then be derived using the two methods. The Wald approximation yielded a confidence interval of 23.3% to 34.4%. To ensure robustness, the exact Clopper-Pearson method was also applied, yielding a slightly narrower interval of 25.3% to 32.1%. These figures estimate the true proportion of responses among the population.

The ratio of respondents to non-respondents is illustrated in Figure 1.

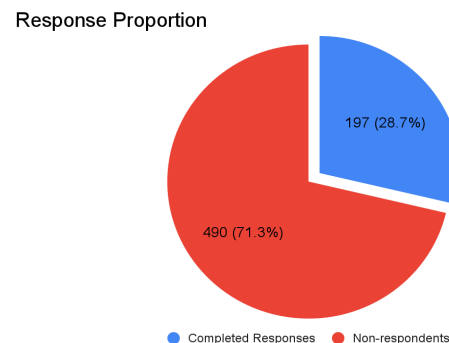


Fig. 1. Distribution of survey responses vs. non-respondents

Of the 687 eligible recipients, 197 provided complete responses (28.7%). Figure 1 illustrates the distribution of respondents and nonrespondents within the study population.

B. Health

Among the 197 families who responded, 75.1% experienced improved or stable health outcomes, meeting the predefined criteria for long-term health improvement. On the other hand, the study also found 29 children whose health significantly degraded after their surgery, making up 14.7% of the proportion. In contrast, 20 unreported deaths (10.2%) occurred in the five years following surgical intervention. Statistical analysis of the improvement proportion yielded a standard deviation of 0.4311 and a standard error of 0.0308. Based on these metrics, the 95% confidence interval for health improvement was 69.1% to 81.2% using the Wald method, whereas the exact Clopper-Pearson method yielded a conservative interval of 68.5% to 81.0%.

These outcomes are visualized in the donut chart in Figure 2.

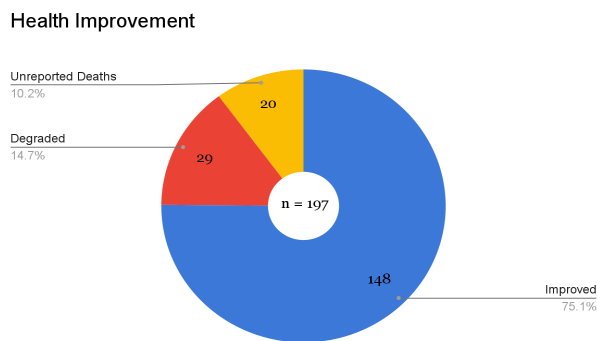


Fig. 2. Health outcomes of respondents five years after intervention

Figure 2 presents the distribution of health outcomes among the respondent sample.

C. Education

Education Outcome

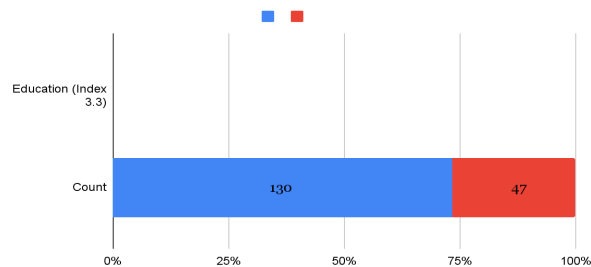


Fig. 3. Education or workforce participation among patients five years after surgical aid

Analysis of the 177 children alive at the five-year follow-up indicated that 130 (73.4%) maintained consistent educational enrollment or regular labor force participation. Statistical calculation for this proportion yielded a standard deviation of 0.4435 and a standard error of 0.0333. Based on those statistics,

the 95% confidence interval for the Wald method was 67.9% to 81.0%, while the more conservative Clopper-Pearson method yielded 66.3% to 79.8%.

Figure 3 presents these education statistics on a filled bar chart.

Figure 3 illustrates that 73.4% of respondents maintained consistency in education or employment. Despite this, 26.6% of the sampled households still face challenges in their children's trajectories.

D. Livelihood

Of the 177 children, 16 families provided vague or insufficient information on the livelihood variable and were excluded from this analysis. However, for the other two sections, which are mostly binary, interviewers obtained sufficient information to include those 16 families in the Health and Education Outcome sections. Within the surviving cohort, 93 of the 161 households (57.8%, SD = 0.4939) experienced meaningful improvements in their daily livelihood. Factoring in a standard error of 0.0389, the true population proportion is estimated to fall between 50.2% and 65.2% (Wald 95% CI), with Clopper-Pearson exact intervals confirming a nearly identical range of 50.1% to 65.4%. The proportion in livelihood improvement (57.8%) was lower among families than the observed percentages for child health and child education.

Figure 4 shows the proportion of improved livelihoods.

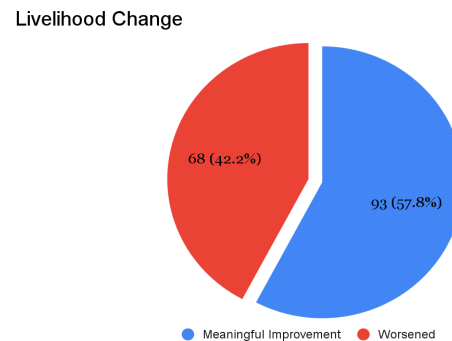


Fig. 4. Reported changes in household livelihood security five years post-intervention

Figure 4 shows the proportion of positive responses across the household livelihood domain. As depicted, although the improved category takes up the majority (57.8%), this proportion is lower than the improvement rates recorded in the health (75.1%) and education (73.4%) sections.

E. Comparison

Table 1 compares the two statistical methods employed for all four sections.

The Wald and Clopper-Pearson confidence intervals were compared side-by-side. The maximum difference between the two methods was less than 0.65% for all sections. This high

Table 1

The maximum percentage difference between Wald and Clopper-Pearson intervals, rounded to the hundredths

Variable/Statistic	Wald 95% CI	Clopper-Pearson 95% CI	Difference between Bounds
Response Rate	25.29% - 32.06%	25.32% - 32.22%	0.16%
Health Improvement	69.09% - 81.16%	68.48% - 81.00%	0.61%
Education Stability	66.94% - 79.95%	66.30% - 79.79%	0.64%
Livelihood Gain	50.13% - 65.39%	49.74% - 65.50%	0.39%

similarity indicates that the sample sizes could be normally approximated and supports that the reported results are robust across methods.

4. Discussion

A. Findings

The follow-up survey showed generally favorable respondent outcomes, even if the proportion of improvement varied across the three domains. Of the surviving children, 75.1% reported favorable health, while 73.4% maintained consistent education or work. 57.8% of the responding households were classified as demonstrating stable livelihood outcomes.

The varying favorable proportions show that improvement was not homogeneous across all measured domains. This matches the Sustainable Livelihoods Framework, which depicts household wellbeing as an interaction of multiple forms of capital and vulnerability rather than income alone. Despite surgical success in a majority of the cases, nearly one-quarter of the children reported a deteriorating health, 26.6% had an inconsistent education trajectory, while 42.3% of households were classified as having an inconsistent or unstable livelihood. These findings suggest that financial aid and procedural success does not restrict the possibility of later difficulties.

B. Implications

The findings imply that one-time surgery may not remove the possibility of future health degradation. 14.7% of the surveyed children deteriorated in their health, while another 10.2% had passed away since the surgery. Thus, charity programs may benefit from adding a long-term follow-up component to track and identify signs of health deterioration among recipients.

The similarity between favorable health and consistent education proportions may be due to their interconnectedness. For example, an improvement in health could be necessary for a consistent education. The study was not designed to test the relationship between these variables, so the similarity should not be interpreted as evidence of causation.

Livelihood had less positive outcomes than health or education. This means that regardless of clinical results, economic security is not guaranteed. Because the recipient households remain exposed to major shocks in employment, caregiving, or debt, continued follow-up could help identify socioeconomic struggles. Therefore, charity programs may also be interested in implementing extended household monitoring.

Taken together, the findings suggest that even if surgical financial assistance may address an immediate barrier, longer-term outcomes remain heterogeneous across health, education, and livelihood.

C. Limitations

At the end of the survey, interviewers received 28.7% of responses from the sampled group in total. This introduces the potential of nonresponse bias: nonrespondents may differ fundamentally from respondents in a way that complicates the findings. This means that households under greater socioeconomic pressure may have been less likely to

participate. Consequently, improvement proportions, especially livelihood, may be overestimated. Results should therefore be interpreted with caution.

Another limitation of the survey is the lack of a randomized control group. The treatment applied to the sample in this case is the surgery financial aid in 2020. Since the study population was pooled from an existing charitable program, not an experiment, it was not feasible to obtain a control group that did not receive treatment. Therefore, association between surgery financial aid and the variables may be drawn, but inferring causality is not possible in this context.

Responses were entirely self-reported. This makes the data prone to inaccuracies such as recall bias and social desirability bias, among others. Standardized interview protocols and interviewer training were used to reduce variation in data collection, while predefined coding criteria (Appendix B) were used to reduce variation in interpretation.

Some researcher judgment remained necessary when dealing with ambiguous, incomplete, or mixed responses across indicators. Potential for classification bias occurs when respondents reported both positive and negative livelihood changes. To minimize subjectivity, classification criteria were codified beforehand, and insufficient information was not inferred as improvement.

The five-year timestamp was standardized but may be prone to inaccuracy. There were no intermediate as well as later follow-up steps, thus not allowing for the observation of recovery progress over time.

D. Recommendations

Current evaluations often stop after discharge. This study demonstrates that meaningful differences in health, education, and livelihood remain five years later. Therefore, a continued household monitoring system evaluating patient outcomes and sustained impacts of the financial aid would benefit charitable funds and healthcare programs. Periodic follow-up primarily could track the recipient's health and the effects of the aid, as well as a multidimensional assessment of its efficacy. Since findings were heterogeneous, aid programs should measure improvement in distinct but interconnected domains, such as health, education, or livelihood. Such approach would give a more precise assessment of the program's efficacy than medical outcomes alone.

While this study utilized the cohort from 2020, the addition of more cohorts would make the evidence rigorous. Replication of comparable statistics across other cohorts (for example, different geographical regions) would allow researchers to judge whether similar patterns are produced. In doing so, replication would improve the external validity and generalizability of these findings.

Future studies could make use of a more detailed classification system. Instead of binary improvement, the methodology could include granular classification, such as a scoring index. This approach would give more insight into household improvement and mitigate the risk of misclassification.

Researchers could use prospective cohort studies or

matched-pair groups as stronger study designs. The methodology could track recipient households alongside similar families who have not been assisted, or conduct repeated follow-up assessments multiple times rather than at a single point. The survey would then provide a clearer view of improvement progress and further strengthen inference about the long-run effects of charity assistance.

E. Conclusion

This follow-up found generally positive gain among households, but the proportions varied by domain. The difference between health, education, and livelihood outcomes supports the use of multivariable assessment rather than relying on a single clinical endpoint.

These findings also indicate that medical recovery and household socioeconomic security do not necessarily develop at the same pace. This study does not establish that financial assistance caused the observed outcomes, nor does it establish whether those outcomes would have differed without assistance. Instead, it provides descriptive evidence of the longer-term circumstances of beneficiaries approximately five years after receiving surgical financial aid.

Overall, this study addresses the gap in the literature by providing five-year evidence from a Vietnamese pediatric cardiac surgical assistance cohort. The findings suggest that surgical assistance's long-term effects are best understood through health, education, and livelihood trajectories, not through access to surgery alone.

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Appendix A

Appendix A presents the complete guide on how the interviewers were trained to inquire and respond. Since the survey was conducted by phone calls and respondents could not always give complete answers, interviewers were trained to focus on the most immediate and relevant questions when retention was limited. Questions were structured according to the list but flowed naturally in a conversation, not necessarily in any strict order.

Appendix A. Household follow-up interview question guide

The question guide aims to cover significant aspects of a post-surgery household, assessing multiple interconnected factors. When respondents indicated that they had low retention, interviewers prioritized primary questions needed to determine the overall health of the child, his or her education status, and general household livelihood. Secondary questions were asked if respondents had enough time or were willing to share, while tertiary questions served to supplement the picture with additional context.

Procedure:

- Dial the provided numbers up to two times each; if someone picks up, introduce the organization and the follow-up reason.
- Confirm that the respondent consents to participating.
- Go through health questions, education or work questions, and family questions, in that order.
- If the respondent has time, ask secondary and tertiary questions.
- If the respondent indicates inability to prolong answering for any reason, focus on primary questions.
- Record descriptive notes of the respondent's answers; don't interpret beyond.
- Make note of insufficient information.

Table A.1

#	Vietnamese Original	English Translation	Importance
1	Bé đã làm phẫu thuật bao nhiêu lần? Có phải phẫu thuật tiếp hay không?	How many surgeries has the child undergone? Are additional surgeries required or scheduled?	Primary
2	Tình trạng sức khỏe của bé như thế nào? Có tái khám không? Tái khám cách bao lâu một lần?	What is the child's current health status? Do they attend follow-up examinations? If so, how often?	Primary
3	Bé còn uống thuốc không? Tiền thuốc khoảng bao nhiêu trong một tháng?	Is the child currently on medication? What is the monthly cost of drugs?	Secondary
4	Bé có đi học không? Bé lớp mấy rồi? Học lực của bé như thế nào?	Is the child attending school? What grade are they in, and what is their academic performance?	Primary
5	Bé có thích nghi với môi trường học không? Lên lớp có giao tiếp với bạn bè bình thường không?	Has the child adapted to the school environment and does he/she socialize normally with peers?	Secondary
6	Trường cách nhà bao xa? Mỗi ngày bé đi học bằng phương tiện gì?	How far is the child's school from home? How does he/she get to school?	Tertiary
7	Công việc và thu nhập của phụ huynh giai đoạn trước phẫu thuật?	What were the parents' occupations and income levels before the surgery?	Primary
8	Khi bé bệnh, ai là người chăm sóc bé? Có phải nghỉ làm để chăm sóc bé không?	When the child was ill, who was the primary caregiver? Did the caregiver have to take time off from work?	Secondary
9	Công việc và thu nhập của phụ huynh sau phẫu thuật? Có thay đổi, tăng giảm gì không?	What are the parents' current jobs and income? Are there any major changes or fluctuations since the surgery?	Primary
10	Sau khi bé phẫu thuật, mẹ có đi làm không? Nếu không, mẹ có làm việc gì ở nhà không? Thu nhập như thế nào?	After the surgery, does the mother work? If not, does she engage in home-based work or income-generating activities? If so, what's her income like?	Tertiary
11	Gia đình còn thành viên nào không? Tình trạng học tập và sức khỏe/việc làm của các thành viên khác?	Are there other household members? What are the health and educational or work status of the other members?	Secondary
12	Nhà có bà con họ hàng ở gần không? Có hay qua lại không?	Does the family have relatives close by? Do you frequently have exchanges/hang out with those relatives?	Secondary
13	Gia đình có phải vay mượn không? Vay bà con họ hàng, ngân hàng, hay nguồn khác? Dự tính trả được hết không?	Does the family ever have to borrow money? If so, where from? Do you think you can pay it off?	Primary

Health:

- Ask about the child's current status and daily functionings; let the respondent describe.
- Clarify the description in case of any ambiguity about the respondent's assessment of the child's health.
- Ask secondary questions about his or her surgery situation and medication intake, if the respondent is willing to answer.

Education:

- Ask whether the child still goes to school; if the child is past school age, ask if he or she is planning higher education or employment.
- Ask about the child's academic performance at school.
- Clarify what grade the child is in; relate the current grade level to the child's age (whether at or below the expected grade).
- Ask tertiary questions to contextualize school and social environments if the respondent is available.

Livelihood:

- Ask about the current family situation; let the respondent explain.
- Clarify major changes, positive or negative, in household livelihood since the surgery.
- Ask secondary and tertiary questions to contextualize if the respondent is available.
- Record insufficient information where no response was given; don't assume.

Appendix B

Appendix B documents how live interview notes are turned into data for interpretation.

1. Health

In general, health status is determined from the overall pattern of current functioning and clinical pressure. The child's daily life is the primary observable indication, while physician findings, surgical history, and medication use are supplementary evidence.

Favorable evidence

- Child can perform normal daily activities.
- No difficulty with movement.
- No difficulty breathing.
- No major functional difficulty reported.
- Common illnesses such as colds, runny noses, or ordinary short-term sicknesses are not evidence of health deterioration. Symptoms should be interpreted relative to their severity and relevance to the health condition.

Unfavorable evidence

- Difficulty moving.
- Difficulty breathing.

- Symptoms such as dyspnea or cyanosis that hinders daily activities.
- Other major physical limitations.

Physician diagnosis and clinical findings

- Reported physician diagnoses from recent follow-ups are considered supporting medical evidence.
- Abnormal findings are evaluated according to their significance.
- If a physician's diagnosis conflicts with a reported normal functioning description, the physician's assessment is preferred.
- A vague or general response that a doctor diagnoses abnormality is not an automatic deterioration without further context.

Surgery

These factors are considered in deciding whether subsequent surgery after the original one means deterioration:

- Why the procedure was required.
- Whether it was minor or planned vs. clinically significant.
- Whether it was a planned device removal or transplant.
- Whether it was invasive or associated with additional implants.
- Whether additional surgery is required or strongly expected in the future.
- Whether the surgical history has functional or physician-documented effects.

In general:

- Minor/expected surgeries do not necessarily change an otherwise favorable classification.
- Significant recurring surgeries or continued surgical consequences gives stronger evidence of an unfavorable health status.

Medication

- Routine supplements or medications for common illness do not indicate deterioration.
- Specialized prescription medication is considered evidence of continuing medical management.
- Dependence on clinically vital medication indicates continuing health burden.
- The type and necessity of medication matters.

Classification

Favorable health generally corresponds to:

- Normal or near-normal daily functioning.
- No clinically significant deterioration documented by a physician.
- Limited or inconsequential ongoing medical burden.
- No substantial recurring surgeries.

Unfavorable health generally corresponds to:

- Nontrivial functional limitations.
- Clinically significant physician-documented abnormality.
- Substantial medical dependence.
- Clinically significant recurring surgeries.

In case of conflicting evidence:

- Indicators are viewed in unison.
- Clinical diagnosis from a physician generally outweighs respondent descriptions.

Insufficient information

- If available information is genuinely insufficient to determine health status, or requires unreasonable inference, classify the case as insufficient.
- A general statement such as “the child is okay” supports a favorable classification when no contradictory information is present. However, this relies partly on conversational context and involves interpretive judgment.

2. Education

For school-age children, continued education is the primary factor, with academic performance and social functioning as extra indicators, and context with tangential relevance. For beneficiaries beyond K-12, tertiary education, employment, or productive work is used as the respective indicator.

Favorable evidence

- Continued school enrollment.
- Continued school attendance.
- Continued kindergarten or planned school where age-appropriate.
- Expected progress.
- For older children beyond school age, employment or other productive work or activity.

Unfavorable evidence

- Persistent school discontinuation.
- Major school interruption or lacking performance attributable to an ongoing barrier.
- No school, work, or productivity at an age when such participation would be expected.

Academic performance

K-12 academic levels in Vietnamese public schools: Xuất Sắc, Giỏi, Khá, Trung Bình, Yếu, Kém; respectively, Excellent, Very Good, Good, Average, Weak, Poor.

- At or above Average (grade point average of at least 5.0 on a scale of 10) is desirable.
- Weak/Poor levels evidence difficulty, but they don’t automatically supersede continued participation.
- Academic performance is a secondary indicator of educational engagement.

Social functioning

- Consider the child’s ability to communicate, interact with peers, participate in social activities, and adapt to the home and school environments.
- Good communication and social participation suggests a favorable development trajectory overall.
- Substantial social dysfunction qualifies an otherwise normal education trajectory.
- Social function does not supersede enrollment and participation at school.

Contextual variables

- Distance from school and mode of transportation are tangentially relevant. They do not by themselves determine the educational classification.
- These variables may bring insight when extreme cases affect participation, or may help explain an otherwise ambiguous case.
- Missing these variables does not render the outcome insufficient when primary information is available.

Classification

- Participation is the primary factor in classifying.
- Academic performance or work productivity is secondary.
- Social adjustment provides additional context.
- Transportation and access factors are tertiary.

In general, a child maintaining age-appropriate education or productive work is classified as favorable unless substantial contradictory or confounding evidence is present. For older beneficiaries, employment or productive work is equivalent to trajectory participation.

Insufficient information

- Missing academic performance or social functioning does not make the entire variable insufficient if the child’s enrollment and participation is clear.
- If school or work participation cannot be established, classify as insufficient.

3. Livelihood

Livelihood is coded as a binary outcome distinguishing favorable or stable household livelihood from unfavorable household livelihood. The multidimensional livelihood assessment was collapsed into a binary variable; positive outcomes correspond to a favorable status, while negative outcomes were classified as unfavorable. Cases with insufficient information to assess were excluded from the livelihood denominator.

Favorable evidence

- Clear improvement and stability in employment.
- Adequate income with no major insecurity.
- Income strongly supports adequate daily living.
- Debt is manageable.
- Functioning household despite some instability.

Unfavorable evidence

- Persistent inability to cover basic needs.
- Severe financial insecurity.
- Substantial unmanageable debt.
- Major income collapse without compensating support.
- Multiple household factors falling short simultaneously.

Insufficient

- The respondent did not give enough details to make a defensible classification.

Income sufficiency

Household income flow is the primary evidence of livelihood. Low income does not on its own equal unfavorable livelihood if the household remains adequately secure. Likewise, higher income does not on its own imply favorable livelihood.

- The focus is on whether income is sufficient to adequately support the household and its functionings.
- Income stability matters equally well.
- The respondent’s assessment of whether income is adequate can be considered alongside the broader evidence.

Material security

- Consider factors such as debt, borrowing, food security, ability to meet daily expenses, any medical expenditure, and other sources of financial pressure.
- Negative indicators include persistent food insecurity, severe or unmanageable debt, repeated borrowing to meet basic needs, and the household’s inability to cover normal expenses.
- Manageable debt on its own does not equal unfavorable livelihood.
- Immediate financial pressure does not necessarily imply the family is insecure.

Employment stability

- Consider factors such as the parents’ employment consistency, availability and frequency of work, any loss of employment, and loss of labor related to caregiving.
- A family with slightly unstable work may still have favorable improvement if other factors demonstrate adequate household functioning.

Other members

- Consider factors such as the health, education or employment, and number of siblings; the number of dependents; the health and economic conditions of grandparents of other relatives in the family; and the total caregiving pressure.
- The situations of other household members matter as much as it tangibly affects the cumulative household livelihood.

Support

- Consider factors such as geographic and intimate proximity to relatives, the frequency of contact, the financial support possible, the ability to rely on relatives during crisis, and any caregiving or material support.
- Geographic proximity or co-residence alone is not support.

Respondent assessment

- The respondent’s own assessment of the household livelihood, useful when tangible indicators are incomplete, is relevant evidence. It should be interpreted together with actual indicators.
- A statement that the household is “doing well” supports a favorable classification when no contradictory insecurity is mentioned.

Household functioning

- Consider whether or not basic needs are met, the household maintains food security, income is sufficiently reliable, debt is manageable, caregivers remain available, the children can continue

school or work, other major burdens are manageable, and adequate support networks exist.

- If favorable, households demonstrate clear improvement OR households maintain an adequately secure and manageable livelihood without significant financial deterioration.
- If unfavorable, Households experience substantial and persistent livelihood insecurity.

External adverse events

- Major events after the surgery are recorded as contextual circumstances. They may affect livelihood classification.
- However, a later accident is not interpreted on its own as evidence that the original surgery aid failed.
- If the event appears external of the intervention, coding should distinguish the household's current situation from the apparent outcome of the original aid.

Mixed cases

- Positive and negative indicators do not by themselves cancel each other.
- If income, debt, household composition, child development, and social support all contradict, the overall pattern of livelihood security is evaluated.
- Evidence of material insecurity carries substantial weight.
- In ambiguous cases, respondent self-assessment and supporting household indicators may help resolve the classification.
- If the overall pattern cannot be reasonably established, nothing was inferred and the household was marked as an insufficient case.

Appendix C

Appendix C showcases three anonymized, worked examples from the notes.

Evidence

Health	Education	Family
- 4 lần đại phẫu mở lồng ngực, 6 lần tiểu phẫu mở thông tim - Sức khỏe hiện tại ổn định, tuy nhiên có hiện tượng mạch đập chậm, nhịp tim thấp -> nếu có dấu hiệu tim tái hoặc ngất xỉu -> bắt buộc đặt máy 2 buồng hỗ trợ nhịp tim cho cháu. - Bé thường xuyên phải tái khám 1 tháng 1 lần, có uống thuốc mỗi ngày, chi phí ~ 8,9 triệu/ tháng	- Hiện tại bé học mẫu giáo, thông minh và nhanh nhẹn - Bé có thể hoà đồng và thích nghỉ với môi trường, bạn bè tốt, tuy nhiên do sức khỏe còn yếu nên các trường không dám nhận em (phải có người nhà túc trực đảm bảo có thể xử lý vấn đề kịp thời)	- Bà làm thợ xây và làm ruộng, mẹ chán nuôi -> khó khăn, mẹ phải thường xuyên ở nhà để chăm sóc cháu vì yếu. - Gia đình vẫn phải cố gắng vay, mượn để có tiền trang trải thuốc và chi phí khám chữa bệnh cho cháu - Có 2 anh chị: anh Trại cả học đại học học viện bưu chính viễn thông, và chị gái học lớp 11 sức khỏe cả hai đều ổn định, học lực tốt.

Analysis

Significant recurring surgery and medical consequences suggest an unfavorable health outcome. Nontrivial physical limitations, significant physician findings, medication dependence, and significant recurring surgeries all indicate a negative result. Ostensible stability does not supersede obvious health burdens. Thus, this child's health status is clearly unfavorable.

Table C.1

Health	Education	Family/Livelihood
The child has undergone four major open-chest surgeries and six minor cardiac procedures. The child's current health is stable; however, sometimes he has a slow pulse and low heart rate. If the child shows signs of cyanosis or fainting, he would need a pacemaker to assist. The child attends monthly follow-up exams and takes medications daily. These cost around VND 8 or 9 million per month.	The child goes to kindergarten and is intelligent and sharp. The child can adapt and socialize with peers well. However, schools are hesitant to admit the child due to his fragile health, and a family members need to remain available to address any issues that may arise.	The father works in construction and farming, while the mother raises livestock. There is considerable financial pressure, and the mother frequently has to stay at home to care for the child. The family continues to borrow money to cover medication and examination costs for the child. The child has two older siblings. The eldest brother attends PTIT in HCMC, while the older sister is in 11th Grade. Both maintain a stable health and education trajectory.

Table C.2

Health	Education	Family
The child had one surgery for perimembranous ventricular septal defect. During a follow-up examination, the child was diagnosed with valvular regurgitation with the mitral and tricuspid valves. His health was then considered weak, and the physician recommended follow-up exams every 6 months. Each examination and the follow-up medications was VND 2 million. Prone to common illnesses. Right now, the child's condition is considerably stable, and there are no significant concerns.	The child attends school and is going into 2nd Grade, and has good academic performance. Very sociable, adapts well to the peer environment, and is energetic and sharp. Somewhat shy around strangers, but the child is very agile and active; there are no signs of cyanosis, fatigue, or shortness of breath.	Before the surgery, both parents worked for hire. After the child's health improved, the family moved to Ho Chi Minh City to sell grilled chicken. Even though their financial situation is still difficult, the household is considerably more stable right now. The family currently has four children, including two girls in 6th and 5th Grade and a 4-year-old boy. All of them are healthy as normal and perform well at school.

Table C.3

Health	Education	Family
Underwent one surgery. Health is currently stable; following the COVID-19 period, the child has not attended any follow-up examinations.	Currently in 2nd Grade and performing well at school. The child plays and hangs out normally and is generally healthy, despite being somewhat thin. Goes to a school near home and is driven there by her older sister.	Around the time of the surgery, the family experienced relative financial difficulty, with the parents taking turns to provide childcare while the other worked as a construction worker, earning VND 5 million a month. When healthy, the child still goes to school normally. Otherwise, the parents alternated off of work to give care when she was sick. Now the parents continue to work as construction workers, and the total salary has exceeded VND 10 million per month. The family has three children in total; her sisters are in 5th Grade and 9th Grade, and both of them are doing well at school.

Health burden does not imply unfavorable education. The primary criterion is participation; the child is enrolled and participating. The caregiver requirement is a qualifier but does not supersede participation unless it substantially hinders participation. Since there is no evidence that the child has stopped attending school, education is classified as favorable.

For this case, multiple negative indicators converge: substantial recurring medical expense, borrowing to cover healthcare costs, loss of labor due to caregiving, and a financially difficult household situation. Due to unfavorable livelihood pointers, the overall pattern suggests a negative livelihood classification.

Evidence

Health	Education	Family
- Bé phẫu thuật 1, thông liên thất bẩm - Tài khám phát hiện hở van tim 2,3 lá -> sức khỏe yếu -> Bác sĩ yêu cầu khám định kì 6 tháng 1 lần, chỉ phí khám định kì và thuốc: 2tr/ lần - Bé dễ bị ốm vặt - Tuy nhiên hiện tại thể trạng về bình thường không có vấn đề gì đáng lo ngại	- Bé có đi học, chuẩn bị học lớp 2, học lực tốt. - Bé thích nghỉ tốt, hoà đồng với bạn bè tốt, năng động và nhanh nhẹn - Hơi nhút nhát khi gặp người lạ, giòn chạy nhảy bình thường không sao, không có dấu hiệu tím tái, khó thở hay mệt mỏi	- Trước khi bé mồ ba và mẹ đều làm công cho người ta (người ta thuê làm gì thì làm đó) -> sau khi bé đỡ bệnh ba, mẹ lên thành phố Hồ Chí Minh để bán gà nướng -> tuy còn khó khăn nhưng vẫn có đồng vốn đồng ra, kinh tế đỡ hơn trước nhiều. - Gia đình hiện tại có 4 bé: 2 bé gái học lớp 6,5 và bé út 4 tuổi -> tất cả 4 bé đều học tốt khá, sức khoẻ ổn định không có phát hiện bị bệnh gì bất thường

Analysis

Physician-documented abnormalities matter, but clinical findings are interpreted according to their significance. We do not have enough evidence to conclude that the valve abnormality means clinically significant deterioration. Even though the child has some kind of ongoing medical burden, the current condition is reported as stable; no major functional limitations are described; no dyspnea, cyanosis, or fatigue; and no major recurring surgery is reported. Under Appendix B's binary coding rule, the overall pattern favors a favorable health classification, albeit with moderate confidence.

The child is clearly continuing in his or her education. Social functioning is additionally favorable, while shyness does not imply social dysfunction. This supports a favorable education classification.

A household can be coded as a favorable case when there is clear improvement and stability, despite some continuing struggles. Since the source judges the economic situation to be comparatively more stable, evidence strongly suggests a favorable livelihood codification.

Evidence

Health	Education	Family
- pt 1 lần. sk ổn, sau đợt covid thì 0 khám	- lớp 2, học ổn bình thường vui chơi quây phá, nói chuyện như bình thường chỉ có cái ốm thôi, cũng cao - trường gần nhà, chỉ chờ	- khó khăn, thay phiên ở nhà đi làm, công nhân 5tr. - lúc đó, bé khỏe thì vẫn đi học, không khỏe thì vk ck thay nhau nghỉ để chăm, bình thường thì vẫn đi học - hiện tại, vẫn đi làm công nhân, có tăng, hai người tầm 10tr hơn - 3 đứa chỉ, lớp 9 lớp 5, hai đứa học ok hết

Analysis

This health description fits Appendix B's definition of normal or near-normal functioning, no clinically significant deterioration reported, limited ongoing medical burden, and no recurring surgery. Therefore, based on the reported stability and absence of major problems, health was classified as favorable.

Education is determined mainly by continued participation. The child is clearly enrolled and attending school. Academic performance and social functioning, though secondary, are positive as well. Hence, education was classified as favorable.

While the family has experienced hardship, struggle alone does not equal unfavorable livelihood. There is evidence of continued employment, improved income, functioning household, continued education of children, and no explicit report of any crisis. This defends a favorable livelihood classification.

Appendix D

Appendix D presents the statistical formulas used to analyze the variables. Wald is the standard confidence interval for binomial proportions, while the Clopper-Pearson interval gives a more conservative estimate. Calculating and comparing both methods quantify the estimations and their accuracy.

Notation

Symbol	Definition
n	Number of complete responses
x	Number of positive outcomes
$\hat{p}$	Sample proportion ($\frac{x}{n}$)
α	Significance level (0.05 for 95% confidence)
z	Normal critical value (~ 1.96 for 95% confidence)

E.1. Definition of symbols hereafter

Wald CI

The sample proportion is

$$\hat{p} = \frac{x}{n}$$

The sample standard deviation is

$$SD = \sqrt{\hat{p}(1 - \hat{p})}$$

The sample standard error is

$$SE = \sqrt{\frac{\hat{p}(1 - \hat{p})}{n}}$$

The interval is

$$\hat{p} \pm z(SE)$$

where the z-score is 1.96 for 95% confidence.

Clopper-Pearson CI

To compare with the Wald method, precise confidence intervals were also computed using the conservative Clopper-Pearson Method.

The lower bound is

$$LB = \beta^{-1}\left(\frac{\alpha}{2}; x, n - x + 1\right)$$

While the upper bound is

$$UB = \beta^{-1}\left(\frac{\alpha}{2}; x + 1, n - x\right)$$

where β^{-1} is the inverse Beta distribution and $\alpha = 0.05$.